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What are Research Joint Ventures (RJVs)? Are They Good for Innovation and for Economic Welfare?

Author: Louis Mitchell

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Introduction

As knowledge is a public good, producers cannot exclude others from taking advantage of their findings, ergo, incentives for firms to engage in R&D activity are lower than socially optimal (Choi, 1993). Patents intend to rectify this market failure however, they are not always effective (Jaffe, 1986; Levin, 2013). In recent decades research joint ventures (RJVs) have become an increasingly more common way to internalise spillovers (Caloghirou et al, 2003). Firms also hope to reduce R&D costs and create innovations that provide comparative advantages allowing for increased profits and market power. However, concerns regarding the effects RJVs have on economic welfare and innovation have arisen amongst many notable organisations (Caloghirou EU Commission, 2000; Hewitt OECD, 2001). So, in this essay, I will explain what constitutes an RJV, review real-world cases, discuss the nuances regarding the topic, and come to a conclusion on what RJVs mean for innovation and economic welfare.

What is an RJV

An RJV can be defined as "organisations jointly controlled by at least two participating entities whose primary purpose is to engage in cooperative research and development" (Caloghirou et al, 2003). However, many other papers have provided their definitions (Council on Competitiveness, 1996; Hagedoorn et al, 2000; Vonortas, 1997).

The Microelectronics & Computer Technology Corporation (MCC) is a perfect example of a successful RJV. The tech industry is notorious for high R&D costs and uncertainty.

Therefore, firms are incentivised to form RJVs to benefit from risk and cost-sharing. MCC members were able to share research discoveries and internalise spillovers; however, contractual obligations were not enough to ensure that the same level of effort or investment was given by each member, which may have resulted in less than optimal outcomes (Harrigan, 1985). Despite this, the MMC enhanced R&D resource allocation for the US economy by supplying strategic research, which is particularly beneficial to welfare as it is the most undersupplied type of R&D relative to its social returns (Peck, 1986).

Another example is Sematech. It consisted of 14 firms and was formed in response to fierce competition from Japanese firms developing new technologies for producing computer chips (Kamien et al, 1992). Sematech demonstrates how industry and government can cooperate to restore manufacturing industries (Hof, 2020). It is responsible for the performance improvement of US semiconductor manufacturers and equipment suppliers during the 1990s (Grindley et al, 1994). Sematechs' formation improved innovation and welfare for the US economy (Song, 2003). However, it was not without its issues. R&D intensities lowered as members became free riders (Irwin et al, 1996).

Effects on Innovation

Now that we understand what RJVs are, we can begin to evaluate their effects on innovation. University of Nottingham professor Joanna Poyago-Theotoky (1997) discusses a framework where firms with differing areas of expertise form RJVs and have the chance to produce a "*super product*". Due to synergies (Caloghirou, 2001), this product is vertically

superior to everything else on the market. With this considered, Poyago-Theotoky created a theoretical model where she concluded that the probability of achieving innovation is higher under RJVs. This demonstrates how pooling resources and economies of scale (Powell, 1987) can result in increased levels of innovation. Additionally, collaboration prevents wasteful research duplication (Röller, 1997). This means R&D efforts will be allocated more efficiently, elevating innovation levels.

Penrose's (1959) approach to RJVs describes the heterogeneous knowledge held by firms as valuable and hard to replicate. This approach can be examined in conjunction with Caloghirou's (2003) statements regarding the research and tacit knowledge each firm brings. So, from this perspective, it is only logical that the way to fully utilise these heterogeneous and immobile resources are to form RJVs. In this way, optimal levels of innovation and resource allocation can be actualised. Empirical data in the form of a survey conducted in Japan further validates this hypothesis. Members of the Japan Research Industries Association identify attaining complementary knowledge as the most important objective in research consortia (Sakakibara, 1997). However, it is important to note that routines or tacit knowledge between firms may conflict, limiting management's control over the outcomes of JVs (Witt, 1998; Ioannides, 1999a and 1999b). This causes uncertainty when forming RJVs which could be harmful to innovation.

This directly links to the issues that arise when effective governance mechanisms are not in place to prohibit RJV members from acting against the best interest of the consortia. Agency theory, first proposed by Harvard Business School professor Michael Jensen (1976), describes principal and agent relationships and how conflict arises when agents pursue

their interests at the principal's expense. In the context of RJVs, each firm acts as a principal who hires the other firm as an agent to perform certain tasks within the RJV. When firms are rivals, the incentives for opportunistic behaviour are high (Pastor, 2002), posing a serious threat to innovation. This behaviour can involve failure to divulge vital information, participating in undisclosed activities removed from the agreement, free riding by reducing effort and even sabotaging the JV's success to gain an advantage over other members (Caloghirou, 2003).

Risk and cost-sharing are also fundamental components when assessing the effect RJVs have on innovation. Initially introduced by University of Chicago Law School professor Ronald Coase (1937) but later built upon by University of California professor Oliver Williamson (1985), transaction cost theory suggests that RJVs are hybrid economic organisations (combines market and hierarchy mechanisms (Ménard, 2004)) formed to economise on transaction costs. These transaction costs can range from purchasing raw materials to testing prototypes, so sharing these costs with other firms increases R&D incentives and therefore increases innovation. Uncertainty is also a critical factor in transaction cost theory; uncertainty directly affects transaction cost (Robertson, 1998), and with uncertainty comes an inherent level of risk. R&D incentives are dampened due to high levels of uncertainty, so the option to share risk in RJVs is conducive to higher levels of innovation.

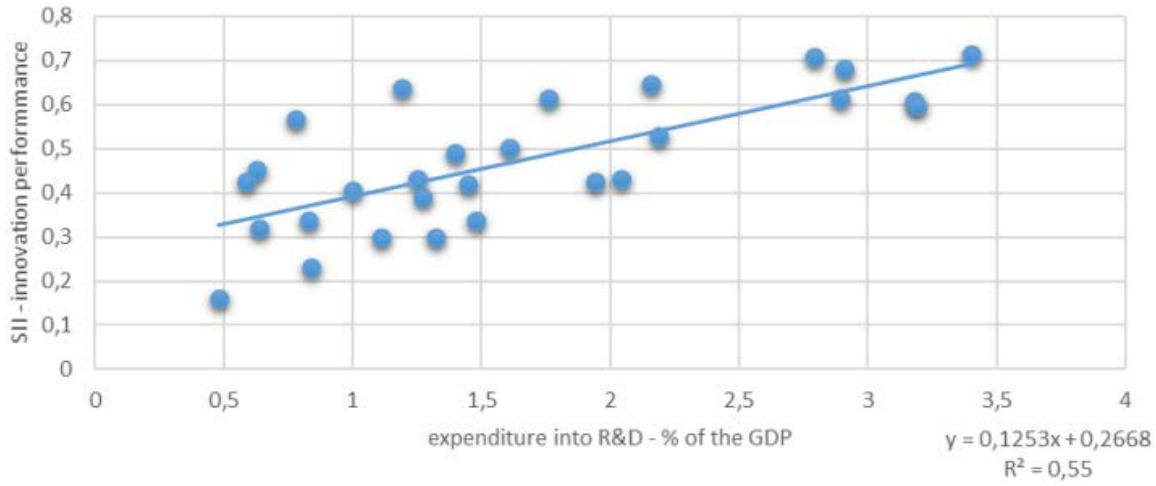

Figure 1. Between R&D Expenditure and Innovation Performance Correlation
Source: Kučera et al 2022

Internalising spillovers is also an attractive aspect of RJVs (Cassiman, 2002). knowledge is a public good meaning the R&D market is prone to free riders who will reap the rewards of their competitor's labours, considerably reducing firms' propensity to invest in R&D, especially when intellectual property rights are weak (Röller, 1997; Leahy et al, 2010). However, when firms form RJVs, they can internalise spillovers (meaning that spillovers remain within participating firms), thus overcoming the free-rider effect meaning increased R&D expenditure (Frischmann, 2007). This is significant because, as Figure 1 illustrates, R&D expenditure and innovation have a positive linear relationship. Furthermore, the R^2 is 0.549, meaning that expenditure can explain 55% (rounded) of innovation. On the other hand, non-participating firms now have fewer incentives to invest in R&D as they will feel a reduction in the possible recompenses due to their competitors' ability to create and patent protect superior products. It is possible that the reduction of expenditure of non-participating firms could outweigh the increased

expenditure of participating firms (Poyago-Theotoky, 1997). The result of these two conflicting forces will significantly affect the innovation outcome of a given RJV.

Effects on Economic Welfare

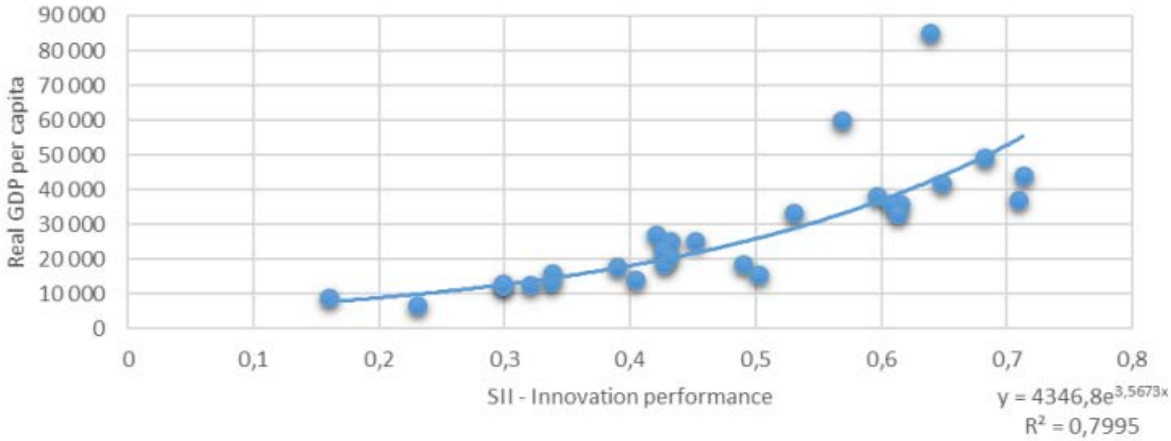

Figure 2. The Effect of Innovation on Real GDP per Capita
Source: Kučera et al 2022

Now that we have discussed the effect RJVs have on innovation, we can build on these points to evaluate their impact on welfare. Figure 2 shows that RGDP per capita has a positive exponential relationship with innovation with an R^2 of 0.8 (rounded). RGDP per capita is an effective indicator of welfare (Greve, 2008) as it is correlated with other indicators of economic welfare, such as employment rates, poverty rates, and access to essential goods and services. This shows that when RJVs are formed, the increased innovation from higher R&D expenditure results in improved economic welfare.

Innovation can cause costs and prices to fall due to vertical and horizontal advancements. Horizontal innovation intensifies competition as more substitutes enter the market; this increased competition erodes prices as firms fight to lower costs. With vertical innovation,

cost reductions are observed as input costs fall and production efficiency rises, this causes prices to drop in equilibrium (Poyago-Theotoky, 1997). lower prices mean higher consumer surplus as consumers can now buy the same product at a lower price. Furthermore, some individuals who could not previously afford the good now have access to it at this lower price, which benefits economic welfare.

Although it has been shown that the increased innovation produced within RJVs can result in enhanced economic welfare, this is only half of the equation. The threat they pose to antitrust regulators is an important issue that must be addressed when evaluating the effect RJVs have on economic welfare. There are two main antitrust concerns related to RJVs. The first is the coordination effect (Chiou, 2001), as RJVs have the potential to facilitate collusion and reduce competition in the market. When firms form an RJV, they can coordinate their behaviour and act like a cartel, setting prices and output levels that conflict with the interests of consumers. They can also use their power to gain legal and political advantages (Caloghirou et al, 2003).

The second antitrust concern pertains to the possibility for RJVs to deprive competitors of innovation benefits by excluding them from R&D activities. If an RJV is too exclusive, it may limit competition in the market by giving its members an unfair advantage over non-participants. These factors can lead to higher prices and reduced consumer welfare (Röller, 1997). In addition, when firms that already possess asymmetric market power form RJVs, their competitive advantages can be exacerbated further, worsening the aforementioned antitrust issues (Röller, 1997). This is corroborated by the Strategic Behaviour Approach,

which suggests that the capacity to reduce competition is a significant incentive for firms entering into JVs (Porter, 1986; Hamel, 1989).

The reduced levels of competition in the market can also mean reduced R&D expenditure as excluded firms are making less profit which could lead to a smaller R&D budget. Moreover, as excluded firms cannot produce a superior product or, as Poyago-Theotoky (1997) would say, a super product, the incentives for innovation are lessened, reducing R&D expenditure and causing lower economic welfare. However, a super product is not a guarantee. It is a case of high innovation output which increases welfare (especially in markets with sharp consumer preferences) which cannot be assured. When RJVs produce medium to low innovation, welfare is higher without collaboration (Poyago-Theotoky, 1997). This is an important caveat because, as we have established, many factors can cause an RJV to underperform.

Cournot and Bertrand Analysis

Cournot and Bertrand competition models can effectively evaluate RJVs effect on innovation and welfare as they represent two different market structures that can arise. Under Bertrand competition, efficient outcomes can be achieved through competition as firms set prices rather than quantities, eliminating the need for RJVs. This is because any cost reduction brought about by shared R&D would cause price to fall by the full amount of the cost reduction (Katz, 1986). Under these conditions, producer surplus is unaffected by innovation, lowering incentives for R&D investment, as it may increase production

costs, reducing profit margins and market competition (Haruna, 2002). Additionally, output is greater in Bertrand competition than in Cournot competition, even though R&D investment is less in the former (Haruna, 2002). This is because incentives to differentiate products through quality improvements are higher in Bertrand competition.

On the other hand, under Cournot competition, firms' propensity for R&D investment depends on the magnitude of spillover (Haruna, 2002). This causes Cournot competition to result in higher welfare and innovation, whereas Bertrand competition will not always reach an efficient outcome (Kamien et al, 1992). This suggests that the conventional conclusion about welfare comparison still holds even when firms have strategic commitment before output or price choice (Haruna, 2002).

Conclusion

In summation, cost and risk sharing, coupled with spillover internalisation and the ability to pool resources and knowledge, make RJVs a powerful catalyst for innovation. This increased innovation then allows for higher levels of economic welfare. However, this comes at the cost of jeopardising competition. After looking at real examples and reviewing different theoretical models and empirical data, it becomes clear that no one policy will suffice for all cases. The innovation and economic welfare produced by an RJV depends on various endogenous and exogenous factors. In the case of Bertrand competition RJVs will most likely reduce both innovation and welfare, whereas, in Cournot, the opposite holds.

As a result, antitrust policymakers must thoroughly examine market conditions regarding competitiveness and the power of the firms entering RJVs. The patent regime in place must also be considered, as it profoundly affects the effectiveness of RJVs and is key when determining if an RJV is necessary. Additionally, even when RJVs are deemed optimal, they must be kept under observation to ensure they operate efficiently. Effective governance mechanisms must exist; as we have seen in both real word examples, the theory of agency aptly predicts firms' behaviour. With this in consideration, under the right conditions, RJVs can have a profoundly positive effect on both innovation and economic welfare.

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