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Agenda

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In praise of the economics of regulation

On 13 October 2014, the Royal Swedish Academy awarded the Nobel Prize in Economic Sciences to Jean Tirole 'for his analysis of market power and regulation'. Tirole made a significant impact in demonstrating how economics theory can be applied to the world of regulation. Here we provide an overview of his contribution

In awarding the 2014 Nobel Prize in Economic Sciences, the Royal Swedish Academy of Sciences described Jean Tirole as 'one of the most influential economists of our time', noting that 'his analysis of firms with market power provides a unified theory with a strong bearing on central policy questions: how should the government deal with mergers or cartels, and how should it regulate monopolies?' The Academy summed up his contributions as providing 'a splendid example of how economic theory can be of great practical significance'.[1]

Tirole's research was undertaken at a time when deregulation was under way and regulation in its traditional form ('rate of return') was being challenged by alternative approaches such as the price cap. Initially, the price cap was intended to be short-lived and to pave the way for competitive forces. In practice, the price cap came to be re-set, and a long-term framework for regulation had to be developed.

In hindsight, various aspects posed a real challenge to the effectiveness of regulation, including asymmetry of information, firms' strategic behaviour, the credibility of long-term commitment by regulators, and the potential for competition along the value chain. Tirole's work provided theoretical and practical insights that have been key in addressing the issues and challenges of regulation. Indeed, his work has influenced the thinking of regulatory authorities across a wide variety of sectors, from water services to telecoms and financial services.

Having worked in the field of regulation for over 30 years, Oxera owes a lot to Tirole.

As also noted by the Academy, it is difficult to do justice to Tirole's 'immense body of work' in a few pages. This article focuses on some of the many contributions that he has made to the development of the theory of economic regulation. For their practical implications and influence, five of these merit particular attention.

Menus

Models of economic regulation have recognised that regulators are not fully informed about the technology, costs and demand faced by regulated firms. These models have sought to address two sources of informational problems:[2]

- **uncertainties about firms' inherent cost opportunities**. The inability of regulators to determine whether a firm has cost-reduction opportunities gives the firm a strategic advantage. Firms with 'low-cost' opportunities can attempt to convince the regulator that they are 'higher-cost' firms in order to obtain a higher tariff;

- **uncertainties about managerial effort**. Managerial effort could reduce a firm's costs, all else being equal. It is also necessary for the full realisation of a firm's cost opportunities. However, managerial effort represents a cost for managers and is not generally observable to the regulator.

A key development in the academic literature, introduced by Tirole in joint work with Jean-Jacques Laffont, was to propose economic models to deal simultaneously with the informational asymmetry problems regarding firms' cost opportunities, and uncertainties about managerial effort.[3] The approach involved a regulatory mechanism in the form of a cost-sharing or sliding-scale contract, where the regulated price is partially responsive to changes in realised cost, and partially fixed ex ante. By offering firms a 'menu' of regulatory contracts with different cost-sharing provisions, the regulator could, in principle, make it profitable for a firm with low-cost opportunities to choose a relatively high-powered incentive scheme, and a firm with high-cost opportunities to choose a relatively low-powered incentive scheme.[4]

The idea of offering a menu of contracts found its practical implementation in countries such as the UK.[5] Ofgem, the energy regulator for Great Britain, first developed a menu approach to assess capital expenditure (CAPEX), also known as a sliding-scale approach or Information Quality Incentive, for electricity distribution network operators for DPCR4 (2005–10).[6] Ofgem had traditionally relied on RPI - X price caps to encourage distribution companies to reduce costs. The regulator highlighted concerns regarding the incentives that companies faced under the traditional model, such as incentives to reduce investment or to overstate expenditure requirements during business planning with the aim of receiving a higher allowance from the regulator.[7] Investment was an important issue at the time, since a significant proportion of electricity network assets were in need of replacement or enhancement. The mechanism was therefore designed to allow for more flexible CAPEX, retain the normal incentive to minimise costs, reward companies for delivering reasonable cost forecasts, and reduce the reliance on Ofgem's estimates.

In 2008, Ofgem extended the use of a menu approach to gas distribution,[8] and more recently it has broadened the scope of the mechanism to include CAPEX and operating expenditure (OPEX) as part of its Revenues Incentives Innovation Outputs (RIIO) controls.[9] Similarly, Ofwat, the economic regulator of the water industry in England and Wales, adopted a menu approach to CAPEX at the last price control review (PR09), and has extended it to both CAPEX and OPEX at the most recent price control review (PR14).[10]

Commitments and renegotiation

Network industries carry out activities over the long term. In order to reassure companies and their investors that regulatory decisions will be maintained, the regulator should be able to commit to maintaining its regulatory decisions over this period. This may not be possible, however, giving rise to two sets of problems.

First, firms may underinvest in cost-reducing technologies, as they assume that, once the regulator has observed the firms' actual costs, it will try to renegotiate the agreement and pass on to customers any benefits arising from cost reductions (for example, by tightening the price cap). Tirole provided a formal model of underinvestment, and illustrated how commitment to a fixed price ex ante may result in inefficient outcomes ex post (i.e. cost overruns).[11]

Second, if long-term commitments are not credible, the regulator may resort to using short-term contracts. In this context, the regulator may be tempted to 'ratchet' into subsequent periods any cost efficiency obtained and revealed by the firm in the first period. This may hold a firm back from achieving cost efficiencies and revealing its actual costs. Laffont and Tirole[12] showed that it may be desirable for the regulator not to pursue short-term cost revelation (and thereby avoid obtaining 'too much information'), and allow the firm the benefits of cost efficiencies for a period of time.[13] In practice, this has been achieved by, for example, extending regulatory lags and thereby adopting more infrequent price reviews. In a similar vein, many regulators have adopted 'rolling incentive mechanisms' that would allow firms to retain the benefits of their cost efficiency for a given number of years (normally a full regulatory cycle), regardless of when the cost efficiencies are achieved in the regulatory cycle.[14]

Quality of service

If incentive regulation were applied exclusively to prices, companies could arguably obtain monetary benefits at the expense of service quality. For example, they could gain from retaining the benefits of reductions in OPEX achieved through lowering service standards rather than improving their efficiency.

Tirole, in joint work with Laffont, showed that where consumers cannot observe the quality of a product before purchasing it (i.e. with 'experience goods'), firms may bring down their costs by reducing the quality of the product.[15] In the short term, at least, this will not affect demand, but the cost reduction benefits the firm and thus its manager's performance. Only in the longer term will the reduced quality actually affect demand for the firm's products. In this context, managers who are focused on the short term may not consider the long-term effects on the firms. Such managers are therefore likely to pursue a strategy of lower quality and lower costs. For such goods, therefore, if there is concern about service quality, a low-powered incentive for cost reduction may be optimal.

The same does not apply to goods for which the customer can see the quality before they buy. In such cases, demand will be linked to service quality, with high quality of goods likely to result in high demand. In turn, this means that firms can be persuaded through incentives linked to sales to deliver higher-quality goods, while high-powered incentives can be retained for cost reductions.

These insights are taken into account when developing the regulatory framework for utilities. In this case, price regulation, which may provide high-powered incentives for cost reductions, is often coupled with additional incentives for the delivery of a predefined service quality, thereby balancing the incentives to reduce costs and preserve or improve the level of service delivered.[16]

Access pricing

A key policy issue that has arisen in several industries (e.g. gas, electricity, rail and telecoms) has been the liberalisation of potentially competitive parts of the value chain (e.g. retail services) when one of the competitors operates a monopoly 'bottleneck'. In such cases, in order to offer their services, competitors need access to the incumbent's facility at the bottleneck and the policy problem is how to set the terms (including pricing) for access to that essential facility.[17] Indeed, high charges could lead to entry barriers and maintain the incumbent's monopolist position in the potentially competitive services, but they could also

induce inefficient bypass or duplication of the incumbent's bottleneck. Conversely, low charges may generate entry by inefficient entrants and may induce incumbents to foreclose access to their bottlenecks and discourage them from maintaining and investing in their networks.[18] The regulator must therefore incentivise an efficient allocation of resources, which would involve balancing the need to create conditions for entry into the competitive segment of the market with discouraging inefficient entry and enabling the incumbent to recover its efficiently incurred costs. Whether these objectives can be achieved depends on the instruments available to the regulator (e.g. whether retail prices are subject to controls).

Laffont and Tirole illustrated the optimal regulation of access, and demonstrated that the setting of prices for access was equivalent to a multi-product monopoly setting prices for its services, some of which consist of access to other firms.[19] The optimal pricing may therefore be set according to Ramsey prices.[20] However, Ramsey pricing alone may not be enough to achieve desirable outcomes. The incumbent may have a good deal of the information necessary to calculate Ramsey prices. This asymmetry of information would provide opportunities for the regulated company to act strategically. The issue of asymmetric information suggests that delegating pricing decisions to the regulated firm in order to utilise its superior information advantage vis-à-vis the regulator may be desirable, and may allow the firm the flexibility to respond to changing conditions in the industry.[21] Laffont and Tirole proposed that one solution to these problems would be the adoption of a global price cap, which would treat the access price in a similar manner to the price of other services.[22]

The global price cap approach involves setting a single, global price cap on the regulated firm's product range (encompassing both access and 'retail' prices), with the firm having discretion to choose its pricing structure within that cap.[23] Although not implemented, the applicability of the global price cap was first considered, for example, by the then UK telecoms regulator, Oftel, for BT's prices in the late 1990s, and similarly in relation to Royal Mail's 2006 price control review.[24]

Although access to one monopoly bottleneck has been a key issue in many sectors and will remain so, in other sectors—notably telecoms—the emergence of new entrants has raised the issue of the design of 'two-way' access policies, where the networks compete for subscribers, but at the same time need to interconnect with each other in order to provide services. That is, mobile companies need to purchase access to a fixed network in order to ensure that their own customers have the ability to call users on the fixed network. As such, the issue of interconnection becomes one of access to multiple bottlenecks.

Tirole, in joint work with Laffont and Patrick Rey, developed some of the most influential papers dealing with two-way access.[25] In their model, Tirole, Laffont and Rey investigate whether freely negotiated charges are compatible with effective competition in the mature phase of the industry (i.e. operators with similar cost structures and coverage). Their work shows that, under certain conditions, symmetric operators will set the common access charge above the marginal cost of access in order to reduce retail price competition. As such, the access charge can be used as a tacit collusive device to soften competition in the retail market. From a societal point of view, this is not desirable, necessitating regulatory intervention in setting the access charges. Motivated by such issues, Tirole, Laffont and Rey consider different pricing models and settings that would make it difficult for operators to collude.[26] Many of these models have influenced the debate in the telecoms sector as the number of mobile operators has proliferated.[27]

Prudential regulation

There are two principal reasons why banks may need to be regulated. First, banks are highly interconnected through a web of borrowing and lending arrangements. This means that, if a bank fails, the ripple effects can be substantial and affect the whole banking system, and potentially the whole economy (this is known as 'systemic risk').[28]

Second, unregulated banks may not have the best incentives to manage financial risks appropriately—especially in times of distress—thereby leaving uninformed depositors in a vulnerable position. Indeed, management may be able to conceal difficulties while taking risky bets (moral hazard), because it is difficult or costly for depositors (particularly retail depositors) to obtain information on banks' financial soundness—i.e. there is a problem of asymmetric information.

Given these features, in times of crisis the government may need to support banks in financial difficulty and prevent their failure in order to avoid the far-reaching consequences of this. However, if banks are bailed out, this may mean that they will take on too much up-front risk, on the assumption that they will be bailed out again if things go wrong.

Tirole's work has focused on the trade-off between ex post efficiency (avoiding systemic crises) and ex ante efficiency (preventing companies from taking too much risk). For example, Tirole and Rochet[29] explored the case for regulating interbank markets, highlighting issues relating to ex ante and ex post efficiency.

This work outlined how decentralised systems (i.e. interbank loans disciplined by bilateral agreements) may work if there is effective peer monitoring. They found that, without such monitoring, other means to reduce the risks to the system may be required, such as centralised payment systems. In order for a decentralised system to be effective, lenders could be made accountable for poor monitoring. However, the incentives for adequate peer monitoring may be lessened if central banks cannot commit not to rescue banks that are solvent and whose financial position is jeopardised by bad interbank loans. A likely ex post intervention dampens the incentive for an ex ante efficient level of monitoring.

In related work, Tirole and Rochet[30] proposed an analytical framework within which to assess the key properties of existing systems, as well as a new organisation for payment systems. This new organisation would aim to combine the main advantages of centralised and decentralised systems. This work contributed to the regulatory decisions taken in response to the most recent financial crisis.

Conclusions

The contribution of Tirole to the development of economic thinking is so vast and diverse (from strategic behaviour to innovation; from vertical restraints in competition policy to two-sided markets and price discrimination) that an article such as this can only begin to describe his contributions to regulation and Industrial Organisation theory.

As practitioners in the field of economic regulation for over three decades, however, Oxera would like to pay tribute to this work that has shed new light on the field. While the body of research dealing with regulatory issues was already well developed, Tirole enhanced the existing analytical framework through the innovative application of tools such as incentive mechanism design and game theory. His work has provided regulatory authorities with key new insights into, for example, the interactions between regulators and regulated firms. Importantly, a number of practical implications have been derived from the theoretical insights provided by Tirole's work and applied by regulatory authorities around the world.

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[1] The Royal Swedish Academy of Sciences (2014), 'Jean Tirole: Market Power and Regulation', Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2014, 13 October.

[2] See Joskow, P. (2007), 'Regulation of Natural Monopolies', in M. Polinsky and S. Shavell (eds), *Handbook of Law and Economics*, North-Holland.

[3] Laffont, J.-J. and Tirole, J. (1986), 'Using Cost Observation to Regulate Firms', *Journal of Political Economy*, **94**:3, pp. 614–41, focuses on managerial efforts (moral hazard problem); and Laffont, J.-J. and Tirole, J. (1993), *A Theory of Incentives in Procurement and Regulation*, MIT Press, covers adverse selection and managerial effort at the same time. Baron, D. and Meyerson, R. (1982), 'Regulating a Monopolist with unknown costs', *Econometrica*, **50**:4, pp. 911–30, focuses only on the adverse selection problem.

[4] Indeed, the simplest version of Laffont and Tirole's models assumes that there are two types of firm (high-cost and low-cost). The model shows that an optimum regulatory system can be obtained by offering the regulated firm a choice between two contracts: a fixed-price contract that leaves some rent if the firm is of a low-cost type, but negative rent if it is of a high-cost type (high-powered scheme); and a cost-contingent contract that allows the firm to expend less effort but leaves no rent (low-powered scheme). Low-cost firms are better off choosing the high-powered scheme (and providing the optimal level of effort), while high-cost firms are attracted by the low-powered scheme (and providing less effort).

[5] For a discussion of the properties of menu regulation, see, for example, Oxera (2007), 'Assessing approaches to expenditure and incentives', report prepared for Ofwat, October.

[6] Ofgem (2004), 'Electricity Distribution Price Control Review: Initial Proposals', June.

[7] Ofgem (2004), 'Electricity Distribution Price Control Review: Initial Proposals', June, para. 6.92, p. 89.

[8] Ofgem (2007), 'Gas Distribution Price Control Review Initial Proposals', May, p. 66.

[9] See, for example, Ofgem (2012), 'RIIO-GD1: Final Proposals - Overview', December.

[10] See, for example, Ofwat (2013), 'Setting price controls for 2015-20 – final methodology and expectations for companies' business plans', July.

[11] Tirole, J. (1986), 'Procurement and renegotiation', *Journal of Political Economy*, **94**, pp. 235–59.

[12] Laffont, J.-J. and Tirole, J. (1988), 'The dynamics of incentive contracts', *Econometrica*, **56**, pp. 1153–75.

[13] In Laffont, J.-J. and Tirole, J. (1990), 'Adverse selection and renegotiation in procurement', *Review of Economic Studies*, **75**, pp. 597–626; the authors show that, even where it is possible to sign a long-term contract and renegotiation is allowed, similar conclusions hold.

[14] See, for example, Ofwat (2004), 'Future water and sewerage charges 2005-2010', December; and Oxera (2005), 'Fine-tuning RPI – X: the impact of changing the incentives mechanism', *Agenda*, December.

[15] Laffont, J.-J. and Tirole, J. (1993), *A theory of incentives in procurement and regulation*, MIT Press, chapter 1.

[16] See, for example, the use of Overall Performance Assessment by Ofwat over the period 1996 to 2010, subsequently replaced by outcomes regulation (with incentives introduced for companies to achieve what customers want). Ofgem has also adopted output incentives as part of its RIIO regulatory approach.

[17] Usually referred to as 'one-way' access.

[18] Laffont, J.-J. and Tirole, J. (2000), *Competition in Telecommunications*, MIT Press, chapter 3.

[19] Laffont, J.-J. and Tirole, J. (1990), 'Optimal Bypass and Cream Skimming' *American Economic Review*, **80**, pp. 1042–61. Laffont, J.-J. and Tirole, J. (1994), 'Access pricing and competition', *European Economic Review*, **38**.

[20] Under Ramsey rules, prices result in a mark-up on the marginal cost that relates to the price sensitivity of demand. The more elastic the demand for the product, the smaller the price mark-up.

[21] For example, firms may still have incentives to raise the access price to make it difficult, if not impossible, for the new entrant to compete in the downstream markets (known as 'foreclosure').

[22] See Laffont, J.-J. and Tirole, J. (1996), 'Creating competition through interconnection: theory and practice', *Journal of Regulatory Economics*, **10**, pp. 227–56.

[23] In other words, access is treated as a final good for the purposes of calculating the price cap. The weights attached to different prices in the price cap are determined separately and are designed to be in proportion to the forecast quantities of the goods. The firm has discretion to charge whatever prices it wants for individual products, including access, subject to meeting the overall price cap.

[24] See, for example, Oftel (1995), 'Pricing of telecommunications services from 1997. A Consultative Document on BT Price Controls and Interconnection Charging'.

[25] Laffont, J.-J., Rey, P. and Tirole, J. (1998), 'Network competition I: Overview and non-discriminatory pricing', *RAND Journal of Economics*, **29**, pp. 1–37.

[26] Laffont, J.-J. and Tirole, J. (2000), *Competition in Telecommunications*, MIT Press, section 5.5. For a comprehensive review of access pricing models, see, for example, Armstrong, M. (2002), 'The theory of access pricing and interconnection', chapter 5, in Cave, M., Majumdar, S. and Vogelsang, I. (eds), *Handbook of Telecommunications Economics*, Volume I, Elsevier.

[27] See, for example, Oxera (2006), 'Call Terminator 3: the ongoing debate in mobile telephony', *Agenda*, October.

[28] The Royal Swedish Academy of Sciences (2014), 'Jean Tirole: Market Power and Regulation', Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2014, 13 October, p. 37.

[29] Rochet, J.-C. and Tirole, J. (1996), 'Interbank lending and systemic risk', *Journal of Money, Credit and Banking*, **28**, pp. 733–62.

[30] Rochet, J.-C. and Tirole, J. (1996), 'Controlling risk in payment systems', *Journal of Money, Credit and Banking*, **28**, pp. 832–62.