

## Ronald Coase on Firms and Externalities

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Ronald Coase was one of the few economists who have changed the way economists have come to think about many issues; especially, the price-mechanism of free markets, the firms, tax to control externalities, and the other government interventions to regulate markets. Most of his writings asked simple but thought provoking questions. The answers he offered, however, agitated majority of the economists of the day. Ultimately, most came around to accept his arguments, which remain as fascinating today as they were back then.

Ronald Coase died on September 2, 2013 at the age of 102. In this tribute to him, I discuss his contribution to two of the sub-disciplines in economics that owe their origin to his writings - 'the theory of firm', and 'law and economics.'<sup>1</sup>

In his writings on the theory of firm, he evaluated the price mechanism versus the other (non-price) mechanisms of the market. His work, provided major insights into the market response to the failures of the price mechanism, and motivated many economists work on the theory of the firm. The theory as it stands today is helpful not only to private firms but also for the policymakers. For instance, it helps us better understand the costs and benefits of captive mining of coal and gas – issue that has become a 'hot-potato' for the UPA government. On these and several other issues, the theory of firm can be used by policymakers to identify the conditions under which allocation of captive mining of coal is optimum and when it is not. In his works on law and economics, Coase set the price-mechanism of the market against the government interventions. His writings have educated economist on the optimum legal and regulatory responses to the market failures.

In fact, the price mechanism and the related issues is a common thread spanning across most of his writings. It will help to put the issues in perspective, in most text-books on microeconomics, the economic system is described as consisting of consumers and firms. Both consumer and firm are presented in purely technological terms. Consumer is described by a utility function and the firm by a production function. While a consumer maximizes his utility, the firm is assumed to be presided over by a manager who works to maximize profit on behalf of the owners of the firm. Each good and service is assumed to have a market. The economic system 'works itself' through the price-mechanism. It is the price-mechanism that determines the direction and quantum of the flow of resources in the economy, including human as well as non-human resources.

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<sup>1</sup> These two subjects emerged as a result of two his paper, Coase (1939) and Coase (1960). These papers were singled out as his most seminal works by the Swedish Academy in awarding him Nobel Prize in Economics.

General equilibrium analysis of the economic system as modeled in text books shows that when markets are ‘complete’, the price mechanism ensures automatic flow of inputs into the production and flow of final outputs toward consumption. Under-suitable conditions, the mechanism produced outcome is well coordinated - the self-interested consumption decisions by consumers and production decisions by firms are consistent in that total demand is equal to total supply at the macro level. Moreover, when markets are competitive, the outcome produced by the price-mechanism is Pareto-efficient, a result known as the first fundamental theorem of welfare economics.<sup>2</sup>

It is worth emphasizing that to achieve above mentioned co-ordination and efficient allocation of resources, the conventional modeling of the economic system does not require use of non-price mechanism to allocate resources at production or consumption levels. In contrast, in a ‘real world’ firm, labour and other resources are allocated to different activities by an authority – the owner, manager or CEO.

### **Firms: Why do they exist?**

As an undergraduate, Coase visited USA on scholarship and studied American automobile industry. It was while watching the car industry in action that Coase noted sever flaws in the contemporary model of the economic system, in particular the ‘black-box’ view of the firm. He noted that in a real world firm, allocation of resources is not guided by the price mechanism. Rather, it is an entrepreneur or a manager of the organization who decides on allocation of several human and non-human resources. That is, within the firm it is not the price-mechanism but some other mechanism that coordinated flow of resources. Moreover, he noted that the actual use of non-price mechanisms varies across activities, firms and industries. Different firms use different mechanisms to buy inputs and sell their output.

In Coase (1937) the questions he asked were: Why firms use price mechanism for some inputs, but non-price mechanisms for some other inputs? Why non-price mechanisms are needed at all – if price mechanism can do all that is claimed by economic models?

To produce its output a firm needs several inputs. For example, a bakery needs flour, oil, sugar, labour, etc. Publication of a journal like Economic and Political Weekly (EPW) require among other things, services of editors, authors, and a printing press. A thermal power plant needs services of engineers, workers, and it requires water and coal, etc.

In general, a firm has several options to secure supply of the required inputs. A bakery can buy flour, oil and sugar from grocery shops in the market in quantities as required from time to time; or it can sign a contract with suppliers to secure supplies for the next six months. For printing, publishers of the EPW can buy services of independent printers on day to day basis; or they can

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<sup>2</sup> Although the conditions needed to ensure existence of a competitive equilibrium are very restrictive.

sign a contract with an independent printer; or can choose to have their own printing press. Similarly, a power plant can choose to buy coal from the spot market, or sign a long-term contract with a coal mining company, or can choose to own a coal mine to secure supply of coal.

While the exact choices can differ from case to case, the real-world bakers generally buy most of the required inputs from the market, i.e., through the price-mechanism, rather than producing the required inputs. In contrast, publishers tend to have their own printing press, rather relying on the price-mechanism of the market for the supply of printing services on date to day basis. That is, publishers generally do not use price-mechanism; they use 'non-price' mechanism namely the ownership of the printing press. Under the price-mechanism, the trade takes place at terms acceptable to both parties, namely publisher and the printer. Each party is free to say no to the demand put forward by the other side. In contrast, the ownership as mechanism empowers the publisher to demand work from the printing press – the consent of the latter is not needed in several aspects. As to the power plants, they also tend to either own a mine or sign a long-term binding contract for supply of the coal.<sup>3</sup> The ownership and long-term contracts give flexibility to the buyer (power plant) to buy coal in quantities as required from time to time.

Why firms use non-price mechanisms? According to Coase, the price-mechanism is costly to use. A typical production scenario involves many transactions. Moreover, the nature of transactions varies from day to day. For instance, a power plant's demand for inputs depends on the demand for electricity, which typically varies from month to month. Therefore, the actual need of the power plant for coal, water, services of engineers and other workers will vary from month to month, and in some cases from day to day. Moreover, the future is unpredictable. Therefore, it is impossible to write a contract listing all the things that the trading parties will need from each other. In such a scenario, if the market mechanism was to be used, each transaction and each change in it will have to be negotiated or contracted upon with every change in the situation faced by the parties involved. Negotiating a transaction, i.e., discovering an agreeable price is costly. So, the use of price mechanism (market) for organizing the entire production line is very costly.

In contrast, 'within the firm' one contract, e.g., employment or ownership contract, can substitute for a series of contracts. Under such a contract, worker as a factor of production agrees to obey the direction of the owner or 'entrepreneur' – the manger of printing press will work as asked by the publisher. Many of the changes required by the publisher will be implemented without needing any further negotiation with the person managing the press. So, the transactions of an activity are less, if the activity is carried out within the firm, rather than through the market. The 'firm' emerges when costs of within-the-firm transactions are less than the costs of using price mechanism. This is why, we observe big firms more frequently than is predicted by the neo-classical theory.

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<sup>3</sup> In countries where most of mining is done by private companies, many power plants own coal mines (see Joskow, 1985). In India, most of mining is done by the Coal India Limited (CIL). So, most of power producers have long term contract (called the fuel supply agreement) with CIL. This is also a form of non-market mechanism.

But, this line of reasoning leads to another set of questions. If a firm reduces transaction costs, why are there market transactions at all? Why are not all transactions carried out within a mega firm? According to Coase, there are ‘diminishing returns to management.’ As a firm gets larger, the returns from within the firm organization of activities reduce. There comes a point when the cost of a transaction within the firm becomes higher than of the cost of carrying out that transaction through market. At that point, the firm stops to grow in size. That is why, firms do not grow infinitely. These insights have led to emergence of two theories firms; *Transaction cost theory* and the *Property Rights Theory*.

According to the transaction cost theory (TCT),<sup>4</sup> the firm size is determined by transaction costs that arise due to incompleteness of contracts. When contracts are incomplete, renegotiations become inevitable. For example, the power plant and the mine owners will have to re-negotiate the contract whenever the plant needs uncontracted-for quantity or quality of coal. But, the private miner may or may not be willing to comply with such demands at a short notice. Sensing great urgency on the part of the plant he may even be tempted to demand unreasonably high price. In the terminology of the TCT, he may 'hold-up' the power plant.<sup>5</sup> In contrast, if the plant owner also owns the coal mine then there is no possibility of such a hold-up.

Note that even if the power plant and the coal mine are independently owned, there will be no hold-up if the plant owner can switch to other coal supplier costlessly - in that case, any coal owner attempting hold up will risk losing his business entirely. Therefore, for transaction costs to arise it is crucial that the close substitutes are not immediately available to the parties. Scenario of hold up is more likely when the power plant owner and/or the coal owners have to make ‘relationship-specific’ investments.

For example, power plant may invest in technology specific to the quality of the coal to be supplied by the miner. In that case, investment by the power plant is relationship-specific – if the miner does not supply the promised quality of coal, the investment by the power plant goes waste. Similarly, the mine owner may also make investment in coal processing technology that meets specific requirements of the power plant. To use Williamson's phrase, it is the relationship-specific that completely transforms the nature of bargaining positions. Once such specific investments have been made, the two owners are at the mercy of each other. In such a scenario, the disputes can have ruinous consequences for the parties that have made relationship specific investments. One way to avoid these costs is joint ownership of the plant and the mine. In sum, according to the TCT the vertical integration (joint ownership) generally lowers the transaction costs of negotiations and precludes possibility of disastrous disputes. While the technology has reduced some transaction costs, it has increased some others on account of complexity and informational asymmetry. As a result, the world is still dominated by large corporations.

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<sup>4</sup> The most notable contribution is by the Nobel laureate Oliver Williamson, who through various writings developed and enriched basic insights provided by Coase . See Willamson (1985)

<sup>5</sup> In India, nationalization of coal mining has rule out such hold ups.

The property rights theory of firm (PRT) focuses on the costs and benefits of relation-specific investments by of the parties involved. It claims that even if the parties could costlessly negotiate to the changes demanded as the future unfolds the property rights over assets (ownership right) will still matter.<sup>6</sup> If the power plant owner also owns the coal mine, he can fearlessly make investments needed to improve productivity of plant, say by upgrading its technology or entering in another power supply agreement. In contrast, if the plant owner does not own the mine, he will be less willing to make such investments, as fears hold up by the miner. Therefore, compared to independent ownerships, the benefit of vertical integration by the plant is the greater investment by the plant owner. What is the cost? Assuming that the plant owner cannot run the mine himself, after vertical integration the mine will be operated by a set of employees. However, due to moral hazard, the employees have lower incentive to operate mine efficiently – earlier the mine owner was directly involved and therefore was operating it efficiently. According to PRT, it is the trade-off between the costs and benefits that will determine whether vertical integration will take place or not, that is, whether the power plant as a firm will become bigger by acquiring the coal mine or not. These costs and benefits differ from industry to industry and firm to firm. The technological advances and access to various sources of finance have reduced importance of ownership (property rights) over physical assets. However, the importance of ownership over human and intellectual resources has increased. Many a times, these assets/investments also tend to be firm or relationship specific. That is why, we observe big firms.

### **Is There Any Role for Law?**

One of the most important results in the area of the Law and Economics is known as the ‘Coase theorem.’ The basic claim behind this ‘informal’ theorem is the following: If there are no transactions costs, the price mechanism will lead to efficient outcome regardless of the legal entitlements of the parties are involved. The logic behind this claim was worked by Coase by discussing contexts involving externality – that is, where activity of a party affects welfare or profit of someone else.

The then prevailing belief was that in the presence of externality the claim about efficiency of market, as discussed in the beginning of this note, does not hold. That is, in the presence of externality, price mechanism does not lead to efficient outcome. Economists argued that corrective intervention by the state or its legal or regulatory institutions was necessary to restore efficiency of the market.<sup>7</sup> In contrast, Coase argued that the presence of externality per-se does not mean that price mechanism will fail. Under certain conditions the price mechanism can lead to efficient outcome even in presence of externality. Again, it will help to use an example.

There is a village inhabited by fifty families for decades. Now, a factory has come up. The chemical waste of the factory is hazardous. The factory can treat its waste and make it safe, or can simply bury it. Burying the waste is costless for the factory but it will contaminate the

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<sup>6</sup> For a lucid and accessible account of the theory by its chief proponent, See Hart (1995).

<sup>7</sup> One particular remedy suggested by economists was tax on externalities, called Pigouvian tax.

underground water used by the families. If the families use the contaminated water it will affect their health leading to harm of say 10 for each family, and total harm of 500. However, the following two measures are available to solve the problem: The factory can install a waste treatment at the cost 150. Alternatively, each family can buy water purifier at a cost of say 5 each – total cost to all families will be 250. Suppose, if the factory is not required to install the treatment device or to compensate the families for the harm, it will make a profit of 800 from its operation.

Note that in this example, a harm of 500 can be avoided either by incurring a cost of 150 by the factory or cost of 250 by the families. Of course, the first solution is the more efficient.

In late 1950s the prevailing economic wisdom had three ready responses to the situations involving externalities as in the above example. One, the factory is *the cause* of the externality. Two, in the absence of state intervention the outcome will be inefficient – the factory will not spend 150 on treatment device, so the families will have to spend higher amount to solve problem. However, the problem can be solved either by imposing tax on the factory, equal to the harm that will result from the externality; or by making the factory owner liable to compensate the harm suffered by the families. The factory owner would prefer to avoid the harm and therefore any tax or liability simply by spending 150 on the device; not doing so will cost him 500.

In his paper the Problem of Social Cost, Coase challenged both of the above arguments. His arguments meant that the families are as much the cause of externality (harm) as is the factory – just like there will be no harm in the absence of factory, there will be no harm if the families were not there.<sup>8</sup>

Moreover, Coase argued that the outcome will be the same even in absence of the state intervention, as long as the parties can negotiate costlessly. To see why, in the above situation, suppose there is no tax or liability is imposed on the factory owner. But, now the families can collectively approach the factory owner and offer to compensate him for the cost of treatment device and little extra. This will cost them only 4 each even if they pay the factory owner 50 plus the cost of the device. This offer will be acceptable for all the parties – families have saved 6 each, and the factory owner has made a profit of 50. The outcome is as under the taxation; that is, the device is installed at the factory. Moreover, the outcome is efficient.

More generally, Coase argued that as long as the parties involved can negotiate costlessly, the exact nature of legal rules does not matter. In any situation, the parties involved will be able to use the price mechanism to achieve efficient outcome, regardless of their legal entitlements.

Is there any role for law at all? In the world of zero-transaction costs, even though the efficiency of the outcome does not depend on legal rules, the distribution of gains from negotiations indeed

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<sup>8</sup> Some contemporaries branded such an approach to externality as immoral.

depends on the legal rules. For instance, cost of device is borne by the factor owner when he is liable to compensate for the harm caused to families; otherwise, the cost is borne by the families.<sup>9</sup> Moreover, it is important to note that the efficiency claim of the Coase theorem holds only under certain conditions. In particular, it requires that legal entitlements are clearly defined, parties have enough of marketable wealth to make mutually acceptable offers and counter offers, contracts/agreement arrived at by the parties are enforceable, and there is no informational asymmetry between the parties. If any of these conditions are violated, the efficiency of the outcome cannot be guaranteed. However, using several contexts involving externality, Coase demonstrated that legal rules affect transactions costs and therefore should be framed so as to minimize these costs.

He emphasized that the price/market mechanism will fail to solve problem of externality if the transaction costs are high. In that case, depending on actual liability rules provided by the law, the outcome may or may not be efficient.<sup>10</sup> We have already seen that in the above example, that if the law holds the factory liable for the harm caused by the families, the outcome will be efficient. On the other hand, if the law does not hold the factory liable and negotiations between families and owners are not possible due to high transaction cost, the outcome will be that the families will have to install water purifiers, an inefficient solution. For contexts where law cannot reduce transaction costs, he demonstrated that legal rules can be framed to induce outcome that will approximate the outcome delivered by price-mechanism under zero transaction costs.

It is interesting to add that in his writings Coase barely used mathematics. If anything, he had an aversion for mathematics. Yet these fundamental insights provided by him have influenced not only economic analysis of law but also other branches of economics, including mathematically dense game-theory, mechanism-design, regulation, and the public economics.

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<sup>9</sup> It turns out the the price mechanism to deliver efficient under restrictive conditions. For example, if the law does not make factory owner liable for harm, and the fishery owners do have enough wealth to pay for the cost of device, the device will not be installed and outcome will be inefficient.

<sup>10</sup> For a complete efficiency characterization of liability rules, see Jain and Singh (2002).