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Non-Profit Maximising Theories of the Firm (A Review of Baumol, Williamson, and Ree Models)

K.K. SAXENA*

In a modern complex economy the economic decisions about price, output, product lines, product mixtures, resource allocation and other standard economic variables are taken not only by individual enterpreneurs but rather determined by many other factors. Many of these decisions are made within the large multi-functional and complicated organisations known as firms. There have been a lot of debates (and differences) on the point that there is considerable variance between the process by which business decisions appear to be made by the modern complex organisations in reality and the way in which they are explained by our economic theory under the title "Theory of Firm."

In this paper, first we propose to outline the conventional theory of the firm, and the debate over it, secondly, to describe the "Non-profit Maximising Theories of the Firm" as developed by W.J. Baumol, O.E. Williamson and R. Rees and finally, to examine how far the present theories of the firm tries to confront the realities of the modern organisation in their full complexity.

The main content of the conventional theory of the firm may be given as follows: the firm in question operates within a perfectly competitive market, and the objective of the firm is to maximise net revenue (i.e. profit or expected profit defined as the difference between receipts and total costs) in the face of given prices and technologically determined production function. The above objective is accomplished by determining the optional mixture of outputs and inputs or in other words the equilibrium position. The usual method for obtaining the equilibrium position of the firm is to derive the order conditions under the constraints by using the methods of differential calculus, the lagrangean multiplier and the theory of quadratic forms. These methods help us to obtain the order conditions in case of the multiproduct firm as well.

The necessary and sufficient conditions for equilibrium yield the following relations:

(a) The marginal physical productivity of a factor with respect to a product (i.e. rate of change of the amount of the factor used with respect to the product's output) is equal to their price ratio's;

(b) The quantity of a commodity produced is determined where its marginal cost (w.r.t. this product) is equal to its (given) price;

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*Mr. Saxena is an Assistant Professor of Economics at Department of Humanities and Social Sciences, Indian Institute of Technology, Kanpur - 208016, UP.

While retaining the basic framework and decision making process underlined for the firm operating in the perfect competition, the theory has also been extended to cover imperfect product and factor markets. Nevertheless the agreement on such extension is somewhat less complete than for the perfectly competitive case.

On the debate side there have been at least two major flaws which make the theory a deficient.

First, the assumptions of rationality (i.e. firms seek to maximise profits and that they operate with perfect knowledge) in the theory of the firm appears unrealistic in the present day world. Profit maximisation, it is commonly alleged, is either only one among many goals of the business firms or not a goal at all. Also the assumption of certainty and perfect knowledge of future events (which helps to introduce the expected value calculations) have been challenged.

Second, the very concept of the firm has been challenged. As we know a "firm" in the conventional theory is not a complete organisation in itself and that is why it has no problem of control and no standard operating procedures, no budget, no aspiring middle management etc. The traditional theory in all its standard forms, identifies the firm only with an individual enterpreneur and completely ignores the fact as to how the decisions are made in the large scale organisations. Though the concepts of internal and external economies do possess the germ of an idea relating to large scale production, nevertheless they completely ignore other organisational aspects of the firm which appear to be more important.

These two criticisms along with their different forms make a strong case for revision of the conventional theory of the firm.

Some economists, like Friedman, Machtep, Earleys Alichian have argued in defence of the conventional theory. They assert that too much concern about the accuracy has led to a misunderstanding of economic theory. In fact, according to them, the function of economic theory is to build propositions with which the world can be analysed and not to reproduce the world.

They also argue that the assumption underlying the theory are not very far from reality. According to them, all the relevant magnitudes: e.g. cost, revenue, profit should be regarded as subjective estimates rather than objective estimates. As such there is no point to criticise the cognitive assumptions of the theory. Again though they conclude that firms do not consciously pursue one to one marginal calculations specified by the theory, yet the firms, according to them in the long run do make the decisions as dictated by economic theory and so the theory does predict the behaviour of the viable firms.

The debate outlined above indicates that though the suggestions for revision have not gone unchallenged by the defenders of orthodoxy, yet a need has been always felt to develop a theory (of firm) which could lessen the disparity between theory and reality, and seek an

alternative to the assumption of profit maximisation (as being the entire objective of the firm without regard for condition of competition in which firm operates) which has been subject of repeated criticism.

The behavioural theory of firm has been the step in this direction as it is described below:

Behavioural theory treats the firm as a coalition (managers, workers, stock holders, suppliers are customers) whose members have conflicting demands that must be reconciled if the firms are to survive. Under normal conditions the management plays the role of chief member of the coalition and working of the firm in some "best sense" is left to the discretion of the management. The working in the "best sense" in behavioural model does not require as in the case of conventional theory, that managers operate the firm in stewardship sense of attending to the stockholders interest by maximising profits. While accepting the fundamental assumption of "self interest seeking" the behavioural theory proposes the "self interests seeking of managers" rather than "best interest of the stock-holders." In other words under the behavioural model, firms objective function which the management seeks to maximise has been reformulated along the lines that reflect the best interests of the managers of the firm rather than maximisation of profits of the firms. The objective function of the firm, thus in a way, is to be the management's reward schedule. The objective function of the firm in this sense, then depends on the three principal components:

1) Staffing (S);

2) Management slack expenditure absorbed as cost (M); and

3) Discretionary spending (power) for investment (I_D).

The management seeks to maximise this function under the condition that separated profits be greater than (or atleast equal to) a minimum level of profit demanded. The decisive variables of the above function are explained below:

(1) Staffing (S): Increase in the size of staff helps the management in two ways. Generally it is observed that management tries to obtain higher salaries indirectly by building pressure from below through staffing rather than by asking for higher salaries directly. On the other side since staff is a source of job security, prestigeaned flexibility management aims at excessive staffing as long as the firm is not confronted with any sort of adversity.

(2) Management slack absorbed as cost (M): This represents the expenditures on the superfluities in which the managers are indulged. The significant amount of these superfluities arise from the political positions that a management enjoys and are dependent upon the conditions of the existing environment. These expenditure can be identified as economic rents which, when curtailed or controlled would not cause managers to seek other employment.

(3) Discretionary spending for investment (I_D): It reflects the extent to which the investment decisions of firm are made on the influence of the management rather than on the economic considerations. The firm's necessitious investments are taken care of by the "minimum profits demanded" which appears in the constraint. As such, it could be observed that the present model treats the necessitious investment along with dividend demands as the first claims on the firms "surplus", after these have been satisfied, the residual is distributed according to managements influence. Discretionary spending for investment, therefore, depends on the difference between the reported profits and minimum profits demanded. The different relations between the minimum, actual and reported profits, are explained as under:

Actual Profits (Π_A): These are the profits that are actually earned by that firm, the objective function of which includes profit and staff components and which shall employ a staff bill in the region where the marginal value product is less than the marginal cost of the factor.

Report Profits (Π_A): These are the profits the firm admits to and which are mentioned in the firms profit and loss account. Π_A is directly related to third component of the function, i.e. the management slack absorbed as cost. Higher is this component, the less shall be Π_R. Also it is out of the reported profits that taxes, dividends and other internal growth funds are to be paid.

Minimum Profits (Π_o): These profits are net of tax and are negotiated by all the members of the coalition.

Π_o is that amount of the Π_R which is distributed to share holders to maintain share values, it should therefore be taken as exogenous and constant. Π_R shall be greater than (or equal to) Π_o. These profits can be expressed in the following mathematical notations:

$$\Pi_A = R - TC \quad (R = \text{Total Revenue, T.C.} = \text{Total Cost})$$

$$\Pi_R = \Pi_A - M$$

$$\Pi_R \geq \Pi o + T$$

$$\Pi_R \geq \frac{\Pi_o}{1-t} \qquad \text{and} \quad I_D = \Pi_R - (\Pi_A + T)$$

In the above relations TC represents total cost (i.e. Production Cost (C) plus staff salaries (S))

R = Total revenue

T = The total amount of tax

t = The rate of tax, so that $T = t.\ \Pi_R$

The model: A general formulation of the behavioural model can now be stated in a form of constrained maximisation problem as below:

$$\text{Maximise } F^* = f\left[s;\ (\Pi_A - \Pi_R);\ I_D\right] \quad \text{----------} \quad (1)$$

Subject to: $(\Pi_R - T)(1-t) - \Pi_o \geq o$ ---------- (1)

Such inequality constrained maximisation problem could now be handled by making use of Khun-Tucker theorem. But as could be observed, the constraint in the problem takes exactly the same form as the last term in the function, i.e. I_D.

Since in equilibrium $I_D > 0$ (there will be no corner solutions) the constraint turns out to be redundant, and the problem becomes one of finding an unconstrained maximum.

The problem is therefore, reframed by introducing two new variables:

i) α - a fraction of actual profits that is reported; and

ii) S - the total expenditure on staff.

The last two components are redefined in terms of these variables:

$$\Pi_A - \Pi_R = (1 - \alpha)(\Pi_A) = (1 - \alpha)(R - c - s)$$

and $$I_D = \Pi_R - (\Pi_o + T)$$

$$= [(\Pi_R - T)(1 - t) - \Pi_o]$$

$$= [\alpha(\Pi_A)(1 - t) - \Pi_o]$$

$$= [\alpha(R - c - s)(1 - t) - \Pi_o] \text{ ----------} \quad (2)$$

Thus the problem now reduced to:

i) Maximise: $F = f[S; \{(1-\alpha)(R-C-S)\}; \{\alpha(R-C-S)(1-t) - \Pi_C\}]$

---- (3)

In order to obtain equilibrium conditions, the cost and revenue functions which are implicit in the above function need to be stated explicitly.

(ii) Revenue function: $R = f(x,e)$, where x is the output and e is the demand shift parameter (eco. environment)

(iii) Total cost function: $C = f(x) + S$

So that the objective function contains 3 decision variables and 3 parameters:

$$F = f(S;x;\alpha;t;T;e)$$

and problem is simply to find the values of decision variables:

S, $(\Pi_A - \Pi_R)$ and I_D (or S, x and α)

which maximise F.

The following first order results are obtained by taking partial derivatives of objective function given in (1) with respect to X, S and R:

$$\frac{\partial F}{\partial x} = \frac{\partial c}{\partial x} \qquad \text{----------} \quad (4)$$

$$\frac{\partial F}{\partial s} = -\frac{\partial F}{\partial s} + (1-\alpha)\frac{\partial F}{\partial(\Pi_A-\Pi_R)} + \alpha(1-t)\frac{\partial F}{\partial I_D} \qquad \text{----------} \quad (5)$$

$$\frac{\partial F}{\partial R} = (1-\alpha)\frac{\partial F}{\partial(\Pi_A-\Pi_R)} + R(1-t)\frac{\partial F}{\partial I_D} \qquad \text{----------} \quad (6)$$

$$\frac{\partial F}{\partial(\Pi_A-\Pi_R)} = (1-t)\frac{\partial F}{\partial I_D} \qquad \text{----------} \quad (7)$$

using f_1, f_2 and f_3 as the first partial derivatives of the objective function w.r.t. S, $(\Pi_A-\Pi_R)$ and I_D:

equations may be rewritten as:

$$\frac{\partial R}{\partial x} = \frac{\partial c}{\partial x} \qquad \text{----------} \quad (8)$$

$$f_1 = -f_1 + (1-\alpha) f_2 + \alpha(1-t) f_3 \qquad \text{----------} \quad (9)$$

$$\frac{\partial F}{\partial R} = (1-\alpha) f_2 + \alpha(1-t) f_3 \qquad \text{----------} \quad (10)$$

$$f_2 = (1-t) f_3 \qquad \text{----------} \quad (11)$$

$$\frac{\partial R}{\partial S} = \frac{-f_1 + (1-\alpha) f_2 + \alpha(1-t) f_3}{(1-\alpha) f_2 + \alpha(1-t) f_3} \qquad \text{----------} \quad (12)$$

substituting (11) in (12)

$$\frac{\partial R}{\partial S} = \frac{-f_1 + f_2}{f_2} \qquad \text{----------} \quad (13)$$

The first order conditions for the maximisation of the objective functions given in (i) are, therefore,

$$\frac{\partial R}{\partial x} = \frac{\partial c}{\partial x} \qquad \text{----------} \quad (14)$$

$$\frac{\partial R}{\partial S} = \frac{f_2-f_1}{f_2} \qquad \text{----------} \quad (15)$$

$$f_2 = (1-t) f_3 \qquad \text{----------} \quad (16)$$

The corresponding conditions for profit maximisation firm should have been:

$$\frac{\partial R}{\partial x} = \frac{\partial c}{\partial x} \qquad \text{----------} \quad (17)$$

$$\frac{\partial R}{\partial S} = 1 \qquad \text{----------} \quad (18)$$

$$\alpha = 1 \qquad \text{----------} \quad (19)$$

Comparing the two models, it is observed that only for the production decisions we obtain results for the behavioural model that are consistent with profit maximizing model. On the other hand, whereas the profit maximising firm employs staff at the level where the marginal value product equals the marginal cost of factor (i.e. $\frac{\partial R}{\partial S}$ should be = 1), the behavioral firm ordinarily employes staff in the region where marginal value product is less than the marginal cost (i.e. $\frac{\partial R}{\partial S}$ is < 1). Only under the conditions where $f_1 = 0$ or when the firm is confronted with severe adversity, so that it takes very large positive values (see Eq. 13), then will the behavioural model be identical to the profit maximising model with regard to "staff". But on examining it is observed that a value of $f_1=0$ would require complete elimination of the "staff" variable from the objective function, hence this possibility can be ignored. Also, since based on the hypothesis that firms do not operate under severe economic pressures continuously, the second condition under which profit maximising rule would determine the staff employment decision should also be treated as unusual. In other words, it is only when the firm is confronted with the economic adversity it would choose to employ staff according to profit maximisation rules; and value of α will be chosen equal to one. In all other circumstances the firm will choose values of α less than unity, i.e. some fraction of actually earned profits will get absorbed by the unproductive (slack) cost.

The behavioural model, therefore, shows that though production decision are made along these lines which are consistent with profit maximisation, while the staff decisions are not important. This testifies the assumption that staff is valued by the managers for reasons apart from productivity though (and in fact) the only satisfaction (return) that management derives from employing labour (staff) is the productive values of this resource.

Thus, given favourable economic conditions, staff (expenditures) is permitted to absorb large amounts of the uncommitted resources that the firm is generating.

Displacement of Equilibrium: for a comparative static analysis it is required to examine how the equilibrium position (i.e. decisive variables: S, x and α) adjust to a change in the parameters; which in the model are economic conditions of the environment (e), rate of tax (t) and lumpsum tax (T).

To generalize the results, each decision variable is designated by a_i and each parameters by b_i. Objective function then can be represented as:

$$F = (a_1, a_2, a_3 -- ; b_1, b_2, b_3) \qquad \text{----------} \quad (20)$$

The general form for obtaining the change in the p^{th} decision variable (p=1,2,3) due to change in the q^{th} parameter (q=1,2,3) is given by:

$$\left(\frac{\partial ap}{\partial bq}\right) = \frac{\sum_{c=1}^{3} \left(\frac{\partial^2 F}{\partial ap\, bq}\right) cip}{|D|} \qquad \text{----------} \quad (21)$$

Where C_{ip} is the co-factor of the i^{th} row and p^{th} column of D. $|D|$ is the determinant of the second partial derivatives:

$$\left|\frac{\partial^2 F}{\partial a_i \partial a_j}\right|$$

The comparative static results are given below. The direction of adjustment of any particular decision variable to a displacement from its equilibrium value due to change in a particular parameter is found by referring the row and column entry corresponding to this pair.

Table 1
Responses to Displacement from Equilibrium

Variables	For Behavioural Model Parameters			For Profit Maximising Model Parameters		
	e	t	t	e	t	t
S	+	+	-	+	0	0
X	+	+	-	+	0	0
α	-	-	+	Does not apply		

As could be seen from the table above, the differences between the two models are substantial - specially in case of tax. Whereas the profit maximising firm responds to neither a profit tax rate nor a lumpsum tax, while the behavioural firm adjusts both its output and staff decisions when taxes are changed.

The interpretation of the signs, in case of three parameters is given below:

(i) Both models predict that the output (X) and staff (s) will be increased in response to better economic environment (i.e. increase in demand shift parameter e). However, the behavioural model also indicates that the fraction of profits reported (α) will be reduced (i.e. the fraction of profits absorbed as management slack will increase). In other words, as the demand for the firm's product increases the management slack absorbed as cost (expenditures such as travel expense accounts, office improvement and so forth) will also increase. The profit maximising model denies that such a relationship would ever exist.

(ii) Since the rise in the tax rate (t) directly hits the firm's profits, in the presence of excess profit tax, the behavioural firm will increase expenditure on advertising, customer services, public relations and so forth (rise in output) and at the same time there will be an increase in the proportion of management slack absorbed as cost (i.e. rise in S). The profit maximising model predicts that there will be no response to any change in the profit tax rate.

(iii) The lumpsum tax (T) cannot be avoided either by profit maximising firm nor by behavioural firm. But since the traditional firm is already maximising its profits, it will continue its operation unchanged (i.e. no response in X and s).

However behavioural firm, which is assumed to be operating on sub-optimal level then traditional firm will immediately revise its operations to increase the profits if there is rise in T. Thus staff, output and the amount of management slack absorbed cost are all reduced as the lumpsum tax is increased.

Here again, the behavoural model predicts that contrary to the conventional theory, fixed costs do influence the firms choice of an optimum configuration of variable factors.

A Revenue - Maximisation Model: Baumol proposed revenue maximisation model in which it is assumed that firms attempt to maximise total revenue rather than profit. Profit can not be ignored altogether in his model because a minimum profit level is introduced as constraint in the model.

Baumol presents several reasons, some based on a casual type of empiricism and others on evidence, to justify the revenue maximisation hypothesis for his model. On the other hand the minimum acceptable level of profits which serves as a constraint on a firm attempts and maximise its revenues is not regarded as purely arbitrary. Baumol feels that this constraint is determined by the capital market.

Though Baumol's model considers procedures for handling the multi-product case along with different forms of profit constraint, for the sake of simplicitly presently we assume that the firm produces only one product. Also in place of Baumol's variable a- the advertising expenditures, we will use Williamson's variable S- the staff expenditures. This does not distort the Baumol's model, since staff expenditures in Williamson's model also include advertising expenditures. Baumol's firm attempts to select values for its decision variables: X and S which,

$$\text{Maximise} \quad : \quad R = p.X. \qquad \text{----------} \quad (22)$$

$$\text{subject to} \quad : \quad (1-t)\,(R-C-S-\bar{T}) \geq \Pi_o$$

(Symbols used in the model depicts the same variables or parameters as in the Williamson's model).

The minimum profit constraint inequality can be transformed with equality on the following reasoning. Assume that the minimum profits

constraint equations would be satisfied at any profit level, say which is above the required minimum, Π_o then staff expenditures can be increased by the amount $(\Pi^* - \Pi_o)$ without violating the constraint. But since $\frac{\partial R}{\partial s} > 0$, this increase in staff expenditures will increase total revenue.

Therefore the values of X and S which maximise R subject to constraint in the form of inequality also maximise R subject to constraint in the form of equality, i.e.

$$(1-t)\ (R-C-S-\bar{T}) = \Pi_o \qquad \text{----------} \qquad (23)$$

The model may be restated as :

$$\text{Maximise} \quad : \quad R = p.x. \qquad \text{----------} \qquad (24)$$

$$\text{Subject to} \quad : \quad (1-t)\ (R-C-S-T) = \Pi_o$$

Using Lagrangian multiplier method:

$$Z = R + \lambda \left[(1-t)\ (R-C-S-T) - \Pi_o\right] \qquad \text{----------} \qquad (25)$$

First order condition with respect to X and S would give:

$$\frac{\partial R}{\partial x-} = \frac{\lambda\ (1-t)}{1+\lambda\ (1-t)} \cdot \frac{\partial c}{\partial x-} \qquad \text{----------} \qquad (26)$$

and

$$\frac{\partial R}{\partial s} = \frac{\lambda\ (1-t)}{1+\lambda\ (1-t)} \qquad \text{----------} \qquad (27)$$

Necessary conditions for revenue maximisation given by (i) and (ii) imply the following conditions:

$$\frac{\partial R}{\partial s} < 1 \qquad \text{and} \qquad \frac{\partial R}{\partial x} < \frac{\partial c}{\partial x-}$$

As could be observed both these conditions are in contradiction to profit maximising model. Nevertheless, so far as first condition is concerned, there does not appear to be any explicit variable from behavioural model. However, the basic determinants of staff expenditures differ in these two models.

In Baumol's model (i) and (ii) imply:

$$\frac{\partial R \,|\, \partial S}{1} = \frac{\partial R \,|\, \partial x}{\partial c \,|\, \partial x} \qquad \text{----------} \qquad (28)$$

In behavioural model:

$$\frac{\partial R \,|\, \partial s}{1} < \frac{\partial R \,|\, \partial x}{\partial c \,|\, \partial x} \qquad \text{----------} \qquad (29)$$

In other words in Baumol's model a firm is essentially neutral with regard to expenditures on staff or on production, each being judged solely in terms of its relative contributions to the revenue criterion. In Behavioural model, on the other hand, the management display a positive preference towards staff. The comparative results are given below:

Table 2
Responses to Displacement from Equilibrium

Variables	For Profit Maximising Model			For Behavioural Model			For Baumol's Model		
	e	t	T	e	t	T	e	t	T
X	+	0	0	+	+	-	+	-	-
S	+	0	0	+	+	-	X	-	-

A comparison of the three models reveals that Baumol's model yields the same quantitative predictions as behavioural model and the traditional model about the ways in which changes in the demand shift parameter will affect output and staff expenditures. The effects of a lumpsum tax on output and staff are the same in Baumol's and in behavioural model, but these are different effects than the traditional theory implies. The results are different with regard to tax rate in the three models. When the tax rate is raised Baumol's firms reduce their output and staff expenditures; behavioural firms increase their output and staff expenditures; profit maximising firms do not change their behaviour.

A Reconsideration of the Williamson's Model: Williamson's firm in order to maximise the objective function, under normal conditions, chooses $\alpha < 1$ and employs staff in the region where marginal value product is less than marginal cost (i.e. $\frac{\partial R}{\partial s} < 1$). In other words, the firm does not choose to employ staff according to profit maximising rule, rather it shows preference for staff for the reasons apart from its productivity.

Prof. Rees, while accepting the above basic conclusion derived from Williamson's model, moves further and discusses three possible ways, in which firm can depart from the profit maximising rule and can show its preference for staff. This he does by introducing a concept of cost minimisation level of staff expenditure S^o; which a firm may or may not take as a constraint. According to him a firm may behave in 3 possible ways with regards to S^o.

i) A firm may choose optimal amount of S without any regard to S^o, i.e. $S > S^o$. It is a "pure staff" surplus case according to him, because in this situation, though staff appear to be fully employed, nevertheless relative to the level required by the real productive activity of the firm, there is over expansion.

The responses of the parameters w.r.t. decision variable under this have been given by Prof. Rees are placed in Table 3.

Table 3

Variables	Parameters		
	t	t	e
x	0	0	+
S	+	-	+
a	0	0	+

The response matrix comes out to be the similar as in case of Williamson's model.

ii) A firm, though chooses S^o as a constraint, but with respect to the some "different" and "higher" relative prices then what is existing. The firm, therefore, chooses to produce with unduly high cost functions. This is called "excess staff intensity" case.

Table 4

Variables	Parameters		
	t	t	e
S	-	-	+
K	-	-	+
x	-	-	+

Here a new variable K has been introduced, which depicts "non staff inputs."

It could be observed that in this case changes in t and T will have negative effect on S and K (i.e. staff and non staff inputs) as well as on output.

CONCLUSION

We have presented three models in the present paper. These models attempt to develop new approaches to the theory of firm. The rationale behind these models is: modern corporate enterprise is a complex organisation far different from the traditional economic notion of a single entrepreneur running his own small firm. Striking characteristic of present day large (scale) firm is the separation of the ownership and the management. The owners of the firms, i.e.; the stock holders, generally have little interest in, and even less direct knowledge of the day to day operations of the firm. The actual power of the stock-holders to influence the firms plan and operations resides in the top management.

This separation of ownership and management functions permits the managers of a firm to pursue their own self interest, subject only to their being able to maintain effective control over the firm. This then raise many important questions, e.g. on what factors depend the management group's self interest? what are those constraints which come in the way of this groups optimising behaviour?; how are, then these goals (in which top management is interested) achieved? and how do certain exogenous factors like taxes affect their goals?

The questions appear to be both intutively realistic and capable of being tested. The three models make an attempt to obtain the solution to these questions.

It is interesting to find that the predictions and equilibrium conditions obtained by these models differ from those of the traditional profit maximising model. This is mainly because these models comprise other aspects of behaviour (variables) and consider the nature of constraints which are not contained in the conventional model of the theory of firm.

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