



## STRATEGIC SUPPLY IN IMPERFECT MARKETS

**T.V.S. Ramamohan Rao**

Indian Institute of Technology, Kanpur, 6-5-45/1 Type 1, Self Finance Colony, Vanastalipuram,  
Hyderabad 500070, India. E-mail: [rmrao@iitk.ac.in](mailto:rmrao@iitk.ac.in)

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**Abstract:** Firms in imperfect markets find it impractical to monitor price changes created by the market and rival firms and change their prices accordingly. Instead, they will find it much easier to alter intangible investments in response to observed disequilibrium. Generally, such intangible investments will be guided by the expectation about the demand that firms can visualize (based on their profit maximization considerations). The resulting excess supply in production is at the apex of the business cycles observed in imperfect markets. Such cyclical behavior cannot be stabilized by demand oriented economic policies. The study therefore suggests a fundamental reorientation in the macroeconomic theory and policy in imperfect markets for goods as well as financial markets.

**Keywords:** Imperfect markets, Information asymmetry, Strategic supply, Intangible investments, Business cycles

**JEL Classification:** D43, E12, E32

## I. INTRODUCTION

Market imperfection may be characterized along several dimensions. (a) The market has a finite number of firms that produce somewhat substitutable products. Perforce, every firm interfaces with the consumers on the market and interacts with rival firms. (b) Firms utilize non-price strategies to inform the consumers about their product and to ensure that their demand curves are stable if not increasing. Similarly, firms utilize intangible investments to increase their productivity and supply.<sup>1</sup> (c) Firms recognize that both the consumers and rival firms find it impractical to obtain complete information about the prices and products of all the firms before devising their own strategies. Every firm experiences information asymmetry and conceptualizes and implements its strategies based on imperfect information.<sup>2</sup> (d) Firms expect that they will lose

their market if they do not have an adequate supply to cater to the demand as it arises. Similarly, firms acknowledge that changing the level of production takes time. In general, production should be ahead of demand. Firms operate on the basis of expected demand. (e) Consumers assign a threshold value to the products of a firm based on the information they obtain as a result of their search process. Such thresholds will be with respect to the price of a product as well as the quantity demanded. (f) The actual level of demand may be different from the expected or planned level. Firms utilize inventories if they expect shortages in the future.<sup>3</sup>

Market price, volume of production, and intangible investment of firms adjust toward their thresholds. The convergence to the threshold values of prices and quantities signal the emergence of equilibrium in the market. Consider the interaction of each firm with its rivals. Every firm plans the utilization of intangible investments so as to maximize its profit given the demand curve. However, the actual supply curve of a firm will also depend on (i) its interface with consumers and (ii) its comparison of the realized marginal revenue and marginal cost. It is important to recognize that changes in the quantities of intangible investments lead to the stability of equilibrium and that price changes *per se* are not the essential institutional mechanism that brings it about. It is therefore necessary to examine the role of quantitative adjustments to equilibrate the system in imperfect markets.

Firms experience business cycles in the transition to such equilibrium. They are a result of the planned excess supply based on expected demand. Such cyclical behavior cannot be explained by shortages of demand. Similarly, the problem of excess supply persists if policies to augment demand are adopted (e.g., bailouts consequent on a financial crisis). Information asymmetry and the resulting uncertainty may perpetuate business cycles and convergence to long run equilibrium will be slow if left to the independent decision making of managers in imperfect markets. Against this backdrop the rest of the study is organized as follows. Section 2 recounts quantitative changes in intangible investments as a major institutional mechanism to equilibrate the market. Section 3 deals with the nature of the strategic supply curve. Its relationship to marginal costs while defining long run equilibrium will be outlined in section 4. Section 5 considers the emergence of business cycles in such imperfect markets. A summary of the major findings of the study will constitute the theme of section 6.

## II. PRICES VS. QUANTITIES

Microeconomic theory generally postulates that (a) price change brought about by the market is the major institutional mechanism to correct disequilibrium, (b) the operation of the price mechanism is instantaneous and impersonal so that it does not involve any costs, and (c) individual initiative is primary and someone

else modifying or directing choices is not acceptable. The impersonal role of the market price is thus reinforced.

Prices are parametrically given to a firm in competitive markets. Given the capital stock of the firm and the postulate that it maximizes profits determines the quantity supplied.<sup>4</sup> A firm will have a desire to change the capital stock and the quantity supplied in the long run if there is excessive utilization of the short run capital. The changes in such quantities will then have implications for price changes. The causation from price to quantity adjustment and vice versa has been acknowledged.

The important observation in all these studies is that price changes brought about by the market mechanism will be the central force to restore equilibrium. Thus, microeconomic theory maintains that equilibrium will be restored albeit with changes in marginal cost and corresponding prices. However, as noted above, price changes are neither instantaneous nor are they without costs. That is, given the intangible investments (non-price choices) of firms (when faced with disequilibrium forces) the operation of the price mechanism cannot be considered as a definitive signal to equilibrate the system.

It is often observed (or empirically verified) that price changes do not have a significant effect on the choice of quantities (in output, intangible investments, inventories, or in the stock of capital). The following arguments are indicative.

Since production should be ahead of demand a firm anticipates future market requirements and makes plans to fulfill them. Firms also make several non-price choices to augment demand. Variations in the revenue of firms, due to changes in the price of the product, are very small relative to the total revenue of the firm. As a consequence, quantity changes, rather than changes in prices, explain such choices.

Observe that the expected changes in demand may not materialize due to reactions of rival firms. Reducing prices, though available as a choice, will involve greater costs of monitoring and calibrating the required changes. The market reactions, taking all the reactions of rival firms into account, may be too slow and relatively more expensive. Inventories, instead of reduction in prices, offer the firm a relative cost advantage. Reducing the level of production is another option. However, the cost of holding inventory may be lower compared to changes in the volume of production. Essentially, price effects follow such quantitative changes rather than precede them. It is often suggested that firms prefer to hold a steady level of production and adjust inventories to the actual level of demand. Even in such a case quantitative changes rather than price changes are indicated.

Consider the cost of obtaining finances. In an imperfect money market both the interest rate and the quantum of credit available will be affected. It can be

expected that an increase in interest rate will decrease inventory via the cost effect. However, interest payment is a small portion of the total cost for it to have any significant effect. Further, interest cost should not matter since firms can recover them by a suitable pricing policy. Hence, quantitative limits on credit, rather than interest rate, are a determinant of inventory investment.

Investment in the capital stock of a firm presents similar considerations. First, some studies consider the changes in the level of production as one of the important factors. The other important feature is the user cost of capital. It depends on (a) the output price, (b) the elasticity of output w.r.to capital stock, and (c) the price of capital goods. That is, it represents the contribution of one unit of finances spent on physical capital investment to the sales revenue. However, empirical observations find the user cost of capital insignificant. Second, some studies consider the expected changes in sales, i.e., expected changes in demand, as a major determinant of investment in capital stock. Prices of capital goods do not have a predominant role in such studies.

Clearly, investment in capital goods must be financed. Imperfection in financial markets may result in some quantitative limits on finances available for investment. Even in this context the general observation is that the cost changes due to variations in interest rates are an insignificant portion of the total cost of acquiring capital for it to have any independent effect.<sup>5</sup> On the whole, it can be suggested that independent individuals in the management make quantitative changes. Price effects follow but do not precede them.

### III. STRATEGIC SUPPLY CURVE

Information asymmetry that firms experience induces them to utilize intangible investments to stabilize or augment their market demand. That is, in the short run, the demand for the firm's product will be  $p = p(S, I)$ . The demand curve will satisfy the following properties:  $p_1 < 0$ ,  $p_2 > 0$ , and  $p_{12} > 0$  since it can be expected that with an increase in  $I$  the consumers get to know the product better so that the demand curve becomes flatter.

Generally, consumers are risk averse in their interface with firms on the market. In particular, it is a common observation that they ignore advertisements once they get to know the value of the product being offered. Clearly, there is ceiling  $I^*$  on  $I$  based on the reaction of the consumers. In general, both the consumer choice and the reactions of rival firms fix a price of the product based on its value to the consumers on the market. This suggests that there is a ceiling price  $p^*$  above which the consumers will not buy the product of the firm. The ceiling on the quantity demanded on the market ( $S^*$ ) will also be determined by the consumers and rival firms. The long run equilibrium in such markets will therefore be determined by  $I^*$ ,  $p^*$ , and  $S^*$ .

The use of intangible investments entails a cost to the firm whether they are demand augmenting or productivity oriented. Such costs should also be included in defining the cost curve. Suppose  $C(S,I)$  denotes the total cost of supplying  $S$  given  $I$  of intangible investment. It can be expected that  $C_1$ ,  $C_2$ , and  $C_{22} > 0$  while  $C_{12} < 0$  since an increase in  $I$  will have a productivity increasing effect.  $C_{12} < 0$  even if the intangible investments are directed to increase demand. This will be a consequence of firms developing brand loyalty to the products of a firm as  $I$  increases. The firms will need to make fewer increases in  $I$  as a result.

On the other hand, firms are risk takers in their interaction with rival firms. In particular, firms may target short run market share advantages in the expectation that the resulting consumer loyalty will persist over time. They also realize that they will lose consumer goodwill if they are out of stock when the demand materializes. Firms also acknowledge that the market share advantages will be reduced due to the reaction of rival firms. This leads to firms being risk averse when dealing with the consumers. Firms adjust the quantity of intangible investments based on such reactions of both the rival firms and the consumers.

Consider the short run choices of a firm in their interaction with rival firms on the market. Every firm can be postulated to choose  $I$  for any given  $S$  so as to maximize its profits

$$\pi = p(S,I)S - C(S,I)$$

The resulting  $I = I(S)$  can now be substituted in  $p(S,I)$ . As a consequence,  $p = p[S, I(S)] = p(S)$  can be designated as the strategic supply curve. See, for instance, Kripalani et al (1990) and Menezes and Quiggin (2020). This defines the desired level of sales of the firm.

In general, profit maximization results in  $Sp_2 = C_2$  and the second order condition  $Sp_{22} - C_{22} < 0$ . Consequently,  $dI/dS = (p_2 + Sp_{12} - C_{12}) / (C_{22} - Sp_{22}) > 0$ . The profit maximizing  $I$  will increase with  $S$ . That is,  $dI/dS > 0$ . Similarly,  $p_2 > 0$  ensures that  $dp/dS > 0$  since  $dp/dS = p_2 (dI/dS)$ . Both these properties indicate that the strategic supply curve  $SS$  is positively sloped.

Note that  $SS$  so defined is stable. Referring to Fig.1 it must be noted that there will be a  $I^*$  such that the short run demand curve for the firm, viz.,  $p(S, I^*)$ , intersects  $SS$  at  $(p^*, S^*)$ . Firms, however, do not know the value of  $I^*$  due to information asymmetry. The firm may choose  $I_1 > I^*$  in the hope that they can convince consumers that their products are of better value. Further, they may expect that consumer loyalty to the products of the firm will make  $I_1$  viable in the long run as well. However, this results in excess supply. There is no market like mechanism to reduce  $I$  and restore an equilibrium. Instead, the firm should recognize it and bring about a quantitative reduction in  $I$ . If this persists over time either the firm will reduce  $I$  or the rival firms alter their choice of intangible investments in such way that  $p(S, I_1)$  is shifted down. The converse holds if the initial choice  $I_2 < I^*$ .

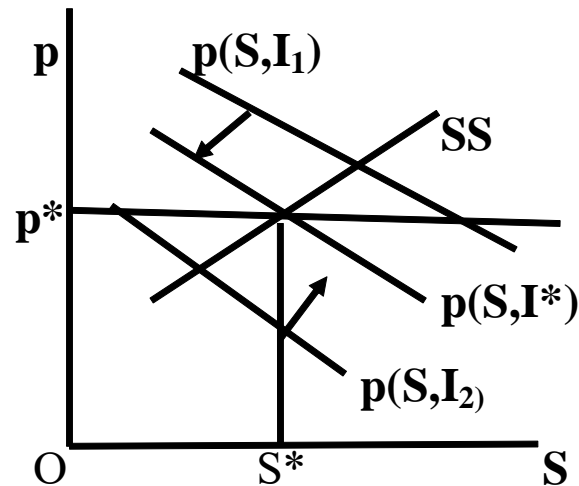


Figure 1: Stability of SS

Such variations in intangible investments render the emergence of  $(I^*, p^*, S^*)$  stable viewed from the perspective of the interaction of the firm with its rivals on the market.

#### IV. CONCEPTS OF EQUILIBRIUM

In the previous sections it was noted that (a) a firm wishes to achieve a certain level of intangible investments (to maximize profits) and in the short run it may choose a different level. Hence, the first equilibration must be in these two quantities. The management of a firm would be less inclined to make these changes based on the variations in market prices. Instead, the immediately obvious decision for them would be in the quantities of intangible investments. (b) The second equilibrium concept pertains to whether the implementation of the strategic supply curve will be commensurate with the marginal cost changes that the firm experiences. Even in this context, the quantitative changes in intangible investments would have an important role.

As noted above, firms interface with consumers on the market as well. The firm will find it possible to achieve the desired level of supply only if it is commensurate with the marginal cost. As Fig. 2 indicates,  $S$  will increase toward  $S^*$  so long as  $MC$  is below the  $SS$  curve. Such an equilibrating force is the choice of  $I$  and not the market price movements. Further, note that the profit maximizing choice of the firm for any given  $p(S, I)$  will be such that  $p = MC (1 - 1/\eta)^{-1}$ , where  $\eta$  is the elasticity of demand. Even in this case  $S$  moves toward  $S^*$  as a result of the changes in  $I$  that a firm brings about.

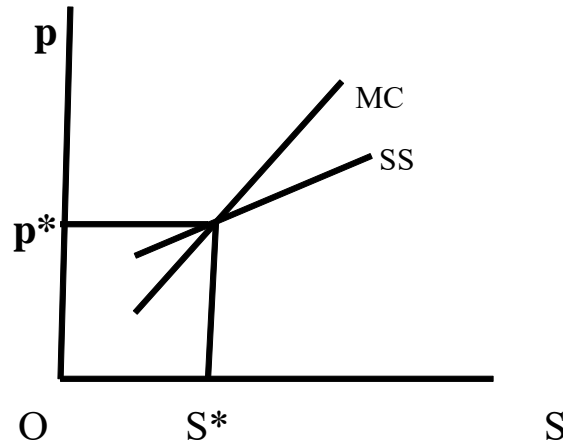


Figure 2: Long run equilibrium

The converse holds if the initial choice  $I_2 < I^*$ . Such variations in intangible investments render the convergence of  $(I^*, P^*, S^*)$  stable viewed from the perspective of the interaction of the firm with its rivals on the market. Therefore, the quantitative changes in  $I$  which the firm brings about will make the equilibrium stable. For all practical purposes it can be concluded that the changes in intangible investments, that a firm brings about, equilibrate the system at  $I^*$ ,  $p^*$ , and  $S^*$ .

In this conceptualization the actual quantity that the firm supplies depends exclusively on the demand that it expects to obtain. That the existence of excess supply is due to the lack of demand is no longer tenable. Further, demand oriented economic policies will only shift  $SS$  to the right and aggravate the disequilibrium.

One aspect of the equilibrating mechanism still needs attention. It can be claimed that an important institutional mechanism has been overlooked even when dealing with the operation of markets. When the market price signals excess supply firms tend to accumulate inventories as a cushion against being out of stock if excess demand materializes in subsequent time periods. A similar role can be assigned to labor hoarding. The primary reason is that production requires time and cannot instantaneously adjust to changes in demand. This mechanism ensures that the firm does not lose consumer goodwill and experience reduction in market shares. Persistent excess supply will result in dissolving inventories and reducing the production level. Thus, for all practical purposes, such a quantitative change constitutes the fundamental institutional mechanism to equilibrate the system.<sup>6</sup> Price changes *per se* may be a result of such changes instead of the causation being the other way around.

Consider the second issue. The marginal cost  $MC$  will be  $MC[S, I(S)]$  if the firm is choosing  $I$  to maximize profits. The firm would be compelled to reduce  $I$

if the actual choice results in MC above SS at  $S^*$ . Similarly, if the MC at  $S^*$  is below SS the firm can afford to increase  $I$  since the price it can obtain is greater than MC. The ultimate equilibrium for every firm is achieved when its  $p^* = MC(S^*, I^*)$ . That is, the choices of  $I$  and  $S$  of every firm would be such that the price that it charges is equal to its marginal cost. Essentially this implies that every firm attains an efficient equilibrium in the long run even if they have different marginal costs.

## V. BUSINESS CYCLES

Given the intrinsic value of the product of the firm there will be a maximum  $I^*$  at which the demand curve will reach its threshold. Thus, the demand curve  $p = p(S, I^*)$  along with the above strategic supply curve will be relevant in the decision making process. If prices are flexible and adjust supply and demand instantaneously the equilibrium  $(p^*, S^*)$  as in Fig. 3 will emerge. However, due to information asymmetry the firms do not know the value of  $I^*$ . Since the firms are risk takers in their interaction with rival firms they tend to utilize  $I' > I^*$  and expect an increase in demand. However, they cannot charge a price greater than  $p^*$ . They can only expect to sell  $S'$  as in Fig. 3 so long as  $p^* > MC(S^*, I')$ .

Consider the nature of the supply curve and the choice of the profit maximizing  $S$  if  $I = I'$ . Since  $I' > I^*$  it can be expected that  $S(I') > S(I^*)$  so long as  $MC(S, I')$  at  $p^* < p^*$ . The supply curve will then be  $p^* = MC(S, I')$  as  $I'$  varies.

Information asymmetry that the consumers experience tends to make it difficult to recognize that  $I'$  is inadequate to reveal the value of the product to them. Consumers may not make swift adjustments to any new information due to the search and transaction costs of switching between products. Both the risk

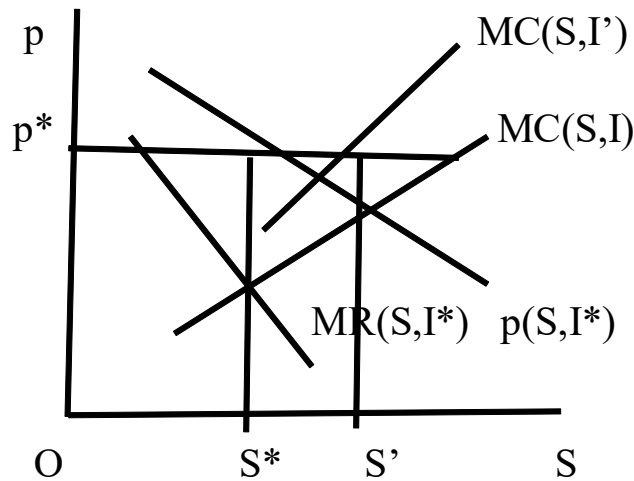


Figure 3: Information Asymmetry and Excess Supply



aversion and inertia indicate that the consumers assign a value  $I^i$ ;  $v < 1$  to the strategies of the firm. The quantity they buy reduces to  $S^i$  as in Fig. 4. Clearly  $S^i < S^*$  for  $I^i > I^*$ . This signals excess supply.<sup>7</sup>

The reaction of firms to this excess supply can be traced as follows. It is obvious that a firm expects to have a transient advantage until decisions of rival firms recognize and react to the cannibalization efforts of the firm. This signals an upswing in the business cycle initially. However, the sales would be less than  $S'$  that the firm expects to sell. The firm temporarily holds inventory in the hope that consumers can be persuaded. However, over time the inability to foresee revival in the near future will induce the firm to reduce the level of production. If for nothing else, it would be induced by the desire to liquidate the accumulated inventories.<sup>8</sup>

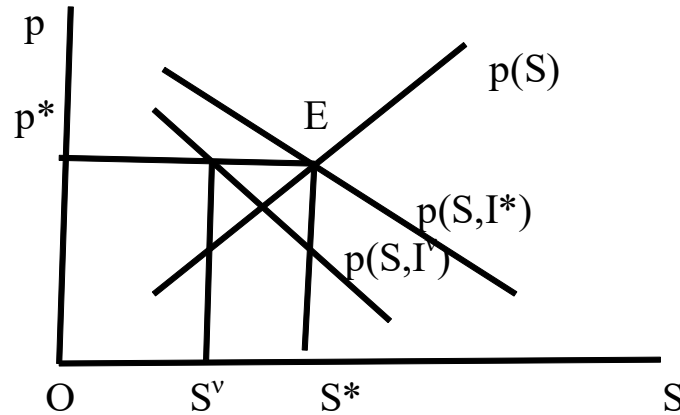


Figure 4: Consumer Risk Aversion and Demand

## VI. CONCLUSION

This study developed concepts of equilibrium in imperfect markets recognizing that firms operate at two levels, viz., in their interface with consumers and interaction with rival firms on the market. In both the cases changes in the quantities of intangible investments have been demonstrated as the sources of stabilizing the equilibrium. Further, both of them will lead to the long run equilibrium where every firm reaches its threshold values of price and market shares such that each of them equalizes its price with its marginal cost. However, disequilibrium excess supply, that is a result of expected demand, has been shown to create short term business cycles. They may delay the long run efficient equilibrium from being attained. Conventionally defined economic policies, such as bailouts to increase demand, will only lead to tendencies to increase excess supply and worsen the problem. Every firm recognizing its thresholds and

formulating its intangible investments independently, and not depending on the changes in market prices, will be the essential institutional mechanism equilibrating the system.

### *Notes*

1. This generic conceptualization is due to Crouzet *et al.* (2022). Their emphasis was on the supply side. Some studies acknowledge that mergers and acquisitions, innovations in technology, and increases in size through capital acquisition (depending on the economies of scale and scope) affect productivity and volume of production. In general, intangible investments may also target consumer demand. For instance, advertising, warranties and other non-price strategies may have an effect on the demand. The concept of intangible investments may encompass both these strategic decisions of firms.
2. Information asymmetry results in some uncertainty. Identification and resolution involves costs of search, adverse selection, and losses due to moral hazard.
3. Note that labor hoarding corresponds to this concept in the operation of the labor market. Thus, this may be included in the conceptualization of intangible investments.
4. Note that the interaction of a firm with its rivals is not relevant in the context of a competitive market since every firm can sell whatever it desires to.
5. An alternative approach to the cost of capital is the q-ratio. The q-ratio is defined as the current market value of common stock to its book value. The emphasis of this approach is the cost of financing through the equity market. It was not significant in empirical applications due to the lower shifts in profitability relative to it.
6. Bureaucratic control is the other institutional mechanism that has been considered. Organizational economics retains this as its main focus. Consideration of quantitative adjustments can include this in its realm.
7. The capitalist minded policy maker considers this I'as sacrosanct. Hence, a shortage of demand is the only way a cyclical downswing can occur. During the financial crisis of the early 2000 a bailout was recommended to boost demand. The crisis will repeat since firms get used to such bailouts. Here, flexibility of supply, either voluntary or induced by policy, is suggested. A change in supply is a much better solution compared to the increase in demand.
8. This process will be assisted by the debt financing institutions that accumulated losses due to non-performing assets.

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