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Towards a Dynamic Microeconomics

Introduction

Alan Meltzer has once remarked that "we need a dynamic micro-theory". The static supply/demand equilibrium analysis of price formation is one-dimensional. It looks at the product in total isolation. It admits no insight into the effect on the price of alternative products, either at the input or at the output end of the production line. It makes no allowance for deliberate variation in product quality on the part of the producer. A dynamic theory of price formation would have to be three-dimensional. It would have to take the inter-dependence of the price with those of substitutes at both the input and the output level into full account. It would have to allow for deliberate variation in product quality. In the present paper we attempt to lay the foundations of such a dynamic theory, explicitly recognizing arbitrage as the driving force of the market process. We shall use the language of traders with daily experience with arbitrage. Their guiding star is the *spread*: the difference in price between two goods (baskets of goods or, even more generally, baskets of goods and other resources). Their basic tool is the *straddle*: the combination of a purchase and a sale. The arbitrageur is shuffling his straddles in pursuit of pure entrepreneurial profit. To the uninitiated it looks as if he is guided by intuition. But theory can establish the basic facts governing arbitrage without appealing to intuition.

The marginal analysis of price formation of consumer goods to be presented here isolates three types of arbitrage: (1) the horizontal arbitrage of the consumer, responsible for the formation of the asked price, using one-legged straddles; (2) the vertical arbitrage of the producer, responsible for the formation of the bid price, using two-legged straddles; and (3) the bid/asked arbitrage of the market-maker, responsible for closing the bid/asked spread.

In the second part of the paper we discuss problems of entrepreneurship and profit in the light of arbitrage. Horizontal arbitrage has a role to play in retrospective strategies to protect profitability, including variation of product quality and increasing capacity utilization. Vertical arbitrage using four-legged straddles has a role to play in

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prospective, forward-looking strategies of aggressively pursuing pure entrepreneurial profit. Entrepreneurial success depends on the skill to mesh these strategies.

This paper is the first in a series. Much work remains to be done to deal with other types of arbitrage, such as inter-spatial and inter-temporal arbitrage having important implications in regard to inter-regional and international trade and the formation of futures prices, and also arbitrage between the bond market and other markets, having important implications in regard to the formation of the interest rate structure. These and other related issues will be dealt with in subsequent papers.

Arbitrage

Arbitrage is the driving force of the market process. It is present in every market action, even though sometimes it may well be hidden. It is not often recognized that barter — a sale and a purchase 'telescoped' into a single transaction — is an instance of arbitrage. By the same token so is every purchase, since an explicit choice always incorporates the implicit rejection of the nearest alternative. The word 'arbitrage' is used in this paper in its broadest possible sense, in order to unify the seemingly fragmented activities of entrepreneurs and the seemingly unrelated sources of pure entrepreneurial profit. Arbitrage is a market strategy that puts the emphasis not on sales *per se* but on straddles, and is motivated not by prices *per se*, but by spreads. A *straddle* is a market position with a long and a short leg. The long leg could be an outright purchase but, more typically, it is a commitment to buy or, just as typically, the liquidation of a commitment to sell. The short leg could be an outright sale but, again, more typically it is a commitment to sell, or the liquidation of a commitment to buy. The commitment to buy or sell (or the liquidation thereof) is always made at the current price. To every straddle there belongs a *spread*, that is, the difference between the prices at which the commitments to buy and sell have been made (sale price less purchase price).

The spread, like the price, is subject to change. But the information-content of a change in the spread, unlike that in the price, is highly significant. In fact the importance of arbitrage, and the reason why human action should be viewed from the vantage point of the spread, rather than from that of the price, is found in the fact that a single move in the price is mostly random. By contrast, a single move of the spread (in a well-traded market) is a signal that is far from being random. The knowledgeable arbitrageur can read it and make most of it. This insight of his is the true source of pure entrepreneurial profit.

Our starting point is the fundamental observation of Carl Menger in *Principles of Economics* that markets do not quote one single monolithic price; they in fact quote *two* prices: a higher and a lower one. In market parlance, the higher one is called the *asked price*, and the lower the *bid price*. The two are never equal, so that the bid/asked spread (*i.e.*, asked minus bid price) is always positive. The fundamental question to ask is how the bid and asked prices are formed by the market process. We shall see that the asked price is the outcome of the competition of the consumers, while the bid price is the outcome of the competition of the producers. Either process can be described as arbitrage, addressing a definite spread, using a definite type of straddle.

The four-legged straddle

When the arbitrageur sees a profitable spread, say, he finds the price of one item x too low while that of a related item y too high, he sets up his *initial straddle* consisting of the *initial long leg* (commitment to buy x) and the *initial short leg* (commitment to sell y) at the prevailing prices. In market parlance, he has entered one market with the long leg, and another with the short. The arbitrageur expects his spread to widen (narrow in absolute value, if negative). If the market moves in his favor, he *takes profit* by offsetting his straddle: he enters the same markets once more but with the long and short legs switched around. Thus his *opposite straddle* consists of the *terminal short leg* (liquidating the commitment to buy x) and the *terminal long leg* (liquidating the commitment to sell y) at the new prices. His profit is the net change in the spread (terminal minus initial spread; if negative, he has made a loss). We refer to this as a *four-legged straddle,* as the profit from the arbitrage can be calculated only after all four legs are in place.

Four-legged arbitrage is the basic strategy of the warehousing business. Suppose a grain- elevator operator normally fills one of his two bins with wheat, and the other with corn. As a result of poor weather in the wheat-growing regions he expects the wheat/corn spread to widen. Acting on his insight he sells his corn (initial short leg) and fills his corn bin with wheat (initial long leg). When his expectation is fulfilled and the wheat/corn spread has widened, he sells his wheat in the corn bin (terminal short leg) and replaces it with corn (terminal long leg). Since the profitability of the arbitrage can be established only after all four legs are in place, this is a four-legged straddle. The foreign exchange trader's basic tool is also the four-legged straddle. This is not surprising if we contemplate that his business also has the characteristic of warehousing. To catch a glimpse of the true significance of the four-legged straddle consider the fact that the volume of the world's foreign exchange markets is estimated at a mind-boggling one and one quarter *trillion* dollars per *day*, more than the *annual* budget of the U.S. government. Virtually all of this trading is hedged, that is, done through the vehicle of four-legged straddles. But the importance of the four-legged straddle goes beyond the range of these examples. Every type of arbitrage can be reduced to four-legged straddles. Note that the four-legged straddles above are special in that the terminal legs liquidate the respective commitments made by the initial legs. In the general case this restriction is removed. In the second part of this paper we shall see examples of a four-legged straddle in the general case, with each leg in a different market.

The two-legged straddle

Consider the vertical arbitrage of the producer. The long leg x of his straddle is in the producer goods market and the short leg y is in the consumer goods market, where x is the input and y the output of his production line. This is called a *two-legged straddle*, because the profit from the arbitrage can be calculated already when the first two legs are in place. We reduce this to a four-legged straddle by adding two terminal legs at zero prices (so that the addition of the phantom legs does not affect the profitability of the arbitrage). The significance of the phantom legs is to satisfy the requirements of double-entry book-keeping. The four transactions

involved are: placing an order for x, taking an order for y, taking delivery of x, making delivery of y. They correspond to the four legs, respectively, of a straddle: (1) the initial long leg x, (2) the initial short leg y, (3) the terminal short leg x, (4) the terminal long leg y.

The one-legged straddle

Consider the horizontal arbitrage of the producer. He buys the favored producer good x (his *present* input) while he refrains from buying the disfavored one y (his *former* input). This creates a straddle with long leg x and short leg y, and the corresponding spread shows the profit (saving) that arises out of the switch from y to x. This is called a *one-legged straddle* because the profit from the arbitrage can be calculated already when the single long leg x is in place. To satisfy the requirements of double-entry book-keeping we reduce this to a four-legged straddle by adding three phantom legs. The four transactions involved, corresponding to the four legs (1) - (4) named above, are: placing an order for x, cancelling the order for y, taking delivery of x, and getting credit for the cancelled order for y, respectively. The terminal legs are entered at zero prices, so that they will not affect the profitability of the arbitrage. We are now ready to present the marginal analysis of the price formation of consumer goods in three steps: the formation of the asked price, the formation of the bid price, and the closing of the bid/asked spread.

Formation of the asked price

As noted above, the asked price is the outcome of competition by the consumers. In more details, *the asked price a of the consumer good x marks the point where the opportunity cost of buying an additional unit of x becomes critical to the marginal consumer of x. He is the first consumer to refuse to buy the uptick in the price of x, and the reference is to his opportunity to buy a substitute instead, namely, the consumer good x'.*

All consumers of x are doing horizontal arbitrage all the time: they constantly shift their custom. Their guiding star is the constellation of horizontal spreads. As a result of the competition of the consumers, the horizontal spreads will *widen*. But the spreads which belong to the one-legged horizontal straddles with long leg x will not continue to widen indefinitely. Their widening will be checked by the marginal consumer of x. His refusal to buy x, and his buying x' instead, constitutes an opposite horizontal straddle, and entering it will stabilize the spread.

Of course, the person of the marginal consumer, and the item x' he considers as his substitute for x, are subject to change without notice. Whenever another consumer takes over that role from the first, his substitute for x may not be the same x'; it could be x''. Indeed, over a period of time when the price of x undergoes a change, hundreds of different people may, one after another, play the role of the marginal consumer of x, while x' sweeps through the spectrum of possible substitutes for x. This picture can be simplified if we personify the marginal consumer of x, and think of him as a figure skater skating in the rink of consumer goods. His long leg is anchored to x, while his short leg is skating through the possible substitutes of x. This, then, is the mechanism whereby the market integrates the fragmented power over the price of x that resides in individual

consumers, crystallizing it in the form of a single number: the asked price.

Formation of the bid price

As already observed, the bid price is the outcome of competition of the producers. In more details, *the bid price b of the consumer good x marks the point where the opportunity cost of selling an additional unit of x becomes critical to the marginal producer of x. He is the first producer to refuse to sell the downtick in the price of x, and the reference is to his opportunity to refuse to buy the producer good y', his input in the production line of x.*

All producers of x are doing vertical arbitrage between consumer and producer goods all the time: they constantly shift their production lines from one vertical straddle to the next. Their guiding star is the constellation of vertical spreads. As a result of the competition of the producers, the vertical spreads will *shrink*. But the spreads which belong to the two-legged vertical straddles with short leg x will not keep shrinking indefinitely. Their shrinking is checked by the marginal producer of x. His refusal to sell x and his refusal to buy y' constitutes an opposite vertical straddle, and entering it will stabilize the spread.

Of course, the person of the marginal producer of x, and his input y', are subject to change without notice. When another producer takes over that role from the first one, his input for producing x may not be the same y'; it could be y''. Indeed, over a period of time when the price of x undergoes a change, hundreds of different people may, one after another, play the role of the marginal producer of x, while y' sweeps through the spectrum of alternative inputs suitable for the production of x. This picture can be simplified if we personify the marginal producer of x and imagine that his short leg is anchored to x on the bottom rung of a ladder while his long leg is trying to get a firm foothold on the next, touching the alternative inputs suitable for the production of x. This, then, is the mechanism whereby the market integrates the scattered knowledge about the appropriate level of the price of x that resides in the individual producers, crystallizing it in the form of a single number: the bid price.

Our results can be formulated more briefly as follows. The asked price of x is determined by the marginal utility of x, and can be characterized as the lowest price at which consumers can buy as much as they want without haggling — explaining how the asked price earns its name. The bid price of x is determined by the marginal profitability of producing x, and can be characterized as the highest price at which producers can sell all they have without haggling — explaining how the bid price earns its name. Incidentally, we have proved the theorem that the marginal productivity of producing x is always lower than the marginal utility of x. (Otherwise the production would not take place.)

Closing the bid/asked spread

In the very nature of the case $a > b$, so there is a positive bid/asked spread $a - b$. The existence of a positive spread, as always, invites arbitrage. The arbitrageur addressing the bid/asked spread is called a *market-maker* (on the floor of the New York Stock Exchange, the *specialist*). The market-maker buys at the lower bid price and sells at the higher asked price (while everybody else must

buy at the higher asked price or sell at lower bid price, unless he is prepared to take the trouble and time to haggle). The guiding star of the market-makers is the constellation of the bid/asked spreads. Competition causes the spreads to shrink. But the process of shrinking the bid/asked spread for x will not continue indefinitely. It will be checked by the marginal market-maker whose withdrawal from arbitrage will stabilize the spread. Ultimately the spread will be narrowed to a point where it appears negligible (hence the impression of a single monolithic price). It is clear from the foregoing that the bid/asked spread is determined by the marginal profitability of the market-making business. Note the beneficial effect of the arbitrage of the market-maker. Everybody benefits: the consumers enjoy a lower buying price, the producers are rewarded by a higher selling price. It is a grave mistake to ignore the arbitrage of the market-maker when discussing the market process.

Of course, the three components of arbitrage (horizontal, vertical, and bid/asked arbitrage) are carried on simultaneously and continuously — not one after the other as the theory might suggest. The decomposition of market agitation into three separate components has purely methodological significance. This completes the marginal analysis of the price formation of consumer goods in terms of arbitrage. The corresponding analysis of the price formation of producer goods can be given *mutatis mutandis* (see below).

Competition and changes in price

Competition of the producers may or may not have the effect of lowering the bid price of x. The marginal producer is confronted with the choice whether to compete or not to compete. If he decides to compete, he will adjust his selling price to that of the competition, and will try to restore profitability through horizontal arbitrage. If he decides not to compete, he will drop out of the rank of the producers of x and another man with a lower selling price will take over as the marginal producer of x. In either case the bid price will get lowered, with the asked price (driven by bid/asked arbitrage) to follow hard on its heels. This is what happens in the case when competition is keen. When competition is dull, the marginal producer may prevail in his effort to hold the bid price.

Analogously, competition of the consumers may or may not have the effect of raising the asked price. But *the two cases are far from being symmetrical.* In fact, the rise in the asked price has an additional consequence. Unlike the lower bid price, a higher asked price tends to widen the vertical spread. This will bring out new competition for the producers. Thus price rises caused by increased consumer demand are mostly temporary, lasting only as long as it takes for the producers to adjust. By contrast, decreases in prices due to increased production, to the extent they reflect technological improvements and increased productivity, are mostly permanent (*cf.* the dramatic fall in the price of personal computers). This is the *feedback-effect*: increased competition on the part of the consumers brings about increased competition on the part of the producers. Note the absence of a feedback in the opposite direction. *The dominant role in the process of price formation belongs to the consumer.* The role of the producer is subordinate. Because of this bias in favor of the consumer and to the prejudice of the producer, the marginal utility of x may be considered the primary factor in the

formation of the price of x, while the marginal productivity of producing x is secondary. The lack of symmetry between the two types of arbitrage can also be described as the *supremacy of the consumer*.

Critique of equilibrium analysis

The superiority of marginal analysis over the conventional supply/demand equilibrium analysis of price formation is clear. The latter is a pale, one-dimensional shadow of reality. It looks at the consumer good (together with its price and quantity) in total isolation. It doesn't admit any insight into the effect on price formation of alternative inputs or outputs, nor can it handle producer-induced changes in quality. By contrast, the marginal analysis of price formation presents a three-dimensional image of reality in living color. It takes the inter-dependence of prices with those of alternative consumer goods at the output level, and with those of alternative producer goods at the input level, into full account. It can handle the problem of producer-induced changes in quality. Marginal analysis puts the market process, and the role of arbitrage in it, into high relief.

F. A. Hayek in *Prices and Production* and Ludwig von Mises in *Human Action* clearly recognized the entrepreneurial activity of the producers in setting up vertical straddles to address selected vertical spreads (of course, they used different terminologies). The adjective "vertical" relates to the vertical structure of goods due to Menger, elaborated in Israel M. Kirzner's *Market Theory and the Price System*. This is a classification of goods according to their remoteness from the final consumer. Thus consumer goods are of the first order, while those goods that enter into the input of the production of consumer goods are of the second. More generally, goods that enter into the input of the production of n-th order goods are of order $n + 1$. In calling the market position of the producer with commitments to buy an $(n + 1)$-st order good and to sell an n-th order good a "vertical straddle", we have simply extended Menger's original terminology.

Horizontal straddles and spreads are understood in exactly the same sense. The choice of the adjective was inspried by Kirzner's concept of "horizontally related goods and markets" mentioned in [4]. In his book *Competition and Entrepreneurship* Kirzner also provides an important example of a horizontal straddle. It is the market position of the producer of the consumer good y who discovers that consumers are willing to pay more for y', another consumer good that he can also produce out of the same input basket x. Accordingly, he switches production *from* y to y' increasing profitability. Notice that the producer has created a one-legged horizontal straddle at the level of first-order goods, with the significant leg being the initial short leg y'. Of course, a producer of n-th order goods can also avail himself of the services of one-legged horizontal straddles, in order to improve profitability. Complementary to this is another type of horizontal arbitrage, that will play a role below in the marginal analysis of the formation of the asked price of n-th order goods. The producer may want to increase profitability by replacing his input basket x by a cheaper one x'. In the latter case the producer's horizontal straddle is at the level of $(n + 1)$-st order goods; in the former, it is at the level of n-th order goods. By a simple extension of this terminology to the level of first order goods we may also call the market position of the consumer, in shifting his custom from one consumer

good to another, a one-legged horizontal straddle.

None of the aforementioned authors referred to these entrepreneurial activities by the name arbitrage. But to do so is helpful in the present context, as it brings out the important common element in the otherwise diverse activities of the entrepreneurs, and it makes the classification of entrepreneurial activities possible. By the same token, consumer buying should also be recognized as an instance of horizontal arbitrage. After all, every purchase is an explicit choice involving the implicit rejection of the nearest substitute. It is true that the savings that arise out of the consumer's horizontal arbitrage are not normally regarded profits. There is no need to quibble over semantics. At any rate, it would appear inconsistent to dismiss the consumer's activity of comparing prices and quality before buying as being non-entrepreneurial in character, having accepted as entrepreneurial the producer's analogous activity of shopping around for alternative inputs — which certainly makes a direct contribution to profitability.

Price formation of producer goods

Marginal analysis is readily extended to the formation of the asked and bid prices of higher-order goods. The former is the outcome of competition of the users of *n*-th order goods doing horizontal arbitrage, at that level, in terms of one-legged straddles. In more details, *the asked price of the n-th order good x marks the point where the opportunity cost of buying an additional unit of x becomes critical to the marginal user of x. He is the first among the producers of goods of order n — 1 to refuse to buy the uptick in the price of x, and the reference is to his opportunity to buy a substitute, another producer good x' of order n instead.*

The bid price of the producer good *x* is the outcome of competition of the producers of *n*-th order goods, doing vertical arbitrage between goods of order *n* and *n* + 1 using two-legged straddles. In more details, *the bid price of the n-th order good x marks the point where the opportunity cost of selling an additional unit of x becomes critical to the marginal producer of x. He is the first among the producers to refuse to sell the downtick in the price of x, and the reference is to his opportunity to refuse to buy the producer good y' of order n + 1, the input in his production line of x .*

We have noted earlier that the role of the consumer is dominant, while that of the producer is subordinate in the process of price formation. The same distinction extends to the producers of higher ordered goods as well. The role of the producer who is less remote from the ultimate consumer is dominant, and that of the more remote one is subordinate. From this remark the principle of imputation can be easily derived.

Of course it may happen that a higher order good serves as input for the production of several different higher-order goods at different levels. For a long time coal has served both as a consumer and a producer good. Platinum is a second order good in artistic applications (making jewelry) but it also serves as a higher order good in industrial applications (making catalytic converters). Whenever a product serves both as an *m*-th as well as an *n*-th order good, we may assume that the formation of the asked and bid prices

takes place at both levels. If there is a substantial difference in the results, multilateral arbitrage will close the spread between the gaping prices. (Exception: negotiated prices for industrial applications. For example, it is known that the platinum-mining industry sells most of its production at negotiated prices which are normally set below the free market price. Not only does the mining industry lock in a price in this way, but it also carves out a market share in advance. The contract must specify that the industrial consumer is prohibited from reselling platinum on the free market — otherwise the intentions of the mining industry would be thwarted.)

In the second part of this paper we discuss the problems of competition, entrepreneurship, and profit in the light of arbitrage. It will appear that introducing arbitrage as the generic form of human action, that underlies all the multifarious activities of entrepreneurs in pursuit of pure entrepreneurial profit, is insightful. It focuses attention on what is important, while deemphasizing what is less important or unimportant in the activities of entrepreneurs, when studied from the point of view of the market process. It also admits classification of entrepreneurial strategies to generate profits into defensive (retrospective) and aggressive (prospective) strategies.

Horizontal arbitrage and retrospective strategies to defend profitability

As we have seen, producers of goods of order n act as arbitrageurs on three counts. They do vertical arbitrage between goods of order n and $n + 1$, and they do horizontal arbitrage between goods of order n (level of output), as well as of order $n + 1$ (level of input). Different types of arbitrage have different roles to play in the market process. First we look at the role of horizontal arbitrage.

As a direct result of production, vertical spreads will narrow, squeezing profits. This effect is natural, it is to be expected, and all producers should be fully prepared to meet the challenge presented thereby. Eroding profitability can be restored, at least to some extent, through horizontal arbitrage at either end of the production line. The alert producer will explore alternative inputs, as he will also explore alternative outputs, compatible with his existing plant and equipment.

This retrospective (or defensive) strategy aiming at the restoration of profitability can be described as horizontal arbitrage in terms of one-legged straddles, as we may recall. If the producer replaces his input basket x by a cheaper one x', he is working with one-legged horizontal straddles at the level of producer goods, with the significant leg being the long leg x'. Alternatively, if the producer replaces his output y by another y' which uses the same input but which is expected to command a higher price, he is working with one legged horizontal straddles at the level of consumer goods, with the significant leg being the short leg y'.

One sign of eroding profitability is that the production plant is not operating at full capacity. Cutting the price of x outright at a time when profits are squeezed might be a short-sighted strategy, since it is likely to be counterproductive. (While not a suitable defensive strategy, price cutting might be effective as an aggressive strategy to increase market share.) But the producer may have recourse to horizontal arbitrage as a more appropriate defensive strategy. Variation

in product quality, complementing variation in price, is an important device to improve profitability. The producer puts an alternative product on the market, say, a higher-quality edition x' of x that could be sold at a higher price with only a small increase in cost. Suppose the capacity of the plant is 100 units, but only 60 units of x are sold at the price of \$3, grossing \$180 per day. The producer can try to sell 30 units of x' at the price of \$4, and cut the price of x to \$2 in the hope that he could increase his sale of x to 70 units, while increasing his gross intake to \$240 per day and, incidentally, achieving full capacity utilization. The producer could afford to spend an additional \$1 per unit of x' to increase quality. If he did, his total profit would still be higher (as long as he can keep the cost of input to less than \$1.25 per unit of x).

Thus variation in product quality in combination with variation in price is an important tool to compensate for the erosion of profitability, and the way to do it is through horizontal arbitrage. We may note in passing that increasing sales will increase profitability on two counts: (1) a larger number of units sold ought to mean larger total profit, (2) as the depreciation schedule for capital equipment falls upon a larger number of units sold, the depreciation quota per unit of production becomes smaller. But the depreciation quota is a cost, and it must enter the input basket. Thus a smaller quota implies higher profit per units sold.

Vertical arbitrage and prospective strategies to reap pure entrepreneurial profits consistently.

Forward-looking strategies become important when defensive strategies no longer suffice to protect profitability. As pure entrepreneurial profits are ephemeral and elusive, it is incumbent upon the alert producer-entrepreneur to make timely preparations for the day when his vertical spread has been exploited to the extent that profitability can no longer be restored by horizontal arbitrage. At that point he must abandon his vertical spread. He must scrap his equipment. He must find a new, wider, and more promising vertical spread waiting to be exploited. He must buy new equipment. He must set up his new production line.

It is possible to continue production without the benefit of pure entrepreneurial profit indefinitely. But it involves taking capital losses periodically. Let's assume that the proceeds from sales are sufficient to cover the cost of all resources expended in the production effort in full, with the sole exception of the return to capital invested. Capital can no longer be amortized according to the original amortization schedule. Its value must be revised downward so that the insufficient return can continue to amortize the reduced capital value at the current rate of interest. It is probably true that today a large part of productive activities in the world is carried on without the benefit of pure entrepreneurial profit. The resulting capital losses are simply passed on to the shareholders, who are forced to absorb it in the form of a reduced dividend income. Note also that marginally profitable enterprises are at the mercy of the rate of interest. Any rise in that rate would render

the enterprise submarginal (i.e., a loss-maker). The profit margin is seen as the very cushion sheltering the enterprise from an untoward rise in the rate of interest.

But of the greatest importance to us are precisely those rare enterprises that can, thanks to alert entrepreneurship, generate pure enterpreneurial profits consistently. Mark the word "consistently". It is one thing to make pure entrepreneurial profit sporadically; it is quite another to make it consistently. As we have seen, the skill to make profit consistently is crucial for the manager of a corporation. It is precisely these profits that shelter the shareholders from suffering capital losses. This is an important aspect, not sufficiently recognized in the scholarly literature, of the *social* role of pure entrepreneurial profits in the modern world, where most production takes place within the corporate framework, and where most retirement pension plans depend on the integrity of the dividend income derived from the ownership of industrial shares. The pension plan will have to declare bankruptcy eventually if the stocks in its portfolio are exposed to periodic capital losses. Today we can hear a great deal of exhortation concerning the need to prod firms to be "good corporate citizens" — to wit: worry about profits less, and worry about civic duties more. The loose talk about "civic duties" misses the point completely. Profits *are* to be worried about indeed, because they are ephemeral and elusive, opportunities to generate them are hard to find, and because profits play such an important social role in protecting the source of income for the retired segment of the population.

What is the "secret" of those entrepreneur-producers who can consistently generate pure entrepreneurial profits? The secret is found in their strategy to shift their production line in a timely fashion through four-legged vertical straddles.

First of all, the provident producer must be aware that profits are ephemeral. He must understand that the more successful he is in producing the consumer good, the faster the vertical spread he is addressing will be eroded, and the greater his need to find an alternative vertical spread will become. The temptation is ever present for the successful producer to rest on his laurels, and to continue doing what he has been successful in doing. However, in the real world of ephemeral profits such a strategy is bound backfire. The initially successful producer, unless he is on his toes at all times, will turn out to be a failure after all.

Secondly, the provident producer must set his depreciation quotas high enough so that they also cover the possibility of his plant and equipment becoming obsolete prematurely. The useful life of plant and equipment is not determined solely by physical criteria having to do with wear-and-tear. It could also be shortened by virtue of shifting consumer preferences. To be sure, higher depreciation quotas will increase costs, thus reducing pure entrepreneurial profit. But this part of lost profits may be recaptured later, after the value of plant and equipment will have been written off completely, when depreciation cost no longer weigh input down. The producer who is in the the habit of setting his depreciation quotas by relaxed standards is living in a fools' paradise.

Furthermore, the provident producer will also set aside a quota dedicated to research and development (R&D). These funds are dedicated to support the inventor

and the technologist to develop new products and better production methods. This will help slowing down the erosion of profitability later, and offer a better chance of finding new profitable spreads. To be sure, R&D quotas will increase costs and thus reduce profitability. But it would be short-sighted to try to do without them, as they are the very goose to lay the golden egg of future profits. If there is no room for R&D funds in view of insufficient profits, then production probably cannot be justified in its present form.

But above all, the provident producer is very much alive to the fact that the vertical spread he has set out to address is shrinking relentlessly, forever squeezing profits. He is making timely preparations for the day when his vertical spread is exploited in full, forcing him to move to greener pastures. He is constantly on the look-out for wider and more promising vertical spreads, waiting to be exploited. When the day comes, he will be ready. He will stop producing x and start producing x'.

It is a frequent objection that switching from one production line to another is a costly move. It involves scrapping the old plant and equipment suitable for producing x, and buying new ones suitable for producing x'. Scrapping may mean large losses, in view of low scrap values relative to the high value of new equipment (hence the phrase "inconvertible capital"). The objection is not valid. These losses arise precisely because depreciation quotas for the plant and equipment to produce x have been set too low. Had they been set with greater foresight, their full value would have been written off by the time the switch fell due, and there would have been no losses on that account. When plant and equipment is fully amortized, the vertical spread gets wider (by the amount of amortization no longer charged). But this once-in-a-lifetime shot-in-the-arm is no more than a temporary reprieve. The natural shrinkage of the vertical spread is going on unabated, putting the entrepreneur on red alert that the time to make the switch in his production line is fast approaching.

The prospective (or aggressive) strategy in pursuit of pure entrepremeurial profit can be described as vertical arbitrage in terms of four-legged straddles as follows. When the producer finally makes his switch from one production line with input y and output x to another with input y' and output x', he has created a four-legged straddle with initial short leg y, initial long leg x; terminal long leg y', terminal short leg x'. Note that this is an example of the generalized four-legged straddle. The terminal legs here are not backward-looking as in previous examples where they simply liquidate the commitments created by the initial legs, but forward-looking as they are entering entirely new markets.

The calculation of pure entrepreneurial profit follows the same formula "terminal minus initial": the new vertical spread minus the old. This means that the producer can reap pure entrepreneurial profit consistently, provided that he makes a timely switch from one vertical spread to another as soon as the profitability of the former has eroded sufficiently, and provided that the profitability of the latter is sufficiently high.

Marx and Keynes have made the prophecy notorious that profitable vertical spreads will ultimately become extinct, and the capitalist mode of production will reach its state of "maximum entropy".

Only people who are utterly unable to understand the true nature of entrepreneurship could believe that. There is no reason to think that an alert entrepreneur could ever run out of profitable vertical spreads (as he may indeed run out of profitable horizontal spreads), partly because of the providence of entrepreneurs like himself earmarking funds for R&D, and partly because of the providence of others in pursuing exploration for new, cheaper, better sources of raw material and energy.

Summary

We have introduced the concepts of horizontal and vertical arbitrage for the purpose of carrying out the marginal analysis of price formation. This was done in three steps: (1) the formation of the asked price due to the horizontal arbitrage using one-legged straddles, (2) the formation of the bid price due to the vertical arbitrage using two-legged straddles, (3) the closing of the bid/asked spread due to bid/asked arbitrage. In actual fact the three types of arbitrage are carried on simultaneously and continuously. Their separation in describing theory is only justified by methodological considerations.

But the concepts of horizontal and vertical arbitrage are also useful to help understanding entrepreneurship, the phenomenon of eroding profitability, and the sources of continuing pure entrepreneurial profit. The would-be producer confronts the constantly changing landscape of spreads. In choosing his line of production he first selects a profitable vertical spread. He is well-prepared to see his spread shrink as a result of competition, squeezing profitability. He is ready to compensate for this through horizontal arbitrage. In trying to reduce the cost of his input and to raise the value of his output, he now looks at the horizontal spreads. He selects those at either end of his production line that will help him restore his profit margin. He is doing horizontal arbitrage in terms of one-legged straddles at two levels: he is shuffling his input as well as his output.

Nevertheless, sooner or later the vertical spread the producer has set out to address will be exploited to the extent that profitability can no longer be restored. At this point the producer takes a fresh look at the vertical spreads. He picks a new one that promises to be profitable, he scraps his old production line, he sets up a new one to address the new vertical spread, and the process will start all over again. The switch involves scrapping old plant and equipment and buying new ones. The producer must do vertical arbitrage in terms of four-legged straddles, with each of the four legs being in a different market. If he is not prepared to follow this procedure, pure enterpreneurial profit will certainly elude him.

The retrospective strategy of the producer aims at improving profitability; it involves horizontal arbitrage in terms of one-legged straddles; improvements in profitability can be conceptualized as the spread. The prospective strategy of the producer aims at finding new sources of pure entrepreneurial profit; it involves vertical arbitrage in terms of four-legged straddles; the pure entrepreneurial profit that arises can be conceptualized as the "spread of spreads" (terminal minus initial spread).

The secret of reaping pure entrepreneurial profit *consistently* can therefore be seen in the entrepreneur's skill

to exploit the available horizontal spreads, and in his skill to find a new, more profitable vertical spread in good time, before the old one is fully exploited.

Conclusion

The static, one-dimensional supply/ demand equilibrium analysis of price formation can be superseded by a dynamic, three-dimensional asked/bid disequilibrium analysis, once we put arbitrage into the center, and adopt the methods of marginal analysis. In this way the price- quantity nexus is replaced by the multivariate nexus of price- quantity-quality. In fact, the input and the output of production become variables in their own right, as indeed they are in real life.

No longer is there a need to pay lip-service to a spurious equilibrium between supply and demand. We still have the two poles, the consumer and the producer, and we still have a pair of opposing forces, one represented by the arbitrageur, and the other by the *marginal* arbitrageur. Price formation is still considered as the result of reconciliation between two forces. But it is more appropriate to describe ours as a *dis*equilibrium model, since the marginal arbitrageur is not a *person* but a *role* — a role that could be played by different persons from one moment to the next, and the next person may have a different set of values; different preferences, opportunities, foregone alternatives, as well as a different time horizon. When worked out in full details, our disequilibrium model of price formation can demonstrate how these differences are accommodated by the market process.

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