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ON THE THEORY OF RENT AND THE DYNAMICS OF PROFITABILITY

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Abstract

For virtually all firms, successfully setting performance targets has proven difficult, likely due to the inherent structure of their environment's competitive dynamics; multi-loop, nonlinear feedback systems. This seems especially true for firms competing with a low cost strategy, in commodity markets, because the mechanics of profitability seem simple but are actually counter-intuitive. This paper presents a dynamic Low Cost Strategy model that explicitly models the competitive dynamics peculiar to commodity markets (energy, agriculture, …etc) to investigate the dynamic causes of rent-type profit. This paper shows that a simple system dynamic model is able to confirm, and make explicit, the abstract propositions of Adam Smith, David Ricardo, John Stuart Mill, and Vilfredo Pareto in regard to Rent-type profit.

For virtually all firms, successfully setting performance targets has proven difficult, likely due to the inherent structure of their environment's competitive dynamics; multi-loop, nonlinear feedback systems. This seems especially true for firms competing with a low cost strategy, in commodity markets, because the mechanics of profitability seem simple but are actually counter-intuitive. A low cost strategy simulation model would help managers to investigate and better understand the dynamic causes of rent-type profit. This paper reviews the mechanics of economic rent and then presents a system dynamics model able to make explicit the abstract propositions of Adam Smith, David Ricardo, John Stuart Mill, and Vilfredo Pareto.

STRATEGY AND THE MECHANICS OF PROFITABILITY

The field of strategy has employed the theory of rent as a basis for arguing policies and behavior that will produce returns in excess of the "ordinary profit" rate. That is, by delineating the causal structure of profitability, one can deduce the actions necessary to formulate an effective strategy for the firm. Our ability to dictate the proper course of action is limited, then, by the extent to which we understand the causal and dynamic structure of profits. Thus, rent, as one component of profits, is integral to our understanding of strategy formulation.

The theory of rent offers a means of clarifying the consequences of the behavior of the firm given knowledge of the firm's competitive environment structure. For example, rent has been used to explain how firms can generate returns above the ordinary rate through simultaneous competition and cooperation (Lado, Boyd and Hanlon, 1997), how unique resources create sustainable competitive advantage (Peteraf, 1993), how investment in specialized assets favor vertical integration (Klein, Crawford and Alchian, 1978), why firms diversify in response to excess capacity of factors that are subject to market failure (Montgomery and Wernerfelt, 1988), and how managerial skills and expertise create sustainable competitive advantage (Castanias and Helfat, 1991).

Of rent theory, Mill states,*"It is one of the cardinal doctrines of political economy; and until it was understood, no consistent explanation could be given of many of the more complicated industrial phenomena"* (Mill, 1902; 520). The potential contributions to the understanding of market forces and the strategic behavior of the firm are likewise profound, and worthy of explication and extension. Ironically, the rent theory was created and developed in economics so that it could be eliminated from further discussion on the creation of value, and the determination of price. Because it is argued not to have an effect on these issues, the theory has, and continues to be debated (Winch, 1992). These debates have led to numerous re-definitions of the term to suit the analytical needs of various academic fields. What is needed is a means of formalizing the abstract reasoning of the last 200 years, to make explicit the causal nature of profit, and to demonstrate that the mechanics hold across time. The purpose of this paper is to investigate how System Dynamics modeling may provide the means to solve this problem.

The problem of inconsistency and ambiguity in the theory of rent

The problem begins with the premise that economic rent is not equal to profit. In explaining why this is so, researchers employ different definitions of rent. Differences in these definitions are understandable given the long, dynamic history of the development of the topic (see Bye, 1940; and Keiper, Kurnow, Clark and Segal, 1961). However, a variety of definitions are all being used at once in the field of strategy. Examples of rent theory cited in strategy research include Ricardian rent (Montgomery and Wernerfelt, 1988), economic rent (Lado, Boyd and Hanlon, 1997), monopoly rents, opportunity cost rent (Peteraf, 1993), managerial rents, (Castanias and Helfat, 1991), organizational rent (Amit and Schoemaker, 1993), Pareto and Marshall rent, entrepreneurial rent (Rumelt, 1987), systematic rent, temporary rent, quasi rent (Schoemaker, 1990), and appropriable quasi rent (Klein, Crawford & Alchian, 1978).

As noted by Marshall (1901: 410), "*This doctrine* (the rent theory) *is however difficult, and easily misunderstood*." This inherent difficulty of applying the rent theory is aggravated, I believe, by our inconsistency and this creates ambiguity. Camerer and Fahey (1990) argue that the field of strategy would benefit from a more deductive logic approach to theory development. Accordingly, when our theoretical premises are not precise, it is impossible to draw any rigorously logical conclusion (Pareto, 1897). Popper (1959, 1983) is more specific, and argues that the fundamental basis of science is the ability to falsify a premise of a theory. Thus, a theory that is ambiguous is of little value, as it may not be refuted by the evidence. The purpose of this paper is to provide a definition of the rent theory that is specific to the field of strategy, in a rigorous, explicit manner. By specific to the field of strategy I mean that the definition will focus on explaining the performance of the firm, and will be tied explicitly to Porter's (1980, 1985) generic competitive strategies. By explicit, I mean that a system dynamics model is developed: the major premises necessary to apply the argument are incorporated explicitly in a dynamic, non-linear model. In this manner, the rent theory can be refuted or updated by rejecting and modifying individual premises (in the model), consistent with Popper (1989).

This project begins with a formal description of a strategy-oriented theory of rent. To provide a basis for arguing this definition of rent, the historical definitions will be quoted to illustrate consistency or inconsistency with the theory prescribed. This theory of strategic rent encompasses the mechanics of the classical (1770-1870) economic definition of the rent concept, as well as the neoclassical period (1870-1935). Next, the specific major premises of the rent theory are presented, and a generic System Dynamics model is presented to make explicit the theoretical mechanics alluded to by Smith, Ricardo, Mill and Pareto. The analysis ends with a discussion of the causal structure of rent, competitive advantage and returns in excess of the "ordinary" profit rate. Managerial implications are discussed. In summary, the mechanics of profitability is described in three components: "ordinary" profit, monopolistic, and rent. Each is regulated by unique rules.

A STRATEGY-ORIENTED THEORY OF RENT

Strategic rent is that component of profit appropriated by owners of an input resource, when a resource is employed with advantage in the production of a commodity. Whether the resource is permanent, as in the case of land rent, or temporary, as in the case of capital rent, or intangible, as in the case of knowledge rent, each is regulated by the same principle: it is the return to that portion of productive inputs which are superior to the inputs of the producer with no advantage. This principle explains the profit-mechanics of the low-cost competitive strategy. Profit from differentiation is explained by an entirely different causal mechanism. Thus, strategic rent theory is intended to clarify the link between alternatives available to the manager, competitive advantage and the performance of the firm.

This definition of strategic rent is a synthesis of classical and neoclassical propositions of the rent theory as developed by Smith (1776), Ricardo (1821), Mill (1871), Pareto (1897), and Marshall (1901). A review of their definitions illustrates the fundamental arguments preserved in the strategy-oriented theory of rent.

Smith's "Rent."

Adam Smith (1776) states that rent is equal to the surplus, or profit in excess of the "ordinary profit" rate, received by the farmer and paid to the landlord:

"Rent, considered as the price paid for the use of land, is naturally the highest which the tenant can afford to pay in the actual circumstances of the land. In adjusting the terms of the lease, the landlord endeavors to leave him no greater share of the produce than what is sufficient to keep up the stock from which he furnishes the seed, pays the labor, and purchases and maintains the

cattle and other instruments of husbandry, together with the ordinary profits of farming stock in the neighborhood. This is evidently the smallest share with which the tenant can content himself without being a loser, and the landlord seldom means to leave him any more (Smith, 1776: 144)."

The farmer cannot appropriate a larger share of the profit because it is assumed the landlord can switch the lease to substitute farmers with no additional cost. As a consequence, the highest rent to be charged is set by the substitutes available to the farmers competing for the use of the farmland. If "ordinary" profit is a required minimum payment necessary to compensate the farmer for his or her opportunity cost of labor, then it may be treated as a cost, similar to wages, and it follows that:

"*Rent, it is to be observed, therefore, enters into the composition of the price of commodities in a different way from the wages and* (ordinary) *profit. High or low wages and profit, are the causes of high or low price; high or low rent is the effect of it. It is because high or low wages and profit must be paid, in order to bring a particular commodity to market, that its price is high or low. But it is because its price is high or low; a great deal more, or very little more, or no more, than what is sufficient to pay those wages and profit, that it affords a high rent, or a low rent, or no rent at all* (Smith, 1776, 145-6)."

It is important to note the use of the term "commodities" in the description above. If the output is not a commodity, then the output has been differentiated and some control over price exists. If any level of control exists, then price is not caused by wages and ordinary profit, a violation of the definition above. Consequently, rent applies only when the resource in question, in this case farmland, is used in the production of a commodity. This indicates an argument can be made that rent does not explain excess returns due to differentiation of the product. This argument will be developed further and made explicit below.

The assumption of a commodity output in determining rent is illustrated further when Smith (1776) explains why changes in the obstacles to production affect price:

"*The lowest price at which coals can be sold for any considerable time, is, like that of all other commodities, the price which is barely sufficient to replace, together with its ordinary profits, the stock which must be employed in bringing them to market* (Smith, 1776: 167)."

On these issues, the formulation of the strategic rent is consistent with Smith (1776).

Ricardo's "Land Rent."

Ricardo (1821) argued that Smith's definition, while essentially correct, was not rigorous enough. He felt that the vague definition allowed inappropriate conclusions to be drawn, and set about defining the rent theory in a manner that would be difficult to misinterpret. It is likely due to the clarity and rigor of Ricardo's definition that the theory of rent is more often attributed to him rather than Smith, or other early developers of the theory (for a review of the history of the rent theory see Buchanan, 1929).

Ricardo (1821) emphasized four major points: rent of land is attributable to *the indestructible power of the soil*, rent is not equal to profit, land is heterogeneous in quality, and rent does not determine price.

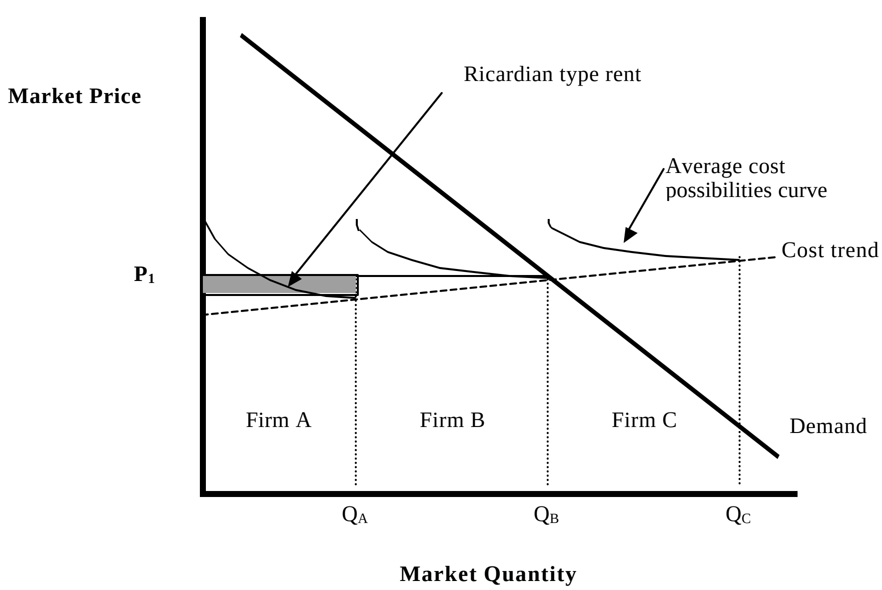
Ricardo was opposed to the attribution of rent to aspects of land other than (what he believed to be) the indestructible power of the soil: "*...whenever I speak of the rent of land, I wish to be understood as speaking of that compensation which is paid to the owner of land for use of its original and indestructible powers* (Ricardo, 1821: 34)." This emphasis is essentially driven by the argument that all other attributes deplete over time, and the cost of replacement must be deducted from the rent.

In emphasizing that rent was not equal to profit, Ricardo recognizes that the causal structure of rent and ordinary profit are entirely different: "*...the laws that regulate the progress of rent are widely different from those which regulate the progress of* (ordinary) *profits, and seldom operate in the same direction* (Ricardo, 1821: 34). Consequently, he argues that it is necessary to distinguish between the two in order to understand and predict the dynamic impact of external events on the financial performance of farms.

To clarify the difference between rent and ordinary profit, Ricardo argues that rent is caused by differences in the productivity of farmland: *"It is only, then, because land is not unlimited in quantity and uniform in quality, and because, in the progress of population, land of an inferior quality, or less advantageously situated, is called into cultivation, that rent is ever paid for the use of it. When, in the progress of society, land of the second degree of fertility is taken into cultivation, rent immediately commences on that of the first quality, and the amount of that rent will depend on the difference in the quality of these two portions of land.*

When land of the third quality is taken into cultivation, rent immediately commences on the second, and it is regulated as before by the difference in their productive powers (Ricardo, 1821: 35)." Because rent is argued to be a function of the differences in the productiveness of the land, Ricardo's theory of rent is often labeled "differential rent" or "efficiency rent." (Figure 1).

Figure 1
Rent: One Component of Profitability



This notion of differences between firms (farms) is a deliberate violation of the traditional "purely" efficient market assumption (Chamberlin, 1962), but is entirely consistent with the resource-based view of the firm (Barney, 1991; Wernerfelt, 1984). That is, competitive advantage is attributable to *ex ante* and *ex post* market failure caused by differences in resources employed by the various producers (Chi, 1994). However, efficiency rent applies only to producers of a commodity. Thus, land rent explains the producer surplus resulting from a low cost competitive advantage. That is, the output is undifferentiated so any excess returns are attributable to differences in production costs between firms.

The efficiency rent assumption of a *commodity output* is reflected in Ricardo's argument that the "marginal producer," or least efficiently produced unit, sets the price (exchangeable value) and consequently establishes the benchmark for all other producers to measure their efficiency rents:

"*The exchangeable value of all commodities, whether they be manufactured, or the produce of the mines, or the produce of the land, is always regulated not by the less quantity of labour that will suffice for their production under circumstances highly favorable, and exclusively enjoyed by those who have peculiar facilities of production; but by the greater quantity of labor necessarily bestowed on their production by those who have no such facilities; by those who continue to produce them under the most unfavorable circumstances; meaning -- by the most unfavorable circumstances, the most unfavorable under which the quantity of produce required renders it necessary to carry on the production* (Ricardo, 1821: 37)."

Further, the commodity output premise is essential to the argument that rent does not cause, or determine price: *"Raw material enters into the composition of most commodities, but the value of that raw material, as well as corn, is regulated by the productiveness of the portion of capital last employed on the land and paying no rent; and therefore rent is not a component part of the price of commodities (Ricardo, 1821: 41)."*

Thus, the major premise of the differential rent theory is: when the sum of all costs to produce a commodity by firm " A" are less than the sum of the costs of the least efficient producer, firm "B," firm A will posses a low cost competitive advantage and earn rent equal to the difference between costs of these two firms: "*Without multiplying instances, I hope enough has been said to show whatever diminishes the inequality in the produce obtained from successive portions of capital employed on the same or on new land tends to lower rent; and that whatever increases that inequality, necessarily produces an opposite effect, and tends to raise it* (Ricardo, 1821: 44)." This is consistent with the resource-based view arguments on the sustainability of a competitive advantage: when an advantage can be transferred between firms on equivalent cost terms, or imitated by rivals, the advantage diminishes and is ultimately eliminated.

Without multiplying instances, I hope enough has been said to show that the strategic rent definition described above is consistent with Ricardo's "efficiency rent" basis for determining the unique performance of the firm.

Mill's "Rent"

John Stuart Mill's (1871) theory of rent is based on the efficiency rent argument of Smith and Ricardo: "*Any land yields just as much more than the ordinary profits of stock, as it yields more than what is returned by the worst land in cultivation* (Mill, 1871; 425)."

Mill, like Ricardo, was concerned with clearly defining the logic of the rent theory, but unlike Ricardo, Mill believed that definitions could be too specific and consequently lose their general utility: "*We must never forget that the truths of political economy are truths only in the rough: they have the certainty, but not the precision, of exact science* (Mill, 1871; 428)."

Mill recognized that efficiency rent can be applied to any inputs to the production of a commodity, not just to land. In the following, Mill discusses efficiency rent appropriated from a cost advantage driven by a patent, or trade secret:

"Cases of extra profit analogous to rent, are more frequent in the transactions of industry than is sometimes supposed. Take the case, for example, of a patent, or exclusive privilege for the use of a process by which cost of production is lessened. If the value of the product continues to be regulated by what it costs to those who are obliged to persist in the old process, the patentee will make an extra profit equal to the advantage which his process possesses over theirs. This extra profit is essentially similar to rent; and sometimes even assumes the form of it; the patentee allowing to other producers the use of his privilege, in consideration of an annual payment (Mill, 1871; 476)."

In this case the efficiency rent is temporary, lasting only as long as the patent protection or until the patent no longer provides a "cost of production" advantage. However temporary the nature of the effect, the mechanics of efficiency rent are unaffected.

In another example, Mill applies efficiency rent to intangibles, such as knowledge: "*The extra gains which any producer or dealer obtains through superior talents for business, or superior business arrangements, are very much of a similar kind* (Mill, 1871; 476)." This is consistent with the knowledge-based view, and helps clarify the causal link between differences in business knowledge and superior performance of the firm (Grant, 1996).

Ultimately, Mill argues that any resource or capability may be exploited in a manner explained by efficiency rent if used to achieve a production advantage: "...*any difference in favor of a certain producers, or in favor of production in certain circumstances, being the source of a gain, which, though not called rent unless paid periodically by one person to another, is governed by laws entirely the same with it* (Mill, 1871; 477)."

As a final note, one premise of rent is that *cost is reduced* relative to at least one other producer of the commodity. Mill discusses this issue in general: "*Rent is the extra return made to agricultural capital when employed with peculiar advantage; the exact equivalent of what those advantages enable the producers to economize in the cost of production: the value and price of the* *produce being regulated by the cost of production to those producers who have no advantages; by the return to that portion of agricultural capital, the circumstances of which are the least favorable* (Mill, 1871: 691)."

The definition of strategic rent is designed to reflect the efficiency rent proposed by Ricardo, but with the broader, all encompassing application of differential rent to any advantages enabling the producer to economize on the cost of production, proposed by Mill.

Marshall's "Quasi-rent"

In the field of strategy, the justification for broad application of efficiency rent is typically attributed to Alfred Marshall, rather than Mill. Marshall's (1901) treatment of rent is more concise than Mill, but is essentially the same. Marshall's rent is based on efficiency advantage, consistent with Smith-Ricardo-Mill. Marshall's noteworthy distinction was to separate "true" land rent, from "quasi-rent" which could be safely applied to any advantages enabling the producer to economize on the cost of production. In this way, Marshall absolved us from violating Ricardo's strict rules of land rent:

"*The net incomes derived from appliances for production already made, may be called their* quasi-rents: *partly because we shall find that, when we are considering periods of time too short to enable the supply of such appliances to respond to a change in the demand for them, the stock of them has to be regarded as temporarily fixed. For the time they hold nearly the same relation to the price of the things which they take part in producing, as is held by land, or any other free gift of nature, of which the stock is permanently fixed; and whose net income is a true rent* (Marshall, 1901: 408)."

Consistent with Mill, Marshall (1901) encourages the application of efficiency rent to all aspects of production, including intangible resources: "*Appliances for production are of many* *different kinds: they include not only land, factories and machines, but also business ability and manual skill* (Marshall, 1901: 409)."

The definition of strategic rent is designed to be consistent with the general, wide applicability of Marshall's quasi-rent. Unlike Marshall, strategic rent does not assume a distinction between resources that are temporary and fixed. Strategic rent assumes that no resources are permanently fixed; even soil is not indestructible. The assumption is that certain resources may be continuously repaired, maintained, or developed. Consequently, with proper planning rent generating resources may last indefinitely, approximating a permanently fixed advantage. However, the mechanics of strategic rent are unaffected by the life span of the cost advantage.

Pareto's "Rent"

Vilfredo Pareto (1897) is often cited in the Strategy literature as justification for defining rent as a type of opportunity cost/profit, rather than an efficiency rent. That is, rent is described as an economic value representing the difference between the employment of a resource in its first best and next best, alternative use. The attribution to Pareto of rent as opportunity cost is incorrect, for two reasons: 1. Pareto's theory of rent is based on efficiency rent, and 2. Rent defined as opportunity cost requires the employment of efficiency rent to calculate the basis of the cost; a logical contradiction.

Pareto's distinction in the rent theory is primarily: 1. Recognizing that the rent exists even when the farmer owns the farmland. 2. That all producers may earn a rent, and 3. That rent affects price, indirectly.

Strategic rent is based on Pareto's argument that the amount of rent that would be appropriated by the landlord, is appropriated by the entrepreneur when the entrepreneur owns the land he or she farms. This translates into surplus earnings explained exactly by the efficiency rent theory, even though no rent is actually paid (it is internalized):

"*We have, for example, two plots of ground the first of which, with an expenditure of 100, produces 6 wheat, the second, 5; the price of wheat is 20 francs. The first plot has a rent of 20, the second of zero. In an organization where there is an owner* (of the farm land)*, an entrepreneur* (the farmer)*, and a consumer, the consumer pays 220 for 11 of wheat; of this amount 20 goes to the landowner as rent, 200 francs are expenses. The cost of production, for the entrepreneur, is equal to the selling price, it is 20.*

If there is only a single person who is landowner, entrepreneur, and consumer, this quantity of 11 wheat is produced with an expense of 200, and each unit costs 18.18. The cost of production is no longer the same as before (Pareto, 1897: 249)."

Thus, resources that provide a low cost advantage produce rents, but rents that are never paid out. The rent is internalized as profit above the normal rate. Such rent can only accrue to the firm if the resource can be acquired or developed with low cost advantage, ex ante market failure. Further, the advantage must be protected ex post. Such acquisition, development and protection of advantages is the intended result of the strategy process: hence "strategic" rent.

Pareto (1897) took a strong position against the assumption that the worst resources brought into production of the commodity would earn zero rent, as proposed by Smith-Ricardo-Mill: "*...there can be a rent for all the landowners* (Pareto, 1897: 248)." The strategic rent theory supports this view, with the following conditions. The marginal producer may earn positive rent when barriers to entry exist (Demsetz, 1989). Alternatively, the marginal producer may earn a loss when exit barriers exist. Also, positive intra-marginal rent may be earned by the least efficient producer; the least efficient farmland earns positive rent on all its acres except the very last (worst) acre, which earns zero rent. In any case, there exist forces toward zero rent on the margin.

The final point is that Pareto believed that rent affected price. His general argument was that one effect cannot be separated from the totality of economic activity. All transactions are linked in a causal chain that cannot be completely isolated. The effect on price takes place in an indirect manner, via mobility between industry segments. Regardless, it would be another 60 years before Jay Forrester would create the field of System Dynamics (Forrester, 1961), a field that could rationalize Pareto's conviction.

A "Strategic" Rent Theory

The following are major premises of a "Strategy-based" theory of rent:

$R_{X,A} = S_{X,A} - O_{X,A} - C_{X,A}$

Where: $R_{X,A}$ *is the rent earned by Firm (x) from sales of commodity (A),*

when $R_{X,A} > 0$.

$S_{X,A}$ *is the total revenues, or sales, for firm (x) of commodity (A).*

$O_{X,A}$ *is the "ordinary" profit required for Firm (x):*

This is the minimum earnings necessary to compensate the owners' for "abstinence, risk, and management effort" (Foreman, 1919). This may be approximated by finding the firm's cost of capital in accordance with the Capital Asset Pricing Model (CAPM).

$C_{X,A}$ *is the cost for firm(x) to produce commodity (A).*

And,

$S_{X,A} = (P_A) * (V_{X,A})$

Where: P_A *is the price of commodity (A).*

$V_{X,A}$ *is the volume of firm(x) units sold of commodity (A).*

And,

$P_A = C_{M,A}$

Where: $C_{M,A}$ *is the unit cost of commodity (A) on the margin; the cost of the last Commodity (A) unit produced to fill the market demand, using the least* *efficient resource(s).*

And,

$R_{X,A} = S[C_{x,i} - C_{M,A}] = S[C_{x,i} - P_A]$

Where: $C_{x,i}$ *is the cost to produce unit (i) of commodity (A), by firm (x).*

The Rent theory assumes the premises of a perfectly efficient market (Cohen and Cyert, 1965), with the following exceptions and additions:

Premise 1. Heterogeneity of producer costs, across firms: The sum of all costs to produce a commodity are not equivalent across firms in the same market.

Premise 2. The rent generating resource is limited in quantity: scarce.

Premise 3. The output of the resource (ex: farmland) is a commodity (ex: corn, wheat, etc): all producers must accept the same price for their output.

Premise 3a. *Producers sell their output in the same market.*

Premise 3b. *Producers sell their output in the same time-frame.*

Premise 4. The last portion of the output necessary to fill the market is produced by the least efficient resources, and the cost structure achieved by these resources sets the price for the output of all producers of the commodity.

Premise 5. Constant or increasing returns to scale are not possible for all output possibilities in production of the commodity. That is, no firm faces a constantly downward sloping long-run average cost curve.

Given the above, the following System Dynamics model is presented to make explicit these assumptions, in the dynamic context alluded to by Smith, Ricardo, Mill and Pareto.

The Rent Generic-Model

In general, management is expected to be susceptible to problems with decision making when the decisions are embedded in multi-loop nonlinear feedback systems, because the human mind is not structured in a manner that accommodates such complexity (Forrester, 1971). Rent-type profit, as described by Smith, Ricardo, Mill and Pareto, is especially associated with such complex systems, and so Ricardo (correctly it seems) points out the counter-intuitive behavior of rent versus ordinary profits. System dynamic models are a means of effectively overcoming such problems of complexity (Sterman, 2000). Thus, to more effectively investigate the impacts of the interaction of competitive dynamics, non-linear demand, and the counter-intuitive mechanics of rent-type profitability, we built a dynamic simulation. The model is a system of nonlinear differential equations describing:

(i) multiple competitors that all must take the same price for their output

(ii) non-linear demand, conforming to the Pareto distribution of wealth

(iii) heterogenous cost structures; across competing firms

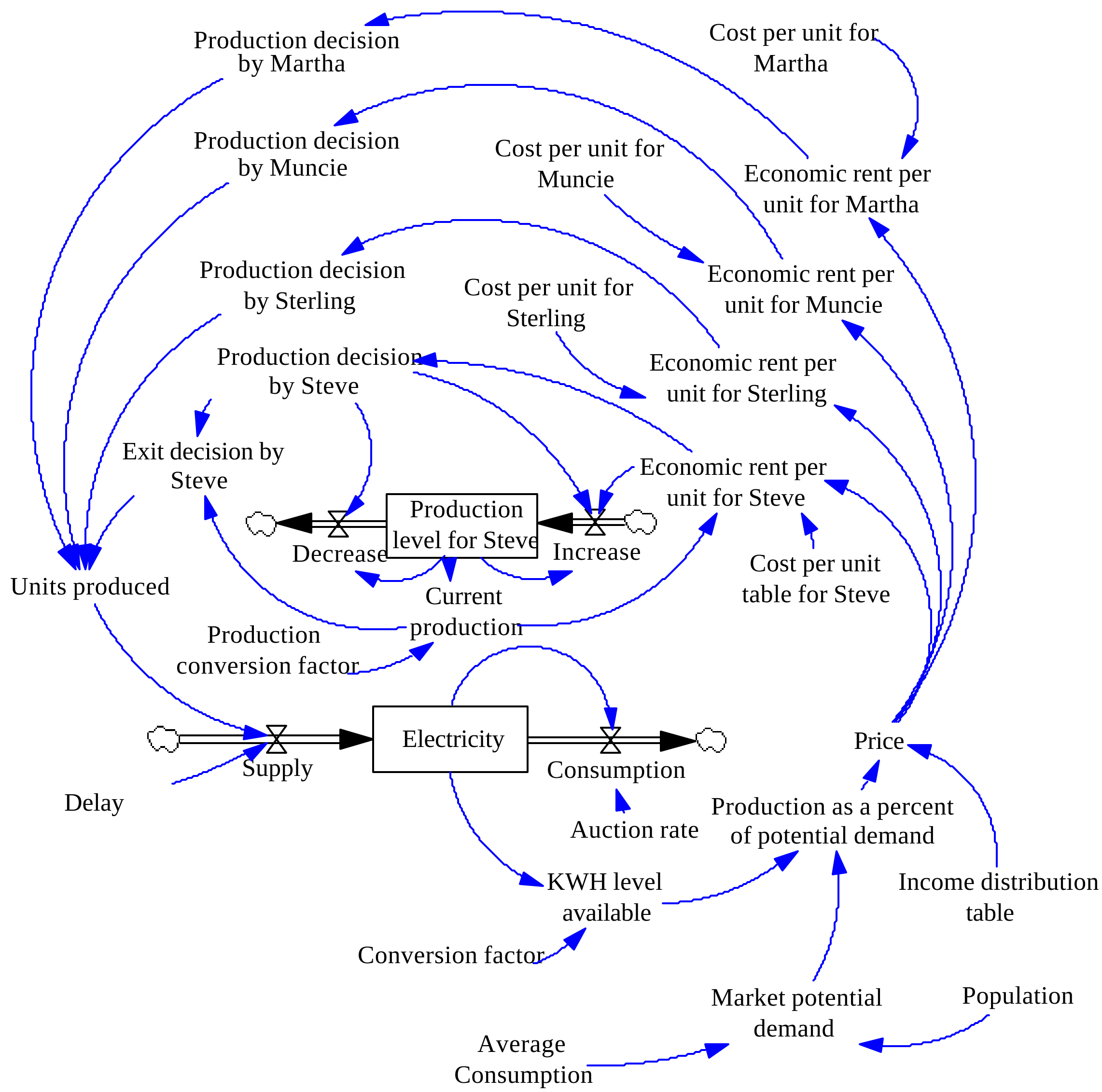
(iv) non-linear cost structure, reflecting the interaction of fixed and variable costs.

(v) an auction–type commodity market

(vi) price as a result of aggregate supply decisions, and non-linear demand

(vii) price level ultimately determined by the least efficient resources necessary to fill the market.

The variables and their interactions are based on existing theories (Smith-Ricardo-Mill-Pareto), summarized in this paper, and my own field studies (see figure below).



Modeling the Competitors

The model simulates the performance of four competing firms, in an auction market. The example here is a market for electricity; sold in kilowatt hours. Each firm is represented by a generic structure, which is customized through parameterization to reflect production cost heterogeneity across competitors.

Three of the firms, with the lowest cost structure, are modeled in a simplified form. This is because these firms are assumed to be operating at their point of maximum efficient scale, and thus have no incentive to expand or contract production as long as rent is earned. It is important to note that this is a deliberate simplification of this industry segment's growth, and the interested reader is encouraged to review Ford's (1997) more comprehensive discussion and model of electric power industry growth dynamics.

The following model variables are described using "Martha's" firm as a generic example of all three firms having the low cost advantage (Martha's, Muncie's & Sterling's):

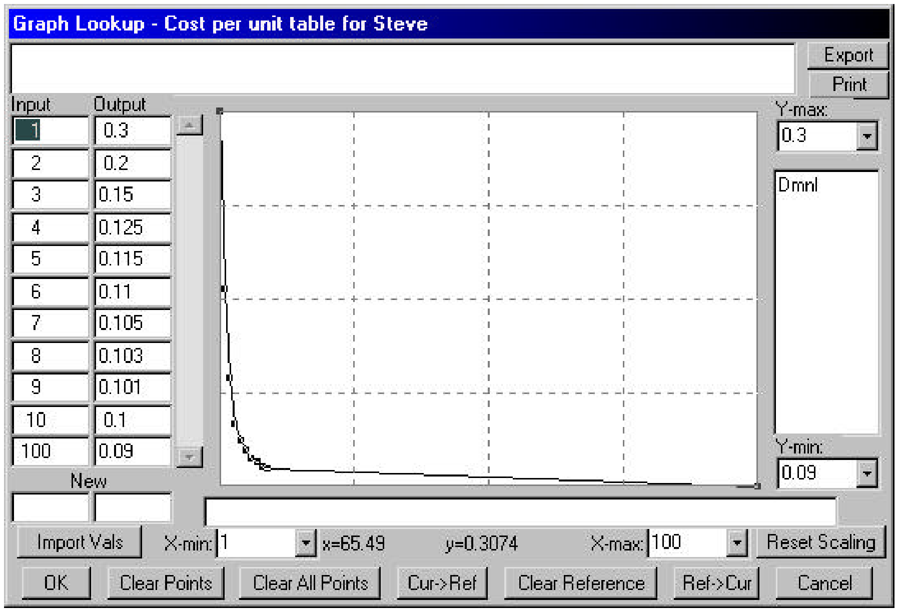
Economic rent per unit for Martha: Calculated as *Price* less the *Cost per unit for Martha*.

Cost per unit for Martha: Constant at $0.05 per KWH.

Production decision for Martha: Calculated as IF THEN ELSE(*Economic rent per unit for Martha*>0, 600000 , 0). The argument here is that the firm is operating at maximum scale efficiency, and there are no barriers to exit if rent falls below zero.

The fourth firm in this market (Steve's) is the least cost-efficient, and therefore is expected to dynamically influence the market price. Thus, this firm is modeled in greater detail:

Economic rent per unit for Steve: Calculated as *Price* less the Cost per unit for Steve. In this case, a cost table was created to reflect a non-linear cost distribution associated with alternative combinations of fixed and variable costs associated with different production levels. Specifically, rent for Steve is: Price-Cost per unit table for Steve(Current production/10000). The cost per unit table (see figure below) is designed with a generic scale of 1 to 100. Thus, the lookup for Current Production is divided by 10000 to scale the actual production levels to the table.



Production decision by Steve: Calculated as IF THEN ELSE(*Economic rent per unit for Steve* < 0, -1 , 1). The assumption here is that Steve will react when rent drops below zero, or rises to zero.

Production level for Steve. Calculated as *Increase-Decrease*. The desired effect here is to capture gradual changes in production level, over time.

Decrease: Calculated as IF THEN ELSE(*Production decision by Steve* < 0 :AND: *Production level for Steve* > 10000 , 1000, 0). The desired effect here is that Steve will cease production only if rent falls below zero and his production falls below his minimum efficient plat scale; of 10,000 units (KWH) per month. Otherwise production will decline 1,000 units per month, every month rent is less than zero. The strategy is that by decreasing the supply to the market, the price is expected to be bid upward. Reducing production is also expected to reduce losses, since rent is less than zero. However, as the production level falls, the firm's costs are expected to rise due to the change in the proportion of fixed to variable expenses.

Increase: Calculated as IF THEN ELSE(*Production decision by Steve* > 0 :AND: *Production level for Steve* < 999000, *Production decision by Steve***Economic rent per unit for Steve**100000, 0). The desired effect here is that Steve will increase production levels in proportion to the positive rent earned. For example, if Steve earned 100% rent-type profit, he would target a 100,000 unit (KWH) per month increase in production.

Current production: Calculated as *Production level for Steve/Production conversion factor*. The desired effect is to create a dimensionless variable that reflects the current production level. This is necessary to execute the lookup table for Steve's costs.

Production conversion factor: Is a constant, dimensioned as KWH, to convert *Current Production* into a dimensionless variable.

Exit decision by Steve: Calculated as IF THEN ELSE(*Production decision by Steve* < 0 :AND: *Current production* < 11000, 0 , *Current production* * *Production decision by Steve*). The desired effect is that Steve will cease production if rent falls below zero and production falls below the minimum efficient plant scale; 10,000 units (KWH) per month.

Modeling the Competitors' Auction (Commodity) Market

The model simulates an auction market. The entire output of the competitors is sold at whatever price the market will pay. In this example, the auction is for electrical power; sold in kilowatt hours, for a particular month.

Units produced. Calculated as *Production decision by Muncie+Production decision by Sterling+Production decision by Martha+Exit decision by Steve*. This is the sum of all production brought to market.

Electricity: Calculated as *Supply-Consumption*. In this model, the example is electrical power sold in units of Kilowatt Hours. The values are not assumed to be "true to scale," and are just for purpose of illustrating the system dynamics.

Supply: Calculated as DELAY1(*Units produced*, *Delay*). The desired effect is to model a delay for availability on the market. In this case, the example is Kilowatt Hours (KWH) electricity co-generation, and so the delay is not necessarily realistic, but is included because of the desire to provide a generic model that has a good basic structure to represent any commodity market. However, because power is actually sold by month in futures contracts, it is realistic to sell your power today for delivery in one or more months. Thus, in reality there does exist a delay between the purchase of the contract and delivery to the market, for those firms that buy and sell forward.

Delay: Calculated as 1 month.

Consumption: Calculated as *Auction rate*Electricity*. The desired effect is to account for the total amount of the commodity (KWH) auctioned, on average.

Auction rate: Constant at 100%. That is, 100% of the supply (electricity) available is auctioned off at the market price.

KWH level available: Calculated as *Electricity/Conversion factor*. The desired effect is to create a dimensionless variable that reflects the current KWH level.

Conversion factor: Is a constant, dimensioned as KWH to convert *KWH level available* into a dimensionless variable.

Market potential demand: Calculated as *Population*Average Consumption*. This is the measure of total aggregate consumption, if price were zero.

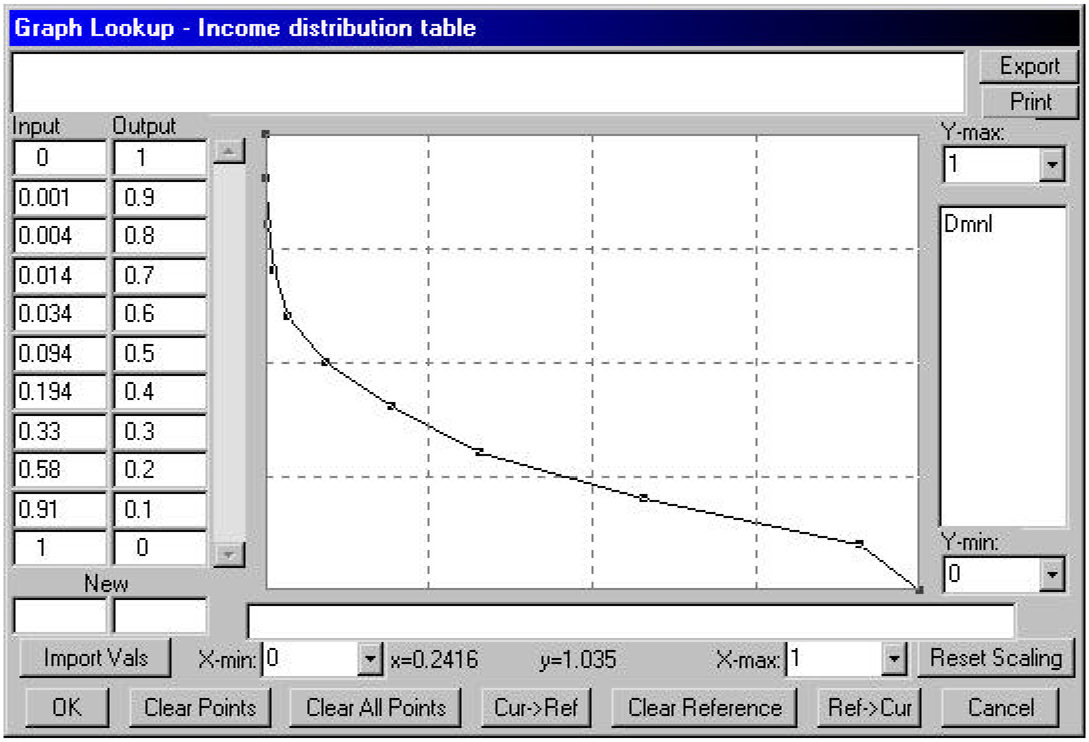
Population: Calculated as 1,000,000+STEP(100000, 30). The assumption is that this market has one million consumers. In month 30, population grows to 1.1 million. The step at month 30 is to investigate the impact of a change in population on price and profitability.

Average consumption: Calculated as 1+STEP(0.1, 60). The assumption is that each consumer would like to consume 1 KWH per month. In month 60, consumption changes to 1.1 KWH per month. The step at month 60 is to investigate the impact of a change in average consumption on price and profitability.

Price: Calculated as *Income distribution table(Production as a percent of potential demand).* The assumption here is that the market price is determined by budget available to the individuals that would consume the product. As price is a rationing mechanism, the price will be bid upward until the budget of the poorest individuals prevents them from bidding higher. When enough individuals have dropped out, supply will equal demand, the auction hammer will fall, and the price is set.

Production as a percent of potential demand: Calculated as *KWH level available/Market potential demand*. The assumption here is that a "price" is only imposed on goods and services that are "scarce" (otherwise, these would be free; like air).   The proportion of total potential demand reflects the products scarcity.

Income distribution table: Calculated as the frequency distribution specified by Pareto (1897: p285). Pareto concluded that this distribution was essentially invariant to scale. Thus, a generic distribution scale is developed here. The salient property of the distribution is that 80% of the wealth is located in 20% of the population. This distribution's non-linear shape (see figure below) is critical in correctly mapping demand. The input is the percent of the population that can be supplied by the market. The output is the price that is within the budget of the poorest consumer in the top percent-distribution of the population.



Rent Dynamics: Rent is the result, not the cause, of price

I used the model to test whether Ricardo's famous statement, "Rent is the result, not the cause, of Price" (Ricardo, 1821) could be modeled in a dynamic manner. The model has not been calibrated, and the model is very simple, but the answer at this point is yes. This will be discussed by viewing the time series graphic results for Price, Rents earned, production decisions, and aggregate supply.

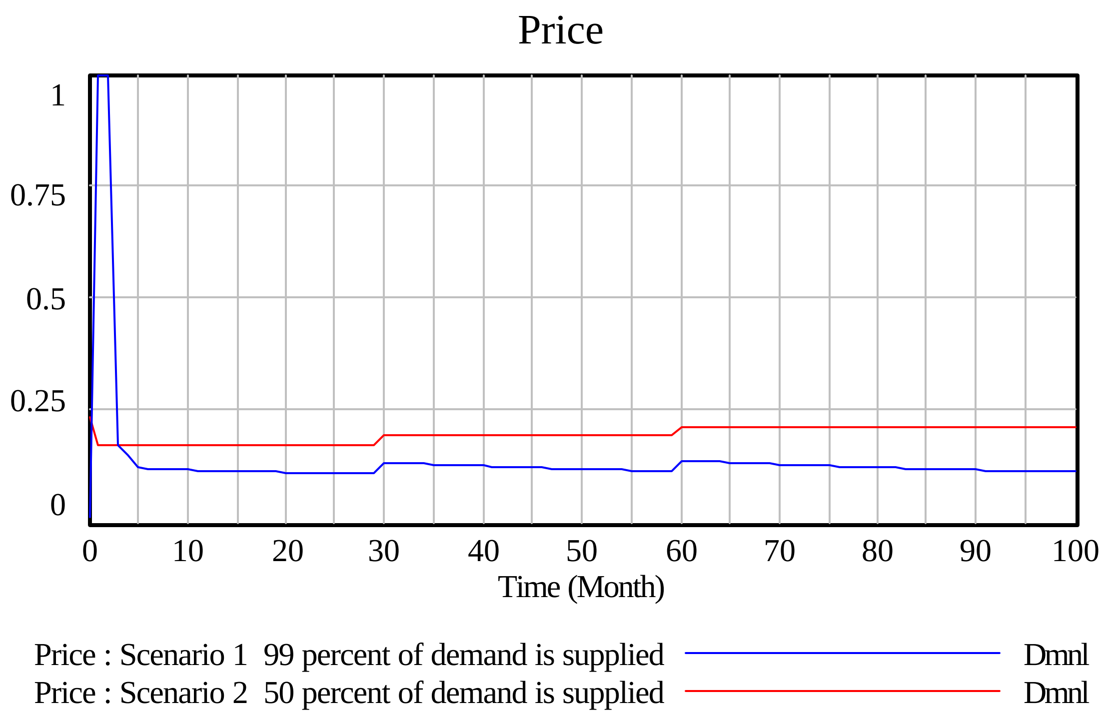
Two scenarios were simulated. Both simulated three identical "events," which shocked the system in manners that allowed observation of rent-type profit dynamics. The three events were deregulation of the market, population growth, and an increase in average consumption.

In scenario 1, at time zero, 99% of the population was provided power (perhaps via price subsidies and legal price discrimination dictated by regulatory agencies), but in month 1 the market was deregulated and price was set by supply and demand.

In the scenario 2, the simulation begins month 1 with aggregate supply sufficient to meet only ½of the total potential demand.

Within each of the two scenarios, two more “events” are created. In month 30, the population grows 10%, and in month 60 the average consumption increases 10%.

Price (of 1 KWH in a given month).

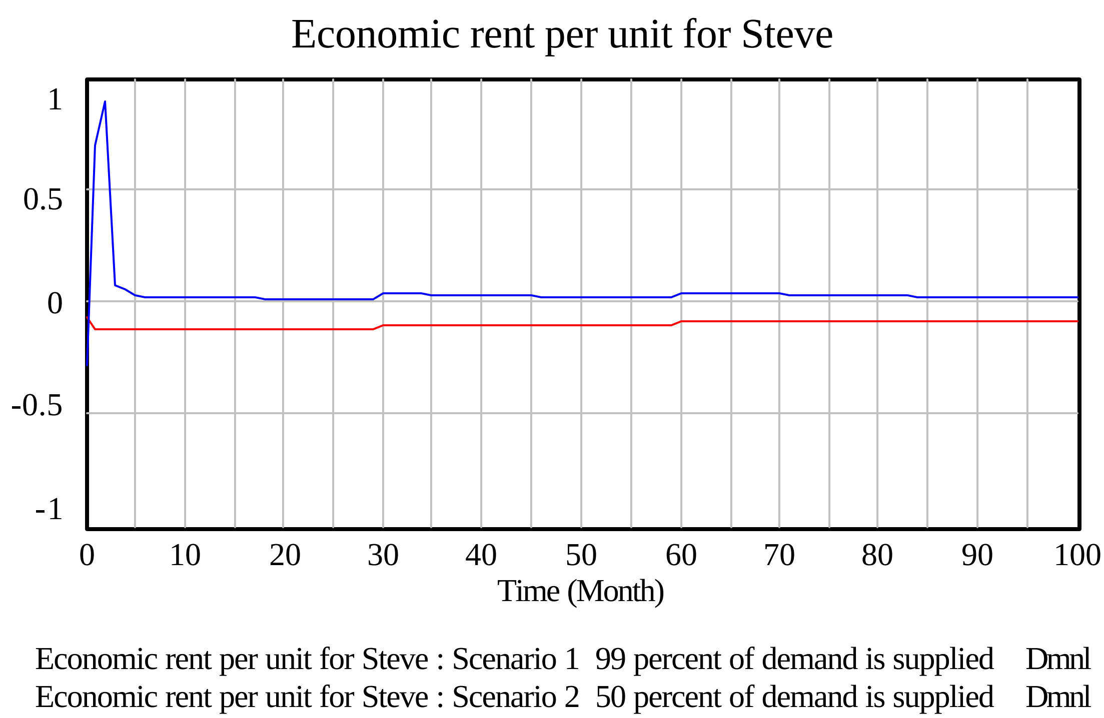


Price in Scenario 1 increases severely at first, then drops just as severely. The implication is that deregulation caused the price to crash because supply was available for 99% of the market, and this heavy supply auctioned off at a very low price. Each of the firms decides to withdraw from this market (perhaps to sell to a different market), and the massive withdrawal creates a severe shortage that causes price to spike. At this point, the market seems attractive, even to the most inefficient firms, and we see price fall again as re-entry occurs. The price almost stabilizes when at month 30 the population grows 10% and we see a price increase. Price falls again until month 60 when average consumption increases 10%. Price falls again, appearing to stabilize by month 100.

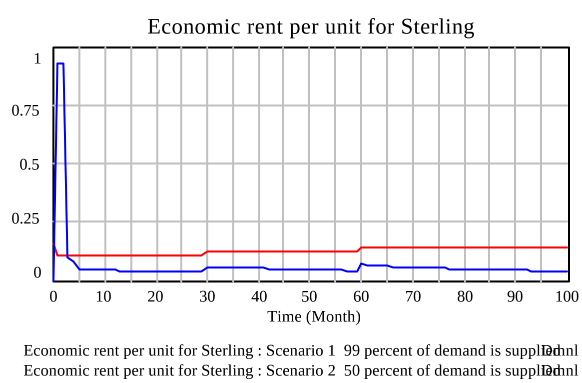
Price in Scenario 2 (begin at ½ of demand) declines at first, and then stabilizes until month 30 when the population increases 10%. At this point the price jumps and then stabilizes at a higher level. At month 60 the price rises and stabilizes again in reaction to the 10% increase in average consumption.

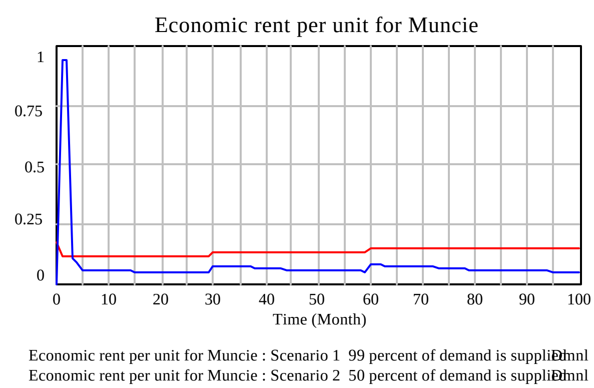
The salient question at this point is why price behaves differently at the three "events," even though the competitive "system" is exactly the same for both scenarios. Again, the only difference between these scenarios is the starting aggregate level of supply. To understand these dynamics, it is necessary to first review the rent-type profits, as this motivates the decision making of the firms.

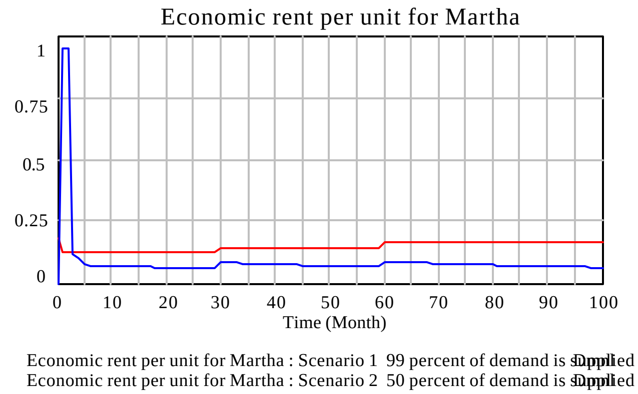
Rent Dynamics.



In scenario 1, rent is negative initially because the market price is too low for Steve to earn rent. As the market deregulates, and firms exit the market in search of profit elsewhere, supply drops to zero and the price spikes as the wealthiest individuals bid up the price in hopes of capturing any KWH available (this spike may seem unrealistic, but in actuality it is not. Several times during the Summer energy shortages in California, following their deregulation of electrical power, the free market price spiked to $999.00 per KWH…and would have gone higher but that the software used by the power market was not designed to allow more digits!).   At this high price, all firms reenter the market and earn high rent (see figure below for the rent-type profit of the competitors). Three of the four competitors enter the market at full production capacity, but Steve enters at his minimum efficient plant scale (MEPS). Steve's cost at MEPS is 30 cents per KWH, which is high compared to the next most costly competitor, Sterling, at 7 cents per KWH. Thus, Steve's production pushes supply higher and the price drops quickly toward 30 cents. With rent low now, Steve expands production, but more slowly so as not to over supply the market; push price below his cost. He will continue to expand output as long as rent is positive (note: at zero rent Steve is still earning his cost of capital, or ordinary profit requirement). Thus, we see a trend to zero rent, by month 29. At this point the price is 10.8 cents, and Steve's cost is 10.8 cents. Thus, we have replicated the proposition of Ricardo; that price is determined by, not the most efficient resources, but the worst resources able to meet the market price, if the rents of the remaining competitors are both positive (because their costs were designed to be lower than steve's) and consstently higher than Steve's (because all producers sell at the same price, and their costs were not allowed to vary).





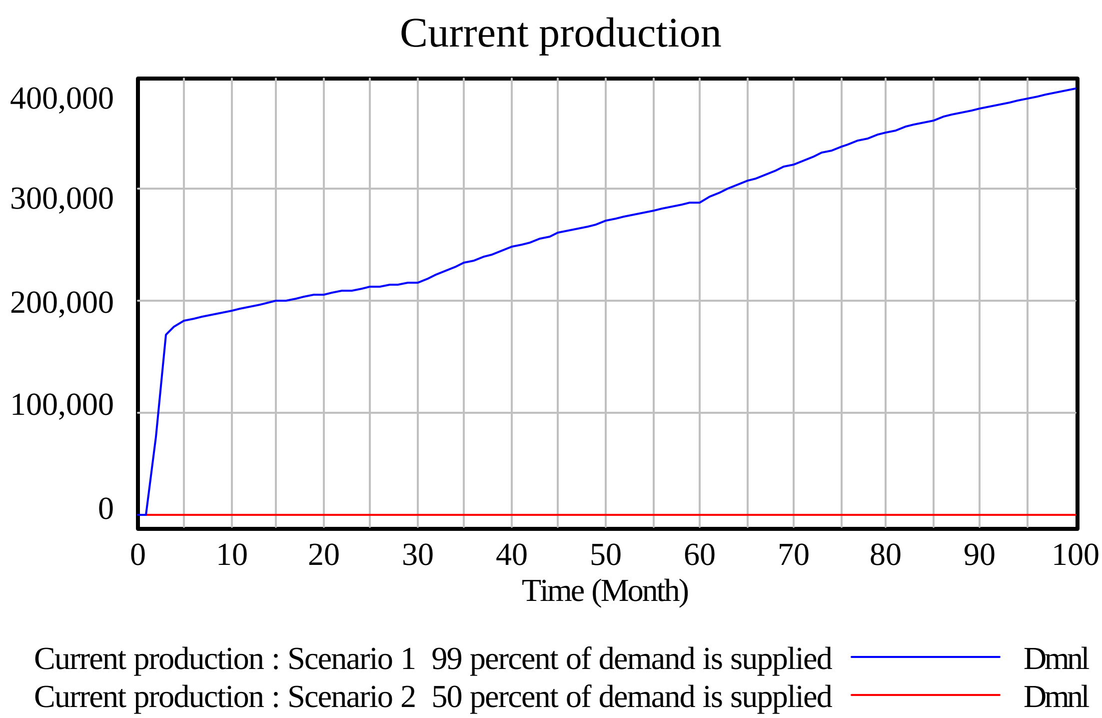


Indeed the data for Steve's competitors show that each competitor experienced the same rent-type profit dynamic, and consistently earned a greater rent than Steve. Thus, each of the competitors was affected by Steve's decisions on expanding output. As Steve expanded output his cost per unit fell, allowing him to expand further in a positive feedback loop. This growth was ultimately limited by decreasing returns to cost improvements, and decreasing prices due to the greater aggregate supply to the market. As a consequence, all the competition felt the blow to their own rent-type profits as Steve was able to expand and push the market price lower.

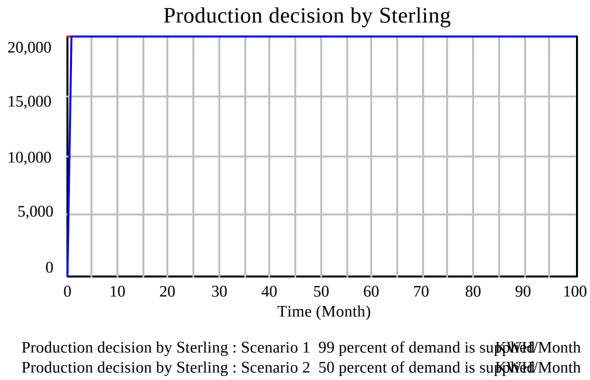
At month 30, the population grew 10% and it can be seen that this sudden increase in demand had a positive effect on profitability, however this joy was brief as Steve took advantage of the higher rent in expanding output more rapidly, thereby driving the market price back down.

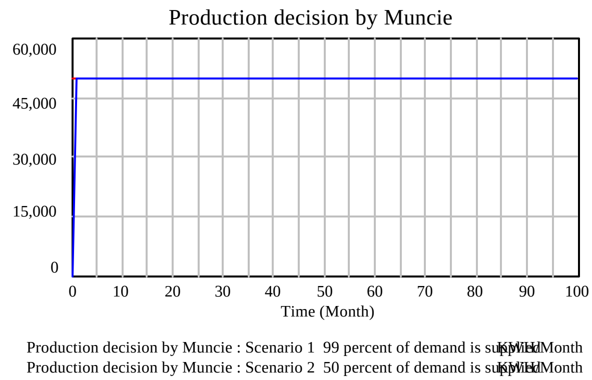
At month 60, average consumption increased 10% and the dynamic impact on profits was the same as was the case for population growth. This would be expected, to the extent that these are just two alternative events that cause the same effect; an increase in aggregate demand.

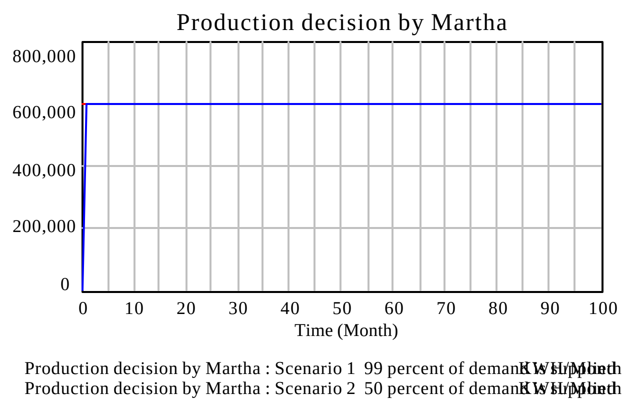
In scenario 2, the market is initially supplied at 50% of potential demand, and the profitability dynamic is quite different from scenario 1, in all three events. First, because the supply of KWH is scarce, compared to scenario 1, the price is initially higher when the market is deregulated. Thus, deregulation does not result in a free market price that is much different from the regulated price. Accordingly, the competitors all initially earn positive rents and so they all remain in the market. The price falls at bit, as all the competitors immediately change production levels to maximum efficient scales. At this point price does not change until the event at month 30, and rent is positive for all of Steve's competitors. The salient question is, why? One of the producers, the least efficient, should be earning zero rent and setting the price for the others. This is not the case. As Pareto suggested, all competitors are earning positive rent! The answer is that barriers to entry prevent Steve (and all others) from selling in the market. The barrier, in this case is the price. The price is never high enough to justify Steve's entry (price must be at least 30 cents for Steve to breakeven at MEPS). Steve never enters the market, the existing competitors are already operating at their maximum efficient scale, and supply is scarce enough to prevent price from falling to cost. Thus, all firms in the market earn a positive rent. When the next two events occur, demand increases, and price rises accordingly. Price never falls because no firm is willing to expand their output (see figure below for the production levels of each firm).



Because rent-type profit is based on efficiency relative to the unit on the margin of cost efficiency, and because Steve's firm was designed to be the least efficient producer,



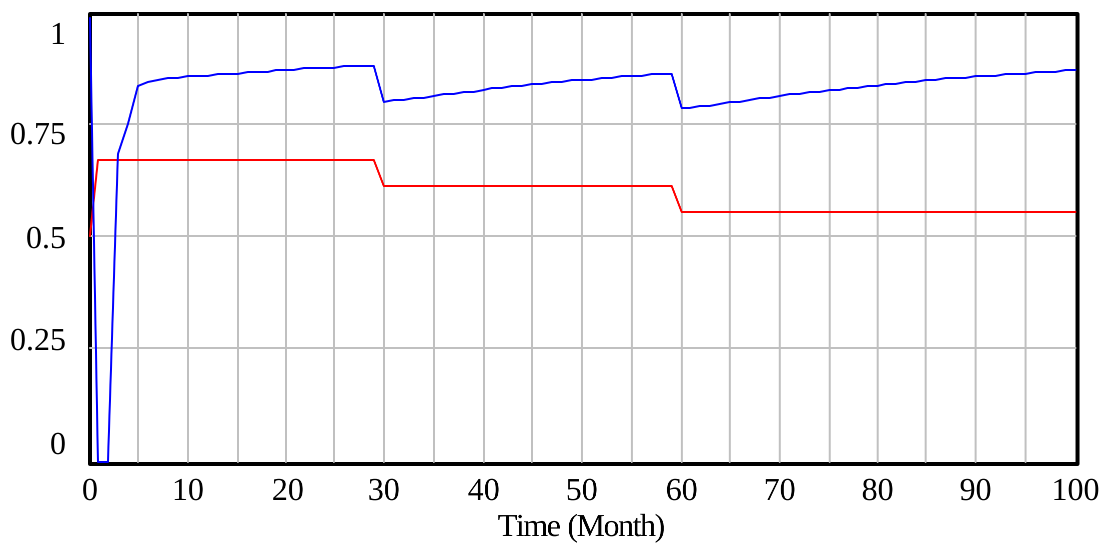




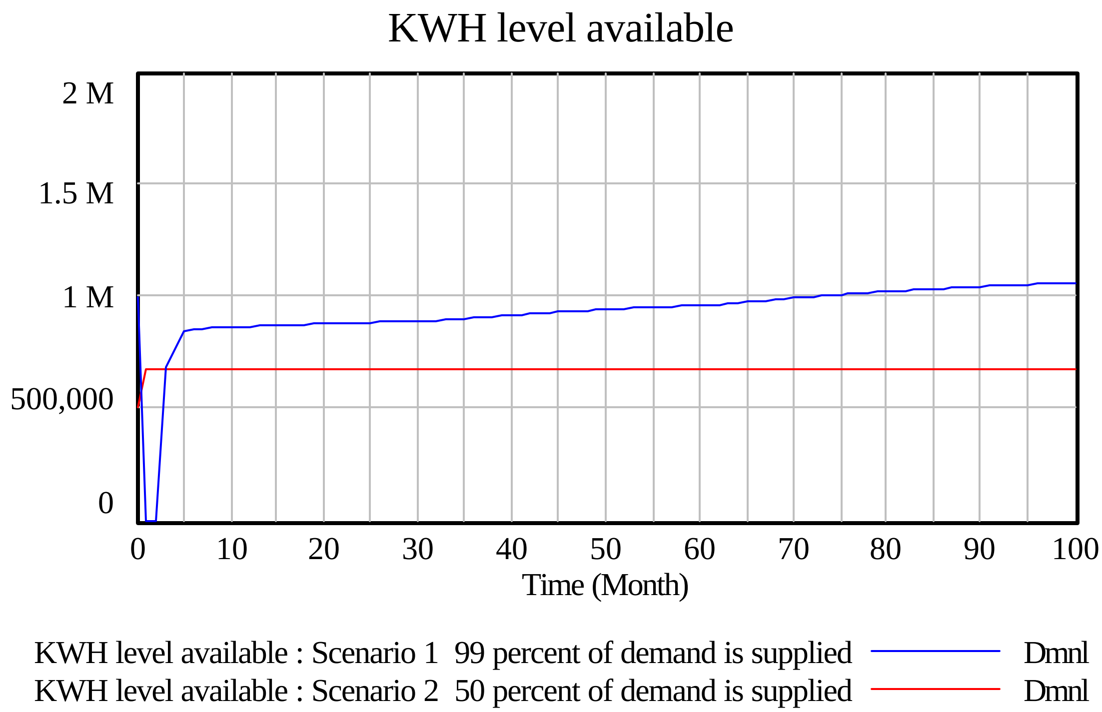
It is important to note that rent-type profit cannot set the price in this model. Price is determined only by the aggregate supply, given the distribution of wealth in the population, the size of the population, and the average consumption rate of the population. Thus, this model is consistent with the declaration of Ricardo, that rent is the result of price, not the cause. Pareto, however, is also correct, in that there exists a causal chain of economic activity that ultimate includes both rent and price. This model offers a simple system of economic activity that explicitly links rent to price, in the sense that rent causes decisions on production, that cause changes in aggregate supply, that cause changes in price. System dynamics can now show that these great thinkers were correct, in a manner that no other field could demonstrate.

As a matter of economic policy, it is interesting to mention the results of the two scenarios on production as a percent of potential demand. It can be seen that a greater proportion of the population can be served when there exists low barriers to entry. Further, the price for all consumers is lower when the greater proportion of the population is served. Thus, social welfare is maximized when Steve was able to enter and compete. The point here is that Steve might have entered the market in scenario 2 if he had "good" reason to believe that positive rent targets could ultimately be achieved. To the extent that management has the ability to draw sound conclusions on profitability, social welfare may be maximized. System Dynamics models, such as the one presented here, are hopefully a step in the direction of facilitating a greater understanding of the dynamic mechanics of rent-type profitability.

Production as a percent of potential demand



Production as a percent of potential demand : Scenario 1 99 percent of demand is Supplied
Production as a percent of potential demand : Scenario 2 50 percent of demand is Supplied



Discussion & Managerial Implications

The implications of the rent theory are numerous, and the discussion that follows can only be considered one small portion of what is, perhaps, a field itself. There are three implications that are particularly important to the competitive strategy dynamics field at this time. The rent theory explains: 1. the profitable co-existence of low-cost strategy firms; 2. why successfully reducing production costs may produce no improvement in performance, and 3. why a change in demand may have no effect on performance.

On the co-existence of profitable low-cost strategy firms. Low cost advantage is often described as only possible for one firm per market; only one firm may possess the lowest cost structure. Accordingly, the touted strategy is to become the low cost leader. The system dynamic view of rent theory predicts, and the model results show, that this is incorrect. All the producers with a cost structure lower than the marginal producer will be profitable. Thus, the strategy is to maximize the cost differential, relative to the producer on the margin, over time.

The difference may seem subtle, but the effect on strategy and performance are substantial. *If we pursue a strategy of low cost leadership, our performance may decline even though we are completely successful in accomplishing the strategic goal.* Consider the hypothetical case where a new process technology is adopted by all producers of a commodity. The cost savings are realized by all the firms, but the impact is greater on the least efficient firms. The net effect is an elimination of major cost advantages enjoyed by a few firms. One firm integrates the new technology more effectively than the others, and becomes the leader in efficiency. However, hypothetically the production cost differential between this firm and the least efficient firm may be smaller than was the case before the diffusion of the technology. Thus, in spite of their success in achieving low cost leadership, the performance of the firm will fall! Contrast this with a strategy of maximizing the differential in production cost relative to the marginal producer. In this case, successful implementation of the new technology is driven by increasing the production cost differential relative to the marginal producer, *not* the lowest cost producer. Successful achievement of this strategic goal will result in improved performance. Further, *performance will improve regardless of whether or not the firm becomes the low cost leader*!

Reducing production costs may produce no improvement in performance. The system dynamic view of rent theory explains why success in reducing production costs is not necessarily rewarded with increased profitability. This occurs in two fundamental scenarios: 1. the firm is the marginal producer, and 2. the marginal producer is a competitor who is reducing production costs with a relatively faster rate of success.

In the first scenario, process improvements may successfully reduce costs but competitive pricing pressure will cause the price to fall to the new level of least productive cost efficiency. Consequently, the firm continues to breakeven until it surpasses the cost efficiency of one firm in the market. If the competitors improve at the same rate, the marginal producer will never realize profitability, even though it is consistently able to achieve cost reductions. Thus, the strategy is to improve at a faster rate than at least one of the competitors.

In the second scenario, the marginal producer is a competitor who is reducing production costs with a relatively faster rate of success. Thus, while the strategy of cost reduction is successful, performance declines because the cost differential relative to the marginal producer is smaller. If the trend continues, the firm will ultimately become the producer on the margin and will only breakeven (earn only ordinary profit) as the price falls to their cost. Thus the strategy is not to reduce cost, but to maximize the cost differential relative to the least efficient producer, or to create a positive differential.

Change in demand may have no effect on performance. The rent theory explains when increasing or decreasing demand will not have significant effects on profitability. The impact on profitability is depends largely on the trend of the average cost curves for all producers in the market. There are two basic profiles: the average cost curves increase at an increasing rate, and 2. the average cost curves increase at a decreasing rate.

Changes in demand will have a strong effect on performance when the average cost curves, across firms, increase at an increasing rate. In this case, it is assumed that additional demand requires increasingly inferior resources to be employed in order to meet the additional demand. Electricity generation is an example. During the summer months, peak demand for electricity can cause traditional sources of supply, such as hydroelectric, to be insufficient. The price rises to the point where relatively inferior resources, such as diesel, wind and solar powered generators can profitably supply electricity. The inferiority of alternative generation sources benefits the efficient generators in the form of higher profit margins.

Conversely, changes in demand will have a minor effect on performance when the average cost curves, across firms, increase at a decreasing rate. In this case, additional demand requires only slightly inferior resources to be employed in order to meet the additional demand. An example is IBM-PC compatible computer sales in the 1980's. The open-architecture design of the IBM-PC allowed multiple producers to assemble a commodity-like product, allowing competition to drive price quickly down toward cost. As price fell, a greater number of individuals were able to afford the PC, and demand increased. To meet demand, IBM-PC clone assembler entrepreneurs were entering the market by operating out of their garage or barn. At this point, increases in demand did not cause increasingly inferior resources to be employed in meeting demand and prices could continue to follow reductions in costs associated with realization of scale economies in component parts. Thus, in spite of tremendous demand, prices did not rise, and profit margins were not high.

Conclusion

The mechanics of profitability are fundamentally composed of three independent profit structures: ordinary profit, rent and monopolistic profit. Ordinary profit is the amount of earnings necessary to compensate the owner(s) for abstinence, indemnity for risk, and remuneration for the labor and skill required to oversee the business (Foreman, 1919; Mill, 1871). This is the minimum amount of earnings required to justify the investment in the business. The Capital Asset Pricing Model (CAPM), as the contemporary basis for approximating ordinary profit in terms of the firm's cost of capital, dictates that the cost of capital is a function of the risk free rate, the return for the market, and the Beta or coefficient of systematic risk for the firm. Of these factors, only the Beta may be influenced by the firm. Thus, the strategy is to increase the present value of future earnings by reducing the cost of capital through a minimization of Beta risk. Such a strategy is likely to involve decreasing the firm's sensitivity to macro environment effects on sales by lowering operating leverage via reduction in the proportion of fixed to variable expenses.

Earnings in excess of the ordinary rate of profit occur only when the market fails; when entry barriers exist or there are differences between firms in their cost structure, or in their output.

That is, in the absence of entry barriers, the firm must have a competitive advantage, low cost or differentiation (Porter, 1980). Rent mechanics explain earnings in excess of the ordinary rate of profit when output is homogenous and input costs are heterogeneous across firms. Rent type profit is a function of cost advantage relative to the least efficient firm in the market. Consequently, rent explains profits earned via Porter's (1980) generic low cost advantage. In contrast, the monopolistic profit mechanics explain earnings in excess of the ordinary rate of profit resulting from heterogeneity in firms' output. Profitability in this case is a function of creating and exploiting an inelastic demand curve produced via Porter's (1980) generic differentiation advantage.

Given that each type of profitability is driven by different variables, strategy formulation requires the separation and understanding of the functional structure of each to enable the deduction of specific goals and actions to control, and thus, maximize the performance of the firm.

As a final note, I believe Marshall (1901; 410) demonstrated proper caution and foresight when he stated, *"This doctrine* (the rent theory) *is however difficult, and easily misunderstood. Further study is required before it can be safely applied to complex issues."*

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