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SUBSTITUTABILITY CROSS-STREAM BETWEEN ORIENTED MARKETS: CONVENTIONS IN THE WINE SECTOR OF FRANCE

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Abstract

I explicitly model the social mechanism that constructs markets.

Producers array along a market profile along which buyers trade off quality for volume. Outcome features can be predicted from two ratios of parameters, yielding a MAP. Five distinct families of market cultures correspond to its regions. As previous work showed, Supply equaling Demand is transmuted into matchings across local variabilities of valuation with volume and with quality. Such matching is vulnerable to unraveling, but it can be achieved with market oriented either upstream or downstream.

This paper probes siphoning between markets lying cross-stream and thus generalizes substitutability within a market. Siphoning is shown to support markets whose members face increasing returns to scale, which violates orthodox microeconomics. Figure 8 illustrates key findings. Results illuminate the wine sector in France.

CONTENTS

Needs that become socially shaped fuel the continuing processes of production whose uncertainty leads established agents of production to combine in mediation by markets. Production flows are pumped and filtered among firms by these markets as mechanisms. Each induces a quality ordering across the producer firms in that market. Then a producer need only watch the profile of volume versus revenue achieved by its fellow firms to decide its own optimal commitment. My *Markets from Networks* (2002) presented explicit model for such markets.

Now I go on to analyze how much one market can substitute for another and with what impact on market size. As its member firms procure from others upstream and sell to still others downstream, a production market also influences markets located cross-stream from it among the cascade of flows that constitute a production economy. Modeling this clarifies how markets can be sustained even in contexts where production firms are experiencing increasing returns to scale.

To make this account self-contained, I first reprise previous results. I start with a fresh, and perhaps simpler introduction to the market model. A transition section then gives background and motivation for the new results in Part II, which depend on degree of substitutability between markets. Results change with substitutability to some extent even for varieties of contexts not marked by increasing returns to scale.

Part I. **Social construction of supply across quality through a market**.

Start from the familiar idea that price in a market comes from equating supply with demand. Plot the dollar worth W of the volume y that some firm produces as just a straight line, whose slope is the price, supposed the same for each firm. The firm anticipates paying out to procure supplies and incorporate them into finished product in a flow of size y. From examining how its cost grows with volume y produced, the firm will pick that volume which maximizes its net income. Other producer firms, with their own cost structures, will offer volumes on that market too--so what price can accommodate them all?

This messy question evokes a simple answer when, and only when, the buyers downstream do not discriminate among flows from the distinct firms. Say the customers downstream are buying hard winter wheat of grade 6, indifferent to the nuances separating Minnesota grain from Dakota grain. Then of course the same price is indeed on offer to every producer firm (here, silo). The total supply on offer is specified uniquely, from the single W(y) offer curve available in common to each producer, as the sum of the volumes each firm picks as optimal given its cost structure. If that total supply is more than the buyers in aggregate will take up, the price, the slope of W(y) will be dragged down, lowering the total volume producers will offer, perhaps also with the elimination of a firm or two with the highest cost structures. And so on, until the combination of lower price and lower volumes together close the gap between supply and demand. This special case is known as 'perfect competition'. (One does worry of course about how and in what time sequence various prices got signaled and volumes offered in an interim period (Arrow and Hahn 1971).)

But usually firms seek different niceness of product, with attendant differences in cost structure. Somehow, the perfect competition picture has to get extended so that differences in quality seen by the buyers is put in correspondence with the different niceness in product sought by different producers. How can such correspondence get socially constructed? What is the market mechanism? One has to meld volume commitments by firms with acceptance by buyers willing to pay more for higher quality as well as higher volume. There is never a Wizard of Oz, a Walras Imp at hand to design and direct such correspondence. This production market is a theatre having no director, just two sorts of actors dancing around.

Go back to perfect competition. Note that just one parameter can specify the demand context that sets the price. Let the exponent that specifies curvature of buyer demand with volume y be denoted by the letter a. Now the market works as perfect competition only if each producer finds some definite volume to be its optimal choice. Let c denote the exponent that specifies curvature of cost with volume y from some producer firm: this choice of a simple form is suitable framing for practical business decision by the producer.

Then the market works for that producer only if

$$\mathbf{a} < \mathbf{c}$$

so that the cost curve bows up, yielding decreasing returns to scale of production, vis a vis the diagonal line of revenue W(y). And even with different producers having different costs, a common price can be predicted, just from a and c. In situations where the qualities perceived for different producers are all the same, they may have close to the same exponent c describing curvature of their costs. Then only the two parameters a and c are involved, and it seems clear intuitively that only their ratio matters.

Draw the range of possible ratios a/c as just a line segment from zero to unity. Position on that line segment will suffice to identify market price, for any given number of producer firms. Figure 1 shows this state space for perfect competition.

-- FIGURE 1 ABOUT HERE --

Now stack another line segment alongside this one for perfect competition, and then another, and another, and so on until one has filled out a whole band on the plane. Let each step indicate an increase in sensitivity to difference in quality across the producer firms. Figure 2 shows such a strip map, an enlarged state space. On this strip, perfect competition is confined to just the top edge, zero sensitivity to quality.

-- FIGURE 2 ABOUT HERE --

This quality sensitivity must itself be some sort of ratio between the extent downstream of buyer sensitivity across degree of quality and the extent upstream of sensitivity to degree of quality evidenced by associated shift in cost structure. Designate these by b and d. So the ratio is b / d, analogous to the ratio a / c with respect to volume. But b / d is not restricted between zero and unity--buyer sensitivity to quality degree may be far greater (as well as far less, toward perfect competition) than the sensitivity of producers costs to quality degree.

For each point in this map for market contexts we want to be able to specify the outcomes to be expected with that context for the market; but with particularities for a specific set of firms filled in only later, the same postponement as when using Figure 1 for predicting results of pure competition. Each point in Figure 2 is identified by two ratios, each of downstream to upstream, of sensitivity of valuation, with respect to volume on the vertical axis, a / c, and with respect to quality on the horizontal axis, b / d.

Instead of using exponents, b and d, on size along some one index, we could have stuck with specifying two separate indices, for niceness, say n, and for quality, from the downstream and upstream perspectives. But it is clear intuitively that the firms must show the same rank order on quality as on niceness for the market to be coherent, and one can approximate differences between one and the other numerical index by applying different exponents to a common index. Hereafter let n denote this common index.

Exactly the rub is that in only a few markets can one observe or report on any such common index. California wines may be one with published ratings for quality sensitivity (Benjamin and Podolny 2000). Participants have no occasion to worry about indexing the cost side from niceness, since each producer is deciding on its own optimum from knowledge of the cost structure it is locked into regardless of how it compares with other firms with their distinct aims of niceness. We as analysts can work up such index from observations on cost, more easily than for quality sensitivity from heterogeneous aggregate buyers downstream.

This sharpens the question of what mechanism can account for this market in differentiated products. Only quantitative indices of quality would suggest particular numerical outcomes to balance a market. The mechanism as social construction must work in terms of quantities observable by the relevant participants. The signaling has to be simple and practicable for business.

The a,b,c,d specifications of context are simple and practicable, but only one of them is observable, c. Prices and volumes achieved in sales by all firms are the other obvious observables. So the mechanism in this social construction of a market must revolve around the array of market prices and volumes together with the c each firm estimates for its own cost structure.

The market mechanism has to sort producers into distinct niches with distinct prices that induce from each producer a volume that downstream buyers accept, because of being equally good deals, that is tradeoffs between price and quality. Lower quality deserves lower price but thereby calls for higher volume: Each separate aspect is simple and obvious but yet will be shown to sustain a remarkable variety of outcomes for the market, such as degree of concentration, sheer sizes, profitabilities of producers.

Market profile as mechanism

Observability is the key. Everyone sees the ordering of producers by quality, the crux for a differentiated market, but aside from prices, the only numerical readings by participants are volumes shipped by various producers, who each can make it their business to know. The observed set of prices for the various producers are easy to array, and to observe. If they can be plotted along some profile curve, it can de drawn through them in a graph of firm revenue W(y) by volume, as in Figure 3.

-- FIGURE 3 ABOUT HERE --

This profile, when the producers read it as the framing for their choice of optimum volume to produce, is the mechanism for constructing a market. That profile will be established as viable for any period where the buyers downstream in aggregate perceived each of the menu of revenue-volume pairs as being equally attractive and requiring less money outlay than the maximum they would have found acceptable.

With this profile seen to be viable in the previous period, producers are motivated to use it to guide their commitment to volume in the next period. They can each scan the whole curve to choose the volume that maximizes their net revenue over cost. (Only in a much longer run, and given resources to invest in infrastructure could the producer hope to change how buyers overall perceive their quality).

To sum up,

> each producer has found a distinct niche by offering as good a tradeoff in quality for price as each other producer. Yet no one needs to or can specify distinct numerical qualities. Each producer will hear what volumes and prices its peers achieved and can fill in between these points to trace a market profile W(y) as its opportunity set for its next choice.
>
> Each producer optimizes separately in terms of the profile interpolated through observations of their several outcomes, revenue received for volume shipped. Because they are computing profit from the

difference between revenue and their cost, Figure 3 has plotted revenue rather than unit price as the ordinate versus volume shipped y as the abscissa. The buyers in aggregate are paying less than the maximum they would tolerate, and find no one of the producers to reject as offering a less good deal. Yet it is the producers who have to commit to volume before each period, and thus can maximize, whereas the only leverage on the buyer side is rejecting a proposal so that they have leverage only to satisfice equally, not to maximize across the menu of offerings from producers.

Such is the mechanism**.**

Choices in a market accordingly calibrate its mechanism with observables and with computations well within business practice. The explicit model simplifies further by assigning simple parametric forms for cost and taste which are plausible while framing solutions simply enough to offer guidance over a great range of variety in context and constitution of market.

We can suppose that a map like Figure 2 can show what combinations of numerical values for quality and volume ratios of parameters, downstream to up, lead to what market outcomes. Or in modeling jargon, specify the state space for this mechanism, as will be done below in Figure 4.

Solutions

In what circumstances will this market mechanism come to reproduce itself for the next period of production? In order to optimize, a firm of quality n chooses the y at which W(y) parallels its cost structure, estimated as

y^c times a scale factor, call it q(n).

But the buyers downstream value that volume as

y^a times a scale factor, call it r(n)

which of course also differs between firms according to perceived quality of their products. The (revenue / volume) pairs chosen by producers are points lying along a profile that guides them to optimum choices, but these must succeed in selling themselves to buyers; so the cost curves must be ordered consistent with the values assigned their qualities by buyers in aggregate: they must jibe. Jibing means enforcing the same ratio of buyer valuation to amount they pay, W(y), for every firm. Designate this ratio by tau, τ

This market mechanism needs to accommodate sets of firms differing in number and in exact spacings on quality. But presentation of the analysis is simplified by thinking it through for a generic firm, with value n on quality index left arbitrary. It is a mathematical fact that the required W(y) profile can be entirely characterized just in terms of the generic firm that can be slid along the profile. This generic firm thus is transposable to play the role of any one of an actual set of producers for a market context.

A differential equation in the market profile W(y) and the cost function of the firm n can be solved, which yields the volume firm n will choose as optimal. The equation of optimum choice is then to be replicated for each n. In parallel, one can equate revenue to some arbitrary but fixed fraction of the maximum value that buyers in aggregate would pay. This constraint from the buyer side sets up an equivalence across the replications across values of n. That proves sufficient to specify the exact shape or twist of W(y) profile that satisfies the pressures from both sides, producers and buyers.

W(y) depends on a,b,c,d of course. Indeed, Figure 2 was suggested as state space for market mechanism on the intuitive ground that the ratio of upstream to downstream was what mattered to market operation. A ratio is a pure number suitable for use as an exponent, and unity stands out as middle value, as in Figure 2 for quality ratio. W(y) also depends on the scaling constants q and r for each producer, which expressions r(n) and q(n) indicate vary from one producer to the next in quality ordering. But the point is that just the exponents b and d characterize this variation sufficiently to specify the shape of W(y), together with just baseline scale factors r and q, think of them as for quality n=1.

One sees that W(y) need not cite n and so can indeed apply to all firms. Equation 1 will present the resulting formula. It groups these various parameters in order to simplify scanning: To begin with, hereafter **designate a/c by v and b/d by u,** for volume and quality**.** At v=1.5, for example, the costs of producers are 50% less sensitive to expanding volume than is eagerness to buy that volume. At u=0.5, impact on costs from producing higher quality is twice the impact on the maximum buyers would pay. At u=1, costs are just as sensitive to upgrades in quality by that producer as is the downstream eagerness to buy its product.

The formula for market profile boils down to:

$$\mathbf{W(y) = (A\, y^{g} + k)^{f}} \qquad (1)$$

with f, g, and A just combinations of the parameters. Intuition suggested that curvature and thence viability of market profile should depend crucially on how far away v is from u, and in formula (1) the exponent **g** proves to be proportional to [1 - (v / u)]. Accordingly, the diagonal is where they coincide, u = v, and curvature vanishes.

The roles of g and f in formula (1) confirm that different locations in a plane map such as Figure 2 yield different profile curvatures, which indicate different patterns in pricing and profit for the representative firm of a market. A profile's overall exponent, designated f in formula (1), is

$$1 / (1-(1 / u))$$

and so is inversely dependent on the inverse of u, the downstream / upstream ratio of quality dependencies.

(The multiplier A sets a scale for the profile. The value of A is proportional to the reciprocal of the product of f and g, and it further depends on the scale factor for cost curves of firms and the scale factor for schedules of maximum payment buyers in aggregate would offer for a menu with volumes of various qualities. A also depends on, besides these parameters, the ratio τ regarding buyers satisfaction)

Guided by this solution we can try out a map of state space, designate it by MAP. But unlike in Figure 2, it is not clear we need to limit the range of v=a/c below unity. A main thrust of this paper is to show that the mechanism above need not be constrained to operate with decreasing returns to scale by producers. Figure 4 reports a MAP.

-- FIGURE 4 ABOUT HERE --

The main diagonal, where curvature vanishes in W(y) as noted above, is highlighted in Figure 4. and this map splits into four quadrants, which give a first cut at differences in viability of markets as well as in performances of their producers. In the lower left, for example, the upper hand is held by buyers as to both volume and quality increases. Here producers vie for buyers who are relatively limited in their demand for volume and quality relative to what they cost producers. So the high volume producer is lower quality, lower cost.[1]

Computations will be complex, especially once locations of a particular set of firms are introduced. There can be a feedback loop between revenue of each individual firm and the total market revenue mediated through the ratio τ. So the quantitative outcomes for any firm within the market will depend on the particular volumes along the profile picked by each other firm. Results are hard to fathom with prediction and computation become complex.

But what is clear from formula (1) is that prediction breaks down when both of the ratios, u and v, are unity. The market profile requires that balancing between buyer and producer sides spread out the firms into distinct optimal niches, which is hard when either ratio of upstream to downstream valuations is unity and is impossible when they both are. Accordingly, lines in Figure 4 have been interrupted at this central point (1,1). And as already noted, whenever u = v the profile is to exhibit zero curvature and may provide inadequate guidance on choices.

Even given that its application is complex, does not this crisp formula (1) seem too neat to be believed? Firm quality n does not appear anywhere in formula (1), derived for the representative firm. Only because this same formula works for all the firms are we justified to speak just in terms of a representative firm of quality n. So the only descriptors of the firm are y, the volume of product, and W, the revenue. What is missing?

Contingency from agency

Aspects of the maze of incidents and accidents in the maneuverings out of which W(y) gets constructed have already been subsumed into the formula (1) for a profile, in the form of two indexes. One is τ : buyers can insist that every producer offer a deal as least as good as the others, which enforces a value for this tradeoff ratio, τ , but its size is indeterminate.

The remaining symbol in formula (1), k, appeared as an integration constant from inverting the differential equation in W(y) to obtain solutions for the profile. One can see that this k shifts the actual height of the market profile, up for positive sign, and down for negative k. Since k is not determined by any of the parameters and descriptors of context, it subsumes and indexes a second indeterminacy in the net impact of the evolutionary path to profile.

The height of profile interacts with the shape or twist in market profile W(y) to affect whether any given firm can actually earn positive profit. So k must have presence in the MAP. Seek for each context the range of values of k which yield profiles that can accommodate would be producers whatever their quality n. (These will be exhibited in Figure 7.) The same range of k applies across whole polygonal sub regions of the MAP. Whereas for tau, which indexes the first indeterminacy, the same range can yield viable profiles at any point in MAP, Figure 4.

Other regions specify contexts where it is impossible for all producers to find distinct volumes optimal, and / or to earn positive profits, for one or more possible profile among those with correct shape for that market context. A profile with any given value of k will induce a distinct mapping from putative value of n to corresponding volume y, y(n), that maximizes profit for that n. But a profile shape which is viable by the criteria introduced thus far may not prove robust across the whole range of heights from values of k specified by Figure 7 for that point. The profile may be subject to unraveling by producers at one end of the quality ordering.

A market profile is robust only if the context is such that the profile is not vulnerable to unraveling by actions of would-be producer firms. The diagonal, u = v, proves to bound on one side the halves of the lower left and upper right quadrants from Figure 4 where profiles are robust, labeled there COMMON and ADVANCED. Equilibrating a market profile from COMMON, for example, depends on the volume valuation tradeoff ratio v between the two sides being larger than the quality valuation tradeoff ratio u. Exactly the opposite statement holds with respect to ADVANCED. (For simplicity refer to these two triangular regions also as quadrants.)

Especially useful for assessing variation of profile with context is the special case of k = 0, a median sort of profile for which computations are simpler. Profit rates of different firms are then the same, and indeed this single profit rate for a market proves to be the same everywhere along any straight line which runs through the central point (1,1) in Figure 4. Examples are shown in Figure 5. But market size varies along such line as we shall see in Part II, and market concentration also varies.

-- FIGURE 5 ABOUT HERE --

Larger stories, and market orientation

Evolution of a market is caught up in still larger stories of contingency and agency. Each market only establishes itself in interactive jockeyings with other market groupings seeking footing among sets of firms with some overlaps--a complex path of evolution. In a longer perspective the population of such markets emerged more or less gradually from earlier Putting Out systems. Reaping profit from the greater capacity and productivity gained from division of labor led entrepreneurs to 'put out' raw materials and / or tools to dispersed households and workshops, prefiguring procurement and supply along stream through markets today, in each of which producers were adding value to the flow.

Today's market constructs itself through its producer firms seeking insulation from Knightian uncertainty in making their commitments for output in the next period. Each firm watches the preceding actions of its peers as signals of a profile of choices for their commitments. If producers' own self-interested choices of volumes lock them into place in a pecking order by quality accepted downstream then their choices of commitment levels are sheltered from downstream uncertainty.

Such market or industry has become taken-for-granted in the perceptions also of other markets and firms upstream and down as the place to go for the overall sort of product identified as and in their line-of-business. But business is subject to larger eruptions, such as inflation, either general or along an industry's own lines of procurement. Pressured by such change, producers in a market may come to agree the greater uncertainty is now upstream, and look upstream for signals to guide their costly commitments.

So the market profile may orient back upstream toward suppliers. (This will be modeled in Section B of Part II--see Figure 9 there). Either way, the setting, and acceptance, of production commitments by producers involves three roles, rather than just buyers and sellers. In vying with each other, producers are each establishing a niche of quality whose volume reflects substitutability with the products of its peers, who as a whole have become established as a line of business, a market for a recognized type of product. But now we see that the substitutability that counts may be in the perceptions of suppliers upstream rather than customers downstream. This leads us toward Part II which analyzes substitutability between markets both when orientation is upstream and when it is downstream. As a transition I lay out some background and motivation.

Conventions, wine markets and PARADOX

Over the past two years I have collaborated with an interdisciplinary French team at INRA in Montpelier to study markets in the wine sector. This team is conversant with the Convention School in French social science, which partitions industries among four or so cultures of justification and quality. Each culture is bound up with distinctive social network configurations. This School had noted (Favereau 1996) a correspondence between these socio-cultural Conventions of theirs and the broad sorts of market mechanism that I had distinguished (White 1981). These 1996 discussions in Paris led me to write a book-length account of W(y) (White 2002).

So the INRA team turned to me in hopes for specific models, applicable to markets within the wine sector in Languedoc-Roussilon that fit into one or another of these Conventions. Also, along with markets, this team were investigating networks in and among producer cooperatives (Chiffoleau, Dreyfus, and Touzard 2001) and in this had been guided by an earlier book of mine (White 1992). Their interests have been widening to now include Midi wine more generally, and also international wines, as well as further reaches of distribution networks.

The first of three difficulties of collaboration was that the INRA team collected statistical reports on average price over time rather than market profile of price. Use of average price presupposes the pure competition fable, wherein anonymous producers enter and leave a market at will in adjustments to a determinate outcome between buyers and sellers. My model has the market mechanism running on variance rather than average of price, whereas the INRA team continued to think in conventional terms of Supply equilibrating with Demand. And the second difficulty was that many of these demarcations of markets for routine statistics do not fit with the boundaries required by my molecular view of market mechanism.

So we had arguments which led me to elaborate on how my model transmutes Supply-and-Demand into pressures cross-stream between markets. The main goal of this paper is further exploration of such pressures, which can also be analyzed at more micro level in terms of uncertainties among egos and alters (e.g., Podolny 2001). And I am having discussions with business school analysts of wine market strategies, who also seek explanatory accounts without invoking or modeling explicit market mechanism (Roberts and Reagans 2002; Roberts and Ingram 2001)

Roberts and Reagans take observed average prices of brands as ex post signals of their quality and argue that previous exposure in the U.S. enhances the attention given to these signals. That is not out of line with the perspective in my models: neither delves into possible consumer segmenting. Their test is a standard approach through nested regression models, with standard claims of estimating statistical probabilities.

The Roberts and Ingrams paper examines instead the organizational infrastructure for wine sales, in particular impacts from access to better support and information from upstream suppliers. Again this is consistent with my social construction view but again there is no explicit mechanism setting the prices. Market prices either just drop from heaven, as in pure competition fable, or rise up out of the black box of ex post statistical modeling. Again the results seem significant in several senses.

Preliminary analysis of data for French wines indicated that in some eras important parts of the wine sector do have markets that face upstream. The third difficulty was that the INRA team, along with other analysts, had special trouble with understanding, much less applying, this dual, upstream version of my model. Section B below aims to ease this difficulty. Matthew Bothner already has offered guidance on strategic implications of possible switches in the orientation by a market (Bothner and White 2001). Difficulty in understanding the upstream model partly derives from the implicit assumption in the usual pure competition story that a market faces downstream, and its neglect of the three-way interaction between upstream, market and downstream in establishing the market.

One change in the French wine sector that had profound impact was consumers turning away, around the late nineteen-fifties, from table wines, wines of low and rather undifferentiated quality.[2] Initial positions in the upper left quadrant (labeled TRUST in my book) were replaced by subsequent locations within this lower left quadrant labeled COMMON in Figure 4.

Two markets for points near each other in the plane of v and u, Figure 5, may well tend to be similar also in underlying infrastructure in social networks of ties (cf. Granovetter 1985; Nohria and Eccles 1992). They may further be similar in the associated mores and tales characteristic of their industries. All together these similarities make up the Conventions of a common culture, as conceived by the French school of that name introduced earlier. (But as we shall see in Part II substitutability between markets need not be thus confined.)

Olivier Favereau was led to claim in 1996 a match between my model's predictions in MAP from using formula (1), on the one hand, and the Convention School's account of four distinctive sorts of industrial cultures, on the other hand. He argues that the interpretive patterns found for each of those four, on the basis of intensive field studies of selected European markets, fit in well with the sort of behavioral outcomes which one might expect for market profiles with u and v values in a quadrant in Figure 5, and which I had assigned to various American industries (White 1981, 1988). The Favereau mapping is from Convention to the polygonal regions distinguished earlier by range of the index of indeterminacy, k (plotted in Figure 7 below).

It was Favereau's claim that energized me to extend and elaborate earlier papers as a book. But a key component in this claimed mapping was a further region not shown in Figures 4 and 5. Indeed this extension doubles the map, adding the whole other side in which u takes negative values.[3] Figure 6 reports this enlargement of Figures 4 and 5. The top of the left side of Figure 6 (which, unlike Figures 3 and 5 has to be laid out sideways) are contexts where every profile is subject to unraveling. So market profiles are viable in this upper region only when $v < 1$.

-- FIGURE 6 ABOUT HERE --

These additional contexts are where product with lower cost structure is more desirable downstream, which seems a paradox, so label the additional allowed quadrant PARADOX. Perhaps a first-mover producer triggers a new market as other producers came in but without the first-mover's advantages in optimal location, or creative ability best developed. This could be in copper mining, and it seems true, for example, of the disposable diaper and the log home industries circa 1970.

Eymard-Duvernay assigns the label *Domestique* to a community of markets that Favereau maps into this region labeled PARADOX in Figure 6. That quadrant is exemplified by AOC wines--distinctive and traditional wines subject to strict oversight. They depend heavily for their certification on inherited formulas and expertise, and / or specific climate pattern and on localities with special gradients and soil compositions of land. Entered in Figure 6 also are the likely identifications of quadrants with Conventions. As to *cepage*, the Australian wines you see in American stores are closely akin to and indeed are displacing French versions in markets like England.

Part II. **Cross-stream substitutability between markets**

The rest of this paper focuses on impacts upon a market as a whole that are the indirect result of the presence of other markets lying in structurally equivalent positions in flows from upstream to down. Just as there are no production flows between producers lying parallel within a given market, so too there are no flows between markets lying cross-stream. At either level the pressures are the indirect effect of transactors, perhaps upstream and perhaps downstream, insisting on comparably valued outcomes from the cross-stream firms and the cross-stream markets. Substitutability within the market is seen as accompanied by siphoning between markets.

It is only at the level of firms within a market that a transitive ordering of quality emerges: Substitutability between markets is conceived in simpler terms and characterized by just a single parameter. And the focus on market siphoning justifies further simplification in portraying the mutual positioning of firms within a given market from the modeling in Part I

Section A lays out the sector model for downstream orientation of the market mechanism and Section B does so for upstream orientation. Section B parallels Section A and so can be much shorter, but we will see the outcomes for upstream orientation are quite different, despite the abstract duality with Section A. Outcomes may apply to clusterings of wine markets that correspond to the Conventions of the French school, as well as to the wine sector as a diverse ensemble of such clusterings. They can suggest feedback effects involving changes in substitutability, complex interactions across the whole wine sector.

Section A: Markets facing down-stream

The first subsection analyzes markets without cross-stream analogs and thus with no substitutability between markets. These no doubt are rare. But many intricacies carry over that are harder to penetrate once cross-stream pressure is addressed explicitly, and yet most of the description and the auxiliary formulas carry over. So the first subsection, which serves to frame the later ones, should be longest, and besides, its main equations are not duplicated in my book (White 2002).

Formulas for a market on its own

Formula (1) for the market profile was derived for a representative firm, with arbitrary value on quality n. We now seek to understand and predict outcomes for the whole set of firms in that market. Since specific quality values are not observed for firms, we have to work with a set of n's, distinct though unknown. Later, in application to a particular market we can resort to numerical computations, in what must be an iterative process to allow for interactions between firm's choices of volume. But insight and guidance come best from explicit formulas. Only for the median case, k = 0, can explicit closed solutions be obtained for a set of firms. This median case is assumed hereafter. This special case, as discussed earlier, imposes a homogeneity, that every firm have the same profit rate. Fortunately, the focus of this Part II is on aggregate market revenues, which should be little affected by imposing an internal homogeneity:

The scale factor for cost curve, from out of the multiplier A in formula (1), is designated as q, for a lowest quality firm, n=1. The scale factor for buyers side, r, is then specified as a ratio to q, a ratio designated as alpha, α . And τ also contributes to A. Whereas α compares buyers scale to cost scale, τ compares buyers scale to amount buyers actually pay which is greater than cost; so one expects that α/τ is greater than unity.

Then for any set of firms scattered along a quality index, one can derive from (1)--the profile for the context specified by some point in Figure 6--an explicit formula for total market revenue: Designate this aggregate market revenue by ***W*** . This is just the sum over revenues of individual firms. For k=0, each of these can be expressed as the same multiple of its particular value of n raised to the same power.

$$\boldsymbol{W} = q\{(\alpha/\tau)\cdot(e/(e+1))^{v}\}^{1/(1-v)}\cdot[\{\Sigma: n=1,..,N\}\ n^{de}] \quad (2)$$

where

$$e = (v-u) / (1-v) \qquad (3)$$

Neither tau nor alpha is observable, but interviews can give a sense of the size of tau, and especially its stability.

Variations of aggregate revenue

W depends on u only through u's impact on e. Note that each value of e identifies a ray, some one of the straight lines that can be drawn through the central point (u=1, v=1) which were illustrated in Figure 5: the slope of a ray is e/(e+1). The diagonal corresponds to e=0, and e = infinity identifies the ray v=1. In the remaining two quadrants of Figure 4, equation (2) does not apply because k=0 does not yield a profile that is viable and robust: (Section B will show that those other two quadrants do yield, for upstream orientation, viable profiles along hyperbolas through (1,1).)

Further derivation confirms that the production costs of the firms, and their aggregate costs across the market, follow a formula which is just a multiple of equation (2). And further that the ratio of revenue to cost remains the same along the whole length of a ray through (1,1). The ratio of cost to revenue is given by e / (e+1). Examples of rays with ratios of 0 (the diagonal), 1 / 2 (for e=1), and 1 (v=1) were entered in Figure 5.

It is clear that ***W*** increases with the number of firms, designate that by #. ***W*** also increases with the range of quality over the firms, which is the upper limit N in the summation over n's. But the extent of the latter increase depends on the value of e.

One can also probe how W depends on various parameters by taking partial derivatives. For example, the proportionate increase of ***W*** with v is easily derived from (2) using the identity

$$d \ln \boldsymbol{W} / d v = (1 / \boldsymbol{W}) (d\boldsymbol{W} / d v).$$

where "ln" is standard notation for taking the natural logarithm:

$$d \ln \boldsymbol{W} / d v = [\ln (\alpha / \tau) + \ln (e / (e+1))] / ((1-v)^2 \qquad (4)$$

with the other parameters held constant, Note that u must be changing in consort with v in order to keep e fixed, by equation (3). (Throughout, u = b / d while v = a / c.)

This pattern of variation makes sense intuitively. The explosion of size of the rate of change of revenue at v=1 is, however, an artifact. The array of firm qualities, which is what distinguishes this model from the pure competition story, does not appear in (4) because of the logarithmic form.

Estimating parameters for prediction

Equation (1) is a creation of analysts. It is to be used to predict and understand changes in market outcomes, as context changes, and / or as particular firms enter and leave, and / or as they change in their quality levels following upon investment. Return to the reality of a particular market with its firms in a viable equilibrium. The participants know neither about equation (1) nor about its many parameters, although they no doubt perceive the ordering of firms by quality.

Each producer has selected an optimum volume with associated outcome in revenue that is public knowledge. An observer can record these points along a profile and also record the profile slopes at those points. That provides all the information needed to estimate all parameters in equation (1), as shown in White (1992, pp. 158-165). This estimation cannot distinguish alpha from tau, however. Neither by itself is observable, only the ratio α / τ.

So it is from the observed W(y), on the left side of equation (1) used as a formula, that these parameters on the right side of equations (1) - (4) are determined. The estimations of k and of (α / τ) have removed the two indeterminacies, but only for the observed case. The issue is which estimates correspond to parameters that one can take as fixed in computing predictions from assumed changes in other estimates: for example, the use of equation (4) to predict change in market revenue from change in producers' returns to scale in cost. Of all the estimates, perhaps the least plausible to keep fixed is k. Alpha may well stay fixed and interviews can suggest whether tau also stays fixed, in which case their ratio, what is actually estimated, stays fixed.

Equation 2 shows that aggregate market revenue ***W*** actually decreases as tau increases. The better the deal buyers end up with, that is, the less revenue there will be in the market. The tau itself may tend to settle on the same level among related markets such as those making up a Convention.

Siphoning between markets

Now, finally!, turn aside from this up / downstream context of a market to examine impacts from its cross-stream context. The context cross-stream consists in markets that are parallel, included neither among suppliers nor customers of producers within the given market. Markets lying cross-stream have no transactions but they are structurally equivalent to some degree with respect to whom they tie to downstream for sales, and also perhaps upstream for procurement. Some degree of substitutability ordinarily reigns between such markets which plays off substitutability across the firms within a market.

This degree of substitutability, being quite independent of the v and u that specify up / downstream context for the representative firm, invokes a parameter of its own. **Designate this parameter by x**, the degree of "Xcuse me for butting in". (This, the inverse of the parameter, gamma, used in White (2002, chapter 6), proves to simplify subsequent equations.)

The limiting case of no substitutability, a market as unique source to downstream customers, is x=1, yields the previous formulae for a market on its own in the previous section. The higher that x lies above unity, the higher the substitutability. This parameter is not a ratio like u and v. The market producers act in consort only in one direction, with respect to down-stream, and so only in that direction can substitutability be specified. The mathematical device used is an exponential cap. This is a cap on the sum of buyers' valuations across the packages (volume and price, W(y)) offered by the various firms. The exponent applied to the sum is 1 / x.

Some degree of substitutability for unique markets is allowed in formulas for firm and market aggregate sizes in White (2002). With some substitutability there appears a split within the upper quadrants of MAP, Figure 6, where $v > 1$, by whether v is greater or less than that x, when that is taken as greater than 1. A lower band of the ADVANCED quadrant with $x > v > 1$ can be labeled CROWDED. Some sort of siphoning is indicated, since the prediction is for W actually to grow when the number of firms, #, decreases.

The present market model is to be specified by a small set of parameters of mechanism and context. These should dovetail to permit explicit numerical calculations across a spectrum of cases wide enough for mapping observable markets. Thus, for example, cross-elasticity of demand, familiar from economics texts, should be kept distinct from x. First, the elasticity construct has no agreed, unambiguous definition. Second, with it there often is appeal to cognitive framing as distinct from social interaction. Elasticity is referred to products already defined in this cognitive framing by intrinsic attributes, whereas substitutability x here specifies siphoning between markets as arrays that each melds producer with product into a quality ordering which is interactive in determining a profile that is path dependent.

Siphoning is useful as a natural science metaphor for these cross-stream impacts. We will find that this siphoning can be backward into as well as forward out of the given market. Just so, if someone stealing gasoline from a car tank is suddenly hoisted up, the stolen gasoline will siphon right back down into the car.

Examine the impact of substitutability on market aggregate revenue, W . The generalization of equation (2) is

$$\boldsymbol{W} = q\left\{(\alpha / \tau)^{x}(e / (e+1))^{v}\left[\{\Sigma: n=1,..,N\}\ n^{-d\ e}\right]^{1-v}\right\}^{1/(x-v)} \quad (5)$$

A whole series of subsidiary equations will be derived to provide a framework for detailed applications.

Increasing returns-to-scale--CROWDED region

When x is greater than v, the aggregate revenue is smaller for larger substitutability, just as intuition requires. Formula (5) also confirms that this erosion in size becomes more extreme within the upper quadrants of MAP, where the power, $1/(x-v)$, can indeed approach infinity. The upper-right quadrant labeled ADVANCED in MAP (Figure 4) corresponds to the *Industriel* Convention in Favereau's terminology. We see that markets from its upper part, with v > x, resemble a good deal the markets in the previous section with v > 1-- and x stipulated to be 1. (This extends to the explosion at x=v being an artifact). No further special analysis need be given, especially since I do not think any examples of wine markets occur here.

Two features of the basic equation (5) are especially important. First, is the appearance of the whole new sort of region, that lying between v=1 and v=x, that was labeled CROWDED earlier. When x decreases to 1 you can think of this region as being collapsed into the single ray, v=1. Markets from this region have a peculiar feature. Aggregate revenue, ***W*** , appears to decline with increase in the number of firms, #, and to increase with the range of quality, N. And perhaps they are combustible -- albeit kept viable by siphoning measured by an x to be assessed relative to v. But detailed analysis is required, and computations in terms of explicit values for parameters.

-- FIGURE 7 ABOUT HERE --

The second important feature is the persistence of rays, such as those shown in Figure 5, which will be repeated in Figure 7. Variation of W with quality sensitivity, u, is traced best along these rays where e is held constant. This variation, complementary to variation with the size of v, flips over between v<1 and v>1, which is to say between COMMON and CROWDED.

For detailed analysis we need estimates of parameters. But we can clarify the general import. Dicta from orthodox economics suggest that a competitive market cannot continue if producers experience increasing returns to scale, corresponding to v > 1. In fact, though, uncertainty continues to dog producers' choices in committing to volumes. This uncertainty presses them to gird themselves with a market profile. Throughout the two upper quadrants, v>1 in MAP, an external theorist may see possible exploding commitments deriving from increasing returns to scale in production across producers of all qualities, but the context is opaque to participants, so that one need not assert unraveling.

The same as with v < 1, the basic market discipline is insistence by the buyer side on equally good deals, calibrated by τ) in equations (2) and (4). And the outcomes with v > 1 continue to make sense. **First**, viable markets are predicted for v>1 only if also the differentiation by quality costs less than it is worth to buyers: u>1. Equation (4) shows that revenue continues to grow as v increases for v large as well as small, but only for larger values of e: As e grows small, ln (e / (e+1)) becomes large and negative, swamping the positive ln (beta). So, **second**, viable markets for v>1 are predicted to crash in size of revenue when v grows further except when the quality impact u grows larger even faster.

The logarithmic form of equation (4) obscures a basic change in regime across the line v=1. The discontinuity at v=1 is built into the market mechanism, which depends on profile curvature derived from inequality between the sensitivity ratios u and v. Equation (2) shows that W grows large as v grows toward 1 and then crashes to a small value for v just beyond unity. So W is indeed still growing there with v, but from a much smaller base than for v just below unity. Thus, **third**, markets are large in addition to robust only for a middle cone in this high-stakes quadrant of MAP, in contexts close neither to the diagonal ray nor to the v=1 ray. Substantively, markets flourish for increasing returns to scale only when quality sensitivity overbalances volume sensitivity without the latter sinking to unity. Later Figure 8 will show how degree of substitutability fits in with this picture.

Estimation of parameters

Again estimation proceeds from direct examination of locations of firms along the profile of a particular market. The procedure is exactly as in the previous section. What then is the test for degree of substitutability? What is the actual estimate of x?

This x does not even appear in equation (1), the basis of the procedure. And the value of (α/τ) no longer is estimated by this procedure: specifically, its value cannot be equated to Agf/q. That now would be a mis-specification because the role of (α/τ) has been enhanced by the self-consistent feedback that determines $\boldsymbol{W}$ once x exceeds unity.

The maximum buyers would pay is, by hypothesis, just τ times $\boldsymbol{W}$. Yet this maximum is also the sum of the buyer valuations of packages of producers taken severally, once the exponential cap, 1/x, is applied. So the tau being estimated is in fact transformed to τ^x times $\boldsymbol{W}^{1-x}$. But only the ratio α/τ is estimable from the observables. The α of course transforms to α^x. So the transformation expressed in terms of observables is:

$$\text{alpha/tau} \dashrightarrow (\alpha/\tau)^x \cdot \boldsymbol{W}^{1-x} \qquad (6)$$

and it is the right side that is to be equated to the number obtained as Agf/q from the standard estimation procedure. Several procedures can lead to identification of x, and thus also alpha / tau. (This is called the fifth phase of estimating W(y) parameters in White 2002, chapter 8--where, as noted earlier, the parameter for substitutability is the reciprocal of x, there designated gamma.)

For convenience, work with the logarithms. The most direct approach is to observe the same market with other parameters unchanged but after a shake-up, triggered say by attempted collusion among producers, led to a new profile with new values for the two indeterminacy indexes. Designate the new size of A as A'. (The new and old sizes k' and k of the other indeterminacy index are not used below). The two equations [which do not derive from equation (5)] are

$$\ln (Agf/q) = \ln (\alpha/\tau)^x + (x-1) \ln \boldsymbol{W} \qquad (7)$$

and

$$\ln (A'gf/q) = \ln (\alpha/\tau)^x + (x-1) \ln \boldsymbol{W}' \qquad (7')$$

Subtracting one equation from the other yields an estimation for x:

$$x = 1 + [\ln (A/A') / \ln (\boldsymbol{W} / \boldsymbol{W}')] \qquad (8)$$

Then (α/τ) can be estimated from (7) or (7)'. If a believable estimate of tau has been obtained from interviews, then insertion of it and $\boldsymbol{W}$ will yield an estimate of alpha.

A <u>second procedure</u> would be to pair equation (5) with equation (7), which requires that k=0. Multiply equation (5) in logarithmic form by (x-v), then subtract it from equation (7). The (α/τ) term has dropped out, so one has an equation with only one unknown, x. This difficult inversion can be eased by the approximations developed below for components in equation (5). Again then equation (7) will yield an estimate for (alpha / tau).

<u>A third procedure,</u> using equation (5), requires observing two contexts for the market with but one parameter changed, and k remaining zero. If this is feasible, one can eliminate most terms by subtracting equations to obtain an

equation in only x as unknown. For example, if the change is in the cost scale, q, perhaps because of an engineering innovation adopted by all the producers, one has the estimation equation

$$x = v \{ 1 - [\ln (q / q') / \ln (\boldsymbol{W} / \boldsymbol{W}')] \} \qquad (9)$$

Variation between rays

Detailed analysis of effects is complicated, and the dependence on e, the ray designator defined by equation (3), is crucial. To make discussion and analysis of this and related formulas less cumbersome, we need to simplify the summation Σ over values of n, each raised to a power in e, as in equations (2) and (5).

We could express this sum as # times an average term, as in White (2002, equations 7.3, 7.4). This or any other approximation implies replacing the arbitrary set of # values with some definite array. Label the highest value of n as N, so that the set of qualities range from its minimum quality of 1 to N.

The baseline array I will use here is regular spacing of the n values. This is apt for applications to wine markets. Then I approximate the sum by a definite integral:

$$\{\Sigma: n=1,..,N\} \; n^{-d\,e} = (\# / N) \cdot \left| n^{d(-e+1)} / (-e+1) \right| \qquad (10)$$

On the right side, the left term (# / N) is the reciprocal of the quality spacing between adjacent firms, which justifies the introduction of dn within the integral. The right term, the bracketed integral, is its value for n = N after subtraction of its value at n=1. The formula, though simpler to compute than the summation, is still not transparent.

There is a special case for the intermediate value of e=1:

$$\{\Sigma: n=1,..,N\} \; n^{-d\,e} = (\# / N) \cdot \ln N. \qquad (10\text{-medium})$$

And the general case simplifies for rays with small e (near the diagonal):

$$\{\Sigma: n=1,..,N\} \ n^{-d\ e} = \# (N -1) \ / \ N. \quad (10\text{-low})$$

And also for rays with large e (near the v-1 ray):

$$\{\Sigma: n=1,..,N\} \ n^{-d\ e} = \ \# \ / \ N (e -1). \quad (10\text{-high})$$

Throughout the numerical computations, set d=1, which simply calibrates n by the cost side. <u>For simplicity this term derived by (10) will hereafter just be called</u> Sum.

It is clear that the average term and thus the Sum is determined essentially by N, except for large e, where the sum gets very large, mainly from the contribution from the lowest quality, n=1. For small e, the average term can be small, while for the border case of e=1 the average term can be near unity. A large range in quality, big N, favors a small sum for e=1, but an average term of unity for e small.

<u>Variation along rays, and backward siphoning</u>

Three approximate versions of the basic equation for aggregate revenue, (5), result from substituting for the Sum factor on the right the three versions of formula (10) for values of the Sum along rays with high, medium and low values for e. The factors inside the parentheses are now rather simple. Yet computations are confusing because of the nesting of various exponentials of terms.

Probe first the change of ***W*** as v is increased along a ray, with x held constant. Then after briefly probing other parameters, end by the crucial probe, that of the cognate variation of ***W*** as x is changed for a given value of v (and fixed value for e and other parameters). The initial probe for v traces change as a function along a ray in Figure 7; whereas a probe for u (folded into e with v) would trace along a horizontal line--moving toward the diagonal ray for u >1 and moving toward the diagonal for u <1.

Consider how aggregate size of market, designated ***W***, varies when a parameter is changed a bit. A partial differential equation is appropriate. Keeping other parameters constant, the proportionate difference in aggregate size of market corresponding to some small difference in v is given by the following formula, with all else held constant:

$$d \ln W \,/\, d v = \{[1 - (x / x_c)] \cdot \ln (\mathrm{Sum})\} / (x-v)^2 \qquad (11)$$

Again, Sum is defined by equation (10). An expression that proves to be a critical value for x emerged in the derivation:

$$(1/ x_c) = \Big\{1 - \big[\ln \{\alpha / \tau) \cdot (e / (e+1))\} / \ln (\mathrm{Sum})\big]\Big\} \quad (12)$$

Note that v does not figure in equation (12), which depends instead on e.

Equation (11) is the analog to equation (4) for x=1. Note the great differences induced by x no longer being unity. The Sum term did not even appear in equation (4), but is crucial in (11) and (12) both. In (11), it is the (fixed) value of x that determines the numerator, since v appears only in the denominator. The Sum is at least unity so that its logarithm is positive, as is the denominator, as a square.

So the crucial question, whether revenue is growing or falling as v increases, depends entirely on whether x is less or greater than the expression labeled x_c by equation (12). When x is greater than x_c then revenue is declining as v increases. Detailed analysis and computations show that x_c tends for many contexts to be less than or not much over unity. And x itself must exceed unity, which suggests that $\boldsymbol{W}$ typically decreases as v increases, and it does so faster since the denominator grows.

Explore further the variation of $\boldsymbol{W}$. There is growth in revenue as e is increased (tending toward the ray v=1) so that substantial values of revenue can be found for contexts in CROWDED. This comes from equation:

$$d \ln W / d e = \{[v/(e/e+1)] + [(1-v) (d \ln (Sum) / d e)]\} / (x-v) \quad (13)$$

The differentiation inside on the right can be expanded from the three approximations to equation (10). Note that the denominator is now a linear not a squared difference. The corresponding equation for N also would require three different versions.

The parallel equation for # is very simple, however:

$$d \ln W / d \# = (1-v) / \# \cdot (x-v) \qquad (14)$$

As already noted, there is growth in revenue with number of producers except for v in the band between unity and x. Yet this proportionate rate of growth gets lower as # increases. If one chooses to regard (α/τ) as a proper parameter, the entailed equation is
similar to (14):

$$d \ln W / d (\alpha/\tau) = x / (\alpha/\tau) \cdot (x-v) \qquad (15)$$

Again revenue increases with the size of the parameter, and at a decreasing rate.

Now, finally, turn to the proportionate change in $\boldsymbol{W}$ with increments in x, for v fixed, along with e, N, #, etc. The result appears remarkably similar to the equations for change with v:

$$d \ln \boldsymbol{W} / d x = \{[1 - (v/v_c)] \cdot \ln (Sum)\} / (x-v)^2 \quad (16)$$

where

$$v_c = x_c \quad (17)$$

and the x_c is defined already in equation (12). The critical point will now be exceeded for each of the upper range of values for v. (Computations show there may be some exceptions with values of e moderately above unity and reasonable values on other parameters)

This suggests backward siphoning: that is, the given market drawing in revenue rather than losing it as the pressure of the substitutability cap exponent increases. The differential equation necessarily is consistent with the basic equation for W , equation (5). Figure 8 plots the curve of revenue versus x, other parameters fixed, for two different values of v, one greater than v_c and one less: note that v_c is fixed by other parameters without regard to the value of v. One can visualize the probe as along a line perpendicular to the plane of MAP, which it intersects at some point in CROWDED region.

-- FIGURE 8 ABOUT HERE --

Note that neither curve converges to zero.[4] Each instead approaches the value (α / τ) as x increases indefinitely. One curve, for $v < v_c$, begins at an indefinitely large value and with a very large rate or decline. The other, for $v > v_c$, begins with zero revenue and grows very fast for first increases.

If v happens to fall right at v_c then there is an indeterminacy. Either curve may occur, depending on the historical details of emergence of that market profile for that context. This is indeterminacy on a level beyond that of k and A indeterminacies.

A program of applied work will need to use tables of prediction formulas specialized by quadrant, along with the computer programs for carrying out numerical iterations when unavoidable. The broadest possible overview is also helpful. To provide that, reformulate the differential equation for decrease of ln $\boldsymbol{W}$ with x:

$$(1/\boldsymbol{W})\, d\boldsymbol{W}/dx = -\{ \ln W - \ln(\alpha/\tau) \}/(x-v) \qquad (18)$$

This offers simple, yet elusive, guidance. The main point is that so long as $\boldsymbol{W}$ is larger than (alpha / tau) it will keep declining (though at decreasing rate) so long as substitutability cap pressure, x, is increasing. Further, we see from formula (18) that anywhere in MAP even the proportionate, the percentage decrement in W is increasing, for given raise in x, with the sheer size of W , albeit only on a logarithmic scale. This is a sort of internal contagiousness to the decrement set off with increase in substitutability due to other markets.

And indeed qualitatively there seem to be such internal feedback loops in withering of the markets of many a cluster of the French wine sector. And of course the formula works in the other direction as well, for decreasing x. If a sort of market, say around *cepage* wines, is exposed to less substitutability--presumably especially in lowered contributions from decaying market clusters such as for table wine--there can be exploding growth.

Substitutability within and across Conventions

Substitutability both reflects and feeds commonalties in approaches to interpretation and to structuring of network relations that characterize markets in a Convention community, which share a culture of distinctive quality. In Figure 6, the two upper quadrants--notably a community of markets with *industriel* convention--rest entirely on sufficient substitutability, specified by x. But everywhere in MAP mechanisms of siphoning off various amounts through substitutability must reflect from and influence the quality culture there.

Supply-and-Demand can be seen as but a warped reflection of the impact of substitutability. With given substitutability x for a market, suppose that it swells in aggregate revenue from some exogenous disturbance. This could be from local epidemic or transportation disruption. In that case, some enlargement will also be appearing in other markets of its Convention cluster: The disturbance translates, according to the MAP model, to a shift in path dependence index k after which that market settles down again into a profile summing to different aggregate size, and with corresponding impacts through x on its cousins. Supply-and-Demand doesn't reign in such stochastic change in a given market, but substitutability may partially equilibrate aggregate sizes across the parallel markets.

Substitutability for a given wine market will be impacted much more by another wine market cousin within the same Convention than by a market that is cross-stream but entirely outside the wine sector. And it appears that the various markets in such a Convention cluster tend to have rather similar values of x, in part just because they account for much of each other's substitutability. This justifies continuing to assign Convention labels to quadrants in a plane MAP since the markets in such a community will tend to have a common value of x as third coordinate.

The basic equations, such as (2), (5), (18), highlighted tau. This descriptor / parameter is closely coupled with x in my derivation of predicted ***W*** , and so tau remained in the shadow along with x for most of my earlier work that concentrated on profiles across the individual market. Tau signals path-dependency in total size of the market as a whole;[5] so tau, via A, is the analog at market level to the path-dependency index k from the level of representative firm along the market profile indexed by k.

Tau is just the ratio of the satisfaction of buyers side--measured as the most it could have been induced to pay for the given menu of purchases along market profile--to how much it actually paid, which is of course just W . This is analogous to buyers' surplus in economics. So tau is also an analog at market level to the profitability, for representative firm. But profit, because chosen by the firm through its commitment choice from the profile, is referred to market level, while I show here how tau can be aimed at a broader sector.

Return to formula (18) and note that tau adds to the rate of decrease of W with increase in x. So tau increases the siphoning impact from increase in substitutability x. The impact of tau on how substitutability shapes aggregate market size is even clearer from the following formula (19) for how ***W*** relates to the value it would have with all parameters the same except for x being set to unity, imposing unique isolation on the market. Designate as $\boldsymbol{W}_1$ the value of ***W*** when x=1: see formula (5).

$$\boldsymbol{W} = \{ \boldsymbol{W}_1^{1-v} / (\tau / \alpha)^{x-1} \}^{1/(x-v)} \qquad (19)$$

Note that tau contributes to W_1 itself, in inverse proportionality with tau to the power 1/(x-v), so that the extent of siphoning depends on tau somewhat less than does W in formula (18). Of course, no market can persist in isolation when v>1, so then there is no $\boldsymbol{W}_1$, and the formula is inapplicable.

But then if tau has the large impacts indicated by these formulas, why has it not been given more attention? The point is that producers choose what volume-price packages to offer. The buyer side can only accept or reject, which does give it power to insist on strict equivalence in how good a deal one and another of the producers is offering. A mnemonic for Tau is “what a Terrific deal here.”

But the buyer side has no leverage, in this MAP model, to insist upon a terrific deal or indeed any particular level of buyer surplus, except that it not be less than zero. For the given market considered alone, tau may be but an historical accident of the path-dependent evolution of the market profile. Thus tau need not have the operational relevance of x. But it may have within the culture of a set of markets in a Convention.

Strategic and policy implications within a sector

Within the larger scope of a whole sector this picture can change. The definition of sector is that most of the substitutability x for one market comes from other markets of that sector. The contribution to x for one market just from its cousin markets within a quadrant with the same Convention, while it is substantial and often mutually symmetric, need not predominate. Overlaps of buying (see White 2002, chapter 8) might be smaller with any given market outside the given one's cluster but still in the sector while yet their total impact is larger.

The key is that whereas one expects each of the markets within a Convention cluster to have much the same substitutability x, whatever the share that is attributable to other cluster members, Convention clusters in different quadrants may well have very different levels of x. And the contribution in one direction from a quadrant to the substitutability parameter x of a market in a different quadrant's Convention will tend to be different from that in the reverse direction.

The INRA research team particularly looks to changes, but these, as in the shift for Table Wines plotted in Figure 4, need not involve changes in x, the degree of substitutability for a market. INRA's attention is focused on major changes underway across the whole wine sector, and there I argue that changes in substitutability do play a big role.[6]

Take as an example the rapidly emerging cluster(s) of *cepage* wine indicated in Figure 6. *Cepage* markets are likely to contribute much to the common substitutability of, but accommodate little in their own substitutability, from the AOC quadrant cluster--and similarly with respect to the table wine cluster(s).

Participants are also trying to reconstruct as well as re-present the existing clusters. Much of these efforts in Languedoc-Roussilon join with those from other parts of the Midi to fashion a new cluster, whose wine labels are identified by d'Oc, which tries to convince all of its high standing. It is a sort of hybrid--with aspects of *cepage* as well as of AOC and of course the table wines that are traditional and remain substantial in the Midi by any measure.

Once substitutability with other markets enters the dynamics, the picture can change for tau. It can emerge fully from the shadows. The buyer side in any given market is buying in various other markets, with the extents of these crossovers being reflected in x (as is suggested by the formula for x in terms of omega in White (2002, ch. 8). Substantively, the buyer side can cross reference different markets it buys in according to the tau it experiences. So a difference in tau can induce a shift between markets as wholes.

However, this very fact suggests that within a quadrant, within a Convention cluster, not only x but also tau will tend to be the same. Yet one neither expects nor observes tau to be the same in one community of markets as in another from different quadrant and Convention. And there can be massive shifts, often perceived in simplified terms as shifts in taste, from the buyer side between such different clusters of markets.

Under such pressure the level of tau in a market is subject to change in ensuing maneuvers realized in changing values on k that are coordinate with changing values of tau. How big is the direct impact on market aggregate $\boldsymbol{W}$? The formal derivation is easy enough. The proportionate decrease in market aggregate with increase in tau has been included in equation (15). Note that the sign here too is negative, as it was in equation (4), and with the same dependence on inverse of (x-v).[7] Here this negative result is not so intuitive. It sidesteps Supply-and-Demand to say that as buyer side gets happier (the deals in a market getting better for buyers) the $\boldsymbol{W}$ can be expected to go down.[8] So this formula (15) suggests even more impact on market size from tau. This adds to the adjunct role enhancing increase in x that is suggested by equation (4).[9]

And feedback loops that involve both x and tau can reach beyond this. When siphoning away increases, buyers may well perceive that and seek still better deals, leading to higher tau in that market. That is, the levels of tau and x may correlate through maneuvers of actors that go beyond the W(y) market mechanism as specified so far. As x is perceived to go up, then through pressures from elsewhere in the sector tau may be enabled to increase, triggered by buyers perception of goods being more easily replaceable.

The fields of Industrial Organization and Strategic Management both talk much of product life-cycles (see White 2002, chapter 13). It should be possible to construe these better in terms of feedback loops in x and tau within, and also across sectors and conventions.[10] The possibilities are manifold. The struggles in the wine sector today, not limited to France, seem to especially concern such changes, and asymmetries in substitutability. And I suggest there may be spiraling feed-backs at work, right within the dynamics working among markets modeled in MAP. They reflect interaction across distinct quadrants , since substitution reaches across the whole sector. The earlier results from this MAP model can guide further thinking.

Extensive empirical studies are needed to test such scenarios. And these raise two major issues. First, is numerical calculation. Even given the many sets of simplifications used in the MAP model, the closed analytic solutions from which we derived the equations of proportionate change underlying the scenarios hold only for the special case k=0. This designates a median path of profile formation with the special property that all the distinct niches for firms are equally profitable, proportionately. Empirical applications of the MAP model will require very extensive numerical computations of self-consistent solutions for other paths. And yet even the most extensive may not give clear qualitative insights such as have been claimed in this initial sketch.

Second, we must probe further equations (4) and (5) above for k=0 solutions concerning substitution effects. Operationalization is needed in terms of parameter values rather than changes in parameters.

Section B: Markets facing up-stream

Production flows, of goods or services, these are what most markets establish today, rather than exchanges of stocks as in traditional sorts of markets. Three roles, not just buyer and seller, are involved in commitments decided in making these markets. Part I worked through the implications of these assertions with the aid of a specific signaling mechanism operating across some set of firms arrayed on quality: The outcomes depended on ratios of contextual sensitivity downstream to that upstream, first with respect to valuations of volume produced and second with respect to valuation of differential quality of these flows.

Across the world more and more of economic action is becoming engrossed into such network systems of production markets. But Part I has left out half the possibilities for viable market mechanism. The operation of each market, its patterning of commitments by firms to production volumes, evolved to shield firms from Knightian uncertainty. In various contexts and eras the focus of perceived uncertainty may lie back upstream versus suppliers, rather than, as assumed thus far, being downstream vis a vis purchasers. It turns out that the two orientations are largely, though not wholly, complementary in that contexts that support viable markets of one orientation will not usually support the other orientation.

We first sketch the mechanism for upstream orientation. The second subsection then explores substitutability and feedback interactions as in Part I. What will remain for further exploration is how cross-stream interactions among markets with one orientation may interact with cross-stream interactions among markets with the other orientation (see Bothner and White 2001). The third section will examine overall how upstream and downstream orientations complement and contrast with one another. It suggests likely correlations to various factor markets as well as industries and Conventions.

Much the same phenomenology of signaling still can support a market profile facing back upstream as shield against uncertainty. This dual upstream mechanism proves to yield much the same MAP space for arraying outcomes for a market according to its context. Again the embedding of a market of firms into context is measured by two sensitivity ratios, one as to volume and one as to quality. The abstract parallelism permits adaptation of the simplified formulas to describe contextual sensitivities for firms in the market as used in Part I. Use the same designators v and u for these two ratios.

But now the context is upside down: Draw the contrast to perfect competition, with which we started. With upstream orientation it is the downstream buyer side that is seen as predictable, with each firm approximating the revenue it anticipates from volume of its output by a determinate curve, analogous to cost structure for downstream (but now lying above the W(y) profile). Take as a first example Home Depot and its competitor wholesalers, or instead supermarket chains in a region. Each such producer has enough marketing expertise and experience to be confident of what revenues it can earn according to overall volume of throughput it commits to. Only in an occasional era would they come to see winds of Knightian uncertainty blowing downstream, say when a movement against coupons and sales as improper morally took hold.

As to wine, consider an established market say in Burgundy or Rhone reds where experience gives the set of producer-brokers confidence about revenues they can get from various levels of production--and with their headache the acquisition of their shares of suitably skilled vintners. One also could think of Australian producers who have created from scratch a whole industry calibrated to predictable sales internationally of their reliable yet distinctive wines of good quality at production volumes large when they can inveigle enough skills to pitch in (possibly recruiting from France). .

So its billings from suppliers, e.g., its wage bill, now is the puzzle for the representative firm in choosing its optimum commitment from among a menu curve it reads from peers' signals. Now W(y) is this revenue expended, rather than the revenue received by the representative firm according to its level of output y. The dual to Figure 3 thus has the set of determinate curves lying above rather than below the market profile. This W(y) is now, in producers' eyes, a liability to be pushed down, rather than its reward to be pushed up. Maximization by the producer pushes down against rather than up with W(y).

What concerns the suppliers, of course, is the gap by which W(y) exceeds their aggregate reluctance to deliver to the representative producer the amounts required to produce flow of volume y. This supplier side can enforce equally good deals, as to wages over their reluctance or distaste. By how much do the wages payments they receive $\boldsymbol{W}$ exceed their aggregate reluctance to supply? This measure, the dual to tau, is the ratio of aggregate reluctance to aggregate $\boldsymbol{W}$. It must be less than unity. Suppliers would simply evaporate from situations described by a ratio of unity or more. Operationally, this reluctance to supply amounts to the minimum aggregate payment suppliers would have accepted for that menu of equally attractive offers.

But again, the choice of volume commitments is still by the producers. Each chooses from its own determinate curve of revenue from downstream. It picks that volume which maximizes its net profit after subtraction of the wage bill W(y) which it paid.

Again the sensitivity ratios determine the curvature of W(y). This is the curvature that can sustain itself against the competing pressures from producers and from suppliers. It coaxes each producer into a distinctive niche on price, such that the niches offer equally good deals in suppliers' eyes.

With such curvature given, again a whole family of profiles, indexed by k, may each prove sustainable. Exactly the same abstract formula (1) continues to apply, but with the substantive meaning reversed, W(y) being a liability rather than a reward of the representative producer.

The results are easiest to read not from formulas but from the upstream analog to MAP that is given in Figure 9. This also reports, like Figure 7, the ranges of k that yield viable markets, now in upstream orientation.

-- FIGURE 9 ABOUT HERE --

Not surprisingly, the pattern of bounding regions by the diagonal and unity lines carries through. Five features are striking. Figure 7 is the dual MAP.

First, what was the COMMON triangle is now forbidden, not viable. So upstream orientation cannot hold in contexts close to what is assumed in approximating the market in terms of pure competition. The contrast between upstream and downstream orientations is greatest just in these contexts.

And the delights of operation in ADVANCED contexts are not available. When buyer sensitivity to quality gets very high relative to suppliers' (large u) that must be counterbalanced by low buyer valuation of higher volume relative to suppliers' disvaluation of such. But then just that quadrant not available in downstream orientation, because of unraveling of profile discussed around Figure 4. So these are the second and third striking features.

The fourth feature is that upstream orientation is maximally viable (range of k largest) for the quadrangle with volume sensitivity ratio greater than unity and quality sensitivity ratio less than unity (rectangle labeled TRUST for downstream orientation earlier). This quadrant is really more turf for upstream. And the fifth feature is that the remaining half plane, PARADOX is indeed equally suitable either for downstream or for upstream orientation of market signaling mechanism.

I will return to the five striking features of upstream orientation after introducing substitutability. I will skip separate treatment of unique market. I will look only at operation for the median profile, k=0. .

Substitutability and feedback

Somewhat the same account can be given for cross-stream interaction as in the latter part of Section A. The analog to cross-stream substitutability across markets facing downstream will continue to be greater than unity, like the parameter x was for downstream. This analog to x is the exponential power by which aggregate reluctance of suppliers to the market in isolation is pushed up by any presence of alternative calls for supplies from other markets. Whereas x reflected the shrinking of buyer call for products from the given markets because of substitutability with the parallel markets.

Continue to designate the cross-stream interaction parameter by x, now a mnemonic for 'Xcuse me for butting OUT'. Again its minimum size is unity. Again, being an independent parameter it defines a third dimension for the dual MAP, Figure 9..

The formula parallel to (18) (which reformulated (16) is

$$(1/\boldsymbol{W})\, d\boldsymbol{W}/dx = -\{\ln W - \ln(\alpha/\tau)\}\, v\, /\, x\,(x-v) \qquad (20)$$

Note that here too the aggregate size goes down with small increases in interaction, but there is an additional weighting factor, v/x, which lowers the predicted rate of decrease..

Turn to total outcomes. The ratios of parameters are inverted, but the label kept because the same numerical value is assigned for computing results which are comparable as to substantive context on cost and buyer sides.

The analog to formula (3) for a ray in terms of e is

$$h = (u - v) / v (u - 1) \qquad (21).$$

It follows that the analog to a ray is an hyperbola passing through the center point (1,1), defined by an equation in coordinates measured from that center, U= u-1, V= v-1:

$$h = (U - V) / (V \cdot U) \qquad (22)$$

whereas in these coordinates the defining equation for the linear ray (which was not reported explicitly in Part 1) is just

$$e = (V - U) / (- V) \qquad (23)$$

The analog to the basic equation (5) is equation (24):

$$\boldsymbol{W} = q\{(\tau / (\alpha)^{v}\{(h-1) / h\}^{x}[\{\Sigma: n=1,..,N\}\ n^{-b\ h}]^{(1-v)\ x}\}^{1/(x-v)}$$

This behaves in accordance with the qualitative preview given above. Similar analogs to many of the other equations in Part 1 can be derived.

Conclusion

Modeling the market mechanism requires nonlinear mathematics. This paper develops analytic guidelines for what, in most empirical applications, will be primarily iterative numerical calculations. I seek to reach the technical audience interested in the resulting problems in identifying parameters and estimating equations for outcomes and statistical assessment of reliability. This led me to provide considerable detail on mathematical aspects and the logics of fitting.

But embedding the model in phenomenology is also crucial for reaching substantive analysts, and the more technical sections were interspersed among more qualitative ones. The substantive aspects raise difficult conceptual issues: How should one think of the potential which given production markets emerge to exploit, and how is this related to siphoning between them, as well as to level of cost of production, influenced as it is by where producers are procuring inputs? These too are issues of social construction, like the mechanism within an individual market seen as isolated.

The overall complementarity between Figures 9 and 6, for upstream and downstream, is crystal clear. Where downstream is viable, upstream tends not to be, and conversely. But turn first to the cone where neither is viable: this area is hatch-marked in Figure 7.

This is a cone of balanced contexts in the sense that the sensitivity ratios on volume and quality are similar. The lesson is, as intuition suggests, that the W(y) market mechanism falls completely flat only with balance--in other words market profiles sustain themselves on the basis of divergence between sensitivity ratio on quality and that on volume.

The upstream orientation indeed sustains itself only when there is the greatest divergence between the two ratios. And these two off-diagonal quadrants, called TRUST and UNRAVELING earlier, are ones that are less likely to sustain robust downstream profiles. In particular the median k=0 profile is not sustained there for downstream orientation.

Downstream orientation sustains itself best when it is on the edge of balance between quality and volume sensitivities: indeed COMMON and

ADVANCED triangles form a cone that crosses the hatched cone of Figure 7. The signaling mechanism supports itself , for downstream orientation,

Only in the PARADOX region are both the upstream and downstream orientations robust for the same context.[11] The paradoxical quality for upstream orientation--that firms of higher quality in downstream eyes encounter less reluctance from the suppliers--indeed is substantively parallel to that given for downstream orientation in Part I.

The real point is interpretation of upstream regions.

To my book just published Part I adds understanding and analysis of how whole markets interact through substitutability with their cross-stream cousins. Supply-and-Demand is transmuted into these higher-level structural interactions. Part II extends this to markets facing back up-stream and integrates results for the two orientations. I have traced implications for evolution both of community clusters of markets sharing quality conventions and of whole sectors.

Today's trends toward greater sub-contracting point back to the putting-out systems of production that preceded the production market economy. And edge markets that deal with services are becoming more prominent, bringing still more of social activity into the economy. Large production organizations are being unpacked into congeries of smaller organizations linked together in such production markets. The parametric mapping of markets by contexts in MAP can site much of these developments.

I developed these extensions while working with a INRA team in Montpelier to apply my market model across the wine sector of France. The sketch of preliminary findings here can guide more intensive investigations and application more broadly in the wine and other sectors. At the same time there is a need for drawing possible policy implications, which surely will call also for exploration of the network and cultural configurations among actors which underlie the contexts and orientations of markets.

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[1] Here it seems hard for producer firms to grow and there may tend to be more of them in interaction, in conditions similar to those in population ecology theories of organization (Carroll and Hannan 1995).

[2] Just after 1900 a massive crisis had led to continuing displacements of market mechanism itself by State intervention and by rearrangement of producers, including the formation of cooperatives. Larger scope in time, in addition to return to network dynamics as in note 1 above, is necessary for modeling the 1900 crisis. The time horizon has to be long enough to model investment programs for upgrading quality and cost structure in anticipation of rapid growth during the boom spirit in Languedoc before 1900.

[3] Equation (1) derives from the signaling model of Michael Spence (1975), who however gave it a cognitive interpretation and incorrectly claimed that a profile could form ONLY for u negative. See chapter 5 of White (2002) for discussion.

[4] Figure 8, and its ray lines in figure 7, can be contrasted with equation 7.4, and the associated Figure 7.4 in White (2002). The latter is a projection (approximate) of how market aggregate varies with median quality, with gamma (equal to 1/x) held constant.

[5] This path dependency also can be seen as feedback loop between tau and x on a first level.

[6] The only sector used as example in this paper is wine. There are other compatible empirical studies, notably that for knitted textile production of Scotland by Porac et al. (1995). Their analysis is couched in terms of cognitive framing for quality (Porac and Rosa 1996), which is an area under active development (Podolny and Hsu 2001).

[7] Also note, for the previous two equations as well as this one, that although u does not appear explicitly, it of course helps govern whether there can be any viable market profile.

[8] And of course thus the buyer surplus in absolute terms may also go down then. But it is implausible to think in terms of a discrete single buyer actor who might seek to maximize its surplus for the given market and manage the computation. The main point is that buyer surplus is adjustable only across markets that the buyer side is in so that sensible effort at absolute maximization is hard to pursue.

[9] That role is not negated by the fact that the rate of change with tau of the rate of change of $\boldsymbol{W}$ with respect to x is itself positive. This second derivative, which is the same also for the order interchanged between x and tau, just says that at any given level of x the erosion of $\boldsymbol{W}$ with small increase in x is lowered.

[10] The relation between sector and convention clusters is somewhat analogous to that between industries and strategic groups (Oster 1982 and see Baum and Dobbin 2000), but does not rest only on strategic maneuvering.

[11] This conclusion is derived only for the k=0 median solution, and numerical solutions for other k will show more incidence of overlaps.

Figure 1. Space of parameter ratio (downstream to up) for predicting outcomex in perfect competition.

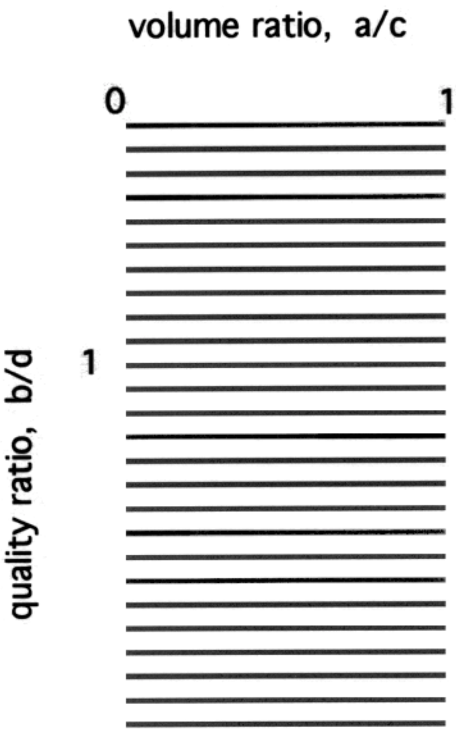

Figure 2. Space of parameter ratios for predicting outcomes in differentiated competition,
vertical axis--valuation by quality, zero to infinity
horizontal axis--valuation by volume, zero to 1 .

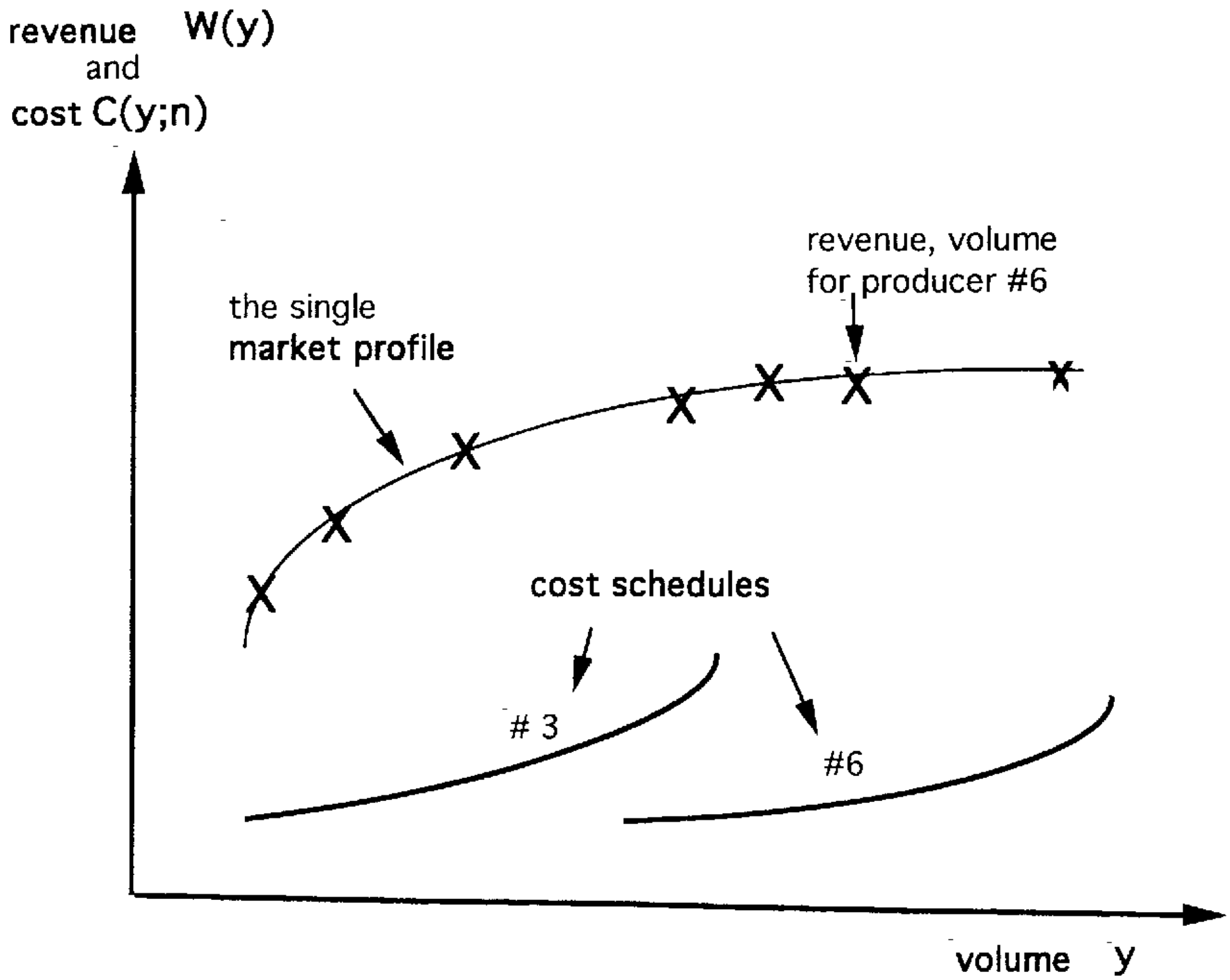

Figure 3. Each producer interpolates a profile through the (revenue, volume) outcomes of all, and then chooses optimum volume versus own cost curve

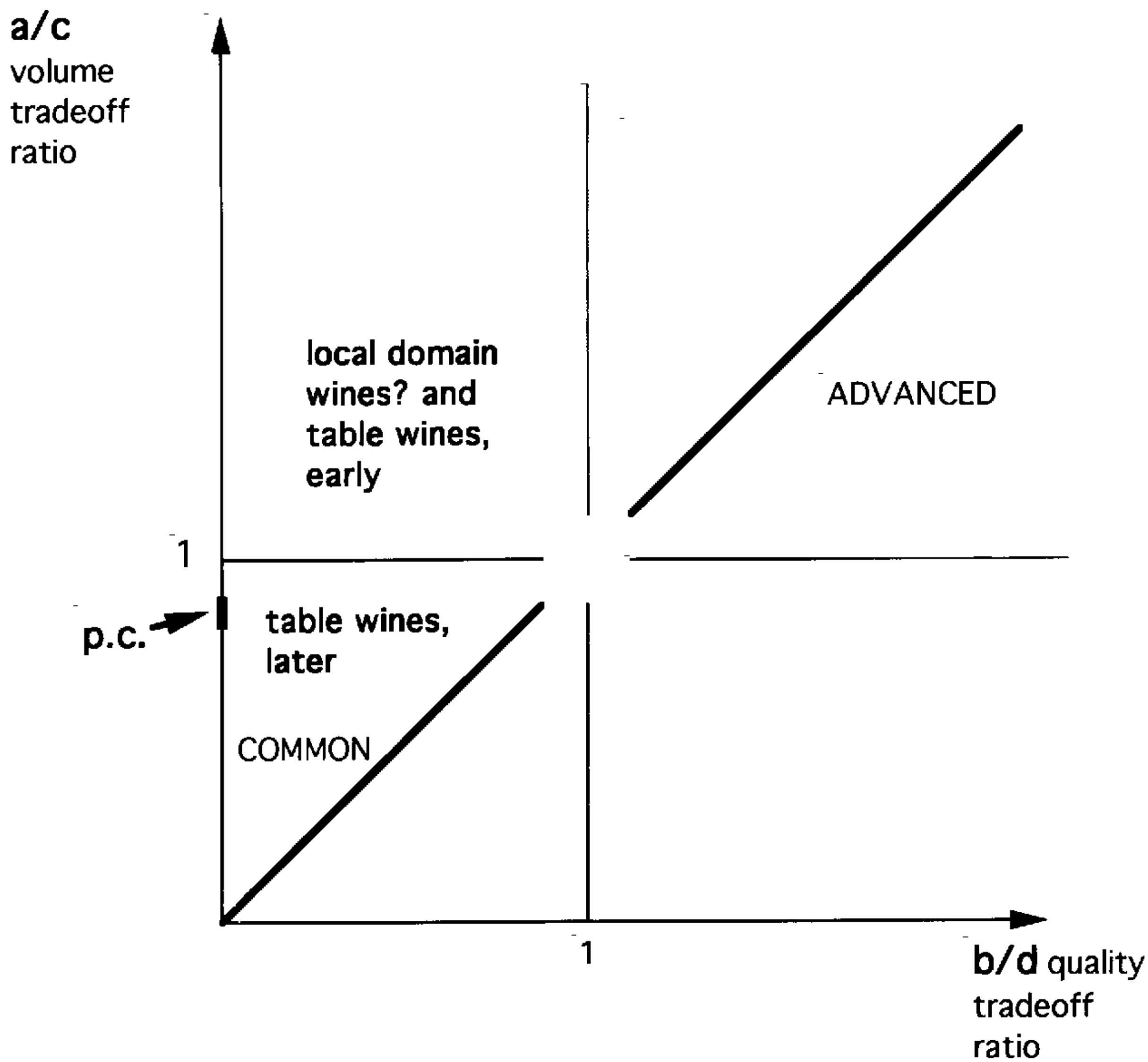

Figure 4 Plane of contexts yielding distinct curvatures of market profile

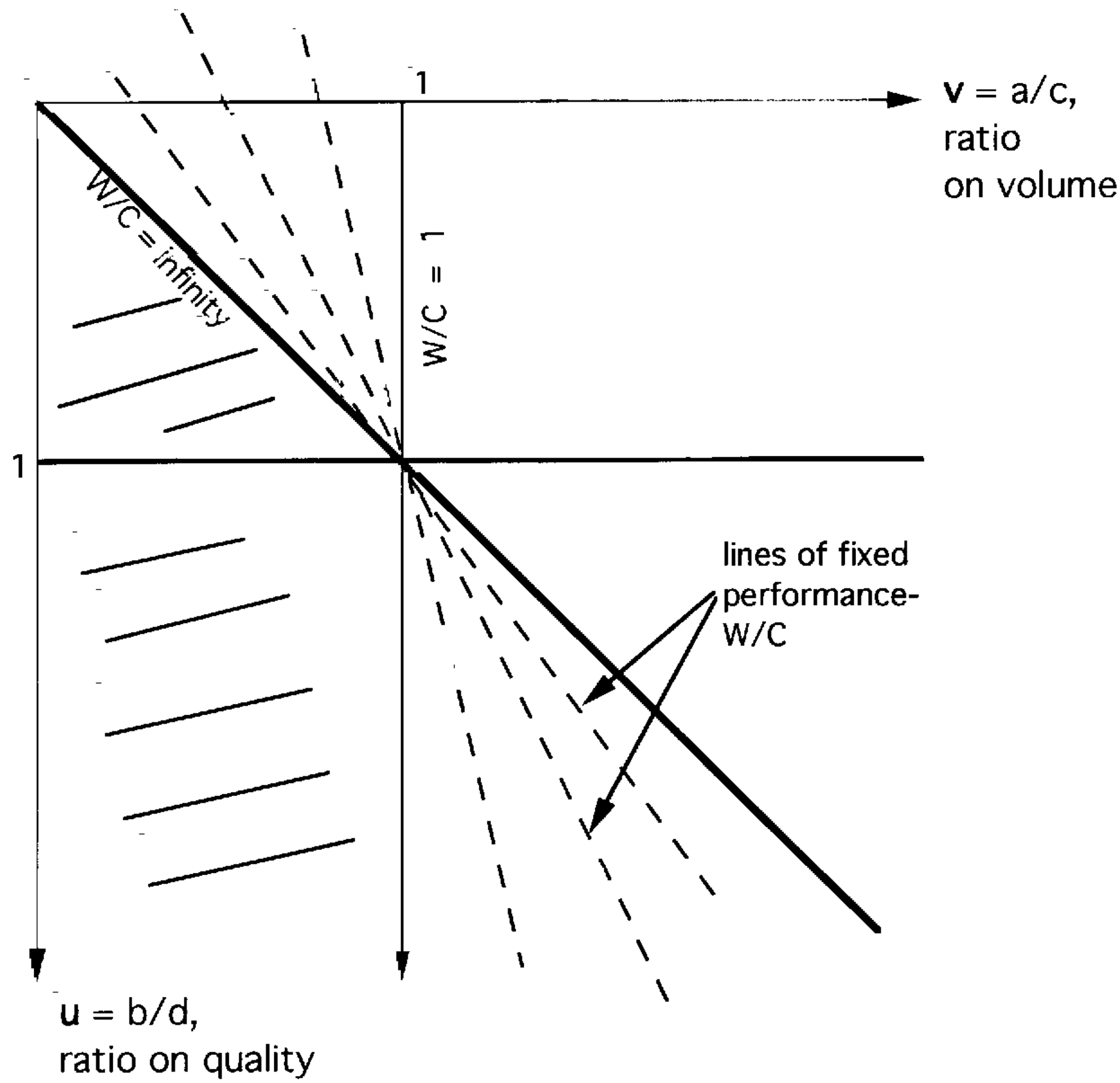

Figure 5 Dependence of firm profitability on location along rays in market space.

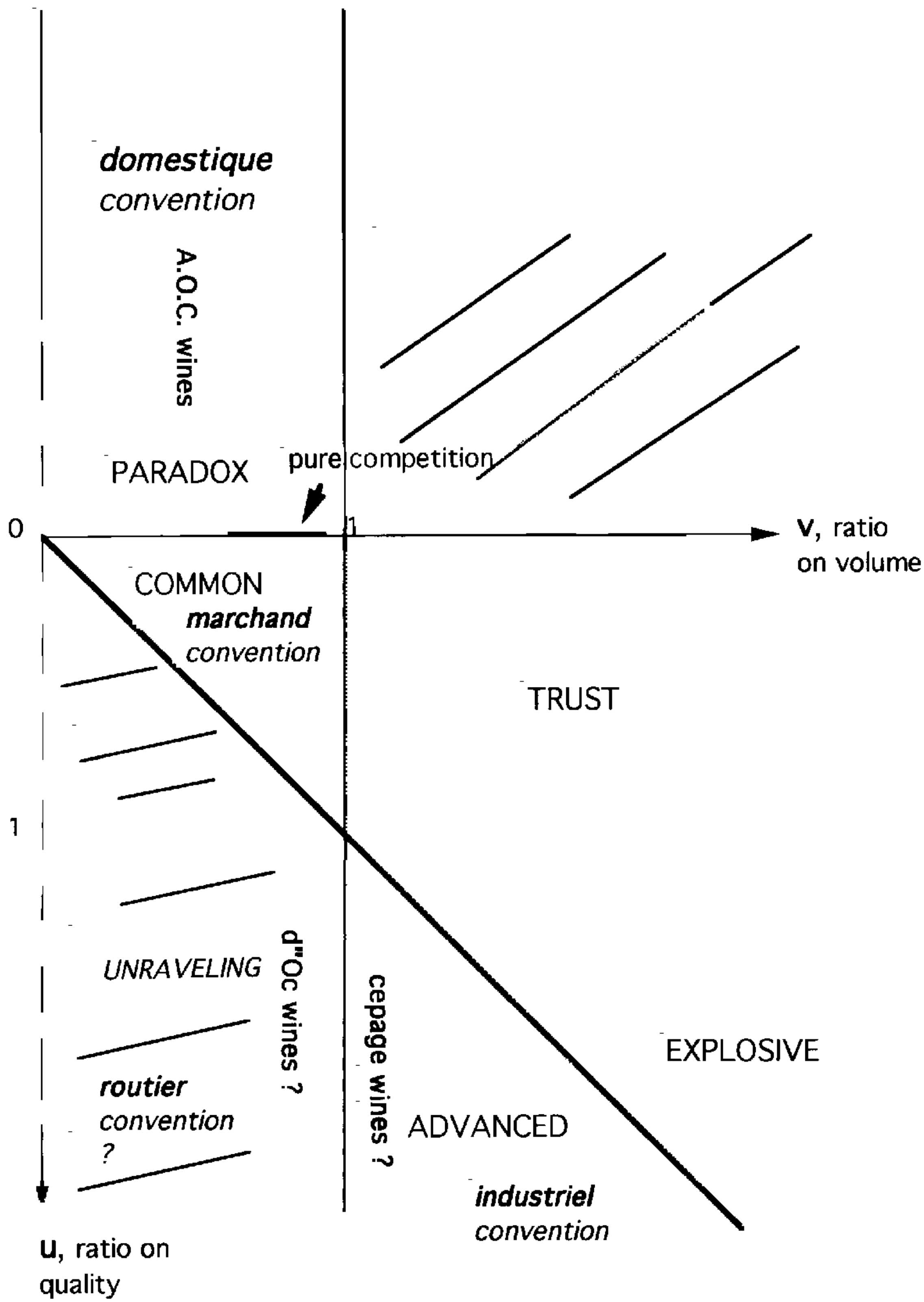

Figure 6. MAP. plane extended to negative u, with assignments of *Conventions* and of wine clusters

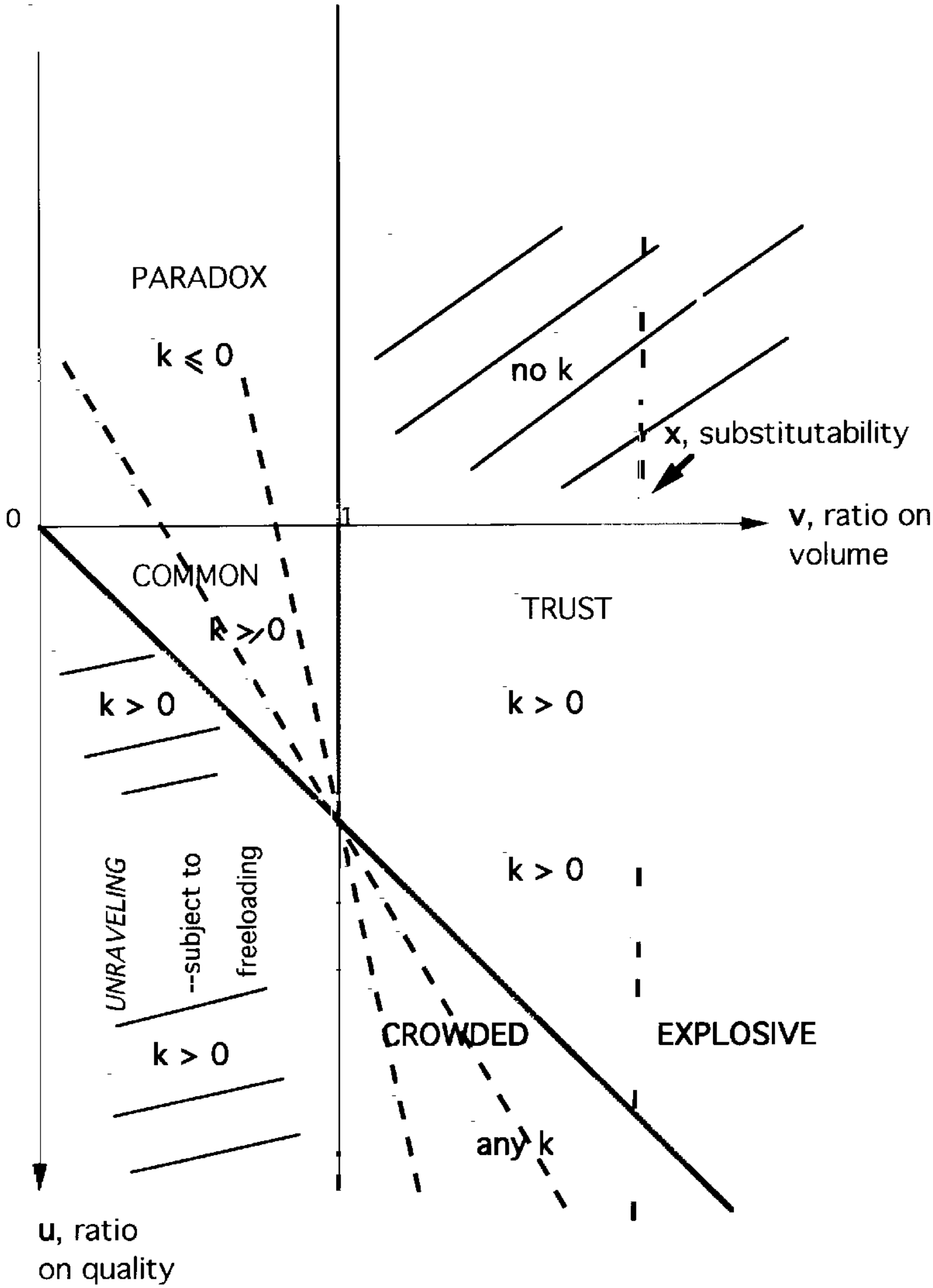

Figure 7 Market plane, MAP, as in figure 6, with third dimension,substitutability x specified, and ranges of k for viable profiles indicated by region.

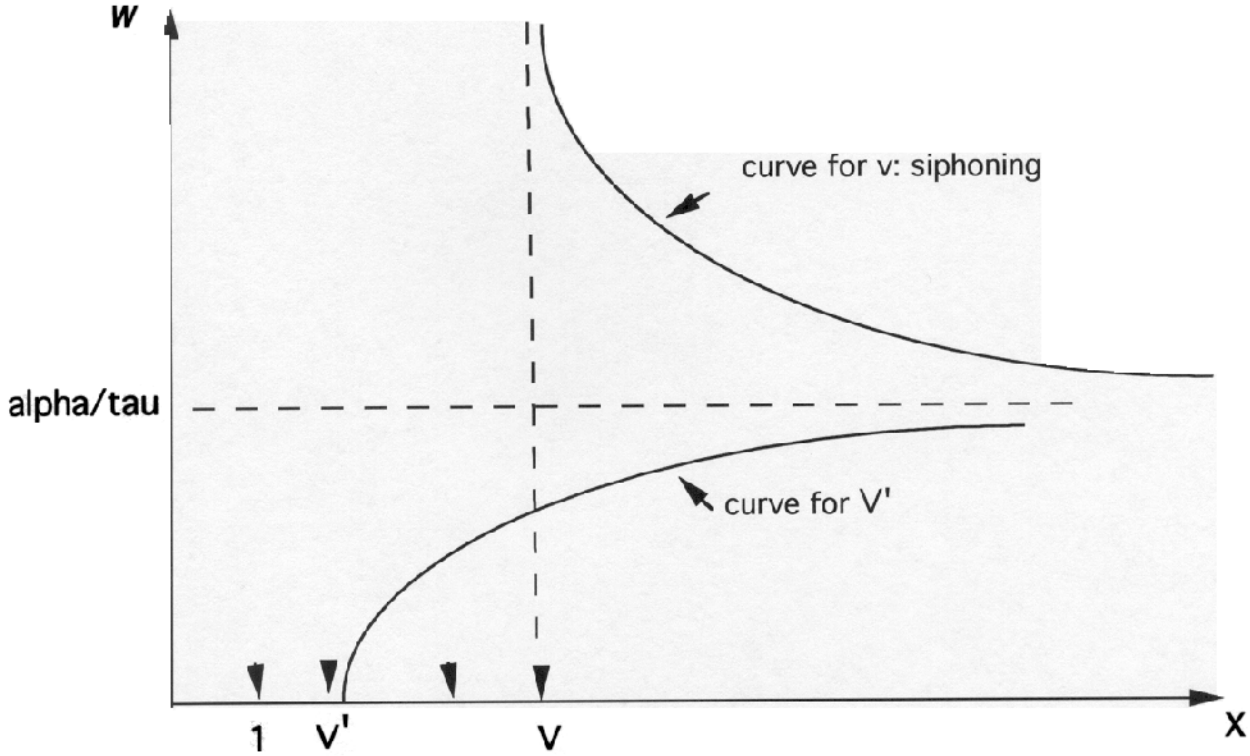

Figure 8. Graphs of market revenue ***W*** versus substitutability, x, given critical size Vc, for two fixed value of V. The curve for V' shows backward siphoning.

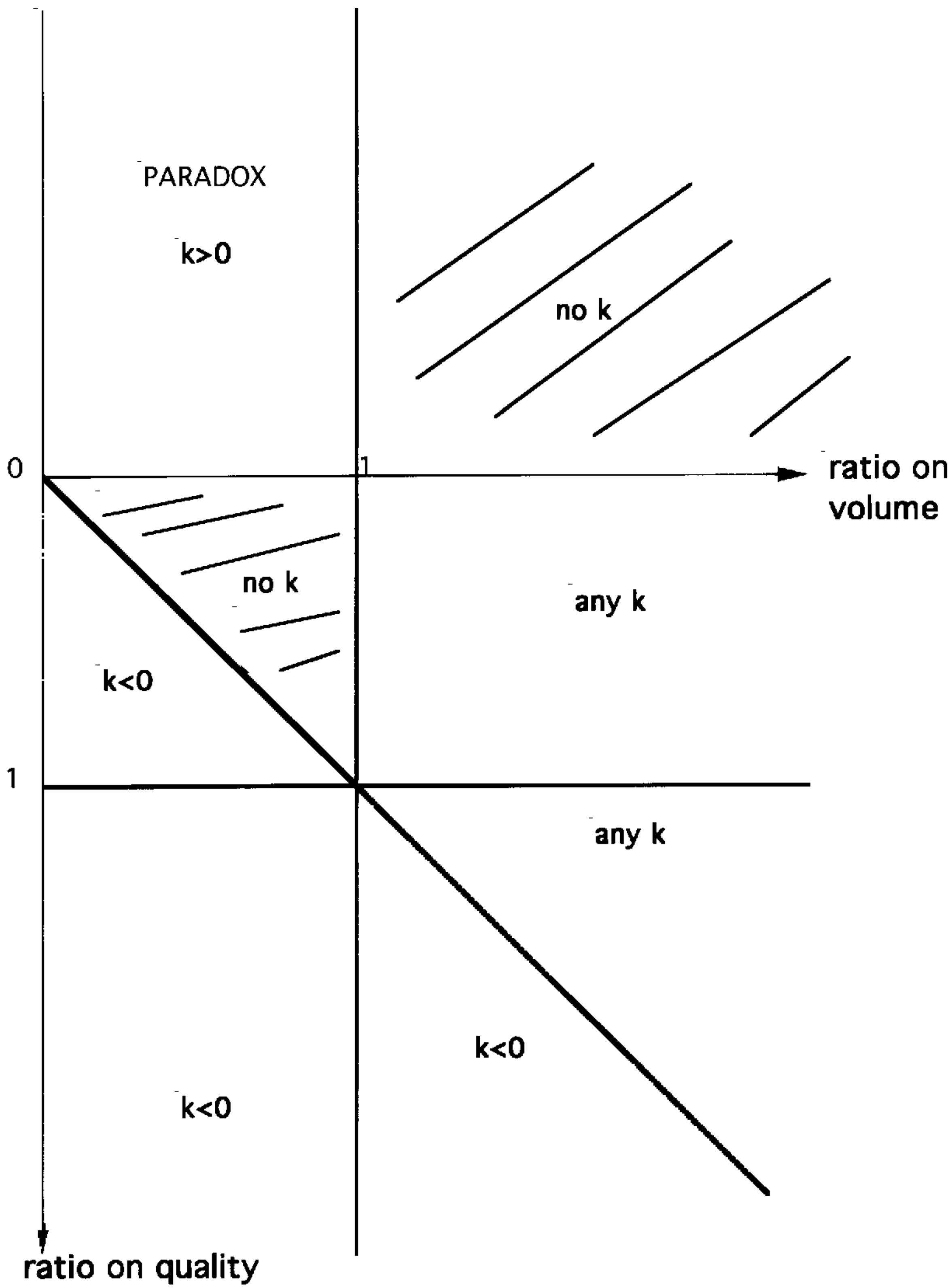

Figure 9. Upstream market plane dual to Figure 6

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