Market Definition:
How Stationarity Tests Can Improve Accuracy

The economics of antitrust is subject to constant review and refinement. This applies to both theoretical and empirical analyses. Even empirical tests that are very commonly used, such as those based on similarities of price movements over time, can be made more robust and reliable. This memo explores how 'price correlation analysis', a well known empirical technique, can be improved upon to produce more reliable results in defining markets.

The shortcomings of price correlation

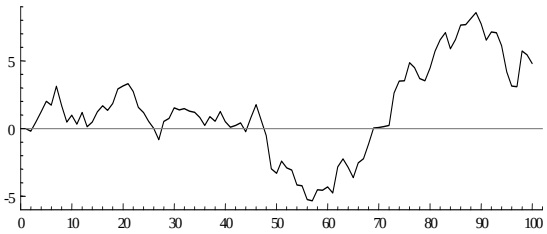
The principle of price correlation analysis is simple: if products are in the same market, their prices should move together over time. Any event that affects one product and changes its price relative to others will trigger substitution (either in demand or in supply). Eventually prices will come back into line (i.e. shocks are not 'permanent'). If substitution is easy and fast, we should see prices moving pretty much together – or with small lags – over time.

While simple and potentially powerful, correlation analysis also has well-known weaknesses. A misleading low correlation (false negative) can arise for several reasons, including the possibility that one price series responds to another with a *significant* lag. A misleading high correlation (false positive) can occur if the prices of both products are subject to a common influence or a common cost. For example, the prices of products which are derived from oil (an input subject to substantial price variation) may be strongly correlated even though they are not in the same market. There are also problems determining what correlation is 'high enough'. Finally it is well known that the results of a geographic analysis can change substantially depending on the currency in which the analysis is conducted.

Stationarity and relative price analysis

Many of these problems can be avoided by use of a 'stationarity' or 'unit root' test. This analysis is an adaptation of the large empirical economic literature on purchasing power parity, a key idea in the economics of currency exchange rates.

Figure 1. A Non-Stationary Time Series



The principles are easy to grasp. A time series is said to be *stationary* if it tends to revert to a constant long-run value, if the effects of shocks are only temporary. A time series is *non-stationary* if the effects of shocks are permanent, or if the time series evolves along a trend. Figure 1 above is an illustration of a simple non-stationary series, a 'random walk' where the effect of shocks are permanent.

In applying this technique to market definition, the variables of interest are *relative prices* (the ratio of one price to another) – either between two products, or between two geographic regions. If two sets of prices arise from transactions in a single market, then, unless there have been major structural changes, we would expect the relative price to be stationary. The basis for this is similar to the idea underlying price correlation analysis: there is a limit to how far prices within a single market can move out of line with one another before one price or the other is forced to realign as a result of competitive pressures.

Stationarity tests provide a rigorous means of testing whether there is a statistically significant tendency for relative prices to revert to a constant value. This kind of test sheds light on market definition by making it possible to conclude whether relative price movements follow patterns we would expect within a single relevant market.

Stationarity tests can also be extended to more than two products. If we have three products and wish to test whether the prices of all three products move together, this can be done by testing whether the two relative prices are simultaneously and jointly stationary.

Advantages and disadvantages

The advantages of this approach over correlation analysis are as follows.

(1) No false positives: common influences affect both price variables; when we look at the *ratio* the effect of common influences cancels out.

(2) Because we look at the behaviour of relative prices over the long term, the procedure is much less sensitive to mistakes arising from significantly lagged (delayed) responses.

(3) It is possible to look at relative prices for a group of countries and, crucially, unlike correlation analysis, the test statistics are the same regardless of the country and currency used as a base. This has been a vexed issue in a series of Euro mergers where the question of geographic market definition is often crucial.

There are some disadvantages.

(1) As with all statistics, if the data are uninformative the statistical results will give a misleading result – in particular it may suggest the market is unduly narrow.

(2) If one good sells at a premium due to transport costs, quality or taxation and this premium changes then there can be a false negative. But if we know the cause of the change in the premium and have a measure of it, it can be controlled for within the model.

(3) The standard method of defining relevant markets is the SSNIP test. Without more information, particularly sales data to estimate price elasticities, we cannot be certain that a non-stationary relative price necessarily implies that the wide market definition would fail the SSNIP test.

But all these disadvantages are common to correlation analysis. Relative price analyses have fewer weaknesses and they offer a consistent approach to the problem of geographic market definition across national markets with fluctuating exchange rates – a key issue in many cases.

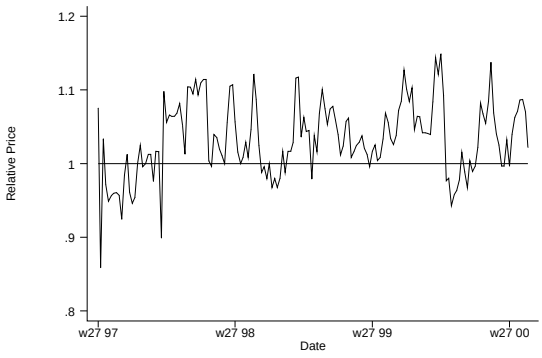
Scottish Salmon in the CC

The use of stationarity testing was recently accepted by the UK Competition Commission in the Scottish Salmon case, where both product and geographic markets were in issue.[1]

(i) Product Market: is Scottish Salmon a market distinct from Norwegian Salmon?

The following graph shows the delivered price of Scottish salmon in the UK relative to the price of Norwegian salmon, over the past three years. The graph is based on UK spot prices and on estimated average Norwegian delivered prices in the UK, both on a weekly basis.

Figure 2: Price of Scottish Salmon relative to Norwegian Salmon in the UK. (Stationary).



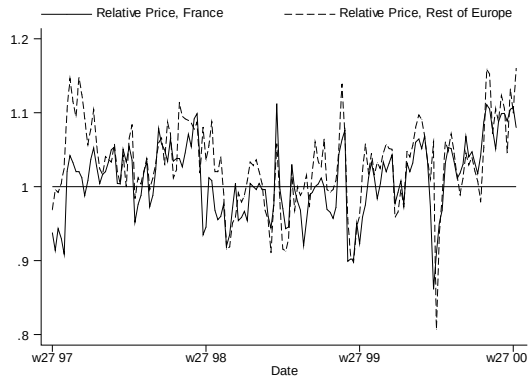
The econometric test for stationarity confirms that the relative price of Scottish salmon to Norwegian salmon is indeed stationary – i.e. tends to return to a constant value after any temporary deviations. The result is statistically significant (meaning that the hypothesis that the relative price is *not* stationary can be rejected with a high degree of confidence). The interpretation of this is that there is a stable differential between the prices of Scottish and Norwegian salmon in the UK over the medium term. This is precisely what would be expected if there is direct competitive interaction between Scottish and Norwegian salmon in the UK – i.e. if both products are within the same relevant market.

(ii) Geographic Market: UK or Europe-wide?

The graph below shows the price of Scottish salmon in France and in the rest of Europe, both expressed relative to the price in the UK , over the past three years.

Both of these relative prices have been tested for stationarity. The econometric test confirms that they are stationary – that there is a stable ratio between the prices of Scottish salmon for sale to the UK and each of the other two regions (France, rest of Europe) respectively over the medium term. The result is again highly statistically significant, and is therefore consistent with a geographic market for salmon which encompasses the UK and France, as well as other European countries.

Figure 3: Stationary time series: Prices of Scottish Salmon in France and Rest of Europe relative to UK



Conclusion

Empirical analysis now lies at the heart of competition assessment. Refinements such as the stationarity test flow from the need for constant improvement in statistical techniques. Their use can materially improve the accuracy of market analysis. Ultimately statistical techniques are a part of the practitioner's toolkit; issues such as market definition are essentially empirical questions and new developments such as the stationarity test can only improve the objectivity of the final decision.

[1] Competition Commission. *Nutreco Holding NV and Hydro Seafood GSP Ltd*. December 2000. Lexecon's analysis of the market definition for gutted salmon was accepted by the CC, but the merger was ultimately prohibited because of concerns about the market for fish feed.

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