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# Design and Implementation of Screens and Their Use by Defendants

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## I. MOTIVATION

Over the last few years, economic analysis in general, and empirical screens in particular, have become increasingly important in cases of conspiracies and manipulations, a trend detailed for example in Abrantes-Metz & Bajari (2009, 2010), Hüschelrath (2010), and Laitenberger & Hüschelrath (2011).[2] Competition authorities and other agencies worldwide have begun using screens to detect possible market conspiracies and manipulations, and defendants and plaintiffs have begun adopting them as well.

Screens use commonly available data such as prices, costs, market shares, bids, transaction quotes, spreads, volumes, and other data to identify patterns that are anomalous or highly improbable. A survey of screening methodologies and their multiple applications can be found in Abrantes-Metz & Bajari (2009, 2010) and Harrington (2008).[3] The use of these methods in conspiracy cases is detailed in the 2010 volume *Proof of Conspiracy under Antitrust Federal Laws*, by the American Bar Association.[4]

Screens' increased popularity and use on both sides of litigation have enhanced the debate on detection tools, their relative advantages and disadvantages, and the realized experience of those who have adopted them. Motivated by this debate, I propose in this article to achieve a two-fold objective. First, I will address some of the main criticisms commonly made against empirical screens and elaborate on the key features of design and implementation needed for a successful screen. Second, I will demonstrate the development and implementation of a screen on behalf of defendants in a case of an alleged conspiracy and manipulation in commodities markets. As the use of these approaches by defendants is as important as their use by competition authorities and plaintiffs, I take this opportunity to show how screens can be successfully developed and applied on that side of a case.

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[2] R. Abrantes-Metz & P. Bajari, *Screens for Conspiracies and their Multiple Applications*, 6(2) COMPETITION POL'Y INT'L, 129-144 (2010), and 24 (1) ANTITRUST MAG., (Fall 2009); K. Hüschelrath, *How Are Cartels Detected? The Increasing Use of Proactive Methods to Establish Antitrust Infringemnts*, 1(6) J. EUR. COMPETITION L. & PRACTICE, 522-528 (2010); Ulrich Laitenberger & Kai Hüschelrath, *The Adoption of Screening Tools by Competition Authorities*, 9(2) CPI ANTITRUST CHRON. (2011).

[3] J. Harrington, *Detecting Cartels*, HANDBOOK IN ANTITRUST ECONOMICS (P. Buccirossi, ed.) (2008).

[4] *Proof of Conspiracy under Antitrust Federal Laws*, AMERICAN BAR ASSOCIATION EDITIONS, Ch. VIII (2010) describes these methods in detail.

## II. UNDERSTANDING EMPIRICAL SCREENS

In designing and implementing screens for conspiracies and manipulations, no matter on which side of the litigation, there are two key "golden rules" which must be kept in mind. As with most golden rules, they are obvious when stated, yet they are often forgotten in practice:

| | Golden Rules of Screens |
|---|---|
| 1 | One size does not fit all |
| 2 | If you put garbage in, you get garbage out |

I have always been and will continue to be a believer in the power and the role of empirical screens in conspiracies and manipulations cases, and use them in most litigation cases I am involved in. But it is important to remember that these are econometric tools, with all the usual caveats, and they may potentially be misused. Screens, just like any empirical technique, can be effective only when properly applied; otherwise they risk producing nonsense.

The above rules summarize my main counter-arguments to many of the criticisms I hear or read about screens. Take the first rule, "one size does not fit all." A screen needs to be designed or at least adjusted to the situation at hand. Just because a given set of variables and model specifications prove highly effective when estimating the demand for bread does not mean that those same variables or specifications work when estimating the demand for cars. We typically do not say "this exercise of using the demand for bread to estimate the demand for cars is useless and imprecise" and therefore abandon econometrics altogether for estimating demand.

The observation that a model of bread demand does not make a good model of car demand does not represent an argument against econometrics in general. The basic idea of setting up an equation that explains quantity demanded as a function of price and other relevant demand-side variables, and estimating it using appropriate econometric techniques, remains valid. Instead, the lesson we take is that we need to think clearly about what we want to estimate, the characteristics of the market at hand, and the appropriate set of variables and demand formulation to use so that the technique can be appropriately tailored to the case at hand.

Screens are no different in this regard. It is not a fair criticism to blame the screen when it delivers different results when applied to the levels of variables rather than their growth rates, when using different benchmarks or different time periods, or when either controlling or not for changes in other factors. Such things represent fundamentals of the empirical specification, they are not "variations on a theme," and just as no "regression model" would be robust across all of them neither should we expect "screens" to be. These are **key** decisions to be made when applying an existing screen, for whatever purpose it will be used.

This also leads us to the second golden rule: As is always the case in empirical work, a screen is only as good as the choices of what is put into it. Expertise is needed when developing and applying a screen. It is critical that the appropriate choices are taken based on sound justifications when designing and implementing an empirical approach to a conspiracy and manipulation case and, for that matter, in any empirical approach. Screens are powerful, but they are not so powerful that they work "everywhere" across "any" data set.

A proper screen should have a theory of collusion underpinning it. For example, there is a significant amount of theoretical and empirical evidence that collusion is likely to induce decreased price volatility, under particular circumstances.[5] But that does not mean that all types of collusion are expected to have that effect on prices. Certainly, it is reasonable to expect that when cartelists are fixing prices, they will, to the extent they are successful, likely induce lower price volatility than would otherwise obtain, due to the nature of their agreement. But it does not directly follow that all types of conspiracies will induce price stability. Does that mean that a variance screen to detect collusion lacks usefulness and power? No, not at all. But it does mean that we need to know how and when to use it, and to appropriately take into account relevant market conditions.

Laitenberger & Hüschelrath (2011) argue that, since it is possible that conspirators and manipulators learn how to disguise market outcomes produced under collusion so as to avoid screens, competition authorities should maintain a degree of non-transparency with respect to the screens they use. I agree, but would stress two points. First, a well-designed screen will go to the core of the conspiracy so that it focuses on the key feature that will be altered by the collusion (if successful). Some screens are more robust in this regard than others. Second, even if well-designed and implemented, a screen still has a margin of error and may produce an erroneous result because, among other reasons, conspirators have learned how to beat it. If so, it is preferable to continually improve the screen and enhance its detection power rather than to abandon it altogether. We should not let the perfect be the enemy of the good.

And even when the screen is applied in an econometrically sound manner, it can still be misused if it blindly flags situations representing candidates for potential illegal behavior while lacking a theory under which such behavior should be observed in the presence of material collusion. The likely outcome of such an exercise is the erroneous identification of several potential cases leading to frivolous identifications and investigations. This is another criticism sometimes leveled against screens, but I would again classify it as a criticism of implementation, not the screening technology itself.

Another common critique of empirical screens is that they are too resource intensive and therefore not practical to implement. Empirical screens can only be applied to markets in which data are either currently available or for which data can be readily collected. Given this constraint, and the fact that screens should not necessarily be used for any and every market at every moment in time, why should they consume more resources than other investigatory tools? Maybe because screens are proactive instead of reactive tools? Then, the fundamental question to address is whether agencies want to engage in proactive policies that will increase their consumption of resources rather than simply react to complaints and leniency applications. If so, the nature of the "too resource intensive" criticism is not specific to empirical screens but common to many—if not most—proactive policies.

Every detection tool has its advantages and disadvantages. Despite the success of leniency programs, many cartels may still remain undetected. The question is how to find ways to supplement leniency programs in order to not only increase the effectiveness of cartel detection

[5] R. Abrantes-Metz, L. Froeb, J. Geweke, & C. Taylor, C., et al., *A Variance Screen for Collusion*, 24 INT'L J. INDUS. ORG.,467 (2006); S. Athey, K. Bagwell, & C. Sanchirico, C, *Collusion and Price Rigidity*, REV. ECON. STUD. 317 (2004); J. Harrington & J. Chen, *Cartel Pricing Dynamics with Cost Variability and Endogenous Buyer Detection*, 24 INT'L J. INDUS. ORG, 1185 (2006).

but also enhance cartel deterrence. Preferably, this would be through engaging in proactive policies that decrease the likelihood that cartels will be formed in the first place. As argued in Klawiter (2011),[6] this may be one of the advantages of empirical screens—to allow for the detection of cartels in economic sectors different from those historically detected by leniency.

Second, I would add, it may well be that leniency is more likely to fail detecting very successful cartels whose members have no reason to apply for leniency because they all enjoy significantly larger profits than under non-collusion. Ironically, these may also be the cartels causing the most harm to consumers and, maybe, inducing more visible market outcomes detectable by screens. Cases detected through leniency programs are, after all, self-selected.

Screens are commonly used in securities litigation, not only by the main agencies to assist in the detection of potential illegal behavior, but also by plaintiffs and defendants at various stages of the litigation. Granted that more data are typically available in those markets, but in general, where data are available, why should screens not be as widely used in antitrust?

As general guidance, the development of a screen and its implementation requires informed and appropriate decisions on the following matters:

| | **Requirements when Developing and Implementing a Screen** |
|---|---|
| **1** | An understanding of the market and industry at hand, including its key drivers and the nature of competition; |
| **2** | A theory on the nature of the agreement among colluders; |
| **3** | A theory on how such agreement will affect market outcomes, for example, prices, bids or market shares; |
| **4** | The design of a statistic delivered by an econometric model capable of capturing the key market drivers and the key factors of the theory of collusion, consistent with the market structure; |
| **5** | Empirical and/or theoretical support for the screen; |
| **6** | The identification of an appropriate non-collusive benchmark against which the theory of collusion and empirical results will be compared. |

Even a screen based on a solid theory of collusion and properly designed and implemented can still produce erroneous conclusions, just as is the case with any other statistical test: It may indicate a conspiracy or a manipulation where one does not exist (type I error), or it

[6] Donald Klawiter, *Enhancing International Cartel Enforcement—Some Modest Suggestions*, 9(2) CPI ANTITRUST CHRON. (2011).

may fail to flag manipulations or conspiracies which do exist (type II error). Again, just as we would not argue that statistical tests are useless because they have margins of error, we should apply the same standards to screens. Our hope is that types I and II errors will not occur with high likelihood, though there is certainly a trade-off between the two.

Screens are very useful for flagging or identifying unusual patterns in data but they cannot prove that any wrongdoing actually did or did not take place, and they certainly cannot speak to whether any wrongdoing was *intended*. Empirical analyses are incapable of distinguishing legal tacit and strategic behavior from illegal explicit coordination because, quite simply, these two legally distinct cases may well produce identical market outcomes and data. But none of the above means that screens are not valuable or lack power, only that they need to be properly developed, implemented, and interpreted.

Below I demonstrate the development of an innovative screen based on a specific theory of collusion and manipulation designed for the particular case at hand and used on behalf of defendants.

## III. DEVELOPMENT AND IMPLEMENTATION OF SCREENS BY DEFENDANTS

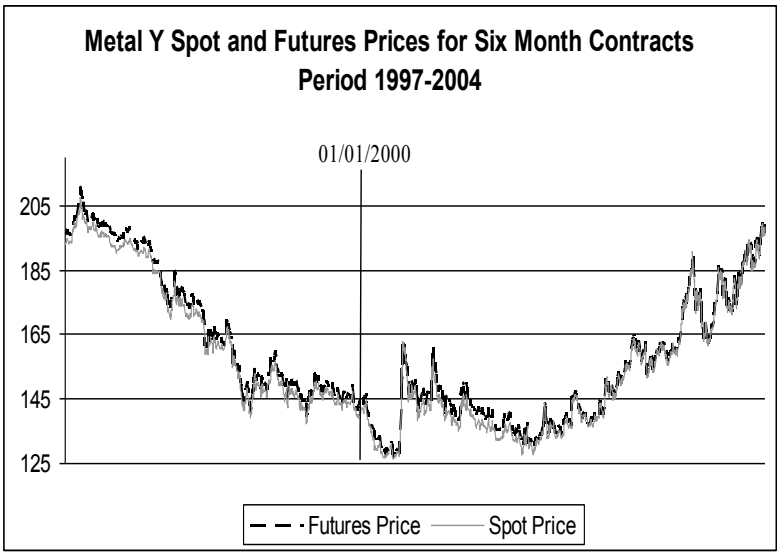
Just as valuable as empirical screens can be on the detection and prosecution sides, so can they be when used by defendants. In my experience as a consultant, I have developed and co-developed numerous empirical screens to assist defendants in litigation involving alleged conspiracies and manipulations in a variety of alleged cheating and markets. A few times, these analyses involved the application of existing screens appropriately adjusted to the case at hand. But more often than not, they also involved the development of new screens specifically tailored to the market and allegations at hand.

The following example discusses how defendant's economists, Abrantes-Metz & Addanki (2007), developed an innovative screen for manipulation and conspiracy in commodities markets that was used to support empirical evidence of either the absence or the non-materiality of such anticompetitive behavior.[7] After studying the market conditions and trading in the relevant commodity, and after considering similarities to previous manipulation episodes such as the famous Hunt Brothers silver manipulation episode of 1979-1980, we decided to use that silver manipulation episode as the empirical support for our newly developed screen. Below I summarize how the method was developed and applied to our market manipulation and conspiracy case. The example provided has been significantly altered and does not reflect the facts or the data in the actual case. It serves to illustrate how a screen can be developed and used in practice to assist in exonerating a defendant.

In our case, plaintiffs alleged that defendants had conspired to manipulate downwards the spot price of metal Y. Figure 1 below represents the evolution of the spot and futures prices for a six month contract of this metal, for the period of 1997-2004:

[7] R. Abrantes-Metz & S. Addanki, *Is the Market Being Fooled? An Error-Based Screen for Manipulation*, Working Paper.

**Figure 1**




### *A. Theory Of Collusion And Manipulation And How Market Outcomes Were Affected*

Allegedly, defendants engaged in a conspiracy to depress the prices of metal Y. The conspiracy was alleged to have come to an end at the start of 2000. This date is marked by a vertical line in the figure above. Prior to this time period, prices steadily fell. To the right of the vertical line, after the breakdown of the alleged conspiracy, prices steadily rose. It was alleged that defendants' motive was to depress spot prices for Y and then buy commodities related to Y at a lower price.

It was also alleged that defendants conspired to drive prices down by offering to sell the commodity at "very low prices" during the allegedly tainted period and, given that they were large participants in that market, that it would have been possible for them to have affected prices in the desired direction. Since defendants were not actively participating in this market every day, the alleged pressure to push the price of Y downwards existed in the days they traded, but not in the days in which they did not trade.[8] This movement between in and out of the market, which allegedly moved prices in one particular direction, should be expected to produce additional variability in these prices which otherwise would not have existed. By driving downwards the price for Y, the conspiracy was alleged to have increased profits from trades in this related market by more than it allegedly lost in the market for commodity Y. The trends in prices to the left and right of the vertical line in Figure 1 were presented as evidence for this alleged conspiracy and manipulation.

Defendants' economists offered alternative explanations for the decrease in prices before 2000 and the increase thereafter. These explanations included relative changes in the supply and demand for commodity Y as well as changes in financial markets as proxied by the S&P 500 Index, and changes in the economy in general.

[8]Other empirical analyses were also pursued comparing days in which defendants traded against days in which they did not. These analyses will not be covered in this article.

### B. Design of the Screen

Along with other relevant analyses pursued to address each of the possible explanations for the observed pricing patterns, defendants' economists designed an empirical screen for manipulation in commodities markets, based on daily commodity spot and futures price data and supplemented by other relevant data at a later stage. The set-up of an econometric model at this stage allowed for the analysis of the hypothesis that no material conspiracy and manipulation had occurred—versus the alternative hypothesis that it had—in an appropriately scientific setting in which materiality could also be addressed as associated with a particular significance level for the specified statistical test.

The basic idea for the screen addresses the expected higher variability and unpredictability of prices during the allegedly tainted period, and is as follows: If manipulation is occurring, not all of the relevant information is being shared in the market place, which means that the market is being "fooled" as it is forming its expectations about future prices based on a wrong or at least incomplete information set. As a consequence, the market's ability to forecast what prices will be in the future is impaired. This decrease in the market's forecast accuracy is expected to induce more frequent and diverse errors when forecasting prices.

Given that futures' prices can be interpreted as the market's estimate of future spot prices, manipulation can be expected to affect these market predictions and their accuracy. If so, forecasts will be more frequently wrong and off by larger amounts, as there is crucial information for price determination that is not being learned by market participants. Empirically, this hypothesis implies that the market's forecasting error, as proxied by the difference between futures' prices today and spot prices at the maturity of the contract (in absolute value, or otherwise divided by the current spot or the current futures prices), is more variable during manipulation periods and may also be larger in absolute value.[9]

### C. Case Law Support for the Screen

We should note that decades ago, Judge Frank Easterbrook suggested a similar relationship between futures and spot prices when markets are manipulated. Easterbrook (1986) states "[s]omeone who buys long positions because he understands the supply of the commodity better than other traders is engaged in normal economic behavior; his actions drive the price in the direction it should move. Someone who is betting on his ability to conceal his own position from others and to profit solely from that concealment, is engaged in fraud…the person who seeks profit solely from concealment makes today's price less, not more accurate as a predictor of future prices. The decrease in accuracy is a source of economic loss."[10]

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[9] Even if there is a bias of the futures price as a predictor to the spot price in the future, for which there is some empirical evidence, the test would look for changes in this bias' average value and variability. Notice that the error that we call the forecasting error is not truly a forecasting error in an econometric sense. There is no reason to believe that the difference between today's futures price and the spot price at maturity has to be independent of all of the known information through today. That is a key statistical feature of a forecasting error. We could have run more elaborate econometric models to find the statistical forecasting error but, in our case, we found that such an increase in accuracy at that level presented no value added for our analysis and in fact it just made it harder to follow.

[10] Frank Easterbrook, *Monopoly, Manipulation and the Regulation of Futures Markets*, 59(2) J. BUSINESS, at S118 (1986).

### D. Empirical Support for the Screen

As an empirical validation to test this hypothesis, Abrantes-Metz & Addanki studied the Hunt Brothers silver manipulation episode and how (forecasting) errors compared between manipulation and non-manipulation periods. The figures below represent the spot price and the futures price for contracts type SI3 (i.e., contracts of average maturities between 5 and 6 months), and the corresponding (forecasting) errors.

We adopted a before-after benchmark approach for our screen. We used as benchmarks the same silver market but before and after the manipulation episode, and compared the properties of our statistics against the alleged manipulation period. In both figures 2 and 3, the spikes in the time series correspond to the manipulation period, in which errors are clearly more variable than before and after the manipulation.

**Figure 2**

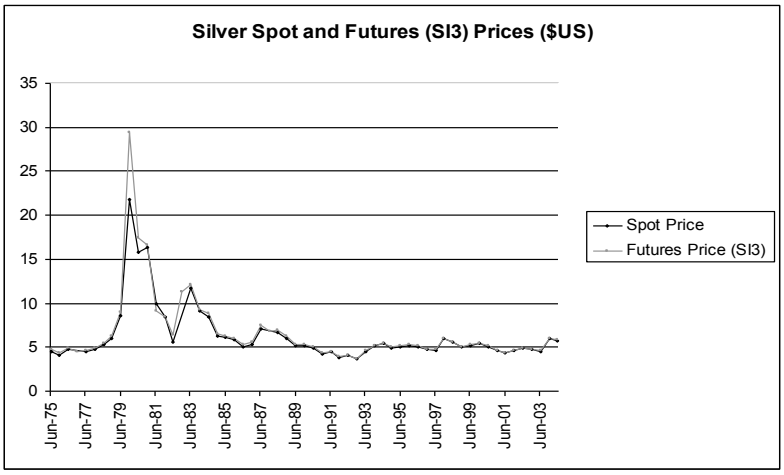
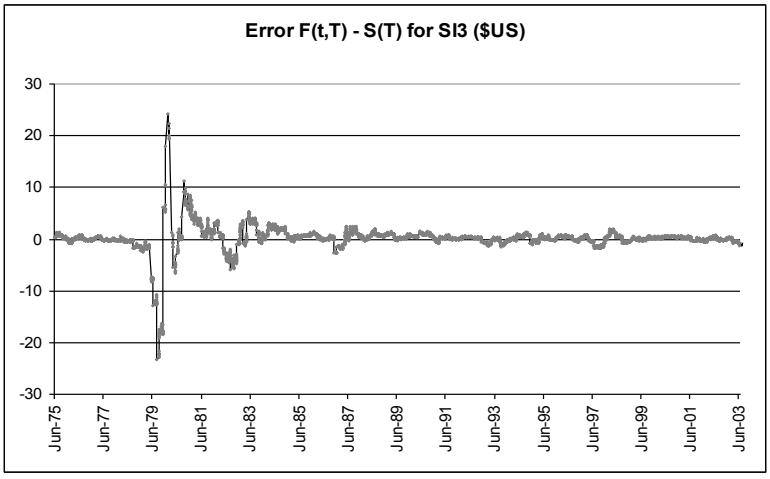



**Figure 3**




We then proceeded to explain this variability in errors as a function of relevant and legitimate factors in the silver market, and we also controlled for macroeconomic and market

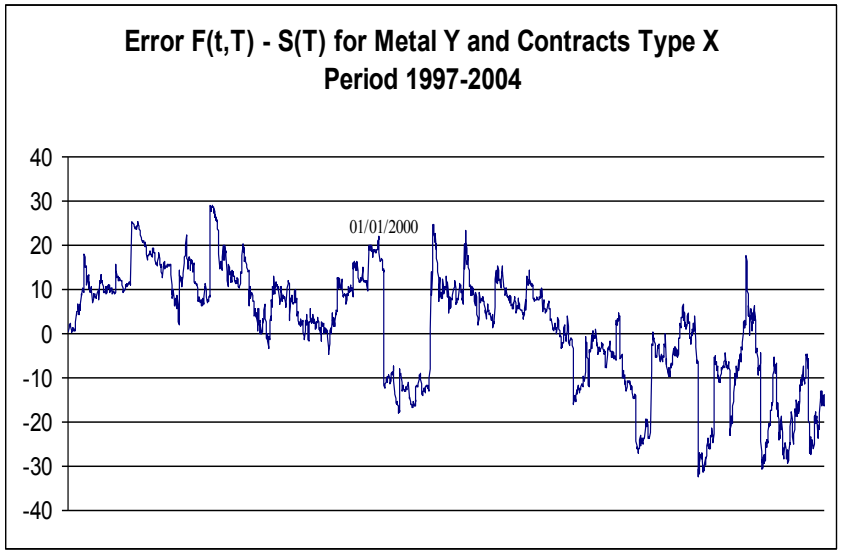
specific conditions not affected by manipulation (but which could be explained by variations in risk premium for this commodity). Our results showed that the noticeably higher variability of the errors during manipulation persisted even after taking into account other relevant factors.

### *E. Benchmark and Application of the Screen*

Abrantes-Metz & Addanki next performed analogous calculations for commodity Y. The difference between the futures and the spot market prices are presented in Figure 4. Note that the volatility in these errors is very similar between the alleged conspiracy and manipulation and the non-manipulation and non-conspiracy periods. The result also held after controlling for other relevant factors, including important changes in the supply and the demand for this metal.

The general downward trend in the errors was explained by an increased scarcity of commodity Y, which induced increases in the spot price with respect to the futures price and, in fact, generated an episode of backwardation in which spot prices today were higher than futures prices. This pattern was shown to have been induced by a slowdown in the general economic activity, and in financial markets in particular, starting in the year 2000. This slowdown induced investors to replace stocks for commodities and therefore exerted pricing pressure on these commodities' spot prices. General market conditions had been the reason for the observed pricing patterns while the properties of the forecasting errors were not consistent with a material conspiracy and manipulation of the spot price of commodity Y as alleged by plaintiffs.

**Figure 4**




The example above is one in which an empirical screen was designed by defendants' economists to illustrate features associated with manipulations and conspiracies in cash markets for commodities. The results were then used as the empirical support for the screen and its application to the market for commodity Y. Given this empirical support, the benchmark used as being the same market at a different moment in time (one in which manipulation and conspiracy were not suspected), it seemed unlikely that a material conspiracy to manipulate spot prices of commodity Y had occurred.

This is a very important application of screens. Depending on the type of conspiracy alleged and the specifics of the case, different empirical approaches tailored to the facts of the case might have to be developed. This type of economic analysis by defendants' economists seems to have gained in popularity over the last few years.

Note that a screen can be useful for defendants even if there is direct evidence that a cartel or other conspiracy existed. For example, suppose that in this case there were written documents that demonstrated efforts to manipulate the price of commodity Y. However, just because conspirators *attempted* to manipulate the market does not necessarily mean that they were successful.

A screen can provide evidence that an attempted conspiracy and manipulation was unsuccessful, and thus undermine material evidence of manipulation. For example, the figure above is fairly convincing evidence that the even if a conspiracy was in place, it seems to have been unable to fool the market. Finding the effect of such behavior is particularly important in manipulation cases, as well as in conspiracy cases, in estimating damages, even if documents show that a manipulation or conspiracy was, in fact, in place.

## IV. FINAL REMARKS

Every cartel detection tool has advantages and disadvantages. The art of cartel detection comes in understanding the strengths and weaknesses of various tools and thereby understanding when and how best to apply them. Screens are no different, but what some have described as weaknesses of screens themselves are more properly understood as weaknesses of implementation and design. Regression analysis is useful; poorly designed and badly executed regressions themselves are not.

Economic analysis and empirical methods are playing ever increasing roles in cases of conspiracies and manipulations. As data become more available and of better quality, and as the nature of screens becomes more sophisticated, this trend is expected only to continue.

It is important to emphasize that screens merely isolate outcomes that are improbable or anomalous under the assumption of competition and thus merit closer scrutiny. They neither prove nor disprove the existence of a conspiracy or manipulation. No purely empirical or statistical approach can ever do that. Nevertheless, screens can provide valuable circumstantial evidence on both sides of litigation. Defendants have as much interest in pursuing screens as do plaintiffs and agencies, since properly applied screens can provide evidence *against* the existence or materiality of alleged anticompetitive behavior every bit as much as they can provide evidence *for* it.