A Framework for the Analysis of Market Manipulation

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Market manipulation is a poorly understood phenomenon, due in part to legal standards that categorize manipulative behavior as either an act of outright fraud or as the nebulous use of market power to produce an artificial price. In this paper, we consider a third type of behavior that can trigger a manipulation – uneconomic trading. We demonstrate that uneconomic trading has characteristics of both fraud and market power, thus providing a foundation for analyzing manipulative behavior in a manner consistent across "fraud-based" and "artificial price" statutes. We develop an analytical framework to assist this process that describes price-based manipulation as an intentional act (the "trigger") made to cause a directional price movement (the "nexus") to benefit financially leveraged positions that tie to that price (the "target"). This framework could simultaneously improve market liquidity and compliance by providing definitional and analytic certainty concerning what behavior does and does not constitute a market manipulation.

1. INTRODUCTION

Passage of the *Dodd-Frank Wall Street Reform and Consumer Protection Act* (P.L. No: 111-203 [July 21, 2010]) (hereafter Dodd-Frank) altered several statutory provisions relevant to the proof of intent in market manipulation cases, including the addition of a fraud provision to the anti-manipulation language of the Commodity Exchange Act (CEA) (7 U.S.C. §§1 et seq. [2010]). Advocates

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for this change included Bart Chilton, Commissioner of the Commodity Futures Trading Commission (CFTC), who stated that "…in 35 years, there has been only one successful prosecution for manipulation" by the CFTC.[1] In disagreement, a noted author argued that a fraud-based standard for proof of manipulative intent will complicate future cases under the CEA because the triggering mechanism for many manipulations is market power, not fraud (Pirrong, 2010). This perspective has an intuitive appeal. Economic theory instructs that the ability of a market participant to unilaterally move prices requires that it wields and uses market power, an act of flexing economic muscles, not of deception or deceit. Without such power, the participant is left to induce others to cause the desired price movement, as might occur from the introduction of false or misleading information into the market. If the universe of actions that may trigger a price-based manipulation is limited to the mutually exclusive categories of behavior associated with the creation of an "artificial price" (by using market power) or through the use of outright fraud, the need for dual anti-manipulation provisions within Dodd-Frank seems cogent.

However, this viewpoint is incomplete. While it is certainly true that market power and outright fraud are means by which to cause a directional price movement, there is a third type of behavior that is oddly understudied in the literature and which intersects both of these categories: *uneconomic trading*. Specifically, a manipulator needs no market power in any traditional sense to directionally move a price in opposition to its stand-alone self-interest. Because other market participants assume (by the self-interest hypothesis) that all bids are placed at or below a buyer's true willingness to pay and that all offers are placed at or above a seller's marginal costs, there is a presumption that execution of those bids or offers maximizes the welfare of their sponsors on a stand-alone basis, thus providing meaningful information as to the value of the underlying asset traded (Hellwig, 1980). This is also congruent with a traditional view of market power, where buyers and sellers benefit on a stand-alone basis from higher and lower prices, respectively, but are constrained by competitive forces. Compare this to a situation where a trader places a bid or offer at a price specifically designed to lose money on a stand-alone basis (e.g., a bid above the trader's willingness to pay or a sale below marginal cost). Increasingly uneconomic bids or offers will face diminishing competition, making their execution increasingly likely. The ability to post such trades is not

[1] Commissioner Chilton's remarks were made on March 23, 2010, to the Metals Market Investors group in Washington, D.C. The "one successful prosecution" referred to is *DiPlacido v. CFTC,* an energy trading case decided in October, 2009.

a function of market power, but rather of the willingness of the proponent to absorb losses on a stand-alone basis.[2]

Concerns about uneconomic trading are heightened if the trades are "price-making," such as through contributions to the formation and publication of a price index. If so, parties with small market shares can cause relatively large directional price movements by placing uneconomic trades strategically so as to maximize their directional impact on the published price index and benefit financially leveraged price-taking positions that tie to that index.[3] The reliance on traditional economic tools to unravel and explain the counterintuitive logic of such loss-seeking behavior may underlie why so few successful enforcement actions exist for what Allen and Gale (1992) termed "trade-based manipulation" under the existing anti-manipulation statutes. The dearth of cases should not necessarily be attributed to shortcomings of current anti-manipulation laws, for uneconomic behavior simultaneously injects false information into the market and contributes to an artificial price. A more plausible explanation is that the absence of a cohesive economic framework to generally explain price-based market manipulation has dampened the analytical process for "distinguishing an illegal scheme from a legal one which might manifest itself in identical behavior, differing only perhaps in private information in the mind of the perpetrator" (Kyle and Viswanathan, 2008). This void perpetuates uncertainty for market participants seeking clarity as to the behavior that will and will not be deemed manipulative, and it frustrates compliance by failing to provide the market and regulators with meaningful guidance.

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[2] Many legitimate reasons might underlie a trader's willingness to incur losses on specific transactions, ranging from stupidity to the need for immediate liquidation (or procurement) of the asset traded. However, the trader's willingness to incur such losses on a repeated or anomalous basis brings into question whether the motivation for the behavior was legitimate on a stand-alone basis. As we discuss, one purpose of the manipulation framework we present is to describe and help identify behavior that could give rise to loss-based opportunism. This behavior is often confused for traditional market power, especially on the buyer side. For examples where concerns about uneconomic entry have led to the mitigation of buyer market power in electricity capacity markets, see *Order on Proposed Revisions to In-City Buyer-Side Mitigation Measures*, 133 FERC ¶61,178 (2010); *Order Accepting Proposed Tariff Revisions Subject to Conditions, and Addressing Related Complaint*, 135 FERC ¶61,022 (2011); and *Order on Paper Hearing and Order on Rehearing,* 135 FERC ¶61,029 (2011), note 57.

[3] The focus of Dodd-Frank is to monitor the accumulation of financial derivatives as price-taking instruments that could enable cross-market manipulations triggered by price-making trades that set the value of underlying physical assets. However, it is possible that the price-making and price-taking assets coexist in the same market, as would occur if price-making sales that set an index value were made out of a long physical position purchased "at index" (i.e., at a price that is taken from the value at which that same index ultimately resolves).

In this paper, we propose and discuss a generalized economic framework ("the framework") for the analysis of price-based market manipulation, whether the manipulation is triggered by uneconomic trades, outright fraud, or the exercise of market power. Much of our analysis centers on uneconomic trading, for it is the least obvious of the three phenomena and fills the gap between the statutes explicitly designed to prevent the other two types of behavior. Uneconomic trading has also provided the basis for several enforcement actions brought by the agencies empowered with anti-manipulation authority. Therefore, we begin by constructing the framework around a definition of loss-based manipulative behavior: intentionally losing money on anomalous price-making trades to benefit the value of the trader's related price-taking positions, where losses are measured relative to the trader's opportunity costs[4] (Ledgerwood, 2010; Ledgerwood et al., 2011; Ledgerwood and Harris, 2012; Ledgerwood and Pfeifenberger, 2012). The manipulation consists of three components:

- The "Trigger": The price-making trades used to inject false information into the market as to the value of the asset traded and to thus cause a directional price movement;
- The "Target": The price-taking positions held by the trader that will benefit from the directional price movement caused by the trigger; and
- The "Nexus": The linkage between the trigger and target – in this case, the price that is directionally moved to execute the price-based manipulation.

By separating the analysis of a manipulation into these three elements, the framework characterizes a trader's decision to use uneconomic trades for manipulation as a cost-benefit analysis, where losses in the trigger are viewed relative to the benefits derived in the target. This holds four advantages. First, it provides certainty as to the types of behavior that are *not manipulative*, such as the financially unleveraged hedging of positional risk. Second, since uneconomic trading simultaneously injects false price information into the

[4] Uneconomic trading may be profitable on an accounting basis, but forego an opportunity to make more money in an alternative trade. For example, see the case of the soybean trader described by Pirrong (2010:17-18) and the case of manipulating financial transmission rights using virtual transactions discussed by Ledgerwood and Pfeifenberger (2012). A party asserting a market manipulation claim therefore faces a difficult burden of establishing that the trader (1) recognized that such opportunities existed, yet (2) intentionally chose not to pursue them. It is for this reason that we include in our definition a requirement that the price-making trades be shown to be sufficiently anomalous so as to distinguish them from legitimate behavior. Though at first blush this might seem to be replacing one vague standard with another, we discuss in this paper some possible methods for screening for such behavior using methodologies already described in the literature concerning price support strategies.

market as to the value of the asset traded and contributes to the formation of an artificial price, the framework provides equivalent analyses of price-based manipulations under fraud-based statutes or the artificial price standard of the CEA.[5] Third, separate analysis of the causal trigger also makes the framework "portable" for analyzing other types of price-based manipulations, including those triggered by outright fraud (which are costless to the manipulator) and actual market power (which profit the manipulator on a stand-alone basis).[6] Finally, the logical construct of the framework's components demonstrates that the success of trade-based manipulations ultimately depends on a few key characteristics that must exist in a market's microstructure to allow such misinformation to produce its desired effect (O'Hara, 1995). We discuss each of these advantages in greater detail in the sections that follow.

The remainder of this article consists of four sections. Section 2 presents the framework within the context of the existing statutes, case law, and literature that pertain to price-based market manipulation. Section 3 provides an example of an index-based market manipulation, demonstrating that a market participant with insignificant market share can effectively trigger a manipulation using uneconomic trades. The presentation is then generalized to a cleared market to characterize the manipulator's profit-maximizing decision and to verify the market conditions that favor manipulation. Section 4 discusses the inefficiency and harm caused by manipulation and posits screens for its detection. Section 5 concludes.

2. THE FRAMEWORK IN THE CONTEXT OF MANIPULATION STATUTES, CASE LAW AND THE LITERATURE

Recent legislation, regulation, litigation, and scholarship concerning market manipulation generally support the characterization of manipulative behavior as either fraud-based or trade-based, with the latter typically ascribed to result from the exercise of some variant of traditional market power. However, the CFTC's historical difficulty in bringing enforcement actions under the artificial price

[5] The proof of an actual manipulation under the CEA's artificial price standard requires the demonstration that the accused trader intentionally caused an artificial price to exist. By comparison, the proof of an actual manipulation under fraud-based statutes (or of an attempted manipulation under the CEA) does not require the showing of an artificial price. For further discussion, see Table 1.

[6] The logic of the framework could also be applied more generally to explain a wider array of behavior, including, for example, predatory pricing (Ledgerwood and Heath, 2012). To maintain focus on the issue of price-based manipulation, we do not address such alternative applications here.

provisions of the CEA, combined with highly divergent and sometimes hostile views toward trade-based manipulation expressed in the academic literature, has prompted the U.S. agencies with anti-manipulation mandates to request and receive fraud-based manipulation statutes based on the Securities and Exchange Commission's (SEC's) Rule 10b-5.[7] Now with equivalent rules, enforcement actions by the Federal Trade Commission (FTC), Federal Energy Regulatory Commission (FERC), SEC, and (post–Dodd-Frank) CFTC can rely on common case precedent, but without the benefit of a common economic foundation.

Here lies the reasoning of using uneconomic transactions as the initial structure for our proposed framework. If placing trades at prices that are intentionally designed to lose money purposefully misrepresents the true value of the exchanged asset, the act is a type of *transactional fraud* that fits within both of the traditional definitions of manipulative behavior. This is because the fraud creates the "artificial" directional price movement that benefits the manipulator's targeted position(s). The framework therefore provides an analytically flexible tool – consistent across statutes, case law, and the economic literature on point – to describe loss-based manipulations. Once the framework is in place for explaining uneconomic trading, extending the framework to other types of triggers becomes conceptually obvious.

2.1. THE FRAMEWORK AND EXISTING ANTI-MANIPULATION STATUTES

Statutory definitions of market manipulation conform to and define the two traditional categories of manipulative behavior. Section 6(c) of the CEA, as amended by Dodd-Frank, prohibits actions that create an artificial price.[8] This standard requires proving the manipulator's (1) ability and (2) intent to cause an artificial price, (3) that an artificial price was in fact created, and (4) that, in fact, the manipulator's actions caused the artificial price.[9] By comparison, the prototypical statutory prohibition against fraud-based manipulation is the SEC's Rule 10b-5, which prohibits (1) the use of a fraudulent device, scheme, or statement (2) in connection with the sale or purchase of a security (3) with the requisite scienter (intent). The anti-manipulation rules of the FERC and the FTC derive from the SEC's Rule 10b-5,[10] as does the new anti-manipulation provision of the CEA post–

[7] 17 C.F.R. § 240.10b-5. Rule 10b-5 arises under the authority granted in 15 U.S.C. § 78j(b) (2010).

[8] For discussion, see *Prohibition on the Employment, or Attempted Employment, of Manipulative and Deceptive Devices - Prohibition on Price Manipulation*, 17 C.F.R. Part 180 (August 15, 2011) ("*CFTC Manipulation Rule*").

[9] See *Id.*, at 67660-67661.

[10] The FERC's anti-manipulation rule is codified in 18 C.F.R. § 1c (2010), as enabled by the Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 et seq. (2005), amending the

Dodd-Frank.[11] The CFTC's original standard is retained and explicitly expanded to prohibit attempts to create an artificial price.[12] The European Union has also adopted dual anti-manipulation rules, most recently for wholesale electricity and natural gas markets[13] (Ledgerwood and Harris, 2012:10-18).

The framework reconciles and clarifies how the elements of proof relate under the fraud-based and artificial-price standards. Table 1 presents this conceptually. The rows contain the elements of proof required under the original artificial price standard of the CEA. The columns compare these elements across the three types of anti-manipulation rules that are in place at the CFTC: the fraud-based standard, an attempted artificial price standard, and the original artificial price standard of the CEA. The information in parentheses conceptually relates these to the framework by components, as defined for a loss-based manipulation.

Table 1: The Elements of Proof under Fraud-Based and Artificial Price Standards

Element of Proof	Fraud-Based Standard (SEC, FTC, FERC, CFTC)	Artificial Price Standard (Attempt)	Artificial Price Standard (Original)
Intent (Scienter)	Required (Loss in Trigger)	Required (Loss in Trigger)	Required (Loss in Trigger)
Ability (Device/Scheme)	Required (Leverage in Target)	Required (Leverage in Target)	Required (Leverage in Target)
Causation (Device/Scheme)	Required (Nexus)	Required (Nexus)	Required (Nexus)
Artificial Price	Not Required	Not Required	Required (Nexus Impact on Target)

Demonstration of the manipulation's trigger requires proof of intentional uneconomic trading, such as through a pattern of losses anomalously incurred by a trader relative to its opportunity costs. Identifying the manipulation's targets then shows that the trader had the ability to recoup its losses incurred from the

Federal Power Act, 15 U.S.C. §717c-1 and the Natural Gas Act, 16 U.S.C. §824v(a). The FTC's anti-manipulation rule is codified in 16 C.F.R. Part 317, as enabled by Section 811 of Subtitle B of Title VIII of The Energy Independence and Security Act of 2007, 42 U.S.C. 17301-17305.

[11] This is codified as a new provision 6(c)(1) in the CEA. See *CFTC Manipulation Rule*, 17 C.F.R. Part 180.1.

[12] This is codified as a new provision 6(c)(3) in the CEA. See *Id.*, 17 C.F.R. Part 180.2.

[13] See *Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation (market abuse)*, OJ L 96, 12.4.2003 (2006) (MAD); Council Regulation (EU) No 1227/2011, On Wholesale Energy Market Integrity and Transparency, at art. 2(4)(a), 2011 OJ L 326, 1.

trigger through proof of price-taking positions that are sufficiently leveraged to more than recoup such losses financially. Proof of causation derives from demonstrating the nexus between the triggering losses and the targeted positions. Finally, the proof of an artificial price derives from measuring the trader's impact on the nexus and resulting gain in the targeted markets, often calculated relative to a "but-for" competitive price associated with the trader's opportunity costs. The framework thus provides a way that is logically and methodologically consistent across both types of anti-manipulation statutes to functionally separate the analysis of a manipulation's cause and effect.

While conceptually helpful, the realities of proving manipulative behavior are less clean than this presentation suggests, as compartmentalization of the analyses does not circumvent the pragmatic difficulties that can arise in real world data. The proof of manipulative intent using trading data is a particularly thorny issue, ultimately requiring a subjective determination that enough circumstantial evidence of losses incurred in the trigger warrants a finding of manipulation. Difficulties arise because many assertions of seemingly uneconomical behavior could be rationalized in the context of different information sets, such that a trader can always attempt to explain its behavior as economically rational when viewed through the appropriate lens. While this can be addressed by showing that the manipulator repeatedly and knowingly ignored its opportunity costs, it presumes that the trader knew of such opportunities at the times when the trades were made. Without more dispositive evidence of intent (such as emails, voice recordings or whistleblower testimony), proof of the manipulative trigger using trading data alone may present a very difficult challenge. In Section 4 we discuss further how an analyst might approach this problem.

Other elements of the framework may also present stand-alone analytical problems. It is possible that some of the positions that are targeted by the manipulation are unobservable, as might occur with derivatives positions acquired off market. For observable positions, the benefit derived may be unquantifiable if, for example, the manipulation benefits some qualitative factor such as reputation (Lewellen, 2006). The lack of a stable and demonstrable nexus presents a similar problem, for an unstable correlation will not support a causal link between the trigger and target. Finally, the proof of an artificial price can be a complex effort requiring tailored econometric analyses to determine a "but-for" competitive price against which the artificial price is measured. The difficulty of bringing successful enforcement actions under the CEA's artificial price standard explains, in part, why the FTC, FERC and CFTC sought legislation for new manipulation rules based on the SEC's Rule 10b-5. These rules avoid the need to prove artificial price as a material element of an anti-

manipulation enforcement action, thus easing the proof required to demonstrate a manipulation with attendant civil penalties up to $1 million per incident per day.[14] Note that fraud-based rules do not eliminate the need for demonstrating the *effect* of the artificial price, because the proof of damages in civil litigation or of disgorgement in enforcement actions still requires measurement of the price distortion caused by the manipulation.[15]

Notwithstanding these difficulties, the framework provides a structure that simplifies the description of what a manipulation is and assists the development of analyses to explain its key components. Moreover, the proof of one component is complementary to the proof of the others. For example, proof of opportunity-based losses in the trades that trigger the manipulation is essential to showing intent (scienter),[16] but is also germane to demonstrating ability, causation, and the creation of an artificial price. Showing ability requires proof of the targeted positions that would profit from the price movement caused by the trigger, but likewise supports the showing of manipulative intent and causation. Proof of the nexus is essential to showing both ability and causation, which are logically relevant only in the presence of the requisite intent. Finally, proof of an artificial price adds weight to the entire analysis by showing and quantifying a demonstrable effect. Thus, as we turn our attention later to ways to overcome the practical challenges raised above, we assert that the ultimate value of these analytical processes is measured by the synergies they create when combined, as the framework seeks to do. This is equally true for the analysis of manipulations that are triggered through the exercise of market power or by outright fraud.

2.2. THE FRAMEWORK AND EXISTING CASE LAW

The framework we propose is consistent with the causation used by the triers-of-fact across the regulatory proceedings and court cases that have evaluated both loss- and fraud-based manipulations. This is because the analyses of the manipulations asserted in these cases all used reasoning analogous to isolating the manipulative trigger from its targets and by explaining the nexus linking the two. Several recent cases before the FERC, CFTC, SEC, and U.S. Department of Justice provide examples of this.

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[14] For example, see 42 U.S.C. §17304 (FTC); 15 U.S.C. §717t-1(a) and 16 U.S.C. §825o-1(b) (FERC); and 7 U.S.C. 13(a)(2) (CFTC).

[15] Note that a private cause of action is not allowed under the FERC's Rule 1c.

[16] Subtle differences may exist across agencies. For example, the FTC has interpreted the scienter standard under its rule as requiring "extreme recklessness." See *Prohibitions on Market Manipulation; Final Rule*, 16 C.F.R. Part 317 (August 12, 2009). By comparison, the CFTC's standard requires only "recklessness."

2.2.1. Amaranth Advisors LLC (Amaranth)

Amaranth was a hedge fund highly invested in speculative positions in New York Mercantile Exchange (NYMEX) monthly natural-gas futures contracts and associated look-alike swaps traded on the InterContinental Exchange (ICE) and NYMEX ClearPort. Led by trader Brian Hunter, the energy trading wing of Amaranth attempted an "experiment" beginning in February, 2006. This involved buying a large number of futures contracts at relatively high prices before the settlement period for the March contract, then selling these contracts back to the market in open outcry trading during the (price-setting) 30-minute settlement period. On a stand-alone basis, this behavior was uneconomic because Hunter willingly lost money on the contracts purchased at relatively high prices before the settlement period and subsequently liquidated those contracts at a lower price during the settlement window. Further, Hunter's behavior was found to be fraudulent because his liquidation through the open outcry process was designed to induce other traders to further the downward pricing momentum by selling for fear of a price collapse. Subsequent analysis revealed that Amaranth had accumulated substantial financial leverage in swap and options positions that were short (price-taking) to the settlement price of the March contract and thus benefitted significantly from the losses in Amaranth's price-making trades. This behavior was repeated for the April, 2006 and May, 2006 contracts, drawing enforcement actions by the FERC and the CFTC.[17]

Hunter's behavior is a quintessential example of a market manipulation as defined by the framework we propose. As stated by the FERC Administrative Law Judge in finding guilt, Hunter was found to have executed trades "specifically designed to lower the NYMEX price in order to benefit his swap positions on other exchanges" in violation of Rule 1c.[18] The sales during the settlement lost money on a stand-alone basis and were executed in a manner designed to mislead other traders to sell into the dip and carry the price lower, thus representing two types of manipulative triggers within the same framework. The trades were thus executed with no legitimate business purpose

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[17] Amaranth Advisors L.L.C., *Order to Show Cause and Notice of Proposed Penalties*, 120 FERC ¶ 61,085, (July 26, 2007), and *United States Commodity Futures Trading Commission v. Amaranth Advisors, L.L.C., Amaranth Advisors (Calgary) ULC, and Brian Hunter*, 07 Civ. 6682 (DC) (S.D.N.Y., May 21, 2007).

[18] *Brian Hunter,* 130 FERC ¶ 63,004 (2010)*,* approved by the Commission in *Brian Hunter*, 135 FERC ¶ 61,054 (2011). Note that the CFTC and FERC settled their disputes with all other parties in August, 2009. See *Consent Order of Permanent Injunction, Civil Monetary Penalty and Other Relief as to Defendants Amaranth Advisors, L.L.C. and Amaranth Advisors (Calgary) ULC, United States Commodity Futures Trading Commission v. Amaranth Advisors, L.L.C., et al.,* 07 Civ. 6682 (DC) (S.D.N.Y., August 12, 2009)*,* and *Order Approving Uncontested Settlement,* 128 FERC ¶ 61,154 (August 12, 2009).

but served only to increase the value of Amaranth's targeted financial positions. Hunter's choice to buy futures before, yet liquidate into, the settlement period in which the price of the derivatives was formed thus exploited the nexus between the manipulation's triggers and targets.

2.2.2. Energy Transfer Partners, L.P. (ETP)

In 2007, the FERC accused ETP of manipulating natural gas prices at the Houston Ship Channel (HSC) trading hub from December 2003 to December 2005.[19] ETP was accused of intentionally losing money on its index-setting sales of monthly fixed-price natural gas at HSC to benefit its physical and financial positions that were short to the published index price at that location. The allegation thus asserted that ETP triggered the manipulation by intentionally making uneconomic price-making sales to lower the value of the HSC index, which served as the nexus to benefit the value of ETP's targeted price-taking positions. The case settled for $30 million in penalties and disgorgement.[20]

2.2.3. DiPlacido

In 2001, the CFTC accused trader Anthony J. DiPlacido and others with the manipulation of two Western electricity trading hubs in 1998.[21] The manipulation involved the placement of uneconomic purchases or sales during the settlement of the NYMEX electricity-futures contracts across several months, causing directional price movements that benefited price-taking contracts held by Avista, their employer and client. Avista and its employees settled, leaving DiPlacido (who was a NYMEX floor broker) as the lone defendant. The CFTC approved a determination by an administrative law judge of DiPlacido's liability on four of the five counts in 2008.[22] This was affirmed in U.S. District Court in 2009, which noted that DiPlacido "intentionally paid more than he would have had to pay for the purpose of causing the closing quotation to increase."[23] This successful application of the CEA's artificial price standard

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[19] Energy Transfer Partners, L.P., et al., *Order to Show Cause and Notice of Penalties* (2007).

[20] *Order Approving Uncontested Settlement* in Docket No. IN06-3-003, 128 FERC ¶61,269 (August 31, 2009). The CFTC also brought an action against ETP with substantially similar allegations that settled for $10 million. See Release PR5471-08, *Energy Transfer Partners, L.P. and Three of Its Subsidiaries to Pay a $10 Million Penalty to Settle CFTC Action Alleging Attempted Manipulation of Natural Gas Prices* (March 17, 2008), available at http://www.cftc.gov/PressRoom/PressReleases/pr5471-08.html.

[21] See *In the Matter of: Anthony J. DiPlacido, Robert S. Kristufek, and William H. Taylor*, available at http://www.cftc.gov/files/enf/01orders/enfavista-complaint.pdf (August 21, 2001).

[22] *In re DiPlacido*, Comm. Fut. L. Rep. (CCH) P 30,970 (November 5, 2008).

[23] *DiPlacido v. CFTC,* 2009 U.S. App. LEXIS 22692 (2d Cir. Oct. 16, 2009). More recently, the FERC settled a $245 million claim against Constellation Energy Commodities Group for

demonstrates that the framework explains the cause and effect of the manipulation, while the calculation of an artificial price measures that effect.

2.2.4. Sumitomo Corporation (Sumitomo)

From 1995 through 1996, the CFTC alleged that Sumitomo manipulated the world market for copper by cornering the entire warehouse supply available to the London Metals Exchange.[24] By concentrating purchases in one location, Sumitomo trader Yasuo Hamanaka was able to significantly raise prices on the exchange, pressuring global spot and futures prices for copper to create backwardation in the forward pricing curve. Subsequently, Hamanaka was able to liquidate Sumitomo's holdings at a premium in global metals markets, including the Comex Division of the NYMEX. After regulator interest prompted cessation of the corner, world copper prices fell significantly, causing Sumitomo to lose billions of dollars (Holley, 1996). Hamanaka was determined to have accomplished the corner through control of less than five percent of the physical copper supply.

By concentrating Sumitomo's small global-market share at one location to benefit the value of its broader portfolio, Hamanaka was able to focus his price-making transactions to trigger a directional price movement that would increase the value of Sumitomo's price-taking positions. This was not an exercise of market power, but rather a lesson as to how the framework applies to a market corner. The price-making trades initiate the corner by causing a (real or perceived) shortage to emerge.[25] The shortage causes the price to increase and prompts others to sell short into the market to capitalize on what is perceived as an inflated price. Ultimately, the manipulator's continued buying initiates a squeeze, wherein short sellers scramble to cover their positions in an escalating market. Their buying drives the price higher still, allowing the manipulator to sell out of its accumulated position as a price-taker to the covering shorts. The manipulator profits on all such trades until the panic to cover subsides. Subsequently, the market price falls, causing the manipulator to lose money on whatever units it still holds. Thus, a corner differs from other loss-based manipulations only in the timing of the loss relative to the gain.

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allegedly manipulating various derivative contracts in three Eastern wholesale electricity markets. See *Constellation Energy Commodities Group, Inc.,* 138 FERC ¶61,168 (2012); and Ledgerwood and Pfeifenberger (2012).

[24] *In the Matter of Sumitomo Corporation*, an order referenced in CFTC Press Release #4144-98 and available at http://www.cftc.gov/ogc/oporders98/ogcfsumitomo.htm (May 11, 1998).

[25] This example is consistent with the characterization of a corner presented by Dr. Pirrong through his various works on point. See, for example, Pirrong (2004).

The Sumitomo case also provides an excellent example of how the concept of traditional market power has been consistently misapplied in the context of market manipulation triggered by uneconomic behavior. Hamanaka's ability to sustain a corner with a five percent market share was enabled through his willingness to uneconomically trigger a shortage at the price-making delivery point that was key to influencing the world copper price (the nexus) to benefit his broader, targeted price-taking spot sales. This provides insight into the axiomatic paradox of why market power does not necessarily equate with market share. Traditional market power with attendant high market share is needed to resist competitive forces and cause a directional price movement that benefits its holder on a stand-alone basis. By comparison, the "market power" needed to move a price in a direction that is injurious to a trader's self-interest requires only the "market share" associated with concentrating uneconomic trades of sufficient size to bias the price-making mechanism enough to trigger the manipulation. As we prove later, this ability depends less on market power than on the manipulator's ability to overwhelm the ephemeral illiquidity associated with temporal inelasticity of market supply or demand.

2.2.5. SEC Cases

SEC case precedent under Rule 10b-5 has involved a spectrum of behavior ruled as manipulative under its fraud-based provisions, albeit without a common economic foundation. Behavior such as "marking the close" involves the use of uneconomic trades at the end of the trading day to bias an asset's closing price, triggering a manipulation to benefit the trader's related positions. This was prohibited in *SEC v. Masri*, based on the premise that "but for the manipulative intent, the defendant would not have conducted the transaction."[26] This and other types of intentionally heavy trading designed to take advantage of ephemeral illiquidity have been ruled illegal because "inaccurate information is being injected into the marketplace" by the price movements triggered thereby.[27] Unfortunately, the standards of proof set by these cases are sufficiently nebulous as to complicate future enforcement to the extent that "it is difficult to distinguish predatory trading from market depth

[26] *SEC v. Masri*, 523 F. Supp 2d 361, 372-372 (S.D.N.Y. 2007). See also *Markowski v. SEC*, 274 F.3d 525, 529 (D.C.Cir.2001) ("'manipulation' can be illegal solely because of the actor's purpose"). The CFTC also brings anti-manipulation enforcement actions for such activity. For example, see *CFTC v. Optiver US, LLC et al.*, Case 1:08-cv-06560-LAP (S.D.N.Y. 2012) (alleged "banging the close" of NYMEX oil futures).

[27] *GFL Advantage Fund, Ltd. v. Colkitt*, 272 F. 3d 189, 205 (2001) (alleged manipulation by a holder of a short stock position who was asserted to have sold shares aggressively to induce other holders of the stock to sell). The term "predatory trading" was used in this context by Brunnermeier and Pedersen (2005).

arbitrage or ordinary speculation" (Kyle and Viswanathan, 2008:243). The use of the framework, and in particular the recognition of the concept of uneconomic trading as a manipulation trigger, could help provide some structure to these and similar analyses.

The framework also applies to cases of *outright fraud* where the manipulator introduces false information into the market but does not necessarily participate directly in the triggering trades. For example, traders in "pump and dump" schemes buy stock positions in advance of disseminating false information to induce others to buy the stock, which then triggers the upward price movement that benefits the manipulator's (price-taking) sales of the stock after the price increase.[28] Indeed, the only difference between this scenario and one of uneconomic trading is the party injured by the trigger. In both cases, the trades that trigger the manipulation are uneconomic and incur losses. The difference is that, in the case of outright fraud, the losses are incurred by the fraud's victims, not by the manipulator.

Other types of fraudulent behavior prohibited under the SEC's rules do not necessarily result in a price movement and thus are not directly described by the price-based manipulation framework we present in this paper. For example, "wash trades" executed to create churn to boost perceptions of volumetric trade (either of the trader or the asset traded) do not necessarily create a price effect nor generate losses (save transactions costs).[29] Similarly, trading based on inside information is a misappropriation of information in breach of a fiduciary duty,[30] possibly falling under the definition of a market manipulation but not necessarily with a verifiable price effect. This does not mean the general structure of the framework could not adapt to explain such cases. For example, wash trades trigger an increase in trading volume, which may act as the nexus to convey false information as to the size of the trader's book (the target). A government official may use inside information about pending congressional legislation (the trigger) to invest in a company's stock (the target) prior to the announcement of a pending bill that will positively affect the stock's price (the

[28] Intentional dissemination of false information is specifically prohibited by Sections 9a-2 through 9a-4 of the Exchange Act. See also the complaint filed in *SEC v. Pawel Dynkowski et al.*, Case No. 09-361 (May 20, 2009), which is available online at http://www.sec.gov/litigation/complaints/2009/comp21053.pdf. Note that uneconomic transactions can also accompany pump and dump schemes if the manipulator purchases stock to help fuel the buying frenzy.

[29] Wash trades are specifically prohibited under Section 9a-1 of the Securities Act.

[30] The "misappropriation theory" is derived from *U.S. v. O'Hagan*, 521 U.S. 642, 652 (1997). Insider trading is prohibited under Section 10b5-1 of the Securities Act.

nexus).[31] Though we do not discuss it further, the general logic of the framework could thus tie together the analyses of various applications by exploring the different linkages that can serve as stable nexuses.

2.2.6. KeySpan-Ravenswood, LLC (KeySpan)

In February, 2008, the FERC issued a report seeking to close an investigation of KeySpan for allegedly manipulating the New York wholesale electricity capacity market.[32] Among other things, the FERC Staff found that a "swap" arrangement between KeySpan and another market participant that incented the raising of bids into the market was not collusive, not fraudulent, and pursued a legitimate business purpose. Thus, while the swap (the target) would benefit from higher bids by KeySpan (the trigger) to raise capacity prices (the nexus), the FERC ruled that KeySpan's behavior did not trigger a manipulation because it was neither outright fraudulent nor uneconomic, nor did it constitute an exercise of market power because it was allowed under the then-existing FERC-approved tariff. Lacking any of the three characteristics that could spark a price-based manipulation, the FERC determined that the behavior complained of was legitimate and thus could not be manipulative. However, this did not deter the U.S. Department of Justice (DOJ) from pursuing its own analysis of the behavior based on a complaint filed regarding manipulating the market in violation of the Sherman Act §1, 15 U.S.C. §1 (1890), which prohibits conspiracies in restraint of trade.

The DOJ's investigation of KeySpan ultimately concluded with a consent decree wherein the company agreed to pay a disgorgement of $12 million.[33] This is a novel outcome, as the DOJ asserted jurisdiction in a manipulation case where the behavior in question was previously determined to be legitimate by the regulatory agency with primary jurisdiction over the matter. While at first this may seem like an overreach, the result makes sense given the reasoning applied by the FERC and the finding that anticompetitive behavior triggered the manipulation. More broadly, because market power benefits its holder on a stand-alone basis, transactions that reflect the exercise of market power serve a "legitimate business purpose" and thus cannot be manipulative. If true across cases, such logic would support Dr. Pirrong's conclusion (stated at the outset of this paper) that agencies with fraud-based anti-manipulation

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[31] This behavior was prohibited by the Stop Trading on Congressional Knowledge Act (the "STOCK Act"), P.L. No: 12t-105 (April 4, 2012).

[32] *FERC Enforcement Staff Report: Findings of a Non-Public Investigation of Potential Market Manipulation by Suppliers in the New York City Capacity Market*, Docket Nos. IN08-2-000 & EL07-39-000 (February 28, 2008).

[33] *U.S. v. KeySpan Corp.*, Case 1:10-cv-01415-WHP, S.D.N.Y., 2011.

statutes cannot properly deter manipulations triggered by the exercise of market power, potentially necessitating intervention by the DOJ in such cases.

This result derives less from the legal insufficiency of fraud-based statutes than from the inappropriate interpretation of the legitimate business purpose standard. Notwithstanding the legality of the trades that reflect the exercise of market power, it is the manipulator's willingness to use such trades to trigger the manipulation that gives rise to the fraudulent device, scheme, or artifice that is actionable under a statute modeled on Rule 10b-5. The legitimacy of such trades must be viewed outside the context of the antitrust laws, as behavior that does not necessarily give rise to antitrust liability may nevertheless be intended to cause a directional price movement designed to execute a manipulation. Therefore, separate analysis of the framework's trigger must not lose sight of the broader context in which such trades may have been placed to enhance the trader's price-taking positions.

2.3. SUMMARY: THE FRAMEWORK AND EXISTING CASE LAW

Table 2 summarizes the examples of price-based market manipulation discussed in this section and identifies the trigger, nexus, and target for each.

Table 2: Summary of Framework Components for Different Examples of Price-Based Manipulations

Manipulation Type	Trigger	Nexus	Target
Index Manipulations (Amaranth, ETP, DiPlacido)	Uneconomic Trading (Index)	Index Settlement Price	Physical and Derivatives Positions
Corners (Sumitomo)	Uneconomic Trading (Volume)	Futures Price (Near Delivery)	Futures
Marking the Close (Masri)	Uneconomic Trading (Volume)	Closing Price (Market-to-Market)	Credit Requirements, Derivatives, Stock
Pump and Dump	Fraud	Stock Price	Stock Position
Economic Withholding (KeySpan)	Market Power	Capacity Auction Price	Other Physical Capacity

The lack of uniformity across these cases explains in part why legal precedent concerning market manipulation is neither deep nor consistent, except within narrow categories of behavior. This "I know it when I see it" approach to manipulation analysis perpetuates uncertainty as to future compliance and enforcement requirements, wasting the scarce resources of market participants and regulatory agencies alike. Adoption of 10b-5 equivalent statutes reflects a desire for greater simplicity of enforcement, but this does not necessarily

equate with consistency of application. Focusing on bringing consistency to the analysis of manipulation by using a consistent platform could add much needed clarity across cases, agencies and statutes.

2.4. THE FRAMEWORK AND THE EXISTING LITERATURE

The subject of market manipulation has received limited treatment in the economic and financial literature in the past two decades. In the early 1990s, authors such as Fischel and Ross (1991) asserted that the vague intent standard of the (pre–Dodd-Frank) CEA created inefficiency by overdeterring legitimate trading behavior to prevent what was viewed by many at the time as a victimless crime. Pirrong (1993) broke with this convention, positing that manipulations such as market corners are statistically measurable phenomena enabled through the exercise of market power and revealed in patterns of behavior that are distinguishable from competitive benchmarks. His later articles and testimony continued to advocate for the use of regression analyses and other statistical tests to prove or disprove intent and to measure the price effect of manipulative behavior (Pirrong, 2004). However, these works continued to explain the ability to execute a manipulation as a function of market power, not uneconomic behavior. This perception led to his ultimate conclusion that fraud-based manipulation statutes do not apply to market-based manipulations (Pirrong, 2010).

The desire to distinguish "market-based" manipulation from "fraud-based" manipulation is understandable given historic differences in the statutory treatment of cases under the 10b-5 and artificial price standards. Because the first successful CFTC enforcement action did not occur until 2009, much of the literature on point focuses on manipulations occurring under 10b-5. For example, Gerard and Nanda (1993) discussed the manipulation of seasoned equity offerings using secondary markets; Jarrow (1994) studied the manipulation opportunities created by the emerging availability of financial derivatives; Aggarwal and Wu (2003) empirically tested SEC data to discern qualitative elements of stock price manipulations; Attari, Mello and Ruckes (2005) observed that strategic trading can profit from liquidations by large arbitrageurs to manipulate markets; Goldstein and Guembel (2008) concluded that strategic trading causes financial market prices to misrepresent equity values, thereby creating incentives to sell and enabling manipulations; and Massa and Rehman (2008) determined that mutual funds exploit inside information to affiliate a bank's pending loans to large customers to build portfolios of those customer's securities timed to the closing of those loans.

It is noteworthy that the analytical focus of much of this literature centers upon relatively narrow and often unrelated types of manipulative behavior. By comparison, a relatively deep set of literature exists concerning the

practice of price support, which can be a legal form of market manipulation under certain circumstances. Specifically, Ruud (1993), Prabhala and Puri (1998), and Lewellen (2006) studied the phenomenon of underwriter price support of stock IPOs, which is a legal form of priced-based manipulation under SEC rules.[34] Golez and Marin (2012) used a similar approach to examine the illegal practice by mutual funds of supporting a parent bank's stock to limit downside movements in stressed times. These studies found empirical evidence of the presence and effectiveness of price support on financial performance using a variety of statistical screens, the efficacy of which we discuss in Section 4 in relation to the analysis of framework triggers. The authors also tested the effects of manipulative behavior on less quantifiable aspects of business, including reputation effects and benefits to unaffiliated entities, factors that we later consider in relation to the analysis of possible manipulation targets.

The general lack of analytic portability across case studies prevents the accumulation of a knowledge base for consistently evaluating manipulations across different cases under the same statute and across different statutes. Some authors have made progress in bridging these gaps. For example, Kyle and Viswanathan (2008) build on the earlier works of Allen and Gale (1992), Kumar and Seppi (1992), and others to provide a reconciliation of SEC and CFTC "trade-based" manipulation cases, ultimately finding manipulation occurs only from distortions of "allocational efficiency that relates to market informativeness and transactional efficiency that relates to market liquidity." This finding supports, and is supported by, the model we present in Section 3. Likewise, Pirrong (2010) raised the issue of comparability between the anti-manipulation statute of the CFTC and the fraud-based statutes of the SEC, FERC, and FTC. However, these works do not consider uneconomic trading, and they remain influenced by the premise that all manipulations are the product of either outright fraud or the exercise of market power, thus providing no consistent guidance for a trier-of-fact to rely upon in generally evaluating manipulative behavior.

The framework we propose provides a vehicle for reconciling these issues. By including uneconomic behavior as a potential trigger, the analytical foundation for analyzing manipulation shifts from the nebulous search for evidence of market power or outright fraud to evaluating whether the manipulator intentionally acted in a manner designed to trigger a benefit for its financially leveraged price-taking positions. Traditional measurements relevant to

[34] This was originally referred to as "Rule l0b-7"and was codified as 15 U.S.C. §10(b) and 17 C.F.R. §240.l0b-7 (1934). This was later recodified as Section 104 of Regulation M, 17 C.F.R. 242.104 (1996).

analyzing market power are relevant to this analysis, for market power remains a possible stand-alone trigger, market share can be concentrated to move an index price, and leverage in price-taking positions can help enable a manipulation. However, the main precursor for the ability to successfully manipulate markets is not the control of a large market share, but the ability to capitalize on temporal illiquidity and to exploit the peculiarities of certain pricing mechanisms within and across markets. The next section discusses the microeconomic foundation for these assertions.

3. THE MICROECONOMICS OF THE FRAMEWORK

In this section, we provide a simple and intuitive example of the loss-based manipulation of a market for condominiums that is consistent with our proposed framework. This example demonstrates the attributes required for a successful manipulation and shows that neither market power nor outright fraud are necessary. This example also provides an opportunity to discuss the role that alternative information sets play in evaluating the manipulation, a prerequisite for the ability to successfully identify manipulative behavior. Next, we generalize the example to a cleared market and develop the profit-maximizing criteria that create the incentives for the manipulator's behavior. We use these criteria to identify three factors that underlie the incentive to manipulate. These are given context through comparison to the manipulation cases discussed in the prior section and generalized to include cases triggered by market power or outright fraud.

3.1. MANIPULATION OF A CONDOMINIUM PRICE INDEX

Assume that two-bedroom condominiums are currently selling for around $500,000, as measured by a website index that tracks comparable sales over a rolling 30-day period and is relied on by the industry as the competitive price for "comps" in the area. Many units are for sale, all about the same and offered at prices around $500,000. If you owned a similar condo and wanted to sell it at a price above market ($700,000, for instance), you would be unlikely to succeed. This is because your ability to raise your price significantly above the competitive price is constrained by the other sellers in the market, a hallmark of effective competition that checks seller market power.

Compare this to a scenario where you offer your condo for a price significantly below market ($100,000, for example). Such an offer would be immediately snapped up, the buyer walking away with a windfall while you incur a loss (relative to your opportunity cost) of around $400,000. This demonstrates a point essential to understanding a loss-based manipulation: the further one is willing to

drop their offer below the competitive market price, the greater the likelihood that they will effectively face no competition from other sellers.[35] The same principle holds for buyers that bid at prices above the competitive equilibrium, underscoring the point that market participants do not need market power nor need to commit outright fraud to successfully execute trades (and therefore post prices) in a manner that injures their stand-alone self-interest.

As discussed previously, uneconomic trades can trigger a market manipulation. Assume there were previously 19 sales on the index such that the $100,000 sale of your condo lowers the average index value of condos sold to $480,000. If other sellers rely on the index price for evaluating the market value of their condos, they will lower their prices in response. You then buy 50 condos for $480,000 each, with each purchase made at the index price (i.e., as a price taker). By willingly taking a loss of $400,000 on your initial sale that tanked the index, you saved $1 million across the 50 condos (at $20,000 each) that you ultimately buy, netting a $600,000 gain.[36] This is a market manipulation because an anomalous price-setting transaction was intentionally used for the sole purpose of moving a price to benefit a price-taking position.

The contrarian may assert that the success of this scheme depends upon the willingness of the manipulator to buy more condominiums than presently reside on the index, thus facilitating the manipulation through the use of market power. This is incorrect, however, because the 50 condominiums purchased are as a *price-taker* to the index and thus irrelevant to setting the price. This underscores three essential elements of manipulation. First, the success of a manipulation requires the ability to substantially move the price that is to serve as the manipulation's nexus, in this case with an uneconomic trade. This relates to the temporal liquidity of the market, which is a function of the elasticity of supply and demand. Second, the manipulator must accumulate sufficient leverage in the targeted price-taking positions such that the benefit outweighs the loss on the trigger (Kleit, 2009). Deep pockets that can afford to accumulate size in the

[35] Of course, the further away from the competitive price such a trade is executed, the greater the likelihood that it will be ignored by other market participants as anomalous and detected by regulators as suspicious. This is consistent with Hellwig, who noted that "in a large market, the equilibrium price will reflect only those elements of information that are common to a large number of agents. Because an individual agent does not affect the price, his information enters the price only to the extent that it is shared by other agents" (Hellwig, 1980:479).

[36] This plan will profit only if a number of conditions exist, most importantly (1) that the index continues to be trusted and used by other sellers as a measure of the competitive price, (2) that the impact the sale will have on the index will be more than sufficient to recoup your $400,000 opportunity cost (i.e., causing a greater than $8,000 average price reduction across the 50 condominiums that you intend to buy), and (3) that scarcity pricing will not cause sellers to demand premiums to the index such that the scheme becomes unprofitable.

targeted portfolio and to absorb losses on the triggering trades therefore improve the likelihood of success, a reason why position limits on derivatives might be an effective (albeit clumsy) anti-manipulation tool. Third, smaller losses in the trigger make the manipulation more likely to be profitable. Aside from enforcement considerations, this means that manipulations triggered by outright fraud or market power are more likely to be successful, as outright fraud incurs no cost in the trigger and market power exercised as a trigger is profitable to the manipulator on a stand-alone basis.

3.2. The Role of Information Sets on Economic versus Uneconomic Behavior

A key criticism of the condominium example and of the analyses of other manipulation cases involving uneconomic trading is that the behavior asserted to trigger a manipulation could always be rationalized as legitimate in the context of a different information set held privately by the manipulator. For example, if faced with a manipulation claim for your activities in the condominium market, you might provide evidence showing any of the following:

- Your sale of the original condominium at a price far below market was economic given your true willingness to sell, private knowledge of that unit's deficiencies, and outlook on the market generally, thus negating your intent to trigger a manipulation.
- The magnitude of the impact your sale had on the index was dependent on a litany of factors such as calculation mechanics and liquidity that were completely outside your control, such that you could not predict the sale's impact on the nexus.
- Your subsequent purchase of the 50 condominiums was a legitimate response to the price decline you observed in the market and, in fact, provided price support to assure that regional condominium prices did not fall further than they did.

Indeed, this points to an inherently recursive logic that complicates the proof of all price-based manipulations: the same price movements that define the outcome of a successful manipulation may simultaneously support the economic rationality of the trades comprising the manipulation's trigger and target, thus casting the agent executing the scheme not as a manipulator, but as a savvy trader who was rewarded for correctly relying on its private information set.

The solution to this problem is not as simple as establishing the existence of each of the framework's components or the timing of when they were assembled – indeed, legitimate risk management and hedging strategies require

a trader to establish *targeted* positions in advance of *triggering* price movements to be effective. Nor is the solution solely a function of proving a stable nexus, as the existence of a correlation between the size of the loss in the trigger and the benefit derived from the target does not mean that the relationship was intentionally exploited. Nor is showing stand-alone losses in the trigger sufficient proof, for approximately half of all trades executed in a fair market should lose money. Nor is proving an artificial price necessarily dispositive, for the fraud-based statutes and post–Dodd-Frank CEA do not require proof of a one-to-one mapping of cause and effect in order to assert a claim of attempted manipulation. These evidentiary concerns have led some authors to conclude that "with regard to trade-based manipulation, it may be difficult or impractical for the legal system to define and enforce such schemes as illegal price manipulation" (Kyle and Viswanathan, 2008:278).

Such skepticism presumes that the revealed manifestations of the manipulator's actions are not distinguishable from other types of "noise" present in the marketplace data, a conclusion that follows only if the efficient markets hypothesis holds such that "at any time prices fully reflect all available information" (Fama, 1970:383). Specifically, in a large market, the equilibrium price reflects only those elements of information that are commonly known to a large number of agents. Because an individual (price-taking) agent does not affect the price, such information enters the equilibrium price only to the extent that it is shared by other agents. Attempts at price-based market manipulation are thus irrelevant in this environment as they contribute only noise to the market data that is ultimately either filtered out or overwhelmed by the weak law of large numbers (Hellwig, 1980:479, 493).

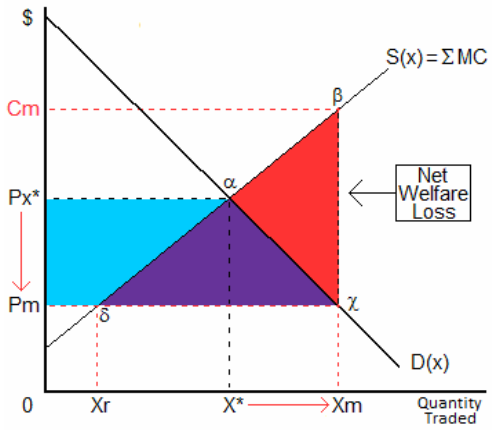
This perspective presumes that sufficient liquidity is present in the market such that the would-be manipulator is rendered a price taker and that all intentionally injected misinformation (whether in the form of uneconomic trading or outright fraud) would be muted by, or discarded in favor of, the clarity of a true equilibrium. However, this would also mean that informed traders in otherwise competitive markets could never earn a return on their information. If information is very inexpensive (the trigger is cheap) or if informed traders have very precise information (thus providing ephemeral market power), then the resulting equilibrium price will reveal most of the informed traders' information because "such markets are likely to be thin" (Grossman and Stiglitz, 1980). If detected by other market participants through efficient markets, any successful manipulation under such circumstances would induce self-correcting liquidity due to arbitrage (Hanson and Oprea, 2009). This is a misnomer, however, as the private nature of the information that allowed the manipulation to occur could also obscure its detection.

The framework we propose offers a potential method for disentangling this informational conundrum by focusing on differentiating the anomalous outcomes of manipulative behavior from the noise otherwise presented by the normal functioning of a marketplace. This potential derives from two sources. First, separating the manipulation's price-making and price-taking trades provides a logical foundation for separating cause and effect. Second, identifying the specific types of behavior that could trigger a manipulation simplifies the creation of screens for detecting anomalous price-making trades. While we defer the discussion of screens that could be used to detect such behavior until Section 4, we note that a presumption of legitimacy will attach to all open market trades as a null hypothesis. The burden falls on the party alleging the manipulation to prove that the behavior in question rejected this hypothesis and thus fell outside of the level of market noise associated with legitimacy. The ability of a market participant to strategically use private information to manipulate a market is then demonstrated by showing its temporal ability to exert a price effect, which ultimately depends on market liquidity. The condominium example provides a specific case of this phenomenon by considering an index as the price-making mechanism for the market. In the next section, we generalize this result by extending the model of loss-based opportunism to the context of a cleared market.

3.3. The Microeconomics of the Decision to Manipulate

To generalize the condominium example to a broader context, it is helpful to change the market pricing mechanism from an index to a cleared competitive model, shown in Figure 1.

Figure 1: Net Social Welfare Loss from Below-Market Sales



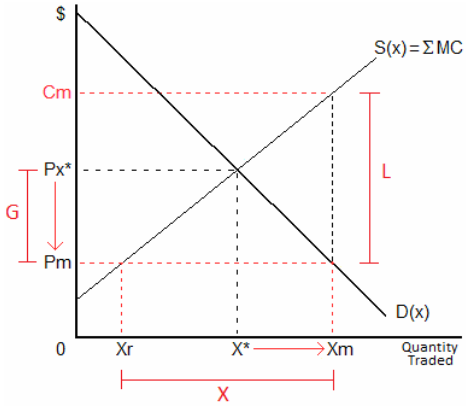
Absent manipulation, this market clears at the competitive equilibrium "α" at the price *Px** and quantity traded *X**. The manipulator in this example offers a quantity (*Xm* - *Xr*) of the good into the market as a price taker. The resulting market equilibrium "χ" lies below and to the right of the competitive equilibrium and beneath the market supply curve, resulting in the lower "artificial" price *Pm* and higher quantity traded *Xm*, with the manipulator supplying the quantity (*Xm* – *Xr*) to the market and competitors left to sell the remaining units *Xr*. Buyers are thrilled by this activity, as the consumer surplus increases by an amount equal to the area *Px**, α, χ, *Pm*. However, all of this gain is offset by a loss of profits of the manipulator (area β, χ, δ) and of the other would-be competitive sellers (area *Px**, α, δ, *Pm*). This results in a net societal loss of welfare shown by the triangle α, β, χ.

Figure 1 demonstrates why traditional microeconomic tools used to detect market power are ill-equipped to analyze loss-based manipulation. Whereas participants possessing market power are incented to *withhold* output from the market, this manipulator is incented to cause the market to *overproduce*. The profitability criterion for the above example is given by

$$(1) \qquad (Px^* - Pm) \cdot R > (Xm - Xr) \cdot (Cm - Pm).$$

To the left of the inequality, the revenue from the manipulation increases as the financial leverage of the related short position "*R*" held by the manipulator increases or as the price decrease below the competitive price caused by the manipulation (*Px** – *Pm*) increases. To the right of the inequality, the cost of the manipulation grows as the size of the triggering offer (*Xm* – *Xr*) grows or as the per-unit loss to the manipulator (*Cm* – *Pm* ≥ *0*) worsens.

Figure 2: Generalization of the Loss-Based Framework

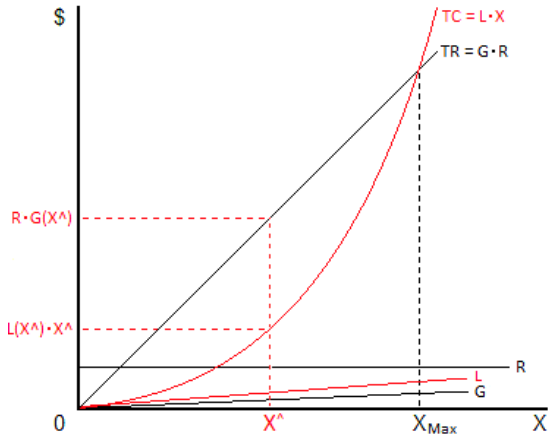


As shown in Figure 2, the profitability criterion can be generalized to account for loss-based manipulations triggered by excessive sales by substituting "*G*" for the per-unit gain made by the manipulator, "*L*" for the per-unit loss in the trigger, and "*X*" for the size of the trigger. The resulting profitability criterion is given by Equation 2.

(2) $$G \cdot R > L \cdot X \ .$$

Assume first that the manipulator wants to maximize the profitability (π) of a targeted derivatives position of fixed size *R* by varying the size of its price-making triggering transaction *X* shown in Figure 2. Because supply and demand are linear in this example, *R* is horizontal while the functions of G and L are linear and upward sloping. The resulting Total Revenue curve is linear, whereas the Total Cost curve is increasing and concave up. These are shown in Figure 3.

Figure 3: Profit Maximization of a Market Manipulation



Profit maximization occurs where the marginal revenue from the manipulation trigger is equal to its marginal cost, shown by the quantity *X*^ in Figure 3. However, the manipulation is profitable for any sized trigger less than X_{Max}, suggesting that a trader could have significant room for error should it contemplate triggering a manipulative scheme. The profit criterion in Equation 2 can be maximized generally in this circumstance as

(3a) $$\max \pi = G \cdot R - L \cdot X \ \Rightarrow \ \frac{\partial G}{\partial X} \cdot R - \frac{\partial L}{\partial X} \cdot X - L = 0 \quad \left| \frac{\partial R}{\partial X} = 0 \right. \Rightarrow$$

(3b) $$X\hat{} = \frac{\partial G}{\partial L} \cdot R - \frac{\partial X}{\partial L} \cdot L .$$

Therefore, the profit-maximizing trigger $X\hat{}$ is a function of the per-unit loss in the trigger, the slopes of the market supply and demand curves, and the leverage built in the related positions.

3.3.1. The Cost of the Manipulation Trigger (L)

The per-unit loss on the bid or offer used to trigger the manipulation should be measured relative to the opportunity cost the manipulator incurs for those units. As discussed previously, this presents a challenge to evaluating manipulative behavior, for a trader can validly assert that its ability to observe what is forensically shown to be a superior opportunity was unclear at the time a trade was executed. A savvy manipulator can use this to its advantage by placing triggers at prices that are profitable on an accounting basis but that fail to cover its opportunity cost. The party seeking to prove the manipulation may then face a difficult burden of proving that a better price was available and that the manipulator intentionally and uneconomically undercut that price.

3.3.2. The Slopes of Market Supply and Demand (Liquidity)

As Figure 2 suggests, as $X\hat{}$ increases in size, the size of the average loss L will increase and will exceed the increase in the average gain G if the curve associated with the manipulation (supply for uneconomic offers, demand for uneconomic bids) has a non-zero slope. Because the size of the average loss will then increase as $X\hat{}$ increases, it must then hold that

(4a) and (4b) $$0 < \frac{\partial G}{\partial L} < 1 , \; 0 < \frac{\partial X}{\partial L} \; \Big| \; X\hat{} \in (0, X_{Max}) .$$

These properties inform the development of an elasticity to measure the sensitivity of losses to changes in the size of the manipulation trigger. Dividing Equation (3b) by X yields

(5a) $$1 = \frac{\partial G}{\partial L} \cdot \frac{R}{X} - \frac{\partial X}{\partial L} \cdot \frac{L}{X} = \frac{\partial G}{\partial L} \cdot \frac{R}{X} - E_{L,X} \Rightarrow$$

(5b) $$E_{L,X} = \frac{\partial G}{\partial L} \cdot \frac{R}{X} - 1 > 0 \; \Big| \; \frac{\partial X}{\partial L}, L, X > 0 .$$

As the slope of the supply or demand curves become steeper, a greater loss is incurred for a given trigger X, thus causing $E_{L,X}$ to increase. Equation (5b) demonstrates that this can enhance the environment for manipulation by making a smaller volumetric trigger sufficient to execute the manipulation (making the trigger cheaper), by increasing the ratio of marginal gains to marginal losses (strengthening the nexus), or by making manipulations more profitable for any given size of the derivatives position targeted by the manipulation (strengthening the target).

This underscores the role that liquidity plays in the success or failure of manipulations. Inelastic demand or supply is symptomatic of illiquid bids or offers, respectively, thus making a manipulation more likely to be profitable if price movements are directionally aimed at the thin side of the market. If an agent's private information set gives it the ability to predict times when such thinness is likely to occur, it can coordinate its price-making efforts accordingly to trigger a manipulation.[37] If markets are efficient, other market participants will perceive the opportunity and arbitrage away future efforts. Conversely, if the pattern of thinness is irregular or, more likely, if the manipulator can influence when and whether such illiquidity emerges (by the exercise of market power, the execution of uneconomic trades, or the commission of outright fraud), the ability to successfully repeat the manipulation over time increases. This possibility may support the logic of investigating and bringing enforcement actions against *attempted* manipulations, for the failure of such attempts might only reflect that the would-be manipulator misjudged or was testing the depth of market liquidity it faced at particular moments in time.

Several of the enforcement actions discussed previously validate the linkage of demand and supply elasticity and manipulation. In *Amaranth*, trader Brian Hunter's "experiment" sought to exploit and exacerbate temporal inelasticity of the NYMEX bid stack to execute trades at low prices that would benefit Amaranth's targeted short derivatives positions. ETP was also alleged to have created and exploited temporal inelasticity of bids in executing fixed-price trades designed to lower the value of an index. In *DiPlacido*, an energy broker was successfully prosecuted for "offering through" bids, taking advantage of inelasticity to post high prices during the NYMEX settlement period to raise the profitability of its related options position. Sumitomo trader Yasuo Hamanaka created inelasticity through his cornering of copper on the London Metals Exchange. In *Masri*, an equity trader allegedly "marked the close" by

[37] As observed by Golez and Marin (2012:31) with respect to price support provided by mutual funds in buying the securities of their parent in times of economic stress, "in turmoil times a small buy initiated trade may have the same price impact than a very large purchase in normal times as investors may view the former order as new (positive) information arriving to the market."

placing a large number of bids at the end of the trading day, playing upon the inability of the offer stack to replenish itself in time to react to the higher price and reflecting temporal inelasticity of supply. That three of these five cases involved the energy sector is not incidental, for energy markets rely heavily on published indices for price formation based on sample surveys of a relatively small number of physical transactions and are prone, thereby, to frequent or episodic issues of price inelasticity of demand and supply.[38]

3.3.3. The Leverage of Related Positions

The importance of leverage in the size of the price-taking position relative to the size of the trigger is mathematically verifiable from the right side of Equation (5b):

$$(6) \qquad \frac{\partial G}{\partial L}\cdot\frac{R}{X} - 1 > 0 \;\Rightarrow\; \frac{\partial G}{\partial L}\cdot\frac{R}{X} > 1 \;\Rightarrow\; R > \frac{\partial L}{\partial G}\cdot X.$$

Thus, since by Equation (4a) $0 < \frac{\partial G}{\partial L} < 1$, then $\frac{\partial L}{\partial G} > 1$ and therefore

$$(7) \qquad R > X.$$

The manipulator gains leverage by acquiring positions that reference the market price, including financial derivatives and physical contracts traded at settlement. This example raises two important points. First, because the trader must have leverage in its price-taking positions to successfully execute the manipulation, price-taking positions that are in total less than or equal to the size of the trigger must be considered a hedge to price risk, not a target for manipulation. This explains the logic of end-user exemptions and position limits in commodities markets,[39] but makes a rather strong assumption that all price-taking positions are observable. Second, Equation (7) requires financial, not physical, leverage.[40] Some price-taking positions may not match one-to-one with the triggering trades. For example, out-of-the-money options held in quantities that are multiples of the underlying asset traded may serve only as a hedge at some prices, but may gain leverage as strike prices are approached.

[38] For a thorough discussion of the evolution of anti-manipulation statutes relevant to wholesale electricity and natural gas markets in the U.S. and Europe, see Ledgerwood and Harris (2012).

[39] See Position Limits for Futures and Swaps; Final Rule and Interim Final Rule, 17 C.F.R. Parts 1, 150 and 151 (2011); http://www.cftc.gov/LawRegulation/DoddFrankAct/Rulemakings/DF_11_EndUser/index.htm (end user exemptions).

[40] Special thanks to Matthew L. Hunter for the many conversations that clarified this point.

Other positions that are improved by a manipulation may not be quantifiable, such as qualitative benefits to reputation or to parties other than the manipulator (Golez and Marin, 2012:7). For application of the logic of Equation (7), one must therefore be mindful that it is the total net financial leverage held by the suspected manipulator that incents the manipulation and, therefore, that requires evaluation relative to the target.

The only limits on the size of financial positions the manipulator can accrue are its funds available for the scheme, the willingness of counterparties to execute contracts that benefit its targeted position, and regulatory controls such as exchange-based position limits. Indeed, it is the relative ease of acquiring such positions that drives many of the reporting requirements envisioned by Dodd-Frank. By comparison, delivery constraints limit the assemblage of price-taking physical positions and may limit the number of available counterparties that are able to trade. Note that the accumulation of a physical index position provides a manipulator with a valuable option; it can keep the position as part of its portfolio of related positions (R), or trade units out of that position at a fixed price, thus using a price-taking position to generate price-making trades. Holding physical index-based positions in addition to a complementary financial position enhances the potential for a successful manipulation, because uneconomic fixed-price trades can then be used to simultaneously flatten physical obligations and benefit any remaining financial and physical positions.[41]

A trader may cite the risk associated with such leveraged positions and characterize them as legitimate speculative investments, capable of generating losses or gains. It is true that these positions place the manipulator (and its counterparties) at risk of unfavorable price movements, as evidenced by the demise of Amaranth. However, this risk is not borne equally, because the ability and willingness of the manipulator to influence the market price to benefit its leveraged price-taking positions biases the likely outcome in a manner that counterparties could not predict. For this reason, intentional loss-based trading should be viewed as a type of transactional fraud. If the manipulator introduces a cleared price-setting transaction to the market that is below its true willingness to sell or above its true willingness to pay, the resulting trade potentiates a loss to the manipulator's counterparties in the targeted markets that they could not reasonably foresee when trading in an

[41] This is the mechanism allegedly used in the ETP manipulation. As the manipulator's share of the total volume of fixed-price trades approaches 100%, the average price of these trades equals the price used to value its physical index position, such that the per-unit cost of the manipulation effectively approaches zero (plus or minus any discounts or premiums relating to those transactions). This compounds the difficulty of proving the manipulation, because an actual or opportunity cost separate from the manipulated index may not exist.

ostensibly competitive market. The resulting transfer of wealth arises, not due to superior foresight or business acumen, but because the price-making agent on one side of the position is willing to execute an artifice to the detriment of the other. The harm caused by such behavior is potentially significant and lasting, as is discussed in the next section.

4. IDENTIFYING, DETECTING AND MEASURING THE HARM CAUSED BY MARKET MANIPULATION

When first presented with our proposed framework, some of our colleagues scoffed at the notion that a market manipulation can create inefficiency (or even be possible) within otherwise competitive markets. Counterarguments reflexively surfaced that the directional price movements caused by triggering price-making trades will be reversed by opposing competitive forces, and that wealth transfers produced by manipulations present nothing more than transitory, zero-sum outcomes. However, such arguments ultimately rely on a presumption of transactional legitimacy that is absent in the presence of outright fraud, uneconomic trading, or market power. Because the manipulator seeks to intentionally bias the price-making mechanism, such trades misrepresent the value of the underlying asset and undermine the price formation process to the extent that the market relies on the misinformation. In this section, we describe the inefficiencies and harm caused by such distortions and discuss methods for their detection and measurement.

4.1. THE INEFFICIENCY CAUSED BY MANIPULATION

Market manipulation that cannot be effectively arbitraged introduces transactional and allocative inefficiencies to the market (Kyle and Viswanathan, 2008). Transactional inefficiency derives from the erosion of confidence in the market price as an indicator of true value. Search costs increase as market agents are forced to validate prices. If they perceive that a manipulation is directionally biasing prices, agents injured by this movement may avoid some or all trading, thus decreasing the liquidity in the price-making market. The exit of these traders reduces the elasticity of supply and demand, thereby making the market that much easier to manipulate. That prices are more likely to be manipulated precisely at the times when demand and supply are most inelastic exacerbates this behavior, for the value of the pricing mechanism as an accurate measure for evaluating scarcity is then frustrated. This will increase volatility and cause wider bid-ask spreads. The cost of legitimate trading, including hedging, will ultimately increase as a result.

Price-based manipulations create allocative inefficiency by causing the market to produce at a price and output combination that "does not reflect legitimate forces of supply and demand" and which thus reflects the creation of an "artificial price" (CFTC Manipulation Rule, p. 41407). If market power triggers the manipulation, this allocative inefficiency derives from the standard "deadweight loss" of monopoly or monopsony caused by the underexchange of the asset traded if compared to the competitive equilibrium. Conversely, if uneconomic trading is used to trigger the manipulation, the allocative inefficiency derives from the *overexchange* of the asset traded relative to a competitive equilibrium, shown by the Net Welfare Loss in Figure 1. The use of outright fraud as a trigger could mimic either of these two outcomes, depending on the relative responsiveness of buyers and sellers to the fraudulent price.

The oft-stated solution to abate efficiency concerns from price-based manipulation is to maximize the liquidity in the price formation process at all times such that manipulative behavior is muted or negated through robust trading. We agree but for the caveat that more volume does not necessarily equate with greater liquidity. Large traders capable of serving as market makers to financial derivatives contracts can bring significant liquidity to the market for legitimate hedging and speculation, but can also accumulate financial leverage sufficient to incent the manipulation of prices. Position limits are a less than stellar tool to abate such behavior, as they will arbitrarily preclude some legitimate trading from the market. A better way to enhance market liquidity is to recognize the characteristics that separate legitimate and manipulative trading. The framework we propose identifies three such characteristics: the use of outright fraud, the exercise of market power, and the execution of uneconomic trades. Legitimate trading lacks these characteristics, exemplified by trading to hedge positional risk, to legitimately undercut or outbid competitors, or to execute a strategy designed to make money (relative to the trader's opportunity cost) on a stand-alone basis. Such trades enhance liquidity and improve market efficiency over time.

4.2. THE HARM CAUSED BY MANIPULATION

The framework provides an analytical basis to assess the harm caused by manipulative behavior when it is found to exist. In this context, the term "harm" is measured by the redistribution of wealth caused either directly or proximately by the directional price movement created by the manipulation. Harm accrues to three groups. First, traders in the price-making market who must detrimentally adjust their bids or offers to accommodate the manipulated price are harmed. This would include, for example, sellers priced out of the market due to uneconomic offers, buyers injured by monopoly prices, or

parties induced to trade against their self-interest on the basis of fraudulent information. Second, the counterparties to the manipulator's price-taking instruments are harmed, as are other market participants with equivalent positional risk. Third, to the extent that a provable nexus can be demonstrated to future periods or other markets, other parties may demonstrate that they incurred harm as well.

This last point may raise legitimate concerns of potentially limitless liability for behavior determined to be manipulative, requiring a high threshold for proof of the nexus. However, this high standard does not negate the fact that the effects of a manipulation may linger beyond its execution. For example, in the case of the condominium manipulation presented in Section 3, the size of the uneconomic purchase that would be needed to reverse the $20,000 price reduction across the 70 index sales left on the index after the execution of the manipulation is $1.9 million. Moreover, because new sales must fight the presumption of legitimacy that is afforded to the prior sales at the manipulated index price, the ability of new sales to significantly raise the index back to its initial value is impinged even as the manipulated sales fall off of the index over time. This phenomenon was empirically verified for underwriter price-stabilization activity for IPOs, which was found to "have a long-lasting or even permanent effect on prices" (Lewellen, 2006:632).

4.3. THE DETECTION OF MANIPULATIVE BEHAVIOR

For a price-based manipulation to be effective, the trigger must impact the price-making mechanism such that the information conveyed is not filtered out as noise nor snuffed out by the weak law of large numbers in contributing to the competitive equilibrium price (Hellwig, 1980:493). To detect manipulative behavior requires, therefore, the ability to screen for anomalous behavior against the backdrop of market noise, a task for which statistical analyses are particularly (though not exclusively) well suited (Pirrong, 1993, 2004). Because anomalies will also include legitimate transactions through which informed traders earn a return on their investments in gathering information, a presumption of legitimacy must attach to all open market trades as a null hypothesis. The burden then falls on the party alleging the manipulation to prove that the behavior in question rejected this hypothesis and thus fell outside of the level of market noise associated with legitimacy. This burden can only be met through proof that the accused used strategic behavior to cause or attempt to cause a directional price movement, whether through one large anomalous trade or through a pattern of trading exhibited over time.

The construction and calibration of such screens need not occur in a vacuum, as examples of successful screening methodologies can derive directly from the

empirical studies discussed in Section 3. These studies use the law of large numbers as presented in the central limit theorem, which states that the sum of a large number of independent random variables is approximately normally distributed. For data that should be normally or log-normally distributed (as the returns on commodities often are), comparisons of the distribution of returns for the market and for the suspected manipulator can be used to test the null hypothesis that the behavior in question was legitimate. For example, Ruud relied on tests for skewness, kurtosis, and chi-square goodness-of-fit to evaluate comparative returns on IPOs, noting that "the distribution of one day returns peaks steeply around zero, and the negative tail of the distribution is significantly curtailed" (Ruud, 1993:140). As price support was withdrawn, positive skewness and kurtosis in the data declined such that:

> The kurtosis tests for normality are confirmed by chi-square goodness-of-fit tests, which find that the null hypothesis of normality for the one-day, one-week, two-week, and three-week distributions can all be rejected at the 1% level of significance. However, the null hypothesis that the four-week distribution is normal cannot be rejected. High initial kurtosis that decreases as the holding period lengthens suggests that underwriters may at first intervene to support IPO prices and then withdraw their support over time (Ruud, 1993:146).

Similar findings were made by Lewellen (2006:625) and Prabhala and Puri (1998:13) as to underwriter price support for IPOs, by Massa and Rehman (2008:302) in showing that affiliated funds change their holdings in the stocks of firms borrowing from affiliated banks on the basis of privileged inside information, and by Golez and Marin (2012:31) concerning the price support by affiliates of parent banks' stocks under times of economic stress.

Inherent to all such analyses are the concerns of Type I and Type II errors. These arise as there may not be a one-to-one mapping from the behavior alleged to cause the manipulation to a demonstrable effect, such that the screens used cannot effectively distinguish between informed trading and manipulative behavior. Prevention of false positives requires robustness checks to confirm that findings of anomalous behavior are not otherwise readily explainable. These could include retesting the identified anomalies with different variable specifications to exclude other possible influences (Massa and Rehman, 2008:301) or testing subsamples of the data to confirm the results (Golez and Marin, 2012:35; Lewellen, 2006:643; Prabhala and Puri, 1998:19). Pragmatically, this can be accomplished for only a limited set of plausible alternative contingencies, as to require otherwise would place the party seeking to prove manipulation in the unacceptable position of having to disprove a relatively limitless number of

counterfactuals (Ledgerwood, 2010:49). Given proper vetting of false positives and a screening methodology consistent with the null hypothesis of trade legitimacy, false negatives can then be mitigated by tailoring screens to detect specific behavior of concern for specific components of the manipulation.

Separation of the manipulation's price-making and price-taking trades provides a logical foundation for determining the manipulation's cause and effect, with demonstration of the nexus providing the linkage between the two. Proof of artificial price then becomes a supportive effort that is not required to prove the manipulation under fraud-based rules, but is necessary to prove the manipulation under the artificial price standard or for obtaining disgorgement.

4.3.1. Establishing the Nexus

In many manipulation cases, proof of the nexus between the trigger and target is almost an afterthought because it refers to the same price. However, this price could and likely does tie to many other prices and price-taking positions that extend across products, geography and time. Establishing (or refuting) a causative nexus is therefore essential to manipulation cases, as proof of a nexus simultaneously demonstrates the intent and ability to manipulate, causation between trigger and target, and the linkage that enables the manipulative scheme to succeed. For a party seeking to prove the manipulation of a particular targeted position by a given trigger, a statistical analysis will often be needed to demonstrate the direction, strength and reliability of the nexus asserted as causative. Practically speaking, this will foreclose from consideration many positions that were likely impacted by the manipulation, but for which insufficient proof of causation is shown. Likewise, a manipulation defense wishing to introduce evidence that incidental positions should be used to evaluate the net exposure of its portfolio to a directional price movement must also be prepared to demonstrate the strength and relevance of any causative nexuses.

Analysis of a suspected nexus should evaluate these linkages during and apart from the times when manipulative behavior is suspected. Tighter linkages strengthen causation between price-making trades and price-taking positions, as is often magnified at times such as settlement when fixities in supply and demand emerge. Therefore, ex ante screening for such phenomena provides critical information as to the markets most in need of monitoring and surveillance and as to the times, instruments, and trading behaviors of greatest concern. This can assist the allocation of regulatory resources to serve their most efficient use and may direct the coordination of reporting requirements within and across regulatory authorities. Knowledge of such oversight efforts will deter manipulative behavior at the times most critical to price formation,

benefitting compliant market participants in the long run through the increased market efficiency derived from better certainty, improved transparency, greater liquidity, and reduced bid-ask spreads.

4.3.2. Screening for Targets

Any position that derives its value from a price affected by a manipulation's trigger could theoretically serve as a target. The manipulation is then profitable if the summed gain to the net position held across all targets affected by the manipulation is leveraged sufficiently to exceed the manipulation's costs, including any potential losses in the trigger. However, as we discussed in Section 3, it is possible that some of the positions that are targeted by the manipulation are unobservable ex ante, as might occur with derivatives positions acquired off-market. Likewise, even for positions that are known, it is possible that the benefit derived is unquantifiable, as may occur if the manipulation benefits qualitative targets such as reputation, benefits to third parties, or career status. As reporting requirements increase under Dodd-Frank and as other agencies add transparency rules,[42] the ability to proactively screen for manipulation targets will improve, but the ability to see all positions may remain elusive absent investments in legal discovery. The absence of effective screens leaves as the only recourse continued reliance on ex post discovery of positions, often due to their extraordinary success (as alleged with ETP, which earned large gains as a result of regional gas transportation disruptions caused by the impact of Hurricane Rita) or spectacular failure (as with Amaranth, which imploded the next year by speculating on future hurricanes that never developed).

4.3.3. Screening for Triggers

A key benefit of the framework is its ability to accommodate the three types of behavior that can trigger a price-based manipulation. From the perspective of creating a directional price movement, the only difference between the triggers is their cheapness to the manipulator, with uneconomic trades incurring a positive cost, outright fraud incurring no cost (the fraud induces others to make the uneconomic trades), and the exercise of market power paying the manipulator (a negative cost). However, the screens needed to detect an exercise of market power are *exactly opposite* those used to detect uneconomic trading. This is illustrated in Table 3.

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[42] For example, see FERC Enhancement of Electricity Market Surveillance and Analysis through Ongoing Electronic Delivery of Data from Regional Transmission Organizations and Independent System Operators, 137 FERC ¶61,066 (October 20, 2011).

Table 3: Comparison of Screens for Market Power and Uneconomic Trading

Basis for Screen	Market Power Screen	Uneconomic Trading Screen
Price Relative to Cost* (Seller)	P > MC*	P < MC*
Price Relative to WTP (Buyer)**	P < WTP**	P > WTP**
Market Share and Concentration	Both Generally High	Focused on Price-Making Trades
Output Relative to Competition	Below	Above

Notes: * MC is Marginal Cost, which includes the opportunity costs of Seller's next-best alternative.
** WTP is Willingness to Pay, as determined by the opportunity cost afforded by prevailing prices.

A corporate compliance officer looking at Table 3 might laugh (or cry) at the level of clairvoyance implied by the combined application of the market power and uneconomic trading screens. Indeed, trades that deviate from competitive benchmarks seem destined for litigation and enforcement actions under antitrust principles or market manipulation doctrine, such that all price-making trades are continually analyzed under the crucible of thousands of potential plaintiffs and regulators. This is clearly untenable, as the outcome would drive liquidity from the markets and chill legitimate trading.

Deliverance from such overregulation derives from the requirement of anomalousness that surrounds the null hypothesis of transactional legitimacy. The party seeking to prove a manipulation must distinguish the behavior from the noise in the market and demonstrate that the behavior motivated (and was not motivated by) the suspected price movement – thus proving the intent to manipulate. While the first task is relatively simple, the second requires proof that the alleged manipulator did not act based upon an unobservable private information set. This is not an issue when market power is the trigger, as then the manipulator's stand-alone self-interest is aligned with the directional price movement associated with the manipulation. In contrast, proof of intentional uneconomic behavior requires an inescapably subjective determination that enough circumstantial evidence of losses incurred in the trigger exists to support the manipulation claim. Without more objective evidence – a "smoking gun" provided through voice recordings, instant messages, emails or whistleblower testimony – proof of manipulative intent using trading data alone may prove difficult at best.

One factor that should ease this burden is the character of uneconomic behavior as a form of transactional fraud. If a market participant is found to have committed outright fraud to cause a price movement, little deference is given as to its private information set. Likewise, showing the participant to

have intentionally engaged in uneconomic behavior to trigger the manipulation should destroy the aura of legitimacy that otherwise surrounds its transactions. Such anomalous behavior may be shown in the form of a pattern of price-making trades that appear to lose money unabated over time (ETP, Amaranth, DiPlacido), or in one large loss of a magnitude sufficiently unusual to warrant attention (as in the condominium example). By showing that the participant repeatedly ignored its opportunity costs (in the case of a pattern) or knowingly engaged in a trade that accrued an unusually large loss, the likelihood that it was acting on a private information set grows increasingly unlikely. While such evidence may not remove all doubt as to whether the suspected behavior was manipulative, at some point the burden of proof must shift from the accuser to the accused under an evidentiary standard of a preponderance of the evidence.

4.3.4. Measuring an Artificial Price

Under the fraud-based standard now shared by the CFTC, FERC, FTC and SEC, the need for proving an artificial price as a material element of a manipulation case is no longer essential. That said, an inability to demonstrate a measurable price movement caused by the trigger raises questions (warranted or not) as to whether the activity gave rise to a manipulation, irrespective of the strength of the other elements of the case. The difficulty of calculating price artificiality rests in finding the appropriate calculation of a but-for competitive price to serve as the benchmark for the manipulator's opportunity costs. The problem is that the first presence of manipulation in the market sets in motion a chain of actions and reactions that would never have unfolded but-for the manipulation, such that the resulting data are poisoned and thus unusable for reconstructing an exact but-for price. The calculation of an artificial price then must rely upon proxy benchmarks that (if contemporaneous with the manipulation) may also have been poisoned by the behavior or, if not, may raise questions as to their suitability as a proxy.

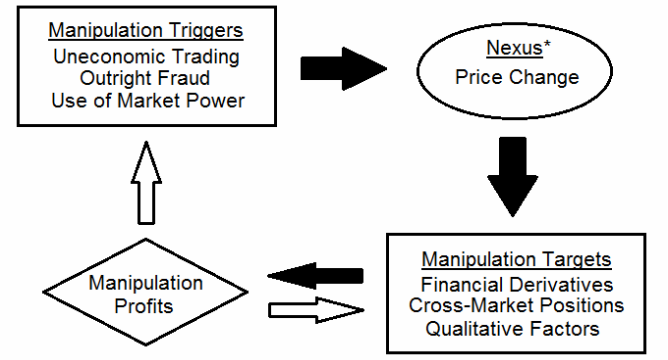
If the purpose of proving an artificial price is for the calculation of disgorgement or some other remedy that is contingent on the amount of harm caused by the price movement associated with the manipulation, then precision is a primary consideration. However, if the purpose of the artificial price calculation is only to confirm the directionality of the price movement caused by the manipulation's trigger, the need for such precision is less important. In these cases, it may be possible to make a simpler showing of the manipulator's directional influence on trading at the times the trigger was used. For example, if the manipulation-involved trades contributed to an index to compute an average price, the poisoned index data may be examined with and without the manipulator's trades to confirm directionality. This analysis would verify the directional effect these

trades had on the index, and might also provide a rough estimate of the harm such trades inflicted pending verification through other benchmarks.

5. CONCLUSION

Market manipulation remains an understudied and misconstrued phenomenon, in part due to lack of cohesive theory for analyzing manipulation across cases, agencies, statutes, and now (with EU financial reform) continents. In this paper, we have discussed how such analytical continuity is possible if the components of a price-based manipulation are separated by cause (the trigger) and effect (the target), with a demonstrable pricing linkage established between the two (the nexus). The resulting logic of the framework is summarized in Figure 4.

Figure 4: Summary of the Framework of Price-Based Market Manipulation



* Other types of manipulations could be analyzed using a nexus other than a price change.

Logical continuity derives from the addition of uneconomic trading to the types of behavior that can trigger a manipulation. We contend that uneconomic bids and offers constitute transactional fraud, thus bridging the more traditional analysis of manipulation cases under the standards of outright fraud or the creation of an artificial price by market power. Once the type of suspected trigger is shown, proof of the remainder of the manipulation follows an equivalent logical path. This approach is consistent with existing statutes and with the academic literature on the point.

Note that we present Figure 4 not as a linear process, but as a loop. This anticipates that profits derived from one iteration of a manipulation may be reinvested into the next, such that profits are used to build more leverage into targeted positions and to add more financial heft to the next round's manipulation trigger. Thus, as can occur with other types of fraudulent activity,

the manipulator may continue to grow the size of the manipulation unabated until detected either by embarrassing gains (as was alleged of ETP) or spectacular losses (Amaranth). Unlike other types of fraud, however, market manipulation is treated as a civil matter unless criminal elements such as conspiracy are present. Furthermore, the remedy often awarded for market manipulation is the disgorgement of profits, which (absent perfect detection) provides little disincentive for the behavior. Civil penalties therefore remain the primary deterrent to manipulative behavior, with agencies such as the FERC combining such penalties with disgorgement and compliance plans to stem such behavior perceived under its jurisdiction.[43]

The historical precedent of manipulation cases tried before the CFTC, FERC, and SEC provide a patchwork of specific types of behaviors determined to be illegal, with no functional linkage to a common economic logic across the cases tried by each agency, much less across agencies. This "I know it when I see it" approach provides little clear guidance to traders as to the types of behavior that each commission perceives as manipulative, potentially leading them to either avoid legitimate trades to prevent suspicion under uncertain enforcement standards or to pay no attention to such concerns given the agencies' historical difficulty in bringing such cases. As the U.S. and Europe implement broad anti-manipulation rules, a more consistent and logical approach to the detection and analysis of manipulation is warranted. To this purpose, the framework we propose could clarify what does and does not constitute manipulation for both market participants and enforcement agencies. Such certainty would ultimately improve market efficiency through improving market liquidity and reducing bid-ask spreads.

References

Allen, Franklin, and Douglas Gale. 1992. "Stock-Price Manipulation," 5(3) *Review of Financial Studies* 503-529.

Aggarwal, Rajesh K., and Guojun Wu. 2003. "Stock Market Manipulation - Theory and Evidence," presented at the 64th Annual Meeting of the American Finance Assoc., http://www.afajof.org/pdfs/2004program/UPDF/P306_Asset_Pricing.pdf.

Attari, Mukarram, Antonio S. Mello, and Martin E. Ruckes. 2005. "Arbitraging Arbitrageurs," 60(5) *Journal of Finance* 2471-2511.

Brunnermeier, Markus K., and Lasse Heje Pedersen. 2005. "Predatory Trading," 60(4) *Journal of Finance* 1825-1863.

[43] For example, since Rule 1c came into effect, the FERC has levied approximately $300 million in civil penalties, $151 million in disgorgement and $5 million in compulsory compliance plans as of June 2, 2012. These statistics are available at http://www.ferc.gov/enforcement/civil-penalties/civil-penalty-action.asp.

CFTC Release PR5471-08, "Energy Transfer Partners, L.P. and Three of Its Subsidiaries to Pay a $10 Million Penalty to Settle CFTC Action Alleging Attempted Manipulation of Natural Gas Prices" (March 17, 2008), http://www.cftc.gov/PressRoom/PressReleases/pr5471-08.html.

Fama, Eugene F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work," 25 *Journal of Finance* 383-417.

Fischel, Daniel R., and David J. Ross. 1991. "Should the Law Prohibit 'Manipulation' in Financial Markets?" 105 *Harvard Law Review* 503-553.

Gerard, Bruno, and Vikram Nanda. 1993. "Trading and Manipulation Around Seasoned Equity Offerings," 48(1) *Journal of Finance* 213-245.

Goldstein, Itay, and Alexander Guembel. 2008. "Manipulation and the Allocational Role of Prices," 75(1) *Review of Economic Studies* 133-164.

Golez, B., and J. Marin. 2012. "Price Support by Bank-Affiliated Mutual Funds," http://papers:ssrn:com/abstractid=1652050.

Grossman, Sanford J., and Joseph E. Stiglitz. 1980. "The Informational Role of Prices," 70 *American Economic Review* 393-408.

Hanson, Robin, and Ryan Oprea. 2009. "A Manipulator Can Aid Prediction Market Accuracy," 76 *Economica* 304-314.

Hellwig, M. 1980. "On the Aggregation of Information in Competitive Markets," 22 *Journal of Economic Theory* 477-498.

Holley, David. 1996. "Ex-Sumitomo Copper Trader Arrested," *Los Angeles Times*, http://articles.latimes.com/1996-10-23/business/fi-56748_1_copper-trader.

Jarrow, Robert A. 1994. "Derivative Security Markets, Market Manipulation, and Option Pricing Theory," 29(2) *Journal of Financial and Quantitative Analysis* 241-261.

Kleit, Andrew N. 2009. "Index Manipulation, the CFTC, and the Inanity of DiPlacido," http://www.met.psu.edu/people/ank1/research-papers/kleit.manipulation.pdf.

Kumar, Paveen, and Duane J. Seppi. 1992. "Futures Manipulation with 'Cash Settlement'," 47(4) *Journal of Finance* 1485-1502.

Kyle, Albert S., and S. Viswanathan. 2008. "How to Define Illegal Price Manipulation," 98(2) *American Economic Review* 274-279.

Ledgerwood, Shaun D. 2010. "Screens for the Detection of Manipulative Intent," http://ssrn.com/abstract=1728473.

_____ and Dan Harris. 2012. "A Comparison of Anti-Manipulation Rules in US and EU Electricity and Natural Gas Markets: A Proposal for a Common Standard," 33(1) *Energy Law Journal* 1-40.

_____ and Wesley Heath. 2012. "Rummaging through the Bottom of Pandora's Box: Funding Predatory Pricing through Contemporaneous Recoupment," 6(3) *Virginia Law and Business Review* 509-568.

_____ and Johannes Pfeifenberger. 2012. "Using Virtual Bids to Manipulate the Value of Financial Transmission Rights," http://ssrn.com/abstract=2050945.

_____, Gerald Taylor, Romkaew Broehm, and Daniel Arthur. 2011. "Losing Money to Increase Profits: A Proposed Framework for Defining Market Manipulation," http://www.brattle.com/_documents/UploadLibrary/Upload919.pdf.

Lewellen, Katharina. 2006. "Risk, Reputation, and IPO Price Support," 61 *Journal of Finance* 613-653.

Massa, Massimo, and Zahid Rehman. 2008. "Information Flows Within Financial Conglomerates: Evidence From the Banks-Mutual Funds Relation," 89 *Journal of Financial Economics* 288-306.

O'Hara, Maureen. 1995. *Market Microstructure Theory*. Oxford: Blackwell.

Pirrong, Craig. 2010. "Energy Market Manipulation: Definition, Diagnosis, and Deterrence," 31(1) *Energy Law Journal* 1-20.

_____. 2004. "Detecting Manipulation in Futures Markets: The Feruzzi Soybean Episode," 6(1) *American Law and Economics Review* 28-71.

_____. 1993. "Manipulation of the Commodity Futures Price Delivery Process," 66(3) *Journal of Business* 335-369.

Prabhala, N.R., and Manju Puri. 1998. "How Does Underwriter Price Support Affect IPOs: Empirical Evidence," http://ssrn.com/abstract=95948.

Remarks of Commissioner Bart Chilton to Metals Market Investors, made March 23, 2010 in Washington, D.C., http://www.cftc.gov/PressRoom/SpeechesTestimony/CommissionerBartChilton/opachilton-30.html.

Ruud, Judith. 1993. "Underwriter Price Support and the IPO Underpricing Puzzle," 34 *Journal of Financial Economics* 135-151.

Cases Cited

- *Amaranth Advisors L.L.C., Order to Show Cause and Notice of Proposed Penalties*, 120 FERC ¶61,085 (July 26, 2007).
- *Brian Hunter*. 130 FERC ¶63,004 (2010).
- *Brian Hunter*. 135 FERC ¶61,054 (2011).
- *CFTC v. Optiver US, LLC et al.*, Case 1:08-cv-06560-LAP (S.D.N.Y. 2012)
- *Consent Order of Permanent Injunction, Civil Monetary Penalty and Other Relief as to Defendants Amaranth Advisors, L.L.C. and Amaranth Advisors (Calgary) ULC, United States Commodity Futures Trading Commission v. Amaranth Advisors, L.L.C., et al.*, 07 Civ. 6682 (DC) (S.D.N.Y., August 12, 2009).
- *Constellation Energy Commodities Group, Inc.*, 138 FERC ¶61,168 (2012).
- *DiPlacido v. CFTC*, 2009 U.S. App. LEXIS 22692 (2d Cir. Oct. 16, 2009).
- *Energy Transfer Partners, L.P., et al., Order to Show Cause and Notice of Penalties*, 120 FERC ¶61,086 (July 26, 2007).
- *FERC Enforcement Staff Report: Findings of a Non-Public Investigation of Potential Market Manipulation by Suppliers in the New York City Capacity Market*, Docket Nos. IN08-2-000 & EL07-39-000 (February 28, 2008), http://www.ferc.gov/enforcement/market-manipulation/nyiso-icap.pdf.
- *GFL Advantage Fund, Ltd. v. Colkitt*, 272 F. 3d 189, 205 (2001).
- *FERC: Initial Decision* in Docket No. IN07-26-004 (January 22, 2010).

- *In the Matter of: Anthony J. DiPlacido, Robert S. Kristufek, and William H. Taylor*. http://www.cftc.gov/files/enf/01orders/enfavista-complaint.pdf (Aug. 21, 2001).
- *In re DiPlacido*, Comm. Fut. L. Rep. (CCH) P 30,970 (November 5, 2008).
- *In the Matter of Sumitomo Corporation,* referenced in CFTC Press Release #4144-98. http://www.cftc.gov/ogc/oporders98/ogcfsumitomo.htm (May 11, 1998).
- *Markowski v. SEC*, 274 F.3d 525 (D.C.Cir.2001).
- *Order Accepting Proposed Tariff Revisions Subject to Conditions, and Addressing Related Complaint*, Docket Nos. ER11-2875-000 and EL11-20-000, 135 FERC ¶61,022 (April 12, 2011).
- *Order Approving Uncontested Settlement*, Docket No. IN06-3-003, 128 FERC ¶61,269 (August 31, 2009).
- *Order Approving Uncontested Settlement*, Docket Nos. IN07-26-000, IN07-26-003, IN07-26-004 and IN07-26-005, 128 FERC ¶61,154 (August 12, 2009).
- *Order on Paper Hearing and Order on Rehearing*, Docket Nos. ER10-787-000, EL10-50-000, EL10-57-000, ER10-787-004, EL10-50-002, and EL10-57-002, 135 FERC ¶61,029 (April 13, 2011).
- *Order on Proposed Revisions to In-City Buyer-Side Mitigation Measures*, Docket No. ER10-3043-000, 133 FERC ¶61,178 (November 26, 2010).
- *SEC v. Pawel Dynkowski et al.*, Case No. 09-361 (May 20, 2009). http://www.sec.gov/litigation/complaints/2009/comp21053.pdf.
- *SEC v. Masri*, 523 F. Supp 2nd 361 (S.D.N.Y., 2007).
- *United States Commodity Futures Trading Commission v. Amaranth Advisors, L.L.C., Amaranth Advisors (Calgary) ULC, and Brian Hunter*, 07 Civ. 6682 (DC) (S.D.N.Y., May 21, 2007).
- *U.S. v. KeySpan Corp.*, Case 1:10-cv-01415-WHP (S.D.N.Y., February 2, 2011).
- *U.S. v. O'Hagan*, 521 U.S. 642, 652 (1997).

Regulations, Statutes and Tariffs

CFTC Manipulation Rule, *Prohibition on the Employment, or Attempted Employment, of Manipulative and Deceptive Devices - Prohibition on Price Manipulation*, 17 C.F.R. Part 180 (August 15, 2011).

Commodity Exchange Act (CEA), 7 U.S.C. §§ 1 et seq. [2010].

Council Regulation (EU) No 1227/2011, On Wholesale Energy Market Integrity and Transparency, at art. 2(4)(a), 2011 OJ L 326, 1, 6.

Dodd-Frank Wall Street Reform and Consumer Protection Act, P.L. No: 111-203 (July 21, 2010).

European Union Market Abuse Directive provision concerning market manipulation, *Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation (market abuse)*, OJ L 96, 12.4.2003 (2006). (MAD).

FERC Anti-Manipulation Rule, 18 C.F.R. §1c, arising under the authority granted in 15 U.S.C. §717c-1 and 16 U.S.C. §824v(a) as amended by the Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 et seq. (2005).

FERC Enhancement of Electricity Market Surveillance and Analysis through Ongoing Electronic Delivery of Data from Regional Transmission Organizations and Independent System Operators, 137 FERC ¶61,066 (October 20, 2011).

FERC Policy Statement on Enforcement, 113 FERC ¶61,068 (October 20, 2005).

FTC Anti-Manipulation Rule, 16 C.F.R. Part 317, arising under the authority granted in 42 U.S.C. 17301-17305 as amended by Section 811 of Subtitle B of Title VIII of The Energy Independence and Security Act of 2007 (2009).

Position Limits for Futures and Swaps; Final Rule and Interim Final Rule, 17 C.F.R. Parts 1, 150 and 151 (2011).

SEC Anti-Manipulation Rule, 17 C.F.R. §240.10b-5, arising under the authority granted in 15 U.S.C. §78j(b) (2010).

SEC Exclusion for Price Support of IPOs, 15 U.S.C. §10(b) and 17 C.F.R. §240.l0b-7 (1934), later recodified as Section 104 of Regulation M, 17 C.F.R. 242.104 (1996).

Sherman Act §1, 15 U.S.C. § 1 et seq. (1890).

Stop Trading on Congressional Knowledge (STOCK) Act, P.L. No: 12t-105 (2012).