



Network similarity and collusion

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ABSTRACT

This study focuses on how collusive construction industry cartels structure their bidding patterns to increase their market shares, while preserving an illusion of competition. Using past research on the economics and social organization of bid-rigging and collusion, we examine a key issue related to similarities within bidding structures that are likely tainted by cartels. The study is empirically based on public procurement data to recreate the structure of interactions between construction industry firms in the province of Quebec (Canada) over a 12-year period (2002–2013). Cross-level multivariate analyses demonstrate that our indicator of similarities in bidding patterns, the Jaccard coefficient, is a positive factor of market shares, but particularly in cities that are targeted for collusive practices. We also emphasize the need to develop a monitoring system that allows researchers and analysts to track collusion patterns in various ways so as to prevent an increase of more sophisticated schemes and cartels.

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The construction industry is a highly lucrative business that is vulnerable to many deviant practices extending from a combination of push and pull factors. In most countries, this industry accounts for five to seven percent of the gross domestic product and is estimated to be a \$1.7 trillion industry worldwide (Kenny, 2007). Accounts of collusion and corruption emerge from many countries. In their global economic crime survey of 3000 senior representatives in 54 countries, Price Waterhouse Coopers (2010) found that corruption and bribery are increasing and are more prevalent in the construction industry than in the more general business world.

The construction industry is known for being extremely complex and diverse, involving non-standard activities that are difficult to assess and monitor. Moreover, numerous participants from various fields of expertise, ranging from engineers and architects to insurers and clients, must be involved to complete any given construction project. The high levels of uncertainty that typically characterize construction projects generate a wide range of vulnerabilities and criminal opportunities. Transparency International (2006) outlined the most prevalent crimes in this industry which include bribery, extortion, fraud, theft, and sabotage, but the emergence of cartels that set up collusive bidding systems is a more important challenge for authorities.

Collusive bidding refers to cases in which independent firms disclose their bidding prices with each other before the bidding process starts. This allows the bidding firms to predetermine who will win the contract. Collusive bidding over an extended period creates cartels of construction contractors and, if ignored or undetected over a lengthy period, it contributes to establishing increasingly organized deviant schemes between winning firms. This extremely lucrative practice is detrimental because construction project costs are likely to increase beyond the standards of a competitive market (Brockmann, 2009). Firms excluded from such cartels can become excluded from the general construction sector because they cannot compete with or within the bid-rigging system.

The objective of cartels is to benefit from anti-competitive behavior by giving themselves a market edge while preserving the illusion of competition. Anti-trust laws prohibit monopolization, trade restraints, and collusion among firms in order to protect clients (Brockmann, 2009), yet violations of these laws are some of the most pervasive and lucrative forms of corporate deviance (Van den Heuvel, 2005). Accounts of collusion in the construction industry have been reported in countrywide and citywide case studies in Japan (McCormack, 1995; Milhaupt and West, 2000; Hill, 2003), China (Ding, 2001; Zou, 2006), Italy (Savona, 2009; Lavezzi, 2008; Varese, 2011, 2006), Australia (Zarkada-Fraser and Skitmore, 2000; Vee and Skitmore, 2003), the United States (particularly in New York City: Goldstock et al., 1989; Ichniowski and Preston, 1989; Jacobs and Anechiarico, 1992; Thacher, 1995; Jacobs, 1999), and the Netherlands (Fijnaut et al., 1998; van de Bunt and van der Schoot, 2003; Graafland, 2004; Van den Heuvel, 2005; van de Bunt, 2010). Most of the factors and indicators identified to explain the rise of

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collusion in the construction industry are related to markets, logistics, surveillance, and culture, all components found at the root of many problems that typically emerge in this industry. Some of the most important factors and indicators are directly linked to structural components that generally characterize the construction industry. Experiences worldwide consistently demonstrate that the industry is generally large scale, time constrained, and composed of a few large firms and many small firms. Small firms are typically short-lived in this highly competitive landscape, whereas larger firms are more likely to have an exclusive status when they submit bids for larger, costlier, and more profitable projects. These large firms, whether they are successful and well-established or only just emerging, can also create the links of collusion or corruption required to guarantee their competitive edge across major projects.

Few studies have thoroughly examined the structural features of bidding in the construction industry, but some key cases do allow us to provide an initial assessment of this critical phase. In the ideal bidding process, each competing firm would submit an estimate for overall project costs without any knowledge of other competitors' bids. This ideal appears to be more of a rarity than a norm, particularly for firms that have considerable experience in bidding competitions. A more likely scenario involves a series of deviations from this ideal, which includes stifling the competition (also known as *predatory bidding*) whereby larger and more established firms bid lower than the market value and eliminate any realistic competitors. Another deviation emerges when cooperation is introduced into the bidding process. This behavior is generally labelled as anti-competitive and is most commonly identified in three scenarios: in *identical bidding*, where all competitors submit similar bids; in *territorial bidding*, where industry sectors (in the current study, the paving and sewer sectors) and regions are divided before the bidding process begins; and in *rotational bidding*, where a reciprocal pattern is established to ensure that losing firms in one bid become the winning firms in subsequent bids.

This kind of cooperative behavior among competitors suggests that the public authority no longer controls the public procurement process and it signals a heightened level of deviance inside the bidding system. The current study addresses this issue by using public bidding data to recreate the bidding structure for over 1000 active firms across competitive and collusive construction industry settings. Our main objective is to identify how firms involved in collusive bidding maintain an appearance of competition, while also hinting at their bid-rigging schemes. This inquiry focuses on how collusive firms become overly similar in their bidding patterns, while also gaining a great share in the construction market in which they participate. More specifically, we examine how similarities in the bidding structure influence a firms market shares, particularly in collusive contexts. To achieve this objective, we first examine past research on the economic and social organization factors that are often at the root of collusion. Past research is generally consistent with the practical aim of the current study: to devise a monitoring system that allows researchers and analysts to track collusion patterns and thereby prevent an increase in more sophisticated schemes and cartels.

Tracking collusion patterns

Tracking systemic deviant or illegal exchanges between private actors is a challenging task considering that these exchanges can occur for years and even decades before they are detected. However, detection is usually the result of extensive media scrutiny, whistleblowing, or lengthy enforcement efforts to prosecute participants. For instance, documenting all trade conspiracies filed by the US government over a 25-year period, Scott (1989) found that the average duration of antitrust violations was seven years, and

most violations were only discovered after complaints were filed by competitors. Because most illicit exchanges are conducted behind closed doors, it has been practically impossible for researchers and authorities to monitor such behavior. Many researchers have gathered publicly available data because direct-observation options are largely inaccessible. As a result, several innovative collusion indicators have been created.

As prevention tools, tracking systems or screens are not designed to work in isolation, but in combination with other measures. Several studies have specified what these measures might include and what types of programs should be established to discourage deviant practices. These measures fall into two major categories: market indicators and structural indicators. Most models developed to detect collusive activities fall into the former, relying on economic features such as price and cost asymmetries among competitors, with attention given to variations in the price/cost ratio across time (Bajari and Ye, 2003; Porter and Zona, 1993). In contrast, structural indicators draw from organizational theories that explain the structure of behaviors and interactions of firms operating in cartel settings. Below, we review the main features of these two sets of indicators, and how they have been used to detect and understand cartel behavior.

Market indicators

There are many ways to track market trends within an industry. Abrantes-Metz and Bajari (2009) and Porter and Zona (1993) demonstrate that the construction industry is vulnerable to collusion because demand is inelastic and stable across most jurisdictions. This inelasticity and stability forces authorities to award contracts to firms even when the costs of these contracts are obviously rising and the lowest project bid consistently surpasses the cost estimated by authorities at the onset of the bidding process. The most straightforward way to detect potential collusion patterns in this context is by examining the dollar amounts of the submitted bids. Shifts in these values are a direct indication of the shape of competition (Bajari and Summers, 2002; Bajari and Ye, 2003). Competition weakens when independence between firms decreases and cooperation emerges as a key component. In the ideal competitive scenario, bids should be substantially different, but as firms begin to share information, they can adjust and agree on submitting higher bids. This is possible when there is a manageable number of competing firms. Therefore, the first two signals that the bidding process is becoming less competitive and more collusive are: 1) a decrease in the number of competing firms, and 2) an increase in 'competing' bids of a similar amount.

Using a spatial econometric approach to identify collusive behavior, Lundberg et al. (2015) explored a recent period in Swedish history during which an asphalt cartel's existence was detected. Seeking to determine whether bidding patterns for cartel-participating firms differed both before and after detection, Lundberg et al. (2015) tested for statistical dependence between cartel members. As evidence of an absence of collusion, their findings identified a positive correlation between losing cartel members' bids as evidence of complimentary bidding during the cartel period and an absence of correlation after detection (Lundberg et al., 2015). Studies have consistently found that price coordination is a crucial operational factor in a collusive cartel (Clark et al., 2017). In addition to dependency and similarity between cartel members' bids, price coordination has also been identified through long-standing stability and low variance around winning bids (Abrantes-Metz and Bajari, 2009; Bajari and Summers, 2002; Hüscherlath and Veith, 2014; Imhof et al., 2016). Past research has suggested that a warning signal exists when the coefficient of variation of submitted bid prices for a contract falls below the seven per cent range (Abrantes-Metz et al., 2005; Chassin

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