

**The Impact of Reforms and Privatisation on Firms' Conduct in the
Presence of Interconnected Conglomerates and Weak and Inefficient
Regulatory Institutions**

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Abstract

Critics of broad reforms, including privatisation, argue that these policies may lead to the creation of rent-seeking interconnected large business groups in the absence of a strong regulatory framework and well-functioning courts. The empirical evidence in a developing country context in particular is however still scarce. Based on a case study of the Pakistani cement industry, this paper fills this gap. Our study shows that due to interconnected conglomerates' tactics, such as exclusionary practices, the acquisition of smaller competitor firms and the addition of significant capacities, the industry has witnessed a stable degree of seller concentration after broader reforms including privatisation. Consequently, colluding conglomerate firms have been able to maintain control over supply and prices for two decades in the post-reform period, despite allegations of tacit collusion leading to the imposition of fines and the issuing of warnings by the regulator, which is, however, weak and inefficient.

JEL classification: D22; K21; L11; L13; L33

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1. Introduction

One of the reasons for privatisation and other broader reforms was the belief that these would supposedly increase competition levels and this would in turn lead to lower and stable prices, optimum output levels and greater levels of efficiency. However, there is a strong indication of growing dissatisfaction with such reforms and the benefits of privatisation are being questioned in both developing and developed countries due to the anticompetitive behaviour of privatised firms which have colluded with other competitor firms from the industry to exploit market power. The anti-privatisation argument has been that any improved financial performance could have been due to a change in the dynamics of industry competition rather than a change of ownership per se. Furthermore, some authors argue that due to the strategic oligopolistic interaction of firms, improved enterprise productivity seldom translates into an overall increase in the welfare of the consumers and society. These benefits generally accrue to interconnected conglomerates and firms' shareholders and creditors. But interestingly, the impact of explicit/tacit collusion on supply and pricing dynamics has been studied comprehensively using theoretical models, but empirical evidence is still scarce. This gap widens even more when the assumptions of stronger regulatory institutions, an efficient legal system and fair play by the interconnected conglomerates are violated.

Following the international trend and under pressure from multilateral donor agencies, such as the World Bank and IMF, the Pakistani government introduced a deregulation policy through institutional and managerial changes in the 1980s. Subsequently, this deregulation policy was complemented by introducing mass privatisation of state-owned firms belonging to manufacturing and service industries in the early and mid-1990s. During the late 1990s and early 2000s, more reforms were introduced, including adhering to international auditing and disclosure standards, and setting up and strengthening regulatory authorities to address post-privatisation complaints of collusive practices. Rather disappointingly, since the time of privatisation and broader reforms, Pakistani *cement industry* in particular has been regularly accused of tacit collusion on the part of large interconnected business groups to manipulate prices and supply quantity, and consequently, there have been a number of investigations by regulator, courts and law enforcement agencies.

Interestingly, despite widespread claims in newspapers of anticompetitive behaviour by cement producers, a number of court cases, stay orders, political interventions to halt or withdraw investigations and fines, no comprehensive empirical study has been conducted so far in this regard using rigorous econometric techniques. One of the descriptive study conducted by the Pakistani competition authority in 2008 concluded “At this point-in-time the Commission has not noted sufficient evidence to suggest there being one (cartel/collusion). The cartel question hence, remains an open one”. But in the same report it stated subsequently “nevertheless, the Commission cannot completely rule out the possibility that this across the board simultaneous price increase may have arisen from collusive behaviour of the incumbent cement producers”¹. Ghulam and Jaffry (2015) assessed the impact of the aforementioned broad reforms, including privatisation, on the Pakistani cement industry and concluded that following these reforms, the industry experienced significant productivity growth due to technological progress. However, similar to other studies in this area, Ghulam and Jaffry (2015) ignore the impact of the privatisation policy on firms’ conduct in terms of price setting and supply dynamics and more specifically investigation of collusion practices by privatised and private firms.

The tacit collusion accusation of the Pakistani cement industry after privatisation and reforms and lack of empirical investigation to ascertain the claim is however not a surprising result as studies on the impact of privatisation on collusion practices have not been forthcoming worldwide. Correia-da-Silva and Pinho (2017) argued that most of the existing literature does not take into account the possible impact of privatisation on private firms’ incentives to collude. By using theoretical model, the authors concluded that “privatization always makes collusion among private firms easier to sustain, and thus it may happen that collusion is not sustainable before privatization but becomes sustainable afterward“. The authors argued that increase in number of private firms helps achieve the sustainability of collusion.

By extending the scope and contributing to the empirical literature on the impact of privatisation and broader reforms on competitive conditions generally and tacit collusion in particular in the context of developing countries, this study aims to establish whether or not the privatisation and deregulation policy

¹ http://www.cc.gov.pk/images/Downloads/research_and_publications/Recent_Cement_Price_Hike.pdf

has made the industry more competitive by evaluating the conduct of producers after acquiring the power to set prices and supply quantity. Alongside empirically testing the collusion propensity after privatisation, this study contributes to debate on industry specific discussion of the collusion/cartel practices. There is continued and ever rising international academic interest in the assessment of the competitive condition of the cement industry. Authors such as, Rosenbaum and Sukharomana (2001), Zeidan and Resende (2009), Salvo (2010), Çelen and Gunalp (2010), Bejger (2011) and Hüscherlath *et al.* (2013) have evaluated the industry's competitive conditions and collusive practices. But interestingly, majority of these studies are related to the relatively high income countries with established and strong regulatory institutions. Hence, the observations and conclusions of this study from a country known for inefficient and weak regulatory authorities and interconnected conglomerates will make a valuable contribution to the international literature, as well as providing some guidance for regulatory and competition authorities in the developing countries in general and Pakistan in particular.

By using a wide variety of new and old methods for testing and screening collusion practices, the main findings of this study can be summarised as follows. Pakistani cement producers have in fact established an effective tacit collusion mechanism that has allowed them to increase prices beyond the increase in the cost of production, based on the production of less than competitive output levels. The conspirator conglomerate firms have been able to maintain this tacit collusion for almost two decades, mainly due to the *inefficient and weak regulatory and legal system*, the acquisition of small and medium-sized competitor firms, significant capacity additions, exclusionary practices, the formation of a powerful producer association, and strong and interconnected business conglomerates.

This study suggests that broader reforms, including privatisation in developing countries, will not bring about the desired policy aim of creating a 'level playing field' and making the industries competitive and efficient without an effective, efficient and authoritative regulatory framework and efficient legal and court procedures, backed by legislation, as well as a reduction of government interventions in investigations of market abuse and the subsequent collection of fines. This study further argues that the regulatory body should keep a close eye on some particular industries with higher sunk costs. Those industries with

transportation issues such as cement due to the bulky nature of the product and exclusionary practices that it is easy to exercise significant market power and form tacit collusion due to the building of larger production capacities, among other factors, need to be carefully regulated and monitored.

The rest of this paper comprises seven more sections. Section two contains information on the state of play in terms of competition policy in Pakistan (regulatory framework, institutions and issues). The next two sections, three and four, provide a discussion of economics of tacit collusion and its relevance for the Pakistani cement industry and then summarise relevant work in the area of privatisation/deregulation and their effects on competition, collusion and conduct of the firms. Section five contains a discussion of the theoretical underpinnings and methodology framework of the study. The data sources and construction of relevant variables are then explained in section six. Section seven contains the empirical analysis and estimation of the different competition indices and estimates related to conduct parameter models. Finally, the last section concludes with a discussion of the results and some important lessons for regulatory authorities.

2. Competition policy in Pakistan – regulatory framework, institutions and issues

The first serious effort in regard to setting up of regulatory framework in Pakistan was made in 1970 with the introduction of the Monopolies and Restrictive Trade Practices law (MRTPO, 1970). The main objective of this law was to put an end to rising industrial concentration and discourage monopolistic practices. Subsequently, the Monopoly Control Authority (MCA) was created to implement this law. The significance and power of the MRTPO was seriously compromised in 1981, when it was made part of the Corporate Law Authority (CLA). The main job of the CLA was to register new companies and look into the corporate affairs of both new and existing companies. The MCA gained its authority back in 1994, but remained toothless in terms of implementing its decisions and warnings due to the lack of a serious attitude on the part of political governments, which feared a backlash from industrial conglomerates that could have resulted in the reduction of already low foreign direct investment (FDI) in the case of action being taken against the violators of competition laws.

The MRTPO was repealed in 2007 and was replaced with a new ordinance in 2007 – the Competition Commission Ordinance (CCO, 2007) – which was modelled on European competition laws. The MCA was dissolved and a new regulatory body, the Competition Commission of Pakistan (CCP), was created. Alongside other functions, the main responsibilities of the CCP are to protect consumers’ interests by restricting producers’ abuse of dominance and market power. In 2010, the CCO was converted into a full law and was subsequently passed by parliament (CA, 2010), notwithstanding considerable opposition from big business lobbies. The CCP has undertaken a few investigative studies on price increases and has provided advice to the government on a range of issues. However, the role played by the new regulator in the identification and curbing of monopoly powers has also been widely criticised since its establishment. It is commonly understood that the CCP has been unable to curb tacit collusion in a number of industries, such as those related to cement, sugar, ghee (cooking oil), automobiles and finance.

The national newspapers are full of stories on how such collusion is harming consumers’ interests. Interference in the working of the CCP has meant that fines imposed by the Commission have never been recovered. Hence, the Commission has been unable to create a viable deterrence for illegal anticompetitive practices. The watchdog role of the CCP, in particular, has been seriously compromised due to its lack of capacity in terms of conducting technical studies that can be defended in a court of law. Based on an examination of almost all studies conducted by the CCP so far, available on its website, it can be concluded that not a single study matches the rigour and technical nature of the studies that are common to regulatory authorities from advanced economies. Most of these studies are in fact cost accounting exercises without any serious economic and econometric analysis.

3. Economics of tacit collusion and the Pakistani cement industry

Tacit collusion can lead oligopolistic firms to achieve monopolistic outcomes, leading to reduced and inefficient equilibrium output, higher prices, and lower consumer welfare (Ciliberto *et al.*, 2017). A number of authors such as Ivaldi *et al.* (2007) suggested that the threat of retaliation in the case of any attempt by a firm to deviate from collusive path to achieve short run benefits would ensure long run sustainability of collusion as well as high prices. More specifically, the magnitude and possibility of severe retaliation as well

as deviation from collusive path depends on the nature of some structural variables, demand side developments, and supply side factors. The empirical and theoretical literature on collusion (both tacit and explicit) suggest that collusion is sustainable when firms are putting sufficient weight on future profits, there are few competitors, market shares, cost and capacities are symmetric, entry barriers are significant, interaction of firms are frequent, market is transparent in terms of output and input prices and is growing, customers have lower buying power and significant cross ownership exists. . In the case of the Pakistani cement industry and its product, all these factors are likely to be relevant as discussed subsequently.

One of the immediate after-effects of the transfer of ownership as a result of broad reform, privatisation and the subsequent mergers and acquisitions has been the emergence of few powerful industrial groups that are interlinked, and a tendency to cooperate in setting prices and production quotas. The underutilisation of capacity and the sustained rise in output prices since 1991 are often cited as a case in point. Immediately after reforms, majority of the firms added significant capacities to maintain their market share and replaced old technology (wet) with relatively better (semi-dry) or advanced (dry). This is true for the former public sector firms. The newer and older privately firms were either already using new technology or started operation with advanced production process. As discussed above, alongside privatisation, a series of post-reform mergers and acquisitions of former publically owned firms as well firms set-up under private ownership but subsequently not a part of interlinked conglomerates and closure of smaller size private producer firms (see Table 1) has perhaps also contributed to a concentration of powers. New privately established and owned firms that started their operations in early and mid-1990s and have survived to date are also part of strong industrial groups with inter-linkages in businesses.

[Insert table 1 about here]

To manage an effective conspiracy, cartels often establish committees or secretariats to collect and share market sales intelligence. Alternatively, cartels may be operated in tandem with trade associations that perform the same function. These trade associations, by pooling information on industry trends, improve a cartel's ability to anticipate demand shocks, thereby reducing price dispersion (Connor, 2005). In the case

of the Pakistani cement industry, the establishment of the producer association, All Pakistan Cement Manufacturer Association (APCMA), immediately after privatisation confirms Connor's (2005) point. The role of opportunistic behaviour and deviation from collusive path as well as information asymmetry in terms of cost and capacities have been minimum due to the interdependence of conglomerates leading to cross ownership and organisation of regular meetings among APCMA members to share information on capacity, production and output prices. In the backdrop of these above mentioned points, evidence of formation of tacit collusion and deterioration of competition levels is/would be hardly surprising.

4. Collusion, firms' conduct, and reforms – review of the empirical literature

A vast body of literature (both theoretical and empirical) exists on the impact of tacit or explicit collusion on the behaviour and performance of individual firms and industries. Cournot (1838) and Marshall (1890) stated that a lack of competitive pressure would result in the reduction of output accompanied by increasing prices. Bolotova *et al.* (2008) calculated that conspirator firms managed to raise prices by 9 and 25 cents per pound in the short term relative to non-collusive periods. Bolotova (2009) further estimated that cartel overcharges amount to around 20% median worldwide. Abrantes-Metz *et al.* (2006) also found evidence of higher price bids by seafood supplier colluders in the United States. Frank and Schliﬀke (2013) estimated an overcharge in the range of 7–9% compared to non-collusive competitive prices. Hüscherath *et al.* (2013) estimated this overcharge to be between 20.3% and 26.5%. Similarly, Andreoli-Versbach and Frank (2015) stated that producers were able to increase prices by 20–30% as a result of collusions.

Having broadly agreed on the significant impact of collusion on prices as discussed above, some authors have looked into the impact of broad reforms, including privatisation (which were introduced in part to promote level playing field), on the dynamics of competitive conditions and resulting prices of individual firms as well as overall industry. Broadly speaking, the available published empirical literature on the impact of broad reforms/privatisation on competition and prices displays mixed evidence. Ho (2010) looked at the effect of easing regulations on the banking industry in Hong Kong. Overall, the author found that deregulation had a positive role, with the industry becoming more competitive and consumers being better off after deregulation. Cetin and Benk (2011) evaluated the effects of deregulation on competition in the

Turkish airline industry. The study found that the policy had a positive effect on competitiveness with consumers benefiting the most. Okoeguale (2015) studied the impact of deregulation in 1996 on the US telecommunications industry and found that it increased merger activity due to increasing levels of competition. The study concluded that “deregulation opened both the local and long-distance telecom markets to competition from new communication technologies, resulting in a significant increase in initial public offering (IPO) and merger activity” (Okoeguale, 2015, p. 1).

However, some authors have questioned the positive impact of reforms on competition. Yildirim and Mohanty (2010) investigated the effect of deregulation on state-level competition in the US banking market over the period 1976–2005. The study concluded that US banks in general operated under monopolistic competition during the period examined and became less competitive due to the rising market power of large-sized banks as a result of geographic deregulation. Maudos and Solís (2011) looked at the role of deregulation in determining competition in the Mexican banking industry in the period 1993–2005. The empirical evidence pointed towards the existence of monopolistic competition. The Lerner index showed an increase in competition in the loan market but a decrease in the deposit market in the post-reform period. Thus, the study questioned the effectiveness of the new regulatory regime in promoting competition in the industry.

Recently, some studies such as Correia-da-Silva and Pinho (2017) have developed theoretical models to show how private firms after privatisation could collude and harm the welfare of the consumer. In particular, the authors looked at the long term sustainability of the collusion and how could privatisation ‘make collusion among private firms easier to sustain’ given the fact that it could have been not possible before. The authors labelled this ‘*the coordinated effects of privatisation*’ which could be substantial if there are higher number of private firms facing the smaller slope of marginal cost. In this case, the authors conclude that privatisation could be surely welfare detrimental. The negative or uncertain impact of reforms on competition and resulting prices due to oligopolistic market interaction is not however only limited to developing countries. Liberalisation and privatisation and resulting restructuring programs in network industries have been evaluated by a number of studies at greater length for developed countries. Some of

the case studies relate to European electricity and telecommunication markets. Authors such as Florio and Florio (2013), Hyland (2013) suggested that the impact of liberalisation in Western Europe on prices was smaller and more uncertain or at best it has no impact on prices. Almost similar conclusions were drawn by Razeghi et al (2017) for the state of California in USA. The study by Bacchiocchi et al (2011) concludes that privatisation was not able to significantly influence prices in the EU telecommunication sector.

Surprisingly, few studies have as yet examined the level of competition in Pakistan, with most of the studies conducted so far being limited to the financial sector. One such example is by Khan (1998), who concluded that there was an increase in the level of competition as a result of reforms introduced in the early 1990s. The study also noted that whilst competition was increasing at the time, it was still nonetheless very limited. In a cross-country study within the sub-continent, Perera *et al.* (2006) show that banking profits are earned under monopolistic conditions. This study also looked into the nature of the banking business and concluded that in the case of the Pakistani banking industry, fee earning business is more competitive, while for Indian banking, interest earned on traditional banking activity, such as deposit taking and loan provision, is more competitive.

This study contributes by evaluating firms conduct in both pre and post reforms period. Compared to a number of studies discussed above, the choice of the cement industry in a developing country context further provides an interesting and distinctive setting where the role of regulators, competition laws, legal system, and institutions could be evaluated more thoroughly particularly in an industry where *ex ante* chances of collusion and cartel are likely to be very high.

5. Investigation of collusion practices – methodology

A number of methods have been developed and used to detect collusive behaviour of the firms and evaluation of competition levels. These include variation in cost (Panzar and Rosse [1987]), rotations of demand (Bresnahan [1982]), and conduct regime analysis (Porter [1983]) among many others. We start with simple screening mechanism to detect any collusion practice and supplement this with the empirical assessment of market power using conduct parameter models (CPM) such as overcharge estimation and

conduct parameter λ . These methods are discussed in detail in the following sub-sections, including the estimation strategy. Subsequently, we relate the findings with regulatory and institutional issues to further understand the outcome.

5.1 Traditional non-parametric competition indices

Traditional non-parametric competition indices include simple ratios, such as the Herfindahl index (H), the concentration index (C_3) measured by the top three firms' market share and mark-up measured by the price–cost margin (PCM). For the sake of comparison and robustness, this study calculates and uses three different versions of the Herfindahl index, using total assets, production capacity and gross sales volume. Similarly, two different versions of price–cost margins are calculated, simple and weighted. Following the empirical literature, the weights are determined by the market share of each firm in aggregated total assets of the industry. These methods are further supplemented by analysis of the trend in capacity utilisation (to measure the extent of under-supply under collusion arrangements) and the distribution of the nominal output price (mean, skewness and kurtosis).

5.2 Estimation of overcharge – “before and after approach” cartel/ collusion formation

Together with the establishment of antitrust rules and a well-functioning legal system that compensates the victims of anticompetitive behaviour, the derivation of robust estimates of the damage cause is very important in the implementation of antitrust rules. In particular, robust and coherent overcharge estimates are necessary for the private enforcement of antitrust rules. Three methods are commonly used to quantify the damage caused by the anticompetitive behaviour of firms after the forming of tacit or explicit collusion. These include the use of dummy variables, the dynamic treatment effect and the straight line method. The dummy variable method compares the output price after/before and during the period in which firms operate under price/quantity fixing.

In this framework, a simple multivariate linear regression model with price as the dependent variable and input prices as independent variables is used. A dummy variable with a value equal to ‘1’ for the collusion/cartel arrangement period and ‘0’ otherwise is introduced to evaluate the impact of

collusion/cartel arrangements on price. A statistically significant and positive coefficient for this dummy variable represents a price overcharge (premium) compared to the non-cartel competitive price. To achieve the robustness of the premium estimates, a number of control variables are introduced, such as prevailing market conditions and the economic and regulatory environment. One of the main advantages of this simple method is that it is straightforward, less time consuming than others and makes fewer demands concerning data requirements. Due to its simplicity and straightforward economic interpretation, this method has been used extensively in academic research, as well as in court proceedings around the world.

As discussed above, Pakistani cement producers have been accused of forming a collusion/cartel many times since the initiation of the privatisation policy (1992, 1998, 2003 and most recently in 2008). Hence, in a way, the whole post reform/privatisation period could be treated as a potential collusion period. For the analysis in this study, the whole post-reform period was divided into two: 1991–1995 covering the immediate impact of reform and privatisation, and 1996–2011, comprising more mature period. The basic regression model is thus specified as follows:

$$p = \delta_0 + \gamma W + \eta q + \phi X_1 + \tau X_2 + \psi t + \pi_1 d_{1991-95} + \pi_2 d_{1996-2011} + \varepsilon \quad (1)$$

The nominal cement price (p) in the above model is determined by various factors: a vector of input prices W (comprising furnace oil, coal, limestone and workers' wages); firms' supply of output, represented by the quantity of cement sold (q); a vector of the firm and industry environment variables (X_1), comprising competitive conditions measured by the industry Herfindhal index; firms' specific cost-inefficiency levels; firm size; role of entry and exit of firms, represented by a ratio $1/((N + 1))$, where N is the number of firms; firm ownership type (privatised and private); and firm geographic location. X_2 in the above model is a vector of the macroeconomic environment variables comprising GDP growth rates and the ratio of exports to GDP. The use of nominal prices rather than real prices as the dependent variable is similar to the approach adopted by Blanckenburg *et al.* (2011), among others. This can further be justified on the grounds that inflation has been in double digits consistently in both competitive and potentially collusive time periods.

To observe the impact of collusion on prices, the study uses producer prices (list prices or gross prices inclusive of government taxes such as sales tax and excise duty) because it is believed that any collusion would have happened among producers at this price. To derive the estimate of overcharge, two dummy variables are introduced, $d_{1991-95} = '1'$ for the period 1991–1995 and '0' otherwise to take account of the initial impact of reforms and $d_{1996-2011} = '1'$ for 1996 onward for the second phase of reforms and '0' otherwise. A time trend variable (t) is also included to capture technological change, etc. Some authors have suggested that (q) could be endogenously determined and hence simple linear regression may not be suitable. The endogeneity of a regressor may arise due to omitted variables, two-way causality and measurement errors, etc. Hence, in the empirical specification, cement demand is instrumented with the GDP growth rate, production capacity, the base interest rate, the number of firms and two dummy variables for production technology (semi-advanced and advanced). All the variables except dummies were log transformed prior to the estimation of the model.

5.3 Conduct parameter model - Bresnahan's (1982) approach

Following Shaffer (1993), it is assumed that the goal of a firm is to maximise profit. Under conditions of perfect competition, the firm's marginal revenue will be equal to its average revenue, or price. Hence, the firm will continue to increase production until its marginal cost is equal to the output price. Similarly, under conditions in which perfect competition does not exist, where the firm's own actions have some effect upon the market price, marginal revenue diverges from price. In line with Bresnahan (1982), the firm's demand function can be written as $q = D(p, y, \alpha) + \varepsilon$ and the true marginal revenue function with semi-elasticity of demand is $mr = p + h(q, y, \alpha) = p + q / \left(\frac{\Delta q}{\Delta p} \right)$, where p is the product price, q is the output, y is a vector of exogenous variables, α is a vector of estimated demand parameters and Δ to represent change in quantity and price .

However, the firm's perceived marginal revenue function is $mr_p = p + \lambda h(q, y, \alpha)$, where $0 \leq \lambda \leq 1$ is a new parameter that can be estimated and represents the distinction between demand and marginal revenue. The λ term is included to represent the degree to which individual firms are aware of the divergence of average revenue (or price) from marginal revenue. If we assume firms' marginal cost function where ω and

β represent vector of input prices and parameter estimates of $c(q, \omega, \beta)$, the profit-maximising firm is likely to set perceived marginal revenue equal to marginal cost such that $p = c(q, \omega, \beta) - \lambda h(q, y, \alpha) + \eta$. Here η is a random error term. When λ is zero, firms behave as if the two are identical (hence indicating that the firm at least believes that it is perfectly competitive and therefore sets the price equal to the marginal cost). When λ is equal to one, it indicates a perfect understanding of the separation of price from marginal revenue and is indicative of monopolist behaviour or a collusive oligopoly. The closeness of the actual value of λ to either of these two competitive extremes indicates the relative extent to which firms understanding to be operating in different competitive conditions. In this way, λ can be seen as an index of market power.

Elementary economic theory also suggests that output of the industry will be lower and prices higher under conditions of monopoly compared to the perfect competition alternative. The extent to which the industry price and output deviates from conditions of perfect competition can be approximated by the inverse of the λ value. The market price deviates from the competitive price by $-\lambda q / \left(\frac{\Delta q}{\Delta p}\right)$, while the deviation in quantity is determined by dividing the competitive output by $\Delta q / \Delta p$, multiplied by the deviation in price. The key to the methodology, therefore, is the accurate calculation of λ . The first step in the calculation of this term is a demand function that is representative of the true demand curve. We approximate the demand function as follows:

$$q = \alpha_0 + \alpha_1 p + \alpha_2 y + \alpha_3 pz + \alpha_4 z + \alpha_5 py + \alpha_6 yz + e \tag{2}$$

where q is the quantity of outputs (quantity of cement produced and sold), p is the respective price of cement sold per tonne (total gross sales divided by total cement quantity sold), y is approximated by demand-enhancing economic activity (GDP growth rate), z is a proxy substitute for cement (as there is no perfect substitute for cement, we use construction activity growth) and e is the residual or error term. The multiplicative terms pz , py and yz are included to estimate λ through the rotation of the demand curve².

² See Bresnahan (1982) for detail on how some of the exogenous variables could change the slope of the demand curve rather than shift in intercept.

The second stage in the estimation of λ is a marginal cost function obtained through a popular translog cost function specification as follows:

$$\begin{aligned}
lnc = & \beta_0 + \beta_1 \ln q + 0.5 * \beta_2 (\ln q)^2 + \beta_3 \ln \omega_1 + \beta_4 \ln \omega_2 + \beta_5 \ln \omega_3 + \beta_6 \ln \omega_4 + 0.5 * \beta_7 (\ln \omega_1)^2 + 0.5 * \beta_8 (\ln \omega_2)^2 \\
& + 0.5 * \beta_9 (\ln \omega_3)^2 + 0.5 * \beta_{10} (\ln \omega_4)^2 + \beta_{11} \ln \omega_1 \ln \omega_2 + \beta_{12} \ln \omega_1 \ln \omega_3 + \beta_{13} \ln \omega_1 \ln \omega_4 \\
& + \beta_{14} \ln \omega_2 \ln \omega_3 + \beta_{15} \ln \omega_2 \ln \omega_4 + \beta_{16} \ln \omega_3 \ln \omega_4 + \beta_{17} \ln q \ln \omega_1 + \beta_{18} \ln q \ln \omega_2 + \beta_{19} \ln q \ln \omega_3 \\
& + \beta_{20} \ln q \ln \omega_4 + e
\end{aligned} \tag{3}$$

where lnc represents the log of total costs (including production, distribution and administration, etc.), while $\ln \omega_1, \ln \omega_2, \ln \omega_3, \ln \omega_4$ are exogenous input prices (log of: yearly employee wage rates, price of furnace oil, price of coal and price of limestone per tonne). The price of packing material is used to impose homogeneity on input prices. The implied marginal cost (mc) function is therefore as follows:

$$mc = \frac{c}{q} [\beta_1 + \beta_2 \ln q + \beta_3 \ln \omega_1 + \beta_4 \ln \omega_2 + \beta_5 \ln \omega_3 + \beta_6 \ln \omega_4] \tag{4}$$

With equations (2) and (4) in place, the calculation of λ can be attempted. The supply relationship is estimated from the above equation, assuming a degree of market power (and hence influence over price), as well as profit maximisation on the part of the firms concerned:

$$\begin{aligned}
p = & - \frac{\lambda q}{[a_1 + a_3 z + a_5 y]} + \frac{c}{q} [\beta_1 + \beta_2 \ln q + \beta_3 \ln \omega_1 + \beta_4 \ln \omega_2 + \beta_5 \ln \omega_3 + \beta_6 \ln \omega_4] + b_7 D q / [a_1 + a_3 z \\
& + a_5 y] + \mu
\end{aligned} \tag{5}$$

where μ represents the error or residual term, while D is a dummy variable used to represent the post-reform period (dummy variable = '1' for the post-reforms period and '0' otherwise). From the above equations, λ is calculated to represent a measure of market power, where the value for firms operating under conditions of monopoly or collusive oligopoly should be higher than that of more competitive market conditions.

6. Data

Panel data covering the period 1986–2011 are used to estimate the various competition indices and conduct parameters estimates explained in the methodology section above. The data set used in this study

encompasses a much wider time post-reform period than most other such studies on the development of competition during the post-reform/privatisation period. To our knowledge, no similar study focusing on developing countries, except the recent work by Ghulam and Jaffry (2015), has been able to obtain comprehensive data on a time period of this length.

Firm-level data on income, expenditures, and input/output prices were obtained from company annual reports, the Karachi Stock Exchange, the APCMA, the CCP, the former Expert Advisory Cell (Ministry of Production and Industries, Government of Pakistan), leading Pakistani stock brokerage houses in Karachi, individual firm websites, and personal contacts with authors in the field who have previously obtained such data for their use. The macroeconomic variables used in this study were sourced from various Government of Pakistan publications, such as economic surveys, etc. The final panel dataset used in this study comprises information on 21 firms (but varying over sample period due exit and entry) over a period of 26 years (encompassing 6 years pre and 20 years post privatisation period). The input price data for fuel, limestone and paper bags are at firm level for public sector firms before privatisation. Such data for private firms however is at the national level due to availability issues.

7. Estimation and explanation of competition indices

7.1 Traditional non-parametric competition indices

As a preliminary empirical analysis, we start with the widely used traditional non-parametric measures of competition. Starting with the Herfindahl index (H_1), this measure in Table 2 suggests no noticeable change in the post-reform period. The index value is not high and the market is not particularly concentrated; hence, the conditions are not conducive to the exercise of market power. In a further step, the Herfindahl index was constructed using two alternative measures: production capacity and gross sales volume. These Herfindahl indices (H_2 , and H_3), based upon the alternative formulation, broadly confirm the above findings. The concentration index (C_3), approximated by the top three firms' market share shows a similar trend. Another traditional measure shown in Table 2, the price cost margin (weighted as well as un-weighted), indicates a marginal decrease in competition during the immediate post-reform period (1991–1995), but the estimates for the subsequent period indicate no significant change compared to the pre-

reform period. The stability in the aforementioned three indices, indicating little change, could however suggest that cartel members were agreeing on market share at the time and subsequently maintained this throughout the sample period.

[Insert table 2 about here]

Next, we turn to the assessment of the utilisation rates of available capacity to look for any evidence of underutilisation of technological resources to manipulate output and prices. The capacity utilisation rate is defined as actual output divided by the maximum output that could be produced by a given technology. Table 3 contains these rates and confirms that capacity utilisation increased significantly for two types of ownership firms (already in the private sector and privatised) during the early years of privatisation (from 93% to 103% for privatised firms and 96% to 119% for private firms). The nonparametric rank sum test confirms that these differences are statistically significant. Public sector firms faced a slight reduction in their capacity utilisation during this period (but the difference is statistically insignificant). Firms, however, did not continue this trend and the industry as a whole witnessed a significant reduction (from 93% to 77%) in capacity utilisation in the overall post-reform period. This is true for all firms, irrespective of ownership, and the decline is also statistically significant.

[Insert table 3 about here]

Another simple method for detecting any tacit or explicit collusion among producer firms is to observe the price variance trend. Similar to studies conducted by regulatory authorities, Abrantes-Metz *et al.* (2006), Blanckenburg and Geist (2011) and Bolotova *et al.* (2008), this study used a price dispersion method to detect the anticompetitive (cartel) behaviour of firms. Connor (2005) argued that as a result of agreement on fixing lower than competitive production levels, higher than average cost facilities would have to be closed. This would reduce some degree of variability in producer costs and hence provide the incentive to cheat. High prices would dampen expected future market growth and this in turn would reduce the incentive for plant expansion and upgrades in lower-cost facilities, thus reducing the variability in prices. Blanckenburg and Geist (2009) found evidence of a decrease in variance during the cartel period due to the

need for cartel members to re-negotiate the prices among themselves. More specifically, the distribution of price changes under a cartel/collusion would have a relatively higher peak around zero. Hence, stability in the price variance during the period considered to be affected by tacit collusion could indicate the existence of price-fixing arrangements. Authors such as Abrantes-Metz *et al.* (2006) have advocated the use of price variance, the standard deviation and the coefficient of variation as a data-screening device to detect the anticompetitive behaviour of firms.

Figure 1 below indicates that since 1991/1992, prices have increased exponentially and have kept rising except for a minor decline in three years. Morrison *et al.* (1996) suggested an interesting signalling mechanism of cartels and collusions detection whereby a price decrease of 25% or more in the current period compared to the previous period can be considered a case of price war and an increase of more than 5%, an evidence of the end of collusion. In this case, a reduction of almost 25% happened in only two years (2007 and 2010). The standard deviation estimates do indeed confirm that the magnitude of deviation was lower in the period 1996–2011 compared to 1986–1995. Hence, the simultaneous reduction in the standard deviation (variance) and increase in price could perhaps signal a collusion practices. However, Bolotova (2008) argues that just one element could also indicate the presence of collusive behaviour.

[Insert figure 1 about here]

A further confirmation of the above result is evident from Table 4, which shows the trend in nominal prices together with the distribution of third and fourth moments measured by skewness and kurtosis. It is clear from the trend that prices have increased continuously by around 7% per annum. The figures for price distribution – measured by skewness and covering the entire distribution of the data – indicate that the right-hand tail becomes shorter and prices become steadier. Similar to Blanckenburg *et al.* (2012), the study also uses kurtosis to explain the distribution of the price trend. This is also called statistical volatility. The lower and decreasing value of this volatility measure in Table 4 indicates that price distribution has become more concentrated towards the mean subsequent to privatisation. As a robustness check, following Blanckenburg *et al.* (2012), a test of the equality of the distribution of the nominal price change between the pre-reform (1986–1991) and post-reform/privatisation (1991–2011) periods was undertaken using the

Kolmogorov–Smirnov test. The test statistics confirm that the distributions of price changes in pre and post reforms and privatisation differ significantly with a p -value of 0.020.

Hence, using these simple screening tools, one could deduce that it is likely that a price-setting mechanism was in place after the broad reforms, including privatisation, resulting in the gaining/maintaining of market share by a few producer firms. These initial observations, derived from widely used competition indices, are useful but a more detailed assessment is carried out subsequently by estimating and interpreting sophisticated and more recent indicators of competition and conduct, such as the estimation of overcharge, and the competition index (λ).

[Insert table 4 about here]

7.2 Overcharge estimates – comparator method

Table 5 shows the empirical estimates of the “before and after” method described in the methodology section. Here, three alternative instrumental variable models are estimated. Overall, the R^2 value of each model indicates a good fit with the data. The sign and magnitudes of the coefficients do not vary significantly across different specifications. These estimates show that overcharge during post reform period was approximately 25.71% ($= \exp(0.2288) - 1$) and 47.43% ($= \exp(0.3882) - 1$) during 1991-95 and 1996-2011, leading to an average post reforms overcharge estimate of 36.57%. The rising overcharge confirms that firms on average charged higher prices as a result of a deterioration in competition levels subsequent to privatisation and other broader reforms. These estimates of overcharge are almost similar to Connor’s (2005) estimates for cement industry cartels worldwide (mean = 40%, median = 25%).

The higher and persistent overcharge estimates spreading over almost two decades need further explanation. Empirical research on collusion and cartel activities has shed some light on the factors which could contribute to the duration and stability of collusion/cartel activity. The research has highlighted that the extent of overcharge depends on the market environment, including factors such as market share, elasticity of demand, number of cartel members and inequality in firm size (Bolotova, 2009). The level of cartel overcharge is positively related to cartel market share and is negatively related to the market elasticity

of demand. Overcharge also depends on the legal environment and cartel characteristics, such as the presence of a third party (trade association). Such a third party presence could in fact reduce monitoring costs, leading to an increase in overcharge. In the case of empirical studies on cartels in the US, in 25–50% of instances, trade associations have been found to be used to develop monitoring mechanisms for the dissemination of information among cartel members.

[Insert table 5 about here]

Similarly, fewer attempts to form cartels are likely to increase overcharge over time. Issues with the stability of cartels include bargaining problems (distribution of rent), opportunistic behaviour and the entry of new non-member firms in the industry. Entry and bargaining problems are considered to be the root cause of cartel failure. Excess capacity could also work as a deterrent to new firm entry. In the presence of excess capacity, colluding firms will have significant power in setting prices and output quantities (as a deviating firm is punished heavily and this will make deviation less likely). In the case of Pakistan, the issue of excess capacity and capacity utilisation in the cement industry has been of great importance since 1996 (see Table 6). In some cases, due to the interdependence of conglomerates, new firms could gain membership of the cartel group within a short period of time. The later part of this empirical section discusses the role of these aforementioned factors in detail, specifically with regard to helping producer firms to achieve higher and prolonged overcharges and the gradual deterioration in the competitive condition of the cement industry over time.

[Insert table 6 about here]

7.3 Bresnahan's (1982) approach – estimation of λ

Equations (2) and (5) are jointly estimated using the 2SLS non-linear full information maximum likelihood method, the results of which can be found in Table 7. Similar to other empirical studies estimating the firms cost function, homogeneity is imposed on input prices. To observe any change in competitive conditions in the two separate periods, i.e. immediately after reform (first five years of the post-reform period) and then in subsequent more mature post-reform years, two shift dummy variables are employed: the first

dummy takes the value '1' for the period 1991–1995 and '0' otherwise; the second dummy takes the value '1' for the period 1996–2011 and '0' otherwise.

The empirical model's theoretical expectations are generally confirmed, with a negative price coefficient ($\alpha_1 < 0$ and statistically significant), a positive income (GDP growth rate) coefficient ($\alpha_2 > 0$), a negative substitute coefficient ($\alpha_4 < 0$) and a downward sloping demand curve ($\alpha_1 + \alpha_3z + \alpha_5y < 0$). Furthermore, for the identification of λ , either α_3 or α_5 should be significant. In this case, both of these coefficients are statistically significant. Overall, the model fits the data well given the fact it uses disaggregated individual firm-level data; 14 of the 16 regression coefficients are statistically significant.

[Insert table 7 about here]

The λ value is negative but statistically insignificant. This is evidence that the industry operated under competitive conditions prior to reform and privatization. The first shift dummy ($\lambda_{1991-95}$), which captures the initial period and immediate impact of reform, indicates a decrease in competition, although the coefficient is not statistically different from zero. The second interactive term ($\lambda_{1996-11}$) is statistically significant and suggests a degree of market power over the period 1996 onward. This seems to indicate that in the latter part of the reform period, there was a decrease in competition and the industry started moving away from perfect competition. The sum of λ and the coefficients for the interactive shift dummies indicate a degree of post-1991 percentage deviation of aggregate output from the competitive equilibrium level regardless of the functional form of demand and supply (Shaffar, 1993, p. 58, footnote 9). This figure is 38% less than the competitive output level. If firms compete on quantity or make a pre-commitment to provide a certain capacity, the Cournot oligopoly model is the better one. The factors such as tacit collusion concerning the quantity of the homogenous product sold, relatively fewer firms, a medium to high entry barrier and a significant portion of fixed costs, could lead to the Cournot oligopolistic model of competition. This perhaps appears to be the case for the Pakistani cement industry subsequent to reforms.

In summary, using a wide variety of methodologies to evaluate competitive conditions and conduct of the firms, the above discussion of the results can be summarised as: traditional non-parametric measures of competition indicate no substantial change in indices subsequent to reform and privatisation suggesting that members were agreeing on market share and subsequently maintained this for a very long period. For a long time, it has been argued that capacity utilisation rates can be used as a good proxy for observing any control on output by colluding members to maintain higher prices. The estimates presented above confirm that except for the early years, the industry as a whole exhibits a statistically significant reduction in capacity utilisation in the post-reform period. An increase in nominal prices and a reduction in standard deviation (variance) over the longer post-reform period can be observed, indicating the presence of anticompetitive behaviour. Third and fourth moments measured by the skewness and kurtosis of prices also confirm the above. These above mentioned findings to some extent are confirmed by other more advanced methods of estimating competition indices. Our overcharge estimates show that cement-producing firms, on average, charge a high premium as a result of deterioration in competition levels. Based on Bresnahan's (1982) approach (λ), the conclusions of this study are fairly similar, namely that competition has deteriorated since reform and privatisation.

The above findings suggest that of firms' conduct which is less competitive. The regulator has been unable to improve the competitive conditions of the industry after privatisation and broader reforms and enforce the existing competition laws to improve the situation. Buccirosi *et al.* (2013) identified the quality of institutions in general and the judicial system in particular as influential in enforcing antitrust laws. In what follows, the relevance of these factors and others which could have contributed towards inducing and prolonging tacit collusive practices in the Pakistani cement industry is discussed.

Starting with the industry environment, the empirical literature on the stability of collusion supports the role of industry-specific exogenous factors. To manage an effective conspiracy, cartels often establish committees or secretariats to collect and share market sales intelligence. Alternatively, cartels may be operated in tandem with trade associations that perform the same function. These trade associations, by pooling information on industry trends, improve a cartel's ability to anticipate demand shocks, thereby

reducing price dispersion (Connor, 2005). In the case of the Pakistani cement industry, the establishment of the producer association, APCMA, immediately after privatisation confirms Connor's (2005) point. Furthermore, the roles of opportunistic behaviour and information asymmetry has been generally absent due to the interdependence of conglomerates and organisation of regular meetings among APCMA members.

Private damage actions are non-existent in poor countries such as Pakistan and hence public interference remains the only option in challenging collusion and cartel activities. Hence, the role of regulator in curbing anticompetitive behaviour of firms is extremely important. In response to increasing reservations and criticism, the government constituted a new regulator, the CCP. However, the role played by the new regulator in the identification and curbing of monopoly powers has also been widely criticised since its establishment. It is commonly understood that the CCP has been unable to curb tacit collusion in a number of industries, such as those related to cement, sugar, ghee (cooking oil), automobiles and finance. The national newspapers are full of stories on how such collusion is harming consumers' interests. Occasional political interference in the working of the CCP has meant that fines imposed by the Commission are difficult to be recovered. Hence, the Commission has been unable to create a viable deterrence for illegal anticompetitive practices. The watchdog role of the CCP, in particular, has been seriously compromised due to its lack of capacity in terms of conducting technical studies that can be defended in a court of law.

But interestingly, this result of regulator not doing its job well after privatisation and liberalisation is not limited to Pakistan only. Some theoretical and empirical studies have recently looked at the regulator not performing its role in curbing monopolies after privatisation and deregulation due to either incentive issues or constraints imposed upon by regulatory framework design. The 'regulatory capture' examples after privatisation and reforms have been mentioned in the Sewol ferry tragedy (You and Park, 2017), increase in income inequality in 91 countries (Manish and O'Reilly, 2018), and gasoline prices in Canada (Sen *et al*, 2011). Similarly, a growing theoretical and empirical literature has recently started focusing on tight institutional capacity constraints imposed on regulator in developing countries in particular. The work of Jean-Jacques Laffont (2005) is considered as a pioneering in this regard. The constraints arises in the

designing of regulatory framework which shall achieve many goals. A number of studies (theoretical and empirical) have however concluded that these goals are difficult to achieve in the context of developing countries due to incentive incompatibilities, limited capacity, lack of commitment and accountability and fiscal efficiency alongside political concerns.

Similarly, the initiation of public and private damage actions and its effectiveness depends on timely decisions by the courts and the judicial system. It has been common practice for decisions taken by governments and regulatory authorities to be challenged in the lower and superior courts. The courts have generally granted stay orders without hesitation. These have lasted for years and in some cases the proceedings on these cases have never restarted or aggrieved parties have stopped following the cases after years of waiting. This has resulted in not a single case of successful prosecution on the grounds of anticompetitive practices. This has further encouraged firms to initiate and continue these illegal anticompetitive practices without any fear of getting caught.

8. Conclusion

Governments around the world have introduced a number of regulatory reforms, including the transfer of ownership of state-owned firms from the public to the private sector with the aim of making these firms profitable/efficient and more productive. At the same time, one of the other primary objectives of these policies is to create a level playing field for new and existing firms in competing against each other on price, supply quantity and quality of the product. However, since the initiation of these reforms in the 1980s, a number of studies have concluded that attaining this objective of increasing competition could be difficult in developing countries for a variety of reasons. A significant number of firms have manipulated the output prices and supply quantity subsequent to privatisation and other broader reforms.

This study has reviewed and used a variety of methods to assess the competitive conditions in the Pakistani cement industry, which has been investigated, fined and warned by the regulator due to serious allegations of tacit collusion since the introduction of the privatisation policy in 1991/1992. This research uses trends and descriptive statistics alongside advanced techniques, such as the “before and after” approach, and

market structure-based methods, such as the estimation of Bresnahan's (1982) lambda. To complete the story, it links firms' conduct to regulatory weaknesses and lack of institutional capacity.

We conclude that subsequent to broader reform and privatisation, and contrary to the main objective of promoting competition through these policies, firms have exercised more market power and competition levels have been reduced due to tacit collusion. In a way, state monopoly has been replaced with a monopoly of business conglomerates. These conglomerates, to some extent, have used all available tools to maintain their control over prices and supplied quantity. These include acquiring small and medium-sized firms, strengthening/maintaining market share through significant new production capacity additions and mergers, the forced exit of competitor firms through exclusionary practices, and manipulating the outdated/inefficient regulatory and legal system. The formation of a strong producer association immediately after privatisation, which subsequently established an effective mechanism to keep control over prices, capacity and supplied quantity at the regional and national levels, has helped this collusion to continue over a considerable period of time.

This study argues that broad reforms, including transfer of ownership, will not bring about the desired objective of creating a "level playing field" and making the industry competitive without an effective and authoritative regulatory framework, an efficient legal system/courts and a reduction in government interventions concerning investigations of market abuse by the competition authorities, the recovery of fines and follow-up investigations following regulator warnings. The regulatory body also needs to keep a close eye on some particular industries, such as cement manufacturing, due to their higher sunk costs, the homogeneous and bulky nature of their product and related transportation issues, as well as exclusionary practices that are easy to exercise due to the building of larger production capacities, etc.

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Table 1: Privatisation of state-owned cement manufacturer firms

Former publically owned firm	Initially sold to	Current status
White Pak	Conglomerate.	Continuing - merged with Mapple Leaf cement and later sold to Kohinoor
Mapple Leaf	Conglomerate	Continuing- merged with Mapple Leaf cement and later sold to Kohinoor
D.G.Khan	Conglomerate	Continuing-sold to Kohinoor mills group
Dandot	Non conglomerate	Continuing-sold to Nishat Group
Gharibwal	Conglomerate	Continuing- later acquired by Chakwal Group (conglomerate) and is now part of Chakwal cement
Zeal Pak	Non conglomerate	Continuing but ceased operation occasionally
Kohat	Conglomerate	Continuing
National	Non conglomerate	Closed
Thatta	Conglomerate	Continuing
Mustahkam	Conglomerate	Continuing
Associated , Wah	Conglomerate	Since 1996, part of Askri cement .
General Refractories	Non conglomerate.	Closed
Javadan	Non conglomerate	Closed
Associated , Rohri	Non conglomerate	Ceased operation in 1999 by the govt. Started operation under private ownership after privatisation in 2004 but ceased production again in 2009 – closed

Source: Privatisation Commission (PC), Government of Pakistan and former Expert Advisory Cell, Ministry of Industry, Government of Pakistan

Table 2: Estimation of competitive conditions (traditional measures of competition)

	Herfindhal index (H ₁)	Herfindhal index (H ₂)	Herfindhal index (H ₃)	Top 3 Firms concentration index (C ₃)	Price cost margin (PCM)	Weighted price cost margin (WPCM)
1986-1991	0.090	0.094	0.087	0.365	0.555	0.565
1991-1995	0.083	0.084	0.082	0.333	0.580	0.604
1996-2011	0.087	0.078	0.080	0.378	0.528	0.570

Notes: H₁: Herfindahl index (total assets)

H₂: Herfindahl index (production capacity)

H₃: Herfindahl index (gross sales volume)

C₃= Market share of top 3 firms.

PCM= (sales-variable cost)/sales

WPCM is weighted PCM. Weights are determined by market share of firm total assets

Table 3: Capacity utilisation levels of the cement industry

Periods	Immediate effect (5 years post reform)	Medium term effect (10 years post reform)	Long term effect (20 years post reform)
Privatised firms			
Pre reforms and privatisation	92.54	92.54	92.54
Post reforms and privatisation	102.88	92.09	76.27
<i>Rank sum test probability</i>	<i>0.008</i>	<i>0.801</i>	<i>0.013</i>
Publically owned firms			
Pre reforms and privatisation	92.54	92.54	92.54
Post reforms and privatisation	80.84	76.26	68.56
<i>Rank sum test probability</i>	<i>0.957</i>	<i>0.093</i>	<i>0.031</i>
Privately owned firms			
Pre reforms and privatisation	95.73	95.73	95.73
Post reforms and privatisation	118.71	85.72	77.98
<i>Rank sum test probability</i>	<i>0.009</i>	<i>0.259</i>	<i>0.009</i>

Table 4: Evolution of nominal gross prices (Pakistani Rupees per tonne)

	1986-1991	1991-1995	1996-1999	2000-2005	2006-2009	2010-2011	1996-2011
Mean	1599.24	2560.84	3431.12	4036.03	4826.45	4997.29	4185.41
Skewness	4.46	2.20	0.18	0.22	0.41	-0.22	0.84
Kurtosis	24.71	9.16	5.06	2.87	2.20	1.65	3.68
Average number of firms	13	14	17	17	17	15	15

Note: Gross prices calculated by dividing the gross sales figures (including sales tax and excise duty) by total quantity sold.

Table 5: Estimation of overcharges (dependent variable = log of producer (gross) price per tonne)

	(1)	(2)	(3)
Dummy variable = 1 (1991-1995)	0.2288*** (0.0392)	0.2382*** (0.0394)	0.2269*** (0.0396)
Dummy variable = 1 (1996-2011)	0.3882*** (0.0624)	0.3962*** (0.0633)	0.3763*** (0.0635)
R ²	0.9237	0.9228	0.9221
Observations	394	394	394
Number of firms	21	21	21

Notes: Standard errors in parentheses. *** p – value <0.01, ** p – value <0.05, * p – value <0.1. Other variables in the regression include quantity of cement sold (log), furnace oil price (log), coal price (log), limestone price (log), workers wage rate (log), firm inefficiency (log), Herfindhal index (log), country export/GDP ratio (log), country GDP growth rate (log), firm size =large, time trend (log), firm ownership = privately owned , firm ownership = privatised, firm area of region = north, 1/(N+1) where N is number of firms. Instruments includes population, discount rate, workers' wages, country employment level, manufacturing production index, value of exports and firm profitability.

Table 6: An analysis of production capacity, utilisation and surplus

	Production capacity (million tonnes)	Actual production (million tonnes)	Capacity utilisation (%)	Surplus capacity (million tonnes)
1991-1995	9.18	7.97	87.00	1.21
1996-2001	14.42	9.63	68.83	4.79
2002-2006	17.69	14.00	78.20	3.70
2007-2011	39.63	30.30	76.60	9.33

Source: Authors compilation from the All Pakistan Cement Manufacturer Association data. Surplus capacity which is the difference between maximum production capacity (what could be maximum produced by the given technology) and actual production represents unutilised capacity.

Table 7: Estimates of demand and supply parameters and market power index (λ) (full information maximum likelihood 2SLS)

Parameter	Variables	Parameter estimate	Standard error	t value	p – value
α_0	intercept (demand equation 2)	3.373931	0.2333	14.46	<.0001
α_1	price of cement (p)	-0.00091	0.000047	-19.33	<.0001
α_2	GDP growth rate (y)	0.112739	0.0510	2.21	0.0276
α_3	$p * Z$	0.000086	5.103E-6	16.80	<.0001
α_4	construction activity growth (Z)	-0.37548	0.0246	-15.27	<.0001
α_5	$p * y$	-0.00006	0.000010	-5.62	<.0001
α_6	$y * Z$	0.0098	0.00226	4.34	<.0001
λ	lambda	-0.02307	0.0384	-0.60	0.5479
β_1	intercept (supply equation 5)	-2.37249	0.9458	-2.51	0.0125
β_2	log of quantity produced/sold (q)	0.179218	0.0112	15.94	<.0001
β_3	log of yearly employee wage rates (ω_1)	0.668115	0.0604	11.07	<.0001
β_4	log of price of furnace oil (ω_2)	-0.33191	0.0645	-5.15	<.0001
β_5	log of price of coal (ω_3)	0.421161	0.1672	2.52	0.0121
β_6	log of price of limestone (ω_4)	-0.2243	0.0465	-4.82	<.0001
$\lambda_{1991-1995}$	Dummy variable=1 for the period 1991-95	0.135619	0.0887	1.53	0.1269
$\lambda_{1996-2011}$	Dummy variable=1 for the period 1996-2011	0.273499	0.0762	3.59	0.0004
Adj. R ² for demand and supply equations					
q	Quantity of cement produced/sold	0.2624			
p	Price of cement	0.0693			

Notes: System of two non-linear equations estimated by two stage least square (2SLS) by using following instruments: GDP growth rate (%), development expenditures (billion rupees), central bank base rate (%) measured by discount rate, total population of the country (million), construction growth (%), firm output (level and square), input prices (ω_1) to (ω_4) (level, square and interactions), dummy variable =1 for public ownership, firm age (years), firm export quantity (tonnes), and yearly dummies.

Figure 1: Development of nominal cement price (per tonne) and its standard deviation

