Strategic Responses of Firms to Product Market Competition

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Table of Contents

List of Figures and Tables

Abstract

This thesis examines firms' strategies in response to more intensified product market competition. Specifically, three studies analyse: (i) the incentive dispersion within a top management team (TMT); (ii) the relative compensation of the CEO to the compensation of other top executives; and (iii) corporate complexity. These strategies are associated with cooperation among the TMT, the CEO's power, and corporate complexity.

The results from the first study demonstrate that TMT incentive dispersion decreases when firms experience intense competition in the product market and this effect is more pronounced for innovative and diversified firms. The implication is that firms promote cooperation in the team by reducing TMT incentive dispersion when facing pressure from product market competition and that cooperation in the TMT is even more essential for firms operating in a dynamic environment, which requires quick responses.

The second study reveals that the compensation disparity between the CEO and other management drops, implying less CEO power when product market competition becomes more intensified, and the impact is stronger for firms with weak corporate governance and "good luck." The results suggest that when powerful CEOs are entrenched, product market competition can act as a substitute for corporate governance and reins in the power of CEOs.

The third study shows that corporate complexity reduces firm performance when firms face increased competition in the product market. Corporate complexity can be related to the inefficiency of resource allocation as the impact of the interaction between corporate complexity and product market competition is more prominent for firms that have strong financial needs but cannot easily access capital.

From a theoretical perspective, the results of this thesis show how social comparison theory, agency costs, and resource allocation issues can explain the strategic choices that firms make in response to product market competition in order to stimulate cooperation in TMT, control CEO power, and enhance flexibility and efficiency, respectively.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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Chapter 1: Introduction

Product market competition is a natural challenge of firms that leads to less profitability due to decreasing market power (Lerner, 1934; Elzinga and Mills, 2011; Xu, 2012). The impact of product market competition on the decrease of firm performance pressures firms to improve their operational efficiency (Hart, 1983; Nickell, 1996), responsiveness (Bourgeois and Eisenhardt, 1988; Boyd, 1995), and monitoring of management decisions (Hou and Robinson, 2006) to be able to continue their competitiveness. In order to gain this improvement, firms design strategies in response to this threat. This thesis examines the strategic reactions of firms to changes in product market competition by focusing on the incentive distributions in a top management team (TMT) and between the chief executive officer (CEO) and other top executives within a firm, and also focuses on the structure of business holding portfolios of firms because they are related to cooperation among the TMT, the power of the CEO, and corporate complexity, which are critical factors in response to product market competition.

Lower TMT incentive dispersion is associated with greater cooperation within the TMT (Fredrickson, Davis-Blake and Sanders, 2010; Gartenberg and Wulf, 2017), which decreases overall heterogeneous strategic decisions in the team, leading to a firm coming up with final strategies quickly (Steinbach, Holcomb, Holmes, Devers and Cannella, 2017). Quick firm reactions are vital in a dynamic environment with intense product market competition (Bourgeois and Eisenhardt, 1988; Boyd, 1995). Moreover, prosocial behaviors among group members in the psychology literature support this argument—that a member tends to be receptive to the suggestion of other group members when they are under stress (Driskell and Salas, 1991; von Dawans, Fischbacher and Kirshbaum, 2012). Therefore, in order to stimulate cooperation among top management teams, it is expected that product market competition will reduce TMT incentive dispersion.

Next, the relative compensation of a CEO to the compensation of other top executives within a firm was considered. It objectively captures the dominance of a CEO over the other executive members, which implies that the pay of a CEO higher than that of other members is associated with greater CEO power (Liu and Jiraporn, 2010; Bebchuk, Cremers and Peyer, 2011; Chen, Huang and Wei, 2013; Vo and Canil, 2019). The influence of CEO power on firm performance is ambiguous. On the one hand, firms empower CEOs to enhance operational efficiency by decreasing communication costs and implementation time for corporate strategic decisions (Cunãt and Guadalupe, 2005; Li, Lu and Phillips, 2019). Therefore, CEO power provides firms with an advantage in the intense competition in the product market in this view, and firms should grant CEOs higher compensation when they operate in intense competition in the product market. On the other hand, powerful CEOs are more likely to be entrenched and firm value is then reduced (Bebchuk, Cohen and Ferrell, 2009; Liu and Jiraporn, 2010; Bebchuk et al., 2011; Chen et al., 2013; Khanna, Kim and Lu, 2015; Vo and Canil, 2019). Hence, CEO power is undesirable, especially when firms face rising competition in the product market, and therefore, it is conjectured here that product market competition will reduce the relative pay of a CEO to the pay of other top executives.

Finally, the structure of the business holding portfolios of firms can be related to corporate complexity. The more affiliates, and the greater the span and depth that a firm's business holding portfolio has, the greater corporate complexity a firm experiences (Altomonte and Rungi, 2013). Prior studies suggest that corporate complexity adversely affects the efficiency in resource allocation because firms cannot concentrate on resource utilization in the core businesses (Hitt, Hoskisson and Ireland, 1990; Seru, 2014). Guadalupe and Wulf (2010) report that firms are flattened after experiencing rising competition in the product market in order to gain operational efficiency and to decrease communication costs. Furthermore, firms with a high degree of corporate complexity are difficult to monitor; for instance, controlling shareholders exploit the benefit of minority shareholders (La Porta, Lopez-de-Silanes and Shleifer, 1999) and CEOs tend to be entrenched (Berry, Bizjak, Lemmon and Naveen, 2006). Under the threat of product market competition leading to a decline in firm performance, it is difficult for firms to allocate their resources efficiently, and hence firms require monitoring of management decisions more carefully (Hou and Robinson, 2006). Thus, firms should consider strategies to reduce corporate complexity in order to enhance their performance when they face intensified product market competition.

In order to examine the effect of product market competition on the firm's strategic decisions, as mentioned previously, this research is separated into three studies. The main common independent variable of interest is product market competition. The Herfindahl-Hirschman index (HHI), which captures industry concentration (Gaspar and Massa, 2006), is used, and the Lerner index, which represents the market power of a firm and implies a lower price-elasticity of demand (Lerner, 1934), are also employed. Greater concentration in the product market and higher market power indicate less competition in the product market. Large U.S import tariff reductions were also employed as exogenous shocks, which firms encounter in the product market. The method of Huang, Jennings, and Yu (2017) was applied to calculate large import tariff reductions. Firms experiencing large import tariff reductions confront new foreign rivals, leading to more intensified competition in the product market.

The first study, Chapter 2 of this thesis, investigates the impact of product market competition on TMT incentive dispersion. In order to measure this dispersion, the methods of Siegel and Hambrick (2005) and Steinbach et al. (2017) were followed by applying the gini coefficients and coefficients of variation to TMT total- and equity-only incentives, pay-performance sensitivity, and compensation complexity among the top-five executives within a firm. A quasi-natural experiment with large tariff reductions as exogenous shocks was conducted in order to mitigate the endogeneity problems that cause spurious relationships between TMT incentive dispersion and product market competition. A propensity score matched (PSM) on firm characteristics was also applied, including firm size, profitability, leverage, stock volatility, and TMT incentive dispersion.

The results of the first study report that the dispersions in total- and equity-incentives and pay-performance sensitivity decline, approximately by 8% - 17% from the means, after firms experience large import tariff reductions—meaning that the more intense competition in product market raises cooperation among the TMT. Moreover, the moderating effects of innovation and diversification on this relationship were analyzed and it was found that this negative impact of product market competition on TMT incentive dispersion is more prominent in innovative and diversified firms, which implies that cooperation between top management teams becomes more essential when firms operate in high-dynamic market sectors (Bourgeois and Eisenhardt, 1988).

The second study, presented in Chapter 3, examines the effect of product market competition on CEO power. CEO power was proxied with the relative compensation of the CEO to compensation of the other top executives, which can be measured according to the CEO pay slide (CPS) and CEO pay gap (Liu and Jiraporn, 2010; Bebchuk et al., 2011; Chen et al., 2013; Vo and Canil, 2019). Regressions of the CPS and CEO pay gap on the HHI and Lerner index were applied. Furthermore, a propensity score matching difference-in-differences (PSM-DiD) approach was employed that matches treated and control firms based on firm size, leverage, profitability, stock volatility and the relative competition as a robustness check.

In this chapter, it was found that CPS and CEO pay gap are positively correlated with both the HHI and Lerner index, and both of them are reduced after firms experience large import tariff reductions of approximately 7% from the means. These results suggest that intense competition in the product market reduces CEO power. The moderate effects of corporate governance and luck on the relationship were further analyzed and it was found that the negative effect of product market competition on CEO power is more pronounced in weak corporate governance firms, which are identified as firms with a higher chance that the CEO is entrenched, that have lower CEO ownership, less analyst following, and “good luck.” It can be interpreted then that product market competition works as a substitute for corporate governance (Giroud and Mueller, 2010; Chhaochharia, Grinstein, Grullon and Michaely, 2017) and that CEO power is associated with entrenchment (Bebchuk et al., 2011; Vo and Canil, 2019).

In the final study, in Chapter 4, the effect of corporate complexity on firm performance when firms operate in a competitive product market was examined. The definition of complexity of Altomonte and Rungi (2013) was applied, as a group contains one headquarter and affiliates. Then, corporate complexity can be captured by the number of subsidiaries, the number of subsidiaries weighted by the percentage of ownership, and the number of chains and hierarchies of business holding portfolios of firms. These measures consider both the span and depth of corporate complexity. In addition, they capture corporate complexity from a cross-holding view, which differs from the work of Damanpour (1996) and Guadalupe and Wulf (2010), who consider complexity within a firm. Here a PSM-DiD approach was used. The treated and control firms are matched with firm characteristics, including capital expenditure (CAPEX), cash holding, firm size, leverage, and stock volatility.

The results show that corporate complexity amplifies the adverse effect of product market competition on firm performance. Firm performance declines by approximately 1% - 9% from its mean. The analysis of the moderating effects reports that the augmented effect of corporate complexity is more pronounced in firms that have a high demand for capital but have difficulty in accessing it, which is determined by high levels of financial constraint, opacity, and CAPEX spending. Notably, corporate complexity provides an opposite effect on firm performance to diversification, which is considered as a proxy of complexity in various studies (for example, Hovakimian, 2011; Seru, 2014; Kuppuswamy and Villalonga, 2015).

This thesis makes several contributions. First, it contributes to the literature on the social comparison theory of TMT incentives. Firms want to decrease their dispersion of incentives among top management teams in order to assure cooperation within the team when firms face tension of product market competition in order to continue their competitive capability. This result complements the social comparison theory, which indicates that the disparity feeling of individuals distorts their capacity (Henderson and Fredrickson, 2001; Fredrickson et al., 2010; Gartenberg and Wulf, 2017). In addition, the findings suggest that cooperation is more necessary when firms operate in a highly-dynamic environment, which requires fast responses, as with innovation and diversification (Bourgeois and Eisenhardt, 1988).

Secondly, the findings contribute to the literature on the agency costs of CEO power. Powerful CEOs tend to be entrenched. For example, they are involved in incentive setting processes, leading to inefficient incentive plans (Bebchuk and Fried, 2004; Morse, Nanda and Seru, 2011; Vo and Canil, 2019) or they are more likely to be involved in fraud (Khanna et al., 2015). Therefore, CEO power is associated with a decrease in firm profitability and value (Bebchuk et al., 2011). In addition, the results support the idea that product market competition is a substitution effect of corporate governance (Giroud and Mueller, 2010; Chhaochharia et al., 2017), as market power reduces CEO power more in firms with weak corporate governance.

Thirdly, this thesis adds to the literature that examines the relation between corporate complexity and firm performance. The results report that under the threat of product market competition, corporate complexity reduces firm performance, which can be explained by the inefficiency of capital allocation. These results are different from the findings of Slovin and Sushka (1997), Hovakimian (2011), and Kuppuswamy and Villalonga (2015). The reason is that the present author considers various dimensions of complexity, including ownership, and the span and hierarchy of firms' business holding portfolios, which is different from prior literature. Moreover, not only the organizational structure within a firm but also the cross-holding structure between firms and their affiliates can influence firm performance.

In sum, under the pressure of product market competition, firms aim to encourage TMT cooperation, control CEO power, and diminish corporate complexity. The findings suggest that incentives of CEOs and top executives are tools of firms to promote cooperation between the TMT and to restrict CEO power by, for instance, balancing the incentives of CEOs and those of top executives. Moreover, firms can consider adjusting the structure of their business holding portfolios when they need greater flexibility, especially in terms of financial assets, by reducing both the span and depth of their business holding portfolios. Thus, incentive policies and the structure of business holding portfolios can be strategically used by firms in response to more intense competition in the product market.

Chapter 2: The effect of product market competition on top management team incentive dispersion

2.1 Introduction

This article examines how firms compensate their executives when faced with increased product market competition. The literature on executive compensation, and in particular on the dispersion of compensation across the top management team (TMT), is characterized by the competing needs for firms to encourage cooperation versus competition among TMT members (Henderson and Fredrickson, 2001; Main, O'Reilly, and Wade, 1993; Ridge, Hill, and Aime, 2017). According to social comparison theory, firms which look to promote greater cooperation among TMT members generally emphasize having a balanced distribution of incentives among peers who are at the same organizational level (Fredrickson, Davis-Blake, and Sanders, 2010; Gartenberg and Wulf, 2017). Conversely, firms seeking greater internal competition can use tournament style incentives where inequality of compensation across organizational levels encourages managerial effort (Lazear and Rosen, 1981; Ridge et al., 2017; Siegel and Hambrick, 2005). It is noteworthy, however, that both approaches treat TMT pay structures as endogenous to the firm (e.g. see Gartenberg and Wulf, 2017). I take product market competition (PMC) as an example to argue and show that firms can use TMT incentive dispersion as a strategic lever, not only in thinking about TMT interpersonal dynamics, but also when responding to exogenous changes in their market environment.[1]

[1] I focus on incentive dispersion among TMT, not salary dispersion among TMT, due to its influence on members' behavior. Incentive pay can be considered as a tool to motivate members of the team to achieve its goals and to encourage the cooperation of the team when the interests of the members become more aligned (Cadsby, Song, and Tapon, 2007) while salary can be considered as fixed pay and is less risky than incentive pay in the view of employees, so firms may have difficulty using salary to change members' behavior.

More competitive product markets can have dramatic and far-reaching consequences for firms. They not only encourage firms to be more efficient (Shleifer and Vishny, 1997), but also cause firms to adopt flatter organizational structures (Guadalupe and Wulf, 2010), and influence key strategic policies (e.g. Flammer, 2015). A further strategic response available to firms is to consider how to best motivate their TMTs when facing increased competitive pressure. However, relatively little is known about the impact of increased product market competition on TMT compensation structures, and in particular if TMT compensation is used as a strategic lever by firms faced with greater competition. In principle, how individual firms respond to competition shocks will be idiosyncratic, and some might in fact choose to promote greater competition among executives using tournament style incentive structures to increase managerial productivity. However, because PMC intensifies external hazards and places stress on organizational response mechanisms, I see two reasons to expect that, on aggregate, firms are considerably more motivated to promote cooperation rather than competition among TMT members during PMC shocks.

First, while firms generally need to be adaptable and responsive, during PMC shocks they especially need the ability to make strategic decisions with speed as their control over the operating environment diminishes (Bourgeois and Eisenhardt, 1988; Gladstein and Reilly, 1985). Second, research shows that the efficacy of group decision making under duress is associated with pro-social behaviors among group members, at least in part because individuals become more receptive to information provided by others when faced with stressful situations (Driskell and Salas, 1991; von Dawans, Fischbacher, Kirschbaum, Fehr, and Heinrichs, 2012). Therefore, firms that are under duress will have an incentive to seek quick strategic decisions and to further encourage pro-social TMTs. Because lower TMT incentive dispersion results in generally lower overall decision heterogeneity, enabling TMTs to reach decisions more quickly (Steinbach, Holcomb, Holmes, Devers, and Cannella, 2017), and given that social comparison theory posits and finds that firms with lower TMT pay dispersion promote greater cooperation (Fredrickson et al., 2010; Gartenberg and Wulf, 2017), I expect that PMC shocks will likely increase the firm-level value of cooperative TMTs relative to competitive TMTs.

To test this proposition this study examines the relationship between PMC and TMT incentive dispersion for a sample of manufacturing firms from the Standard and Poor's (S&P) 1500 between 1992 and 2014. I capture changes in PMC which are exogenous to firm pay structure using large reductions in U.S. import tariffs between 1995 and 2011 (Huang, Jennings, and Yu, 2017), and measure changes in TMT incentive dispersion (along total, equity-only and pay-performance sensitivity dimensions) by looking at both the gini coefficient and the coefficient of variation in pay among the top five executives for my sampled firms (Fredrickson et al., 2010; Gartenberg and Wulf, 2017; Steinbach et al., 2017). While there is some evidence to suggest that individual firms seek to influence their product market environment through lobbying during trade negotiations (Flammer, 2015; Huang et al., 2017), I do not expect that such efforts are based on the TMT pay policies of individual firms, and also argue that any effect of such efforts is likely minimized for the large-scale tariff reductions I examine. Furthermore, my econometric analysis applies a propensity score matched (PSM), difference-in-differences (DiD) methodology (e.g. as in Flammer, 2015) where treatment and control firms are matched on several characteristics, including proxies for size, profitability, leverage, stock volatility and TMT incentive dispersion. Treatment firms are in sectors which are subject to large-scale tariff reductions whereas control firms are not. Supplementary to this, prior research on the effects of PMC shocks shows that tariff cuts do not necessarily have uniform consequences across firms, and particularly so in the case of manufacturing firms (e.g. Dasgupta, Li, and Wang, 2018). Since firms differ, to some extent idiosyncratically, in response to PMC shocks, I expect that TMT incentive dispersion will also reflect variation in the demands placed on TMTs to process information and to perform their respective roles under divergent firm-level conditions. My analysis therefore raises two further, but equally important, questions about how the relationship between PMC and TMT incentive dispersion varies across firms.

First, I draw on the literature which examines the role of innovation in predicting firm outcomes. Innovative firms not only face additional risks relative to firms which pursue efficiency- or stability-based strategies (Hou and Robinson, 2006; Siegel and Hambrick, 2005), but as a result, are also especially susceptible when industry conditions deteriorate (Han, Nanda, and Silveri, 2016). How firms respond to adverse changes in their operating environment is therefore particularly consequential for innovation-oriented firms (Han et al., 2016). In addition to this, Siegel and Hambrick (2005) show that innovativeness also imposes a significant need for collaboration among senior executives since it necessitates greater coordination across business units and multiway information processing within organizations. Taken together, these findings suggest (i) that external threats pose unique challenges to innovation intensive firms, and (ii) that effective innovation requires collaborative TMTs. I therefore conjecture that, if PMC does in fact induce lower TMT incentive dispersion, this effect will be stronger for more innovative firms. I test this hypothesis by examining whether R&D expenditure moderates the relationship between PMC and TMT incentive dispersion such that more innovative firms experience greater declines in TMT incentive dispersion when faced with increased PMC.

Second, I examine the role of business diversification in moderating the relationship between PMC and TMT incentive dispersion. Stern and Henderson (2004) show that when competitor firms are relatively more active in introducing new products, the probability of firm failure is disproportionately higher for more diversified firms. Greater competition in a firm's product market appears to pose additional risks for more diversified firms, with this further exacerbated for firms which respond by also increasing the number of new products they bring to market (Stern and Henderson, 2004). At the same time, diversified firms inherently present greater challenges to managers because they generate more onerous information processing requirements than undiversified firms (Henderson and Fredrickson, 1996, 2001). As a result, centralized decision making models, where CEOs take greater responsibility, are less effective, implying that collaboration and coordination among TMTs are crucial to effective functioning in highly diversified firms. These findings place an emphasis on how diversified firms respond when confronted with greater PMC, suggesting that such firms might have a greater need for cooperative, as opposed to competitive, TMTs. I therefore hypothesize that, if PMC does in fact reduce TMT incentive dispersion, this effect will also be stronger for more diversified firms, and test for the moderating effect of business diversification using the two-digit SIC business segments of the firms in my sample.

My empirical results support my theoretical predictions. More specifically, I find that increased product market competition is associated with significantly lower TMT incentive dispersion for the firms in my sample. This relationship is more strongly negative for more innovative firms, and also stronger for increasingly diversified firms. In addition, supplementary tests reveal that this relationship holds when I consider the level of parity in TMT compensation complexity instead of incentive dispersion, along with evidence to suggest my results are linked with increases in firm value. My main results hold in the presence of a number of controls for firm characteristics and corporate governance differences across firms, and importantly, are not subject to some of the more common endogeneity related concerns because product market shocks (i.e. tariff cuts) are exogenous at the level of individual firms.

This study makes several contributions to the literature on TMT incentives. Foremost, it demonstrates that firms can use the distribution of incentives among TMT members as a strategic lever in response to external product market threats. In fact, control over the spread of compensation across senior executives likely offers a key mechanism for influencing multiple aspects of how firms respond to exogenous changes in their operating environment, including potentially the speed with which they respond and the degree to which executives collaborate with one another when faced with external pressures. This complements existing research and suggests that TMT incentive dispersion need not necessarily only relate to endogenous socio-behavioral or economic comparisons within organizations, but can also be the product of firm-exogenous effects such as product market instability.

My results therefore also shed light on the ongoing debate centred on tournament versus social comparison theory (Henderson and Fredrickson, 2001). Firms facing new entrants in their product market can choose, to some degree, between either using tournament incentives to promote more robust decision making at the TMT level, or emphasizing reduced differences between executives, promoting social cohesion, and thereby improving the speed with which decisions are made. My results suggest that generally firms prefer to seek cooperative TMTs during adverse product market events, as evidenced through a reduction in TMT incentive dispersion. In alignment with social comparison theory, reduced TMT pay dispersion facilitates cooperative behavior (Fredrickson et al., 2010; Gartenberg and Wulf, 2017). Conversely, I find no evidence to suggest that firms promote greater competitiveness among TMT members in response to more competitive product markets through increased tournament incentives (i.e. increased TMT incentive dispersion).

Finally, for practitioners, the findings highlight that more innovative and more diversified firms are particularly likely to benefit from reducing the dispersion of TMT incentives when confronted with a more competitive product environment. These firms generally find themselves in more diverse, more dynamic or more high-velocity market segments, and as a result appear to be at greater risk to adverse effects stemming from PMC shocks. Quick strategic responses to outside threats seem especially important for this group, not only in manufacturing, but I suggest also across other sectors (c.f. Bourgeois and Eisenhardt, 1988).

2.2 Prior Literature and Hypothesis Development

2.2.1 Product Market Competition and TMT Incentive Dispersion

Changes in product market conditions can have profound consequences for firms, particularly when firms are faced with more competitive markets where barriers to entry for new participants are lower. Increased PMC is not only positively correlated with volatility in firm profits, but also creates informational uncertainty in product markets and, through these channels, is associated with greater idiosyncratic volatility in the stock returns of individual firms (Gaspar and Massa, 2006). For firms ill-prepared to deal with any decline in profitability, PMC ultimately increases the likelihood of liquidation (Schmidt, 1997). In combination, the firm-level risks of increased PMC and the exogenous nature of PMC shocks to individual firms place a strong emphasis on how firms navigate threats in their product market environment.

The strategic management literature categorizes firm responses to instability in the external business environment along two dimensions: those based on resources and those based on organizational capabilities (see for example Grant, 1996). With respect to resources, Fresard (2010) shows that firms with large cash reserves are better able to capture market share after competition in product markets intensifies. Importantly, this effect is also stronger when the number of strategic interactions between firms is greater (Fresard, 2010), although the extent to which this results in a sustained competitive advantage is unclear because cash-based strategies are readily imitable (Barney, 1991). A relatively less imitable alternative is available to firms who exploit their control over human resources in response to PMC. For example, Dasgupta et al. (2018) find that following PMC shocks, manufacturing firms are more likely to experience forced CEO turnover, with subsequent improvements in both performance and productivity.

Capability-based responses offer further alternatives for firms faced with adverse changes in their product market environment. For instance, Guadalupe and Wulf (2010) show that trade liberalization has a causal effect on firm hierarchies such that firms faced with more competitive product markets adopt flatter organizational structures where CEOs have a broader span of control over decision making. Parallel to this, firms also appear to reduce the frequency with which they issue voluntary earnings forecast announcements as a result of incurring increased proprietary costs following a PMC shock (Huang et al., 2017). Corporate policies, such as the decision to invest in corporate social responsibility, can also be an effective response to PMC, especially when they enable incumbent firms to differentiate themselves from foreign competitors in the eyes of local stakeholders (Flammer, 2015). Taken together, these findings suggest not only that firms are aware of the threats posed by product market instability, but also that a number of resource- and capability-based strategic levers are available to them in response to such instability.

One further possible response to product market events relates to how TMTs are incentivized via their compensation. I utilize findings from the literature on social comparison theory to argue that the degree of cooperation (versus competition) among TMT members is particularly important for firms faced with a PMC shock, and therefore that TMT incentive dispersion is a key strategic dimension of how firms respond to PMC events. SCT posits that the distribution of pay among top teams elicits comparisons which, in turn, affect how TMT members perceive their socio-political and social-psychological standing within organizations, and subsequently how they behave (Gartenberg and Wulf, 2017; Henderson and Fredrickson, 2001; Ridge et al., 2017). Such comparisons have been shown to occur vertically, between senior executives and the CEO (Main et al., 1993); horizontally, between individuals at the same level in organizational hierarchies (Siegel and Hambrick, 2005); and most recently, externally, between TMT members and referent others from outside organizations (Ridge et al., 2017). Among the primary social-psychological effects of such pay comparisons is the finding that greater pay equality engenders perceptions of fairness among top teams (Gartenberg and Wulf, 2017), and that this promotes cooperation and coordination between TMT members

(Fredrickson et al., 2010; Henderson and Fredrickson, 2001). That is, firms which wish to increase cooperation among top teams can at least in part do so by reducing pay dispersion.

I argue that cooperation among TMT members is strategically advantageous because, among other things, it facilitates faster firm responses to instability in product markets.[2] Previous evidence suggests that firm performance improves with faster response times in highly dynamic environments (Boyd, 1995) and that firms which make strategic decisions quickly are also more effective in high velocity environments (Bourgeois and Eisenhardt, 1988). Likewise, product market competition presents firms with challenges which, if not met immediately, leave firms vulnerable to predatory strategies from rivals and new market entrants (see for instance Dasgupta et al., 2018). While it is certainly an option for firms to respond by generating a more competitive atmosphere among top teams via greater TMT incentive dispersion (Lazear and Rosen, 1981; Main et al., 1993), I contend that, crucially, this slows firm responses because it generates greater decision heterogeneity among TMTs (Steinbach et al., 2017), and is therefore unlikely overall to be an attractive response strategy to PMC shocks. In addition, the psychology literature suggests that there is a preference towards pro-social behavior when group decision-making occurs under duress (Driskell and Salas, 1991; von Dawans et al., 2012), implying that a more natural response towards increased external competition is to increase internal cooperation. To the extent that PMC shocks pose an urgent threat, I therefore expect firms to behave in a manner consistent with the need to cooperate more and react quickly, which would be more in alignment with finding a decline in TMT incentive dispersion during periods of intensified PMC. This leads me to hypothesize that:

[2] Some literature argues that dispersion among TMT, which leads to heterogeneity in decision-making, benefits the firm because it encourages the firm to use objective information in decision-making (Landier, Sraer & Thesmar., 2009), enhancing internal governance (Landier, Sauvagnat, Sraer & Thesmar, 2012) and reducing the risk of corporate fraud (Khanna et al., 2015). These studies examine TMT dispersion in terms of the number of executives hired after the CEO is appointed (Landier et al., 2012) or in terms of the connectedness of the CEO and the other executives via past employment, education and the social organization they join (Khanna et al., 2015). However, the heterogeneity in decision-making can cost firms inefficiency by delaying policy implementation.

Hypothesis 2.1 Exogenous increases in product market competition lead to lower TMT incentive dispersion.

2.2.2 Innovative and Diversified Firms

Firms which place an emphasis on innovation face unique challenges. Innovation-based strategies oblige firms to employ specialized personnel and to develop differentiated products, but R&D activity often results in technological change which complicates firm planning and imposes additional information-processing requirements on top teams (Henderson and Fredrickson, 1996). Moreover, innovation requires that firms integrate activities and pool resources across subunits (Henderson and Fredrickson, 1996; Michel and Hambrick, 1992). This implies that intrafirm cooperation is pivotal for effective innovation, and therefore that innovativeness may magnify the need for collaboration among TMT members when firms are faced with increased competition (Bushman, Zhonglan, and Weining, 2016; Fredrickson et al., 2010; Siegel and Hambrick, 2005).

While innovation can be a key source of competitive advantage (Ettlie, 1998), it is also inherently risky (Hou and Robinson, 2006). Not only are investments in R&D volatile, but innovation-based strategies require firms to contend with uncertainties relating to the possibility of being pre-empted by a competitor, or realizing lower than expected market demand for innovations (e.g. see Kamien and Schwartz, 1974). In comparison to firms which adopt efficiency- or stability-based strategies, the risks associated with investment in R&D also leave innovative firms more vulnerable to industry downturns (Han et al., 2016). Additional to these external risks, R&D expenditure also puts internal management-based demands on firms. For example, Bushee (1998) shows that myopic CEOs sometimes use cuts in R&D spending to enhance short term financial performance at the expense of long term firm value. One response to this, which illustrates that top team pay can be used to resolve complexities in innovative firms, is that compensation committees often discourage opportunistic reductions in R&D by more closely aligning R&D spending with CEO pay (Cheng, 2004).

While increased PMC represents a significant deterioration in the operating market conditions of all incumbent firms, I argue that it is particularly harmful for more innovative firms. PMC increases the risk of firms experiencing lower demand for new innovations and product substitutability by competitors, and therefore puts an added emphasis on the need for top team collaboration in innovative firms. As a result, if firms do in fact use reductions in TMT incentive dispersion as a strategic response to PMC shocks, then I expect this relationship is more pronounced for more innovative firms. Specifically, I hypothesize:

Hypothesis 2.2 The negative effect of exogenous increases in product market competition on TMT incentive dispersion is amplified for more innovative firms.

Business diversification is a further factor that I postulate will moderate the relationship between PMC and TMT incentive dispersion. While in some diversified firms (e.g. conglomerates) business lines can be largely independent, requiring minimal TMT coordination across business units (Fredrickson et al., 2010; Michel and Hambrick, 1992), others (e.g. related diversifiers) need greater TMT cooperation to overcome the information-processing burden imposed on managers by complex, varied and interdependent operations (Henderson and Fredrickson, 1996, 2001; Hill, Hitt, and Hoskisson, 1992). Moreover, Hill et al. (1992) show that related diversifiers perform better under organizational structures which emphasize cooperation, whereas Stern and Henderson (2004) use within-business diversification to demonstrate that the probability of firm failure is higher for more diversified firms when competitors are more active bringing new products to market. Together these findings suggest not only that PMC might carry additional risks for more diversified firms, but also that strategic responses like lowering TMT incentive dispersion, which promote intrafirm cooperation, might be particularly viable for at least some highly diversified firms.

It is also possible that TMT incentive dispersion increases with the level of business diversification, if for example, more diversified firms have relatively fewer business units exposed to competitive shocks, and therefore subsequently, a lower need for cooperative top teams when responding to competitive pressures. However, this is implausible in the context of large firm-exogenous competition shocks. I measure PMC using large-scale import tariff reductions which are at least three times the median reduction during my sample period (Huang et al., 2017). The majority of these tariff cuts result from multilateral trade agreements which have a broad impact across firms in multiple industries, and for thousands of individual products (Flammer, 2015; Huang et al., 2017). To the extent that competition shocks are driven by large-scale multilateral trade agreements, it is unlikely that more diversified businesses experience localized impacts from PMC. In fact, I argue that, in response to PMC, the need for cooperation and hence for lower TMT incentive dispersion is relatively larger for more diversified firms because of the information-processing demands on managers (Henderson and Fredrickson, 1996), and the risks associated with poor strategic response choices (Stern and Henderson, 2004). Therefore, I hypothesize:

Hypothesis 2.3 The negative effect of exogenous increases in product market competition on TMT incentive dispersion is stronger for more diversified firms.

2.3 Method

2.3.1 Sample

To test my hypotheses I collect data on manufacturing firms (SIC 200-399) included in the S&P 1500 between 1992 and 2014, and set up a quasi-natural experiment where treated firms, which experience a PMC shock, are matched on a number of characteristics with control firms that do not. This allows me to observe a total of 384 firm-level competition shocks across 55 three-digit manufacturing sectors during the period. I consider TMT incentive dispersion among the five most senior executives in each firm, including the CEO (e.g. as in Steinbach et al., 2017), and restrict my sample to only include instances where there is no CEO turnover during a fiscal year. Overall, including both treated and control firms, my full sample comprises 11,452 firm-year observations. Data on executives' compensation and ownership are collated from Execucomp and ISS Incentive Lab, and firm financial and corporate governance data are from Compustat.

2.3.2 TMT Incentive Dispersion and PMC

I capture TMT incentive dispersion using several measures to ensure that my results accurately reflect multiple dimensions of executive compensation which might influence cooperation among TMT members. First, I follow Steinbach et al. (2017) and consider the total incentive-based compensation TMT members receive as a proportion of their overall compensation. To do this I calculate the cumulative value of both new and previously awarded stock options, restricted stock, and long-term performance plans, and then divide this by total compensation, calculated as incentive-based compensation plus salary and bonuses. Option values for my sample are derived using the modified Black-Scholes present value method available via Execucomp and restricted stock is valued at the prevailing common stock price for each firm (Fredrickson et al., 2010). Next, I adapt my measure of total incentive-based compensation to isolate the component which can be directly linked with equity only, excluding accounting-based long-term performance plans. I therefore also calculate the proportion of equity-based compensation TMT members receive as the ratio between stock options plus restricted stock granted, and total compensation.

Recent evidence further suggests that dispersion in pay-performance sensitivity (PPS) also reflects aspects of how firms use TMT compensation to incentivize coordination and effort among TMT members by optimizing executive pay (Bushman et al., 2016). PPS offers a more direct measure of the change in executive incentives when firm value changes, and is defined as the dollar change in granted incentives corresponding to a one percent change in firm value, standardized by total compensation. I therefore follow Bushman et al. (2016) and capture PPS as in Equation 2.1:

$$PPS_j = \frac{(Number\ of\ Shares + Number\ of\ Options \times Delta) \times (Stock\ Price/100)}{Total\ Compensation} \quad (2.1)$$

is the PPS for firm j, where share and option totals are from Execucomp, deltas are estimated using the approach outlined in Coles, Daniel, and Naveen (2006), stock prices are the prevailing ordinary equity price at the time of observing PPS, and total compensation is comprised of salary, bonuses, and incentive-based compensation.

For each of my total incentive-based, equity-based, and PPS dependent variables, I measure dispersion using both gini coefficients (GINI) and coefficients of variation (CV) to ensure that my results are robust in either case (Fredrickson et al., 2010; Siegel and Hambrick, 2005; Steinbach et al., 2017). I define *GINI* as in Steinbach et al. (2017) such that:

$$GINI_j = 1 + \frac{1}{n} - \frac{2}{n^2\bar{y}}(y_1 + 2y_2 + \cdots + ny_n) \quad (2.2)$$

is the gini coefficient for firm j, with n TMT members, where y_i is the proportion of total-incentive based compensation, equity-based compensation, or PPS of executive i, in descending order, and $\bar{y}$ is the mean TMT compensation ratio. A *GINI* of zero signals perfect equality (i.e. nil dispersion) in compensation, whereas a *GINI* of one signals complete inequality in compensation among executives. *CV* is defined as the ratio between the standard deviation of

TMT compensation and mean TMT compensation for a given firm (Pfeffer and Davis-Blake, 1990; Siegel and Hambrick, 2005). Higher *CV* values represent greater TMT incentive dispersion.

Since I am interested in the firm-level effects of PMC on TMT incentives, my main independent variable of interest is *Tariff Cut*. Large tariff cuts, which I define as those which are at least three times the median U.S. import tariff reduction between 1994 and 2011 (Dasgupta et al., 2018), are widely used to proxy for the exogenous shocks which firms encounter in product markets (e.g. Flammer, 2015; Fresard, 2010; Guadalupe and Wulf, 2010; Huang et al., 2017). To evaluate my primary hypothesis, that exogenous increases in PMC are associated with lower TMT incentive dispersion, I therefore follow the literature and operationalize *Tariff Cut* as a dummy equal to one for firms which are in industries that experience a large tariff reduction, and zero otherwise (Fresard, 2010; Huang et al., 2017).

2.3.3 The Moderating Effects of Innovation and Diversification

I further hypothesize that the relationship between PMC and TMT incentive dispersion might be exacerbated by certain firm-specific characteristics which potentially impose a greater need for collaboration and cooperation among TMT members. Specifically, my second hypothesis posits that the negative effect of exogenous increases in PMC on TMT incentive dispersion is stronger for more innovative firms. I proxy for the moderating effect of firm innovativeness by generating *Innovative*, a variable calculated as the ratio between firm R&D expenditure and total number of employees (e.g. as in Hill and Snell, 1988).

Similarly, I expect that the negative effect of PMC on TMT incentive dispersion is also stronger for more diversified firms. Therefore, to test for the moderating effect of firm-level diversification, I follow Bebchuk, Cremers, and Peyer (2011) and calculate *Diversified*, a count of the number two-digit SIC business segments reported in Compustat for each firm.

2.3.4 Controls

Prior research shows that a number of financial and corporate governance characteristics might also influence the distribution of pay among TMT members at the firm level, including in particular as firms respond to product market events. I therefore include a number of controls in my models to account for this. Fresard (2010) shows that cash policy has a substantial strategic dimension, allowing firms to grow their market share at the expense of competitors following a product market shock. Larger cash balances may therefore provide firms with an alternative response to PMC, and possibly a reduced incentive to use TMT compensation as a strategic lever during PMC. Hence, I control for firm cash holdings as a proportion of firm total assets (*Cash*). Some studies report significantly larger executive pay differentials for larger, more profitable firms (e.g. Henderson and Fredrickson, 2001; Sanders and Carpenter, 1998). Better performance and larger firm resources may influence TMT incentive dispersion in some firms, so I also control for *Firm size*, the natural logarithm of firm total assets, and firm profitability, as measured by industry-adjusted return on assets (*ROA*). Additionally, I follow Bebchuk et al. (2011) and Dasgupta et al. (2018) and control for industry-adjusted Tobin's *q* as a further market-to-book based measure of firm performance. My remaining firm financial controls account for differences in firm risk and leverage because riskier firms with larger debt burdens can be particularly constrained during PMC (Huang et al., 2017). Specifically, I control for *Leverage*, calculated as the ratio between long-term debt and firm total assets (Bebchuk et al., 2011), and *Firm risk*, the standard deviation of monthly stock returns (Karuna, 2007).

A number of corporate governance characteristics may similarly affect TMT incentive dispersion at the firm level. For instance, CEOs with longer employment tenure may be better able to shape firm compensation structures (Fredrickson et al., 2010; Ridge et al., 2017). Powerful CEOs, who simultaneously chair the board of directors, can also exert greater influence over strategic decisions, including those on executive pay (Adams, Almeida, and Ferreira, 2005). In addition to this, significant stockownership also affords insiders similar control benefits (Bebchuk et al., 2011; Steinbach et al., 2017). I therefore include controls for *CEO tenure*, the number of years a CEO has held their position, *Insider ownership*, the fraction of shares owned by insiders, and *CEO duality*, a dummy equal to one for firms whose CEO is also chairman of the board, and zero otherwise. My final governance control is *Number of VPs*, defined as the number of vice presidents within the TMT, because CEO-like executives can similarly exercise influence over executive pay decisions (Bebchuk et al., 2011; Henderson and Fredrickson, 2001).

Finally I also include firm and year fixed effects in my models to control for unobserved firm-specific characteristics and any trend in TMT incentive dispersion over time which might affect my results (Huang et al., 2017).

2.3.5 Supplementary analyses

Although my primary analyses utilize several distinct measures of TMT incentive dispersion, each measure is related to the spread in absolute, dollar-based compensation among TMT members. However, it is also possible that other aspects of executive compensation, in addition to overall pay, create opportunities for social comparisons among executives, and in turn, impact on TMT collaboration and cooperation. For instance, recent research by Albuquerque, Carter, and Lynch (2018) notes the trend of rising complexity in executive compensation contracts over time. This might mean that while executives in some TMTs are receiving relatively equal overall pay, they may at the same time be subject to mixed levels of compensation complexity. If this places executives on comparatively more stable salary-based contracts together with others who, for example, receive a larger proportion of their compensation via individual awards, then I argue that this too can be a basis for social comparison within TMTs, with some executives required to work harder to achieve equal pay or to accept greater proportions of increasingly variable and complex pay. Therefore, if firms do in fact use TMT incentive dispersion as a strategic lever following PMC shocks, then I also expect PMC to be associated with reduced dispersion in compensation complexity and lower overall use of individually derived performance compensation.

To address this I look at both individual performance awards (IPAs) and overall compensation complexity. I capture the level of IPA compensation using two measures. First, I use a dummy equal to one for firms which grant IPAs to at least one executive during a fiscal year, and zero otherwise. Second, I measure the percentage of IPA compensation executives receive as a proportion of their total compensation, and then use the TMT median IPA percentage to represent the rate of firm-level IPA.

Next I use three measures to capture the dispersion of compensation complexity. First, I capture the CV of complexity indices calculated for all TMT members in each firm, where each index is based on the number of components which feed into possible final pay and the number of conditions imposed on each component for each executive (Albuquerque et al., 2018).[3] Second, I consider the CV of TMT compensation diversity, calculated as one minus the Herfindahl-Hirschman index (HHI) of each executive’s incentive components as a proportion of total compensation:

$$Diversity_{it} = 1 - \sum_{j=1}^{n} \left(\frac{Component_{it,j}}{Total\ compensation_{it}} \right)^2 \qquad (2.3)$$

where $Diversity_{it}$ is the diversity of compensation for executive i in year t, and each component of total compensation is either salary, cash bonuses, non-equity incentives, option

[3] For short- and long-term cash bonuses, restricted stock, and stock options, I allocate index points for each incentive component with a time condition (up to a maximum of 4), and assign additional index points if the award has absolute (or relative) performance conditions based on more than one performance objective or on more than one time period (up to a maximum of 24).

awards, stock awards, deferred compensation, or other compensation. Third, I count the number of incentive components individual executives receive and capture dispersion in this measure using standard deviation.[4]

I conclude my supplementary analyses with difference-in-difference (DiD) t-tests examining the financial performance of the treated firms in my matched sample against that of my control firms. Specifically, I calculate Tobin's *q* for both groups for the three years preceding and then the three years following large tariff cuts, and compare changes in *q* around this period as firms vary in their level of TMT incentive dispersion and their exposure to the product market shock.

2.3.6 Estimation Procedure

I follow prior research and apply propensity scored matched difference-in-differences (PSM-DiD) regressions to examine the effect of large tariff cuts on the TMT incentive dispersion of firms in my sample (Flammer, 2015). Large-scale tariff cuts are generally considered outside the control of individual firms, even if firms exert lobbying effort during trade negotiations (Flammer, 2015; Huang et al., 2017). Large tariff cuts therefore present a plausibly exogenous shock at the level of individual firms, around which I construct my DiD models to alleviate any potential endogeneity in my estimations. Moreover, to account for possible differences in the characteristics of treated and control firms, I match treated firms, which experience a tariff cut, with control firms using nearest neighbor propensity scores based on five variables. These include TMT incentive dispersion, firm size, profitability, leverage, and firm risk. There are 299 firms that experience large tariff reductions during my sample period and I lose more observations due to matching process thresholds not being met (with the calipher

[4] I include short- and long-term cash bonuses, restricted stock, stock options, unit cash, phantom stocks, reload options, and stock appreciation rights.

set at 1%). The end result is that I have less than 600 firm observations when combining the treatment and control groups. I then estimate the following regression:

$$\Delta TMT\ Incentive\ Dispersion_{i,t} = \alpha + \beta \times Tariff\ Cut_{i,t-1} + \gamma' \boldsymbol{X}_{i,t-1} + \theta_i + \theta_t + \varepsilon_{i,t} \tag{2.4}$$

where $\Delta TMT\ Incentive\ Dispersion_{i,t}$ is the difference between three-year average incentive dispersion following large tariff cuts and three-year average incentive dispersion prior to large tariff cuts for firm i in year t, and where these averages are either based on total-incentive, equity-only, or PPS dimensions of compensation. $Tariff\ Cut_{i,t-1}$ is a dummy equal to one for firms which experience a large tariff cut in year $t-1$, and zero otherwise, $\boldsymbol{X}_{i,t-1}$ is a vector of lagged controls, θ_i and θ_t are firm and year fixed effects respectively, and $\varepsilon_{i,t}$ is the error term. Each of the matching variables is included as a control in $\boldsymbol{X}_{i,t-1}$ and robust standard errors are clustered at the three-digit SIC level in each regression. The coefficient I am interested in is β, which captures the direction and significance of the difference in $\Delta TMT\ Incentive\ Dispersion_{i,t}$ between treated and control firms.

I further build on my baseline regression in order to examine hypotheses 2.2 and 2.3. Specifically I extend the model in Equation 2.4 to include moderation terms which interact my *Tariff Cut* dummy with first my *Innovative* ratio, and then separately my *Diversified* count. My analyses conclude with my robustness tests where I examine the effect of tariff cuts on the dispersion in TMT compensation complexity and individual performance awards.

2.4 Results

Table 2.1 presents descriptive statistics and correlation coefficients for my measures of TMT incentive dispersion as well as all control variables. Although my *GINI* and *CV* measures for some of the independent variables are highly correlated, I note that this is not always necessarily the case. For example, the correlation between PPS_{GINI} and PPS_{CV} is only 0.44, suggesting at least some variation in the information captured by each measure. Moreover, in tests not presented here, I also note that my results are not likely subject to multicollinearity concerns since variance inflation factors in my regressions do not exceed 5.

In Table 2.2 I report preliminary results from univariate tests for mean differences between my treatment and control firms both in terms of their absolute level of TMT incentive dispersion, and the change in pre- versus post-tariff cut TMT incentive dispersion. Consistent with Hypothesis 2.1, which predicts that exogenous increases in product market competition lead to lower firm TMT incentive dispersion, I find that aggregate incentive dispersion is significantly lower (at the 1% level) for firms in industries subject to large tariff cuts for both my measures of total and equity-only incentive compensation. Moreover, while total and equity incentive dispersion both decrease around tariff cuts for treated firms ($GINI_{Total}$ and $GINI_{Equity}$ = -0.0093), they actually increase for my control sample over the same time period ($GINI_{Total}$ = 0.0551 and $GINI_{Equity}$ = 0.0533). This difference is again significant at the 1% level, and each of these results holds equally for my CV measure of incentive dispersion. However, I see no significant differences between my treated and control firms both in terms of their level and changes in PPS dispersion.

Table 2.3 presents the pre-trend test of the dependent variables. I do not find any statistically-significant difference between the dependent variables of the treatment and control firms, which confirms that the levels of TMT incentive dispersions of the treatment and control firms after matching process before large tariff reductions are not different.

In Table 2.4 I further evaluate Hypothesis 2.1 using my sample of matched firms and DiD regressions which control for a number of financial and corporate governance characteristics. As predicted, the coefficient on *Tariff cut* is negative and significant across each of my specifications, supporting Hypothesis 2.1. For example, when using *GINI* to capture the change in total-incentive based compensation I find that tariff cuts are associated with a significant reduction in the spread of TMT incentives (b = -0.0364; $p < 0.05$). This result persists if I use *CV* instead of *GINI*, and if I look at equity-based incentives only or pay-performance sensitivity instead of total-incentives. Together, these results suggest that multiple dimensions of TMT incentive dispersion converge in firms exposed to increased competition following an exogenous product market shock, consistent with Hypothesis 2.1.

Table 2.1 Descriptive statistics and correlations[a,b]

	Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1	Total incentive dispersion (Gini)	0.05	0.24												
2	Total incentive dispersion (CV)	0.14	0.63	0.96											
3	Equity incentive dispersion (Gini)	0.05	0.24	0.99	0.95										
4	Equity incentive dispersion (CV)	0.13	0.64	0.95	0.99	0.96									
5	PPS dispersion (Gini)	0.01	0.25	0.03	0.03	0.03	0.03								
6	PPS dispersion (CV)	0.01	0.45	0.15	0.15	0.16	0.16	0.44							
7	IPA (Dummy)[#]	0.04	0.41	0.02	0.01	0.02	0.01	0.00	-0.02						
8	IPA (%)	0.00	0.04	0.06	0.07	0.06	0.07	0.01	0.03	0.70					
9	Complexity dispersion (CV)	0.00	0.14	0.05	0.05	0.05	0.05	-0.06	0.08	-0.03	-0.01				
10	Complexity dispersion (Diversity)	-0.01	0.16	0.21	0.18	0.21	0.18	0.02	0.23	-0.01	-0.01	0.21			
11	Complexity dispersion (SD)	-0.01	0.52	0.02	0.02	0.02	0.02	-0.02	0.10	-0.04	-0.01	0.38	0.16		
12	Cash	0.11	0.11	0.05	0.04	0.05	0.04	0.00	0.00	0.00	-0.06	0.04	0.00	0.02	
13	Firm size	7.07	1.57	0.06	0.05	0.06	0.05	0.01	0.03	0.04	0.10	-0.06	0.06	-0.04	-0.30
14	Leverage	0.17	0.15	0.01	0.02	0.02	0.02	0.00	0.02	0.02	0.02	-0.02	0.01	-0.01	-0.34
15	ROA	0.00	0.09	0.03	0.03	0.03	0.03	0.00	0.02	0.02	0.04	-0.02	0.06	0.03	-0.10
16	Firm risk	0.12	0.06	-0.03	-0.03	-0.02	-0.03	-0.01	-0.02	-0.01	-0.05	0.05	-0.03	0.02	0.30
17	Tobin's *q*	0.31	1.30	0.01	0.01	0.01	0.01	-0.01	0.01	0.02	-0.02	0.04	0.02	0.03	0.24
18	CEO duality[##]	0.59	0.49	-0.02	-0.02	-0.02	-0.02	-0.01	0.03	-0.07	0.00	0.01	0.06	0.02	-0.18
19	CEO tenure	6.94	6.73	0.00	0.00	0.00	0.01	-0.05	-0.06	0.00	-0.01	0.09	0.03	0.02	0.04
20	Insider ownership	0.04	0.09	-0.04	-0.04	-0.04	-0.03	-0.02	-0.06	0.03	0.00	0.02	-0.01	0.03	0.03
21	Number of VPs	2.60	1.19	0.07	0.06	0.07	0.07	-0.01	0.00	-0.03	0.00	0.03	0.05	0.03	0.06

	Variable	Mean	SD	13	14	15	16	17	18	19	20
14	Leverage	0.17	0.15	0.26							
15	ROA	0.00	0.09	0.20	-0.09						
16	Firm risk	0.12	0.06	-0.37	-0.06	-0.31					
17	Tobin's *q*	0.31	1.30	-0.09	-0.17	0.28	0.14				
18	CEO duality[#]	0.59	0.49	0.20	0.07	0.10	-0.15	-0.01			
19	CEO tenure	6.94	6.73	-0.14	-0.07	0.05	0.00	0.02	0.14		
20	Insider ownership	0.04	0.09	-0.22	-0.09	0.04	0.02	-0.02	0.03	0.37	
21	Number of VPs	2.60	1.19	-0.12	-0.01	0.01	0.08	0.04	-0.05	0.01	-0.17

[a] n = 11,439 for all variables except those which proxy for IPA and Compensation complexity dispersion, where n = 5,620.
[b] All correlations greater than 0.02 in absolute value are statistically significant at the 5% level (except for those which relate to IPA and compensation complexity dispersion, which are statistically significant at 5% when greater than 0.03 in absolute value).
[#] 1 = Firm grants IPAs to at least one executive; 0 = Firm grants no IPAs.
[##] 1 = CEO is also chairman of the board; 0 = CEO is not chairman.

Table 2.2 Univariate analyses contrasting TMT incentive differences between treatment firms which experience tariff cuts and control firms

	Total incentive dispersion		Equity incentive dispersion		PPS dispersion		Δ Total incentive dispersion		Δ Equity incentive dispersion		Δ PPS dispersion	
	GINI	CV	GINI	CV	GINI	CV	GINI	CV	GINI	CV	GINI	CV
A: Treatment firms experiencing large tariff cuts												
Mean	0.2147	0.5098	0.2286	0.5493	0.3507	1.1646	-0.0093	0.0125	-0.0093	0.0068	0.0166	-0.0078
SD	0.2066	0.5377	0.2127	0.5489	0.2459	0.4829	0.1798	0.4680	0.1851	0.4749	0.2620	0.4628
Obs.	343	382	343	380	312	333	325	347	326	347	301	315
B: Control firms not experiencing large tariff cuts												
Mean	0.2892	0.6797	0.2952	0.6989	0.3738	1.2024	0.0551	0.1392	0.0533	0.1340	0.0050	0.0150
SD	0.2584	0.6733	0.2573	0.6694	0.2491	0.4829	0.2396	0.6387	0.2405	0.6405	0.2504	0.4462
Obs.	12,060	13,314	12,038	13,275	11,215	12,091	11,127	12,032	11,113	12,005	9,694	10,412
A – B	-0.0745***	-0.1700***	-0.0666***	-0.1496***	-0.0231	-0.0378	-0.0645***	-0.1267***	-0.0626***	-0.1272***	0.0116	-0.0228
S.E.	(0.0141)	(0.0348)	(0.0140)	(0.0347)	(0.0143)	(0.0268)	(0.0134)	(0.0346)	(0.0134)	(0.0347)	(0.0147)	(0.0255)

*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2.3 Pre-trend test

	Treatment firms		Control firms		Diff in mean	S.E.
	Mean	SD	Mean	SD		
TMT total incentive dispersion (GINI)	0.2101	0.1677	0.1967	0.1654	0.0134	0.0146
TMT total incentive dispersion (CV)	0.4631	0.4034	0.4543	0.3907	0.0088	0.0354
TMT Equity incentive dispersion (GINI)	0.2201	0.1663	0.2117	0.1640	0.0084	0.0147
TMT Equity incentive dispersion (CV)	0.4950	0.3975	0.2427	0.3955	0.2523	0.0354

Table 2.4 PSM-DiD regressions modeling the effects of tariff cuts on TMT incentive dispersion[a]

	Δ Total incentive dispersion		Δ Equity incentive dispersion		Δ PPS dispersion	
Variable	GINI	CV	GINI	CV	GINI	CV
Tariff cut	-0.0364**	-0.0691**	-0.0266**	-0.0540*	-0.0442**	-0.0900*
	(0.0169)	(0.0276)	(0.0126)	(0.029)	(0.0189)	(0.0472)
Lagged dep. variable	-0.9825***	-1.1800***	-1.1384***	-1.1888***	-1.2670***	-0.9418***
	(0.1826)	(0.0873)	(0.0909)	(0.074)	(0.1080)	(0.1121)
Lagged firm financial controls:						
Cash	0.8809***	1.3934	0.6206	1.5570	-0.5794	-0.2481
	(0.3320)	(1.0394)	(0.4734)	(1.1576)	(0.4643)	(1.0704)
Firm size	0.0459	-0.0744	-0.0260	-0.0276	-0.1121*	0.0128
	(0.0655)	(0.1063)	(0.0453)	(0.1176)	(0.0574)	(0.1376)
Leverage	0.2234	-0.0381	0.1672	0.2214	0.0184	0.6028
	(0.2638)	(0.4076)	(0.1651)	(0.4351)	(0.2331)	(0.4654)
ROA	-0.4896	-0.3134	-0.0058	-0.0711	0.1988	2.3845***
	(0.4421)	(0.6982)	(0.2840)	(0.7140)	(0.3543)	(0.8279)
Firm risk	0.5154	-4.0470**	-2.0316**	-3.7129**	-0.2149	1.1967
	(0.6201)	(1.6411)	(0.7864)	(1.7630)	(0.8158)	(1.7126)
Tobin's *q*	-0.0229	-0.1316***	-0.0579***	-0.1358***	0.0478*	0.0246
	(0.0142)	(0.0500)	(0.0197)	(0.0515)	(0.0257)	(0.0715)
Lagged corporate governance controls:						
CEO duality	0.0779	0.1451*	0.0596	0.1161	0.0952	0.1111
	(0.0538)	(0.0870)	(0.0464)	(0.0952)	(0.0614)	(0.0813)
CEO tenure	-0.0005	0.0017	-0.0007	-0.0073	0.0178	-0.0197
	(0.0056)	(0.0218)	(0.0082)	(0.0218)	(0.0108)	(0.0247)
CEO tenure^2	0.0003	0.0009	0.0005	0.0011	-0.0007**	0.0004
	(0.0004)	(0.0013)	(0.0005)	(0.0013)	(0.0004)	(0.0012)
Insider ownership	0.6172	8.3610*	3.5853*	8.3725*	-1.2266	1.1970
	(0.8332)	(4.9468)	(1.9057)	(4.4865)	(0.9767)	(2.9061)
Insider ownership^2	1.0130	-15.0383	-6.8387	-15.3806	0.0212	1.0916
	(2.4631)	(12.5853)	(4.9514)	(11.5331)	(1.8499)	(6.7499)
Number of VPs	0.0200	0.1632***	0.0592***	0.1514***	0.0298	-0.0585
	(0.0157)	(0.0427)	(0.0191)	(0.0430)	(0.0286)	(0.0393)
Constant	-0.1820	-0.0595	-0.0759	-0.5814	1.4124***	1.3938
	(0.4980)	(1.8987)	(0.8055)	(1.9593)	(0.4224)	(1.1393)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.607	0.737	0.704	0.755	0.736	0.633
Obs.	502	502	502	502	480	502

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

To test Hypothesis 2.2, which predicts that the negative effect of exogenous increases in product market competition on TMT incentive dispersion will be stronger for more innovative firms, Table 2.5 contains regressions which use my *Innovative* variable to moderate the effect of tariff cuts on my measures of TMT incentive dispersion. As I predict, the interaction coefficient is negative and significant (e.g. when using *GINI* to capture total incentives, $b = -0.0060$; $p < 0.05$), across each of my regressions except in the case where I use *CV* to measure total incentive dispersion. Figure 2.1 contains a plot of the interaction. While total incentive dispersion in low innovation firms appears flat to moderately increasing, high innovation firms experience a sharp decline in incentive dispersion following a tariff cut, supporting Hypothesis 2.2.

Finally, I examine Hypothesis 2.3, that the negative effect of exogenous increases in product market competition on TMT incentive dispersion will be stronger for more diversified firms. Table 2.5 shows regressions using my *Diversified* variable to moderate the effect of tariff cuts on my measures of TMT incentive dispersion. As predicted, the coefficient on the interaction term is negative and significant (e.g. when using *GINI* to capture total incentives, $b = -0.0189$; $p < 0.05$), across each of my regressions except in the case where I use *CV* to measure pay-performance sensitivity. Figure 2.2 illustrates a plot of the interaction. While total incentive dispersion in relatively under-diversified firms is lower prior to a tariff cut, this relationship reverses following tariff cuts such that highly diversified firms experience a sharp decline in, and lower overall incentive dispersion following a tariff cut, consistent with Hypothesis 2.3.

Table 2.5 Moderating effects of innovation and business diversification on the relationship between large tariff cuts and TMT incentive dispersion

	Δ Total incentive dispersion		Δ Equity Incentive dispersion		Δ PPS		Δ Total incentive dispersion		Δ Equity Incentive dispersion		Δ PPS	
Variable	GINI	CV	GINI	CV	GINI	CV	GINI	CV	GINI	CV	GINI	CV
Innovative × Tariff cut	-0.0060**	0.0023	-0.0096*	-0.0207**	-0.0141*	-0.0054**						
	(0.0029)	(0.0089)	(0.0052)	(0.0082)	(0.0078)	(0.0025)						
Diversified × Tariff cut							-0.0189**	-0.0308**	-0.0167*	-0.0340**	-0.0931***	-0.0110
							(0.0087)	(0.0139)	(0.0087)	(0.0143)	(0.0316)	(0.0112)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main effects#	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.892	0.824	0.872	0.888	0.797	0.912	0.805	0.817	0.797	0.791	0.946	0.791
Observations	244	226	280	218	250	250	446	336	446	350	280	336

Robust standard errors clustered by three-digit SIC are in parentheses.
Main effects are *Tariff cut*, and *Innovative* and *Diversified*, which are respectively only included in the models where they are used to moderate the relationship between tariff cuts and TMT incentive dispersion.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

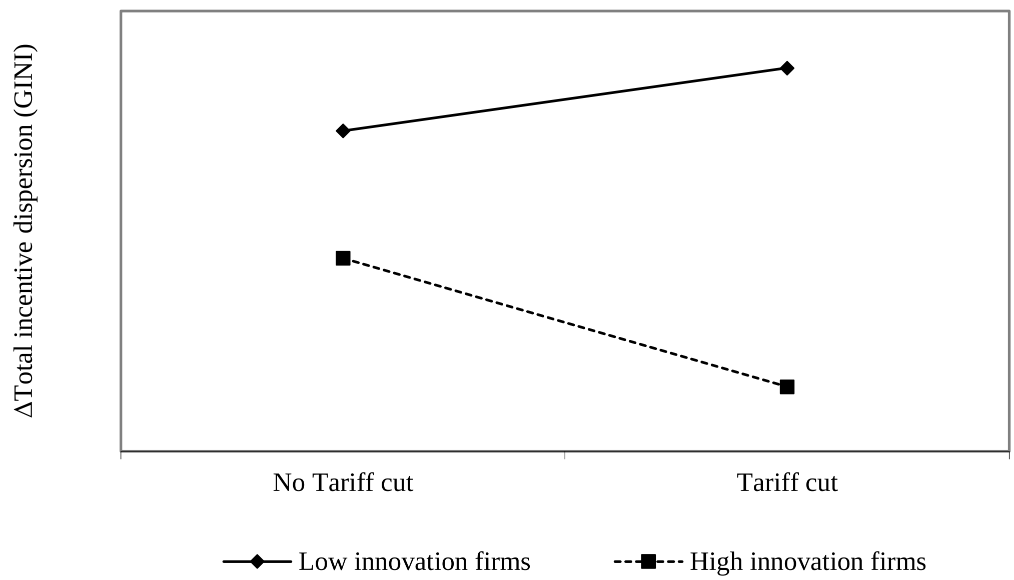

Figure 2.1 Moderating effect of innovation on the relationship between large tariff cuts and TMT incentive dispersion

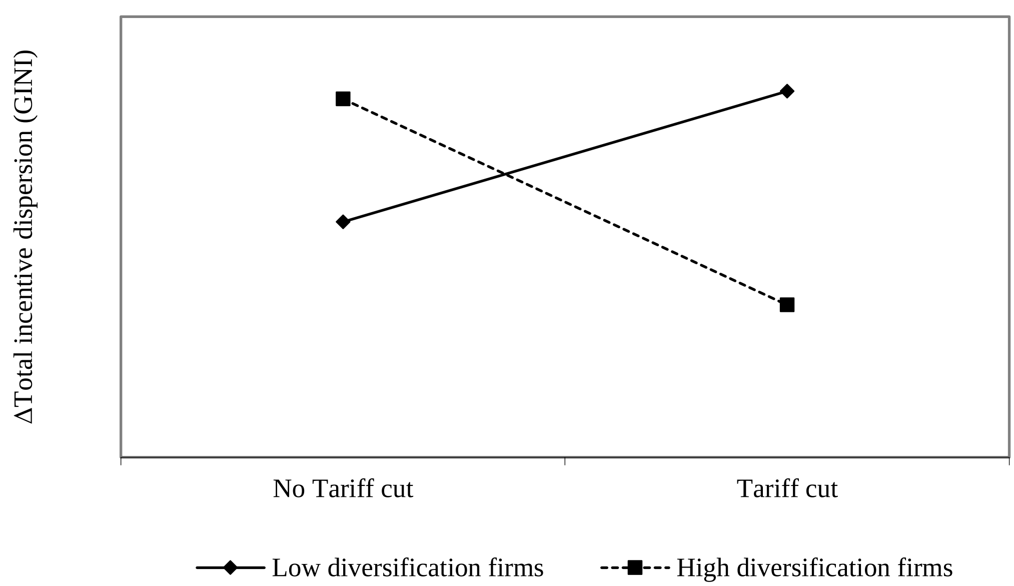

Figure 2.2 Moderating effect of diversification on the relationship between large tariff cuts and TMT incentive dispersion

2.5 Supplementary results

I further examine if other aspects of TMT compensation react similarly to tariff cuts in line with my results on the spread in absolute, dollar-based compensation among TMT members. Table 2.6 contains models where the dependent variables are measures for differences in the use of individual performance awards (IPAs) and the dispersion of compensation complexity. The results show that firms reduce their use of IPAs and also significantly reduce the dispersion in compensation contract complexity among TMT members following tariff cuts. For instance, I find that tariff cuts are associated with a significantly lower incidence of firms using complex compensation when complexity is measured as the standard deviation of the number of incentive packages offered to executives ($b = -0.1538$; $p < 0.05$). These results offer additional support for Hypothesis 2.1, showing that exogenous increases in product market competition not only lead to lower dollar-based TMT incentive dispersion, but also lower dispersion of compensation complexity and a reduced use of individual awards.

Table 2.6 Robustness tests for the relationship between large tariff cuts and TMT compensation complexity

	Δ Individual performance awards		Δ Dispersion of compensation contract complexity		
Variable	Dummy	Percentage	Index CV	Diversity	Incentives SD
Tariff Cut	-0.1018***	-0.0072**	-0.0554*	-0.0242***	-0.1538**
	(0.0284)	(0.0029)	(0.0300)	(0.0078)	(0.0600)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	SIC3	SIC3	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
PSM	No	No	Yes	Yes	Yes
R-squared	0.282	0.223	0.758	0.584	0.878
Observations	2,670	5,808	146	470	190

Robust standard errors clustered by three-digit SIC are in parentheses.

Although my results suggest that product market competition is linked with decreased TMT incentive dispersion, it is not clear to what extent this relationship benefits firms. To shed some light on this question I use my matched sample to perform auxiliary analyses which examine changes in the financial performance of treated versus control firms around tariff cut events. Specifically, I look at changes in three-year Tobin's *q* for firms which reduce TMT incentive dispersion by relatively more and contrast this difference against control firms from my matched sample. The results, which compare firms in the first and third terciles for reductions in TMT incentive dispersion, suggest that treated firms, which reduce TMT incentive dispersion most, perform significantly better than matched control firms with similar characteristics over the same time period (see Table 2.7). For instance, when TMT incentive dispersion is measured using *GINI* of total incentives, I find that *q* is significantly larger for firms which reduce dispersion by more following a tariff cut ($\Delta q = 0.4071$, $p < 0.05$), and that this difference is also significantly larger relative to the corresponding difference for my set of control firms ($\Delta q = 0.3847$, $p < 0.01$). This latter DiD result remains significant if I capture total incentive dispersion using *CV*, or if I look at either equity-only incentives or pay-performance sensitivity. Finally, I note that for total- and equity-only incentives, *q* improves monotonically across terciles as firms make greater reductions in TMT incentive dispersion. Overall, these results suggest that firm value is related to incentive dispersion such that firms which experience greater reductions in the spread of TMT incentives following a product market shock subsequently perform better.

Table 2.7 The effect of reduced incentive dispersion on firm performance[#]

	Incentive Terciles	Δ Tobin's *q*			
		Treatment (GINI)	Control (GINI)	Treatment (CV)	Control (CV)
Δ Total incentive dispersion	1st	0.2749	-0.0481	0.2991	-0.0487
	2nd	0.1471	0.1013	0.1577	-0.0061
	3rd	-0.1322	-0.0705	-0.1679	-0.1050
	1st - 3rd	0.4071**	0.0224	0.4670**	0.0563
	S.E.	(0.1830)	(0.1056)	(0.1833)	(0.1541)
	T-C##	0.3847***		0.4107***	
	S.E.	(0.0239)		(0.0282)	
Δ Equity incentive dispersion	1st	0.3441	-0.0505	0.3428	-0.0167
	2nd	0.0986	-0.0052	0.1639	-0.0697
	3rd	-0.1464	-0.1031	-0.2033	-0.0710
	1st - 3rd	0.4905***	0.0526	0.5461***	0.0543
	S.E.	(0.1808)	(0.1529)	(0.1816)	(0.1574)
	T-C##	0.4379***		0.4918***	
	S.E.	(0.0272)		(0.0281)	
Δ PPS dispersion	1st	-0.2220	-0.4042	0.0432	-0.1320
	2nd	-0.0758	-0.2043	0.2258	-0.0197
	3rd	-0.1726	-0.2917	0.1077	0.0169
	1st - 3rd	-0.0494	-0.1125	-0.0645	-0.1489
	S.E.	(0.1639)	(0.1731)	(0.1654)	(0.1033)
	T-C##	0.0631**		0.0844***	
	S.E.	(0.0268)		(0.0221)	

[#] Values represent the difference in Tobin's *q* after a *Tariff cut* (3-year average *q* after a *Tariff cut* minus 3-year average *q* before a *Tariff cut*) in the first, second and third terciles of changes in TMT incentive dispersion after a *Tariff cut* (3-year average TMT incentive dispersion after a *Tariff cut* minus 3-year average TMT incentive dispersion before a *Tariff cut*). The sample in this table is the same as the matched sample in Table 2.3.
[##] Treatment – Control.
[*], [**] and [***] indicate significance at the 10%, 5% and 1% levels, respectively.

2.6 Discussion

This study examines whether firms use TMT incentive dispersion as a strategic lever in response to exogenous changes in product market competition. I extend existing research on social comparison theory that shows reduced incentive dispersion increases TMT cooperative behavior to argue that firms faced with greater PMC also have an incentive to reduce TMT incentive dispersion because fostering improved cooperation among TMT members will enable firms to respond more quickly to external threats. I test my prediction on a large sample of manufacturing firms using PSM-DiD regressions, which allow me to isolate the causal effect of PMC on TMT incentive dispersion, and find support for this reasoning. Tariff cuts are associated with significantly lower dispersion in several TMT incentive measures, including total- and equity-only incentives, and pay-performance sensitivity. Moreover, I find lower TMT incentive dispersion is subsequently associated with increased firm value relative to peer firms. These results are consistent with the notion that firms can use the spread of compensation among executives as a strategic tool when managing threats in their operational environment, supporting and even increasing firm value relative to peers who do not.

My results add to the literature on TMT incentives and social comparison theory (e.g. Henderson and Fredrickson, 2001; Fredrickson et al., 2010). In particular, I show not only that firms can use the distribution of incentives among TMT members strategically, but also that this can occur in response to firm-exogenous stimuli such as increased PMC. This finding complements existing studies on SCT, which emphasize the role of interpersonal dynamics among TMT members within firms (Gartenberg and Wulf, 2017; Ridge et al., 2017), and suggests that SCT might have utility beyond this context because some firms also act in line with SCT when managing their responses to external events.

In addition, I further theorize and show that my results are particularly relevant for more innovative and more diversified firms. Prior research shows that innovative and diversified firms generally operate in more dynamic market segments (Bourgeois and Eisenhardt, 1988), place added information processing requirements on TMTs (Henderson and Fredrickson, 1996), and as a result, have particular need for coordinated and cooperative TMTs (Bushman et al., 2016; Hill et al., 1992; Michel and Hambrick, 1992; Siegel and Hambrick, 2005). Such firms are therefore potentially more vulnerable to PMC shocks, and consequently have greater need for coordinated decision making and quick strategic responses to outside threats. Indeed, I find that innovative and diversified firms are more likely to undertake greater reductions in TMT incentive dispersion, consistent with my argument that these firms are among those which stand to gain the most from cooperative and coordinated executives when confronted with a more competitive product market.

One limitation of my study is that I am unable to observe and aggregate the firm-specific mechanisms by which individual firms implement lower TMT incentive dispersion. That is, while I take several measures of TMT incentive dispersion, each is an outcome of internal firm processes (e.g. compensation committee meetings), for which data are not readily available, but which may result in differences in executive compensation amounts and items across firms. To at least partially address this, my supplementary analyses examine measures of compensation complexity based on the use of individual performance awards and the dispersion in overall compensation complexity, captured as a function of the number of compensation components offered at a firm level (Albuquerque et al., 2018). Consistent with my main results on incentive-based pay and pay-performance sensitivity, I find that firms also look to reduce differences among executives in terms of their compensation complexity following a PMC shock. These results suggest it is unlikely that there are any significant firm-specific differences in executive compensation not captured in my empirics.

Finally, I pose that TMT incentive dispersion is only one strategic lever available to firms as they face tariff reductions and subsequently increased competitive pressures. For instance, Guadalupe and Wulf (2010) show that competition stemming from trade liberalization also leads firms to flatten their corporate hierarchies, while Flammer (2015) demonstrates that firms can respond by increasing their engagement in CSR. Future research could therefore examine the interplay between TMT incentive dispersion and other characteristics of organizational design, which firms use strategically following PMC shocks, to integrate and advance my understanding of whether compensation and other policies work in unison as complements of one another, or as substitutes for one another.

2.7 Conclusion

This article investigates how increased product market competition affects TMT incentive dispersion. Using large tariff cuts to identify exogenous changes in competition, I build on the social comparison perspective of TMT compensation to extend my understanding of how firms react to adverse events in their operating environment and the role of TMT incentives. My results show that firms use the spread of compensation to incentivize cooperation among executives during periods of increased competition, consistent with my expectation that firms need to respond with urgency to new market entrants, and in turn that this is associated with increased firm value. These findings have important implications for both researchers and practitioners. Most notably, my findings suggest that the internal distribution of incentives among executives, and the subsequent interpersonal implications for TMTs, can be strategically used by firms in response to external markets.

Chapter 3: The effect of product market competition on CEO power

3.1 Introduction

Chief Executive Officers (CEOs) are the most dominant decision-makers within firms. Firms empower CEOs in order to reduce communication costs and improve operating efficiency so that they can promptly respond to uncertainty (Nickell, 1996; Schmidt, 1997). CEOs, however, have a personal incentive to utilize their power for private benefits rather than shareholder value (Bebchuk and Fried, 2004; Grinstein and Hribar, 2004). Moreover, powerful CEOs are generally associated with weak corporate governance (Bebchuk et al., 2009, 2011; Khanna et al., 2015) such that it is difficult to mitigate this agency issue with internal governance mechanisms. In this case, can product market competition play an external role in disciplining CEO power? Casual observations indicate this possibility. Consider Facebook, seemingly a monopoly that dominates the social media market. Its founder and the CEO, Mr. Zuckerberg, remains in his position even after the Cambridge Analytica Scandal. In contrast, the co-founder and former CEO, Mr. Kalanick, of Uber, a leader in the competitive ride-sharing service market, was forced to resign in June 2017 due to discrimination issues in the organization and following the #DeleteUber campaign. These two examples suggest that CEOs of firms that face more direct competition, such as in the case of Uber, may savor less power. In this study, I formalize this idea to establish my primary hypothesis that product market competition (PMC) shapes CEO power.

CEO dominance, on the one hand, is subject to agency costs that reduces firm value (Liu and Jiraporn, 2010; Bebchuk et al., 2009, 2011; Chen et al., 2013; Khanna et al., 2015; Vo and Canil, 2019). Since PMC serves as an external disciplining mechanism and improves the efficiency of firms (Giroud and Mueller, 2010, 2011; Chhaochharia et al., 2017), stronger PMC should reduce CEO power. However, the ability to respond fast to market conditions is considered a competitive advantage for firms and granting CEOs more power can reduce the implementation time for corporate decision making (Cuñat and Guadalupe, 2005; Li et al., 2019). As such, powerful CEOs can benefit firms, especially in the presence of heightened competition in the product market.

Furthermore, the effect of PMC on CEO power may crucially depend on the internal governance of firms. Adams et al. (2005) argue that powerful CEOs can sometimes display very poor performance, and yet in other cases excellent performance, depending on corporate governance and the firm's corporate information environments. Chhaochharia and Grinstein (2007) and Bebchuk et al. (2009) contend that in the absence of corporate governance, agency problems are more likely to arise and adversely affect firm value. Moreover, Allen and Gale (2000), Giroud and Mueller (2010, 2011), and Chhaochharia et al. (2017) show that corporate governance regulations have a greater impact in firms with less competitive product markets.

The above research leads me to posit that a significant moderating force in the relationship between PMC and CEO power is when the firm is more prone to agency problems. In particular, given that CEO power can potentially inflate agency issues, one reaction to increased PMC is for the firm to reduce CEO power when the firm's internal corporate governance structure is weak. The reason being that with increased competition, there is a greater motivation for the firm to resolve agency issues in order to remain competitive in the new environment. Conversely, if firms already have good corporate governance, then there is less need to worry about the CEO using their power for private benefits. Indeed, in the presence of good corporate governance there can be an advantage in providing CEO's with power as additional CEO power will allow for firm management to respond more quickly to uncertainty and profitability changes triggered by PMC (Cuñat and Guadalupe, 2005; Gaspar and Massa, 2006; Li et al., 2019). Therefore, given the above arguments, I postulate additional hypotheses around the notion that the impact of PMC on CEO power will be more pronounced where firms are more likely to be exposed to agency problems, such as in the case where they have weak internal corporate governance.

To test the above hypotheses, I utilize the data of firms in the manufacturing sector (SIC 200–399) from the S&P 1500 for the period of 1992 – 2016. I follow Adams et al. (2005) and focus on managerial structural power. This captures the aspect of the dominance of the CEO over the other executives.[5] Specifically, I use the relative compensation of the CEO to that of the other top executives within a firm, i.e., the CEO pay slice (CPS) and CEO pay gap, to capture CEO power. These proxies are arguably more objective and capture more information of CEO power than other proxies utilized in the literature (Liu and Jiraporn, 2010; Bebchuk et al., 2011; Chen et al., 2013; Jiraporn, Liu & Kim, 2014; Vo and Canil, 2019). The argument for using this measure is that a higher relative compensation that the CEO has to the other executives is a signal that the CEO will likely be less dependent on the other executives to determine and execute decisions, implying higher CEO power. While it can also be argued to capture efficient contracting (Bugeja, Matolcsy & Spiropoulos, 2017), it has been used in the literature to examine the impact of CEO power on dividends and stock repurchases (Chintrakarn, Chatjuthamard & Jiraporn, 2018), capital structure (Jiraporn, Chintrakarn & Liu, 2012), independent directors (Jiraporn, Jumreornvong, Jiraporn & Singh, 2016) and corporate social responsibility (Jiraporn and Chintrakarn, 2013). It has also been used as a measure to examine the impact that say on pay laws have on managerial pay gaps (Correa and Lel, 2016).

[5] Finkelstein (1992) identifies four sources of CEO power: structural power, ownership power, expert power, and prestige power. Structural power is most commonly cited in the literature on organizations (e.g., Adams et al., 2005; Liu and Jiraporn, 2010; Bebchuk et al., 2011).

I employ the Herfindahl-Hirschman index (HHI) – the concentration in the market – and the Lerner Index – the reverse of the price elasticity of demand – to capture the degree of PMC (Gaspar and Massa, 2006). The lower the HHI and Lerner Index is, the more intensified competition there will be in the product market.

To deal with potential sample selection bias that can arise from the fact that firms in high PMC environments may have different characteristics relative to those firms in low PMC environments, I match my high and low HHI/Lerner Index cohort of firms by a number of firm characteristics. Using regression analysis, I examine the effect of PMC on CEO power and, consistent with the agency theory of CEO power and the disciplining role of PMC, I find a statistically and economically significant and negative relationship between the level of PMC and CEO power. For example, CPS increases by approximately 8% and 6% when comparing firms in a low PMC environment (measured by HHI and Lerner Index, respectively) to a high PMC environment.

A methodological concern for my regression analysis is that it may suffer from omitted variable bias. It is possible that both the level of PMC and CEO power can be related to unobservable factors, leading to a spurious relation between them. Another concern is reverse causality. CEO power may influence PMC. For example, less powerful CEOs may be under pressure to act more aggressively, such as raising sales and excessively increase investment to improve firm performance, which can all lead to higher competition. To mitigate these potential endogeneity problems, I use two identification strategies to test the robustness of my baseline results.

My first identification strategy is to employ an instrumental variable (IV) approach. Specifically, I use HHI and the Lerner Index of firms on their IPO dates as an instrument for firms' HHI and Lerner Index, respectively, and then conduct a two-stage least squares regression analysis. HHI and the Lerner Index of firms on their IPO dates represent the level of PMC in the earliest years, which could not have resulted from CEO power in the subsequent years and thus reduce the possibility of reverse causality.

My second identification strategy is to utilize tariff reductions as a quasi-natural experiment and run a propensity-score-matching-difference-in-differences (PSM-DiD) regression. Specifically, I first perform a PSM analysis to control for the differences in firm attributes between my treatment and control firms. Treatment firms are those firms that experience a large import tariff cut. I then employ tariff reductions as an exogenous shock that shifts PMC for my treated firms. I find my baseline results are robust to the instrumental variable estimation and the PSM-DiD analysis.

To test the impact that firm agency problems have in moderating the relationship, I conduct sub-sample analyses. I focus on how management entrenchment, as captured through the E-index (Bebchuk et al., 2009), CEO ownership, and analyst coverage moderate the impact of PMC on CEO power. I also follow Garvey and Milbourn (2006) and compare instances where firms experience good or bad luck (i.e. windfall performance). I find that PMC only has a significant effect on CEO power for firms with poor corporate governance, with a weak information environment, and experiencing good luck. My findings support the notion that PMC works as a substitute for corporate governance in disciplining CEO power, where the firm is more likely to be exposed to agency problems.

This study contributes to the literature on agency problems of powerful CEOs. Bebchuk and Fried (2004) and Morse et al. (2011) show that CEO power dampens the efficiency of managerial incentive schemes. Grinstein and Hribar (2004) find that powerful CEOs tend to engage in larger deals relative to the size of their own firms, and the market reactions to their acquisition announcements tend to be more negative. Liu and Jiraporn (2010) and Chen et al. (2013) find that firms with powerful CEOs have a higher cost of debt and equity, respectively. Bebchuck et al. (2011) document that firms with powerful CEOs are associated with lower profitability and firm value. Khanna et al. (2015) show that CEO power arising from appointment decisions are more likely to be associated with fraud and interfere with the detection of fraud. Vo and Canil (2019) argue that powerful CEOs can influence the pay-setting process such that they can get larger compensation. My results complement these prior studies by highlighting that market power works as a substitute for corporate governance in disciplining CEO power prone to agency problems.

This study also contributes to the literature on the effect that PMC has on managerial incentives and corporate governance. Among others, Aggarwal and Samwick (1999) show that firms in more competitive industries place more weight on rival firm performance than their own firm performance when designing their executive compensation. Cuñat and Guadalupe (2005) find that a higher level of product market competition increases the pay-performance sensitivity of compensation schemes for CEOs. Chhaochharia et al. (2017) and Giroud and Mueller (2010) utilize exogenous shocks to corporate governance and find that corporate governance has a stronger positive impact on firm efficiency when the market is more concentrated. Li et al. (2019) find that in high demand product markets where firms are facing entry threats, investors react more favorably to the announcements of granting more power to CEOs. Dasgupta et al. (2018) document that the likelihood of forced CEO turnover and its sensitivity to performance increases with competition shocks induced by tariff cuts. Tang (2018) extends Giroud and Mueller (2010) by highlighting the role of performance correlations. I complement this prior literature by showing how CPS and CEO pay gap, the relative pay within a firm, is affected by PMC and how corporate governance moderates this relationship.

The rest of the chapter is organized as follows. Section 3.2 reviews the theory and develops hypotheses. Section 3.3 describes the data and summary statistics. Section 3.4 shows the regression results. Section 3.5 conducts robustness tests. Section 3.6 presents the subsample analysis and section 3.7 provides a conclusion.

3.2 Hypotheses Development

In this section, I develop my hypotheses based on the agency theory of CEO power and the disciplining role of PMC. While CEO dominance is a crucial determinant of corporate decisions, powerful CEOs are prone to a variety of shareholder-management agency conflicts. These agency conflicts result in excessive corporate acquisition decisions (Grinstein and Hribar, 2004), rigged executive compensation designs (Bebchuk and Fried, 2004; Morse et al., 2011; Vo and Canil, 2019), negative impacts to firm value and profits (Bebchuck et al., 2011), higher financing cost of capital for firms (Liu and Jiraporn, 2010; Chen et al., 2013), and greater likelihood of corporate fraud (Khanna et al., 2015). These indicate that CEO power is subject to a variety of agency costs and may thus lead to adverse consequences that, overall, adversely affect firm value.

Tracing back to Smith (1776), it has long been argued that competition in the product market plays a disciplining role in moderating agency problems. Nalebuff and Stiglitz (1983) show that if the shocks affecting firms in an industry are common rather than firm-specific, the performance of competitors allows shareholders to make inferences about these shocks. An increase in competition generates additional information that can be used to reduce moral hazard. Hart (1983) also argues that product market competition reduces potential free cash flow and limits the amount of managerial slack if the shocks are industry-wide, but not if they are independent across firms. Nickell (1996) contends that firms' productivity grows when more players compete in the market. Schmidt (1997) shows that PMC increases the probability of liquidation and thus incentivizes managers to work harder to survive. Raith (2003) argues that competition makes it easier to steal product demand from rivals and thus incentivizes managers to exert more effort. Intensified PMC also implies that firms operate in a risky environment (Hou and Robinson, 2006). Shareholders will therefore have stronger incentives to scrutinize the decisions of the CEO, leading to lower CEO power. Also, Kim and Lu (2011) show that the relation between CEO ownership and firm valuation hinges critically on the degree of industry concentration. All these studies point to PMC being an external mechanism that can improve firms' operating efficiency and mitigate agency problems inside firms. This leads me to my first hypothesis:

Hypothesis 3.1 CEO power declines with the level of product market competition.

External governance plays a more significant role when internal governance is poor (Bruno and Claessens, 2010; Kim and Lu, 2011). As such, PMC can work as a substitute for corporate governance to mitigate agency problems. Giroud and Mueller (2010) report that after the enforcement of business combination laws, that weakens anti-takeover provisions, those firms in non-competitive industries tend to experience a decline in operating performance whereas those in more competitive industries do not.[6] This shows there is an important association between PMC and corporate governance. Giroud and Mueller (2011) show that firms with weak governance have lower equity returns in non-competitive industries. Chhaochharia et al. (2017) also present evidence that firm operating performance improves after the implementation of the Sarbanes-Oxley Act (SOX), which implies stronger corporate governance, and this result is more pronounced when firms face less competition in the product market. Dasgupta et al. (2018) find that the probability of forced CEO turnover increases when PMC intensifies, and this effect is more pronounced for firms with poor governance. In line with these arguments, my second hypothesis is:

Hypothesis 3.2 The effect of PMC on CEO power is stronger for weakly-governed firms

[6] Tang (2018) extends Giroud and Mueller (2010) by showing that PMC improves firm performance after the enforcement of business combination laws only when firm performance is highly correlated with the industry performance or when firms compete in Bertrand-style competition.

Other than corporate governance, a number of other factors can reduce agency issues. Jensen and Meckling (1976) suggest that CEO ownership can reduce agency problems since it encourages the CEO to act in the interest of shareholders. Moreover, Mehran (1995) reports that firms use equity-based pay to monitor CEOs' performance and balance the percentage of equity-based pay to their CEOs with the percentage of equity holdings and that firms use less equity-based pay when there is more monitoring from blockholders. Kim and Lu (2011) find that CEO ownership is positively correlated with firm performance and is a substitute for external governance (e.g. PMC). As such, firms with low CEO ownership may be more subject to agency problems. In line with these arguments, my third hypothesis is:

Hypothesis 3.3 The effect of PMC on CEO power is stronger for firms with low CEO ownership.

I also consider how the information environment, proxied by analyst coverage, moderates the relation between PMC and CEO power. Financial analysts can be considered as an external monitor of executives (Jensen and Meckling, 1976) because they can reveal corporate fraud due to their ability to access corporate information (Healy and Palepu, 2001; Dyck, Morse & Zingales, 2010). Yu (2008) documents that firms with more analysts following tend to manage their earnings less. Moreover, stocks with intensive analyst coverage are more informative (Hong, Lim & Stein, 2000), thereby reducing information asymmetry (Chang, Dasgupta & Hilary, 2006). As such, analyst coverage can strengthen corporate governance and reduce information asymmetry. This implies that firms with low analyst coverage are more prone to agency problems. Following these arguments, my fourth hypothesis is:

Hypothesis 3.4 The effect of PMC on CEO power is more pronounced for firms with low analyst coverage.

Finally, I examine the moderating effect of luck on the relationship between PMC and CEO power. Bertrand and Mullainathan (2001) find that CEOs are rewarded by luck, which is defined as changes in firm performance that is out of the CEO's control, and that well-governed firms design managerial compensation more efficiently than weakly-governed firms. However, it is not clear if CEOs influence the payment setting and enjoy pay-for-luck since they may also suffer when firms experience bad luck. Garvey and Milbourn (2006) further investigate this issue and find that CEOs enjoy higher pay when firms experience good luck. This problem is also amplified when firms have weak governance. The evidence of Cheng and Indjejikian (2009) support this notion by showing that CEO pay increases when firms experience good luck, but incentives are not rewarded based on skills. This indicates that CEOs are more likely to attribute success to themselves and utilize their power for opportunistic gains when firms experience windfall performance. As PMC disciplines CEO power, I conjecture that it will also balance incentive payments by reducing the power that allows CEOs to benchmark their performance against criteria that fit their own interest when firms experience good luck.

Hypothesis 3.5 The effect of PMC on CEO power is more pronounced when the firm experiences good luck.

3.3 Data and summary statistics

My sample comprises of the S&P 1500 firms in the manufacturing sector (SIC 200–399) for the period of 1992–2016. I obtain the number of vice presidents in firms and CEO characteristics, such as their compensation, whether they serve as both a CEO and as chairman of the board (i.e. CEO chair duality), CEO ownership, and tenure from ExecuComp. Firm's financial and stock price data are from Compustat and CRSP. I use data from the Institutional Shareholder Services (ISS – formerly RiskMetrics) to construct the *E-index*, which I use to proxy for the corporate governance of the firm. Analyst coverage data is obtained from I/B/E/S. I restrict my sample to only include observations where CEOs serve in their position for at least one fiscal year. My final sample consists of 1,329 unique firms and 14,591 firm-year observations.

In line with Adams et al. (2005), I focus on managerial structural power, the power of the CEO over the top executive team. Specifically, following Liu and Jiraporn (2010), Bebchuk et al. (2011), Chen et al. (2013), Jiraporn et al. (2014), and Vo and Canil (2019), I proxy CEO power by the relative compensation of the CEO to the other top executives' compensation in the firm, which can be captured by CEO pay slice (*CPS*). *CPS* is defined as the ratio of the CEO's total compensation to the summation of the top five executives' compensation. Total compensation is from item TDC1 in ExecuComp, which includes salary, bonus, other annual, restricted stock and stock option grants, long-term incentive payouts and all other total compensation. Bebchuk et al. (2011) clarify the advantages of using CPS in that it captures CEO power more objectively than, say, CEO chair duality, and that it inherently controls for firm-specific characteristics that influence compensation.[7]

I also consider an alternative measurement of relative compensation that being a dummy variable to capture the pay gap CEOs have relative to the top management team. CEO pay gap is defined as the difference between CEO total compensation and the median of total compensation of the top five executives (Vo and Canil, 2019). To complement my first measure, *CPS*, which is a continuous variable, I capture *CEO pay gap* as a dummy variable to split the sample of firms between those with a high and low pay gap. *CEO pay gap* is equal to one if the pay gap is greater than the industry median for any given year, and zero otherwise. I classify industries within the manufacturing sector based on their three-digit SIC.

[7] Some studies use CEO chair duality as a proxy of CEO power (for example, for example, Adams et al., 2005; Li et al., 2019; Morse et al., 2011). I include CEO chair duality as a control variable in my analysis.

For my regression analysis, I capture the level of PMC, the independent variable of interest, using the Herfindahl-Hirschman index (*HHI*) and the *Lerner Index*. The *HHI* measures industry concentration (Gaspar and Massa, 2006). The higher the industry concentration, the less competition in the product market. The *HHI* is computed as the sum of the squared market share of firms in each year and in each industry based on their three-digit SIC. The market share is calculated from the sales item in Compustat. My alternative measure of PMC, the *Lerner Index*, is a measure of the market power of a firm. Higher market power implies a lower price-elasticity of demand and less competition in the product market. The *Lerner Index* is calculated by first dividing earnings before interest, taxes, depreciation and amortization (EBITDA) by sales.

I include both firm financial and corporate governance control variables that may relate to CEO power. *Cash holdings* and *Leverage* affect CEO entrenchment and risk-taking behavior (Berger, Ofek and Yermack, 1997; Liu and Mauer, 2011). In addition, along with the argument that the decision on these corporate policies may influence the risk of firms, Adams et al. (2005) show that powerful CEOs influence corporate performance variability. Hence, I include the standard deviation of monthly stock returns (*Stock return SD*), representing firm risk, as a control variable. I include *Firm size* as the logarithm of the book value of total assets. The return on assets (*ROA*) and *Tobin's Q* are also included and are adjusted by the median of the three-digit SIC code that they are in. These measures capture firm performance and firm value, respectively. CEO chair duality and CEO ownership are also associated with CEO power (Finkelstein, 1992). I thus capture *CEO chair duality* through a dummy variable that is equal to one if the CEO also serves as the chair of the company's board, and otherwise zero. *High CEO ownership* is equal to one if the CEO holds 20% or more of the firm's shares, and otherwise zero. *CEO tenure* is the number of years that the CEO serves in the position. *Insider ownership* is the fraction of shares owned by insiders, and the *Number of VP* is the number of vice presidents the firm has, as reported by ExecuComp. Definitions for all the variables are provided in Appendix B.

To ensure I do not suffer from a sample selection bias, as firms from low PMC environments may be characteristically different to those from high PMC environments, I split my sample of firms into low and high *HHI* / *Lerner Index* cohorts (based on median values) and then propensity score match the two groups of firms on a pairwise basis based on *Firm size*, *Leverage*, *ROA* and the standard deviation of stock returns (*Stock return SD*). I set the calipher at 1%. Table 3.1 shows the results from this matching process, providing me with a base sample of 5,182 firm-year observations from 1,086 individual firms. The co-variates used in the matching process are all insignificantly different from zero with the exception of *ROA* for the HHI-split and the standard deviation of stock returns in the Lerner Index-split.

Table 3.1 Descriptive statistics of the matched sample

This table shows the descriptive statistics of the key variables used in the matched sample of S&P 1500 firms in the manufacturing industry (SIC 200 – 399) between 1992 – 2016. Panels A and B present the descriptive statistics of variables used in the matching process using high/low HHI and Lerner Index, respectively. ***, ** and * indicate the significance at the 1%, 5% and 10% levels, respectively.

Panel A

	Low HHI firms			**High HHI firms**			***Diff in mean***	***Standard error (diff in mean test)***
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**		
HHI	0.077	0.068	0.031	0.304	0.235	0.187	-0.227***	0.004
Matched co-variates								
Firm size	7.487	7.279	1.631	7.447	7.315	1.491	0.040	0.043
Leverage	0.189	0.179	0.154	0.190	0.182	0.144	-0.001	0.004
ROA	0.005	0.000	0.084	0.001	0.000	0.061	0.005**	0.002
Stock return SD	0.106	0.094	0.056	0.105	0.090	0.061	0.001	0.002

Panel B

	Low Lerner Index firms			**High Lerner Index firms**			***Diff in mean***	***Standard error (diff in mean test)***
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**		
Lerner Index	0.097	0.105	0.088	0.210	0.189	0.071	-0.113***	0.002
Matched co-variates								
Firm size	7.384	7.250	1.408	7.433	7.323	1.441	-0.049	0.040
Leverage	0.194	0.188	0.144	0.200	0.191	0.167	-0.006	0.004
ROA	0.005	0.000	0.045	0.005	0.000	0.045	0.000	0.001
Stock return SD	0.109	0.097	0.059	0.106	0.091	0.060	0.004**	0.002

3.4 Empirical results

Table 3.2 reports the multivariate regression results for the effect of PMC on CEO power based on the aforementioned matched sample. The level of PMC is proxied by two dummy variables, *High HHI* and *High Lerner Index*, which equals one if the firm is in the high *HHI* / *Lerner Index* cohort, and zero otherwise. Columns 1 and 2 are OLS panel regressions while columns 3 and 4 are logit panel regressions. Columns 1 and 2 shows that *CPS* is greater when the industry is more concentrated (i.e. *High HHI*) and when firms have more market power (i.e. *High Lerner Index*), significant at the 1% level, respectively. CPS increases by approximately 8% and 6% from the mean when the *HHI* and *Lerner Index* shift from the low to the high cohort of firms, respectively.[8] Columns 3 and 4 provide similar results, with the coefficients for *High HHI* and the *High Lerner Index* being positive and significant at the 5% levels.

Overall, the results in Table 3.2 support Hypothesis 3.1 in that CEO power decreases with the level of PMC. This is consistent with the agency theory of CEO power and the disciplining role of PMC. CEOs of firms in a more competitive market seem to lose some of their power.

[8] *CPS* of firms with high *HHI* (*Lerner Index*) is 0.0311 (0.0238) higher than firms with a low *HHI* (*Lerner Index*). The mean of CPS of firms with a low HHI (Lerner Index) is 0.378 (0.380). This implies a proportional change of 8.23% (6.26%) in *CPS* when moving from the low to high sub-samples.

Table 3.2 Multivariate regression analysis with matched sample

This table presents the multivariate regression results of PMC on CEO power from a matched sample of firms from high and low PMC environments. CEO power is proxied by *CPS* and *CEO pay gap*. The intensity of PMC is measured by *HHI* and the *Lerner Index*. The sample is matched between low and high HHI / Lerner Index associated firms. Columns 1 and 2 are OLS panel regressions while columns 3 and 4 are logit panel regressions. Robust standard errors, clustered by the three-digit SIC industry codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	CPS		**CEO pay gap**	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
High HHI	0.0311***		0.7404**	
	(0.0084)		(0.3774)	
High Lerner Index		0.0238***		0.5670**
		(0.0076)		(2.5121)
Cash holding	-0.0093	0.0061	-1.2912**	-0.6642
	(0.0211)	(0.0165)	(0.6524)	(-1.2852)
Firm size	-0.0070*	-0.0023	0.7893***	0.7739***
	(0.0039)	(0.0052)	(0.1103)	(7.1195)
Industry median CPS	0.8088***	0.7394***		
	(0.0466)	(0.0511)		
Industry median CEO pay gap			-0.0001**	-0.0001
			(0.0000)	(-1.0570)
Leverage	-0.0130	-0.0337*	-0.1078	-0.5556
	(0.0163)	(0.0175)	(0.3797)	(-1.5816)
ROA	0.0710**	0.0226	2.8624***	0.3444
	(0.0314)	(0.0210)	(0.7874)	(0.5247)
Stock return SD	-0.0581	-0.0062	-2.7341***	1.0846
	(0.0400)	(0.0283)	(1.0036)	(1.2599)
Tobin's Q	0.0048***	0.0005	0.3015***	0.2169***
	(0.0017)	(0.0013)	(0.0678)	(5.1096)
CEO chair duality	0.0033	-0.0086	0.3857***	0.2470*
	(0.0057)	(0.0060)	(0.1291)	(1.7778)
High CEO ownership	-0.0084	0.0288	-0.4257	-0.1062
	(0.0174)	(0.0286)	(0.5041)	(-0.1606)
CEO tenure	0.0017	-0.0003	0.0292	-0.0077
	(0.0011)	(0.0010)	(0.0201)	(-0.3384)
CEO tenure^2	-0.0001**	-0.0000	-0.0012	-0.0001
	(0.0000)	(0.0000)	(0.0007)	(-0.1510)
Insider ownership	-0.2955***	-0.3851***	-4.4215*	-4.8820*
	(0.1057)	(0.1236)	(2.4316)	(-1.7258)
Insider ownership^2	0.4533***	0.5368***	7.9811*	8.6651
	(0.1697)	(0.2044)	(4.7277)	(1.4091)
Number of VP	0.0056***	0.0004	0.1799***	0.2505***
	(0.0020)	(0.0018)	(0.0485)	(4.5634)
Constant	0.1083***	0.1301***		
	(0.0319)	(0.0482)		
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.183	0.103	0.071	0.065
Observations	5,162	4,630	3,834	3,188

3.5 Robustness Tests

In this section, I examine the robustness of my baseline results. I acknowledge that my multivariate regression analysis is subject to potential endogeneity problems. In particular, they may suffer from omitted variable bias. Although my firm fixed effect regressions alleviate, to an extent, the potential omitted variable bias, the relation between PMC and CEO power may be confounded by unobservable factors, leading to a spurious relation between them. Reverse causality may also be a problem. That is, CEO power may influence PMC. CEOs with less power may have greater pressure from shareholders to improve firm performance, leading them to implement more aggressive corporate policies, such as boosting sales or excessive investment. These firm decisions can, in turn, influence the policies of peer firms (Leary and Roberts, 2014) such that the product market becomes more competitive. This can lead to CEO power causing a change in the competition level of the product market. I alleviate these endogeneity concerns by first employing an instrumental variable (IV) approach and then by utilizing a quasi-natural experiment.

3.5.1 Instrumental Variable Estimation

My first identification strategy is to employ an instrumental variable approach. Specifically, I use HHI and the Lerner Index of firms on their IPO dates as an instrument for firms' HHI and Lerner Index, respectively. HHI and the Lerner Index of firms on their IPO dates represent the level of PMC in the firm's earliest years, which cannot have resulted from CEO power in the subsequent years and thereby reduces the possibility of reverse causality. I conduct the two-stage least squares regression analysis with my prior sample used in my baseline regressions. Columns 1 and 2 of Table 3.3 report the result of the first-stage regressions where the dependent variables are *High HHI* and *High Lerner Index,* respectively. The explanatory variables include the above-mentioned instruments and the same control variables as in the baseline regression. The coefficient estimates for the instruments in the first-stage regressions (1) and (2) are statistically significant at the 1% and 5 % levels, respectively, suggesting my instruments are valid. Columns 3, 4, 5 and 6 of Table 3.3 report the result of the second-stage regressions where the dependent variables are *CPS* and *CEO pay gap*, respectively. The variables of interest are the coefficients with the predicted values of *High HHI* and *High Lerner Index*. All the regression coefficients for *High HHI* / *High Lerner Index* are significant to at least the 5% level and are all positive. This is consistent with my main hypothesis (Hypothesis 3.1).

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Table 3.3 Two-stage least squares

This table presents results from a two stage least squares regression approach where the *HHI* and *Lerner Index* values during the IPO date of each firm is used as an instrumental variable. Firms having an age of less than 10 years are excluded. Columns 1 and 2 are OLS panel regressions while columns 3 and 4 are logit panel regressions. Robust standard errors, clustered by the three-digit SIC industry codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	1st Stage		2nd Stage			
	High HHI	High Lerner Index	CPS		CEO pay gap	
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
High HHI			0.0187**		2.3793**	
			(0.0087)		(1.2005)	
High Lerner Index				0.0196**		0.8905***
				(0.0095)		(0.2337)
IPO HHI	0.8996***					
	(0.3404)					
IPO Lerner Index		0.0008**				
		(0.0004)				
Cash holding	-0.7120***	0.1866***	-0.1250*	-0.0045	-12.3404**	-0.2157
	(0.2459)	(0.0520)	(0.0650)	(0.0194)	(6.1735)	(0.4352)
Firm size	-0.0289	0.0388***	-0.0129**	-0.0069***	0.4028*	0.8036***
	(0.0175)	(0.0040)	(0.0054)	(0.0015)	(0.2333)	(0.0420)
Industry median CPS	-0.0532	-0.1409	0.8361***	0.7799***		
	(0.2443)	(0.1673)	(0.0435)	(0.0470)		
Industry median CEO pay gap	0.0001**	0.0001***			-0.0001*	-0.0004***
	(0.0000)	(0.0000)			(0.0000)	(0.0000)
Leverage	0.3623**	-0.1392***	0.0298	-0.0161	6.7225*	-0.0906
	(0.1438)	(0.0339)	(0.0415)	(0.0125)	(3.6867)	(0.2845)
ROA	0.1262	2.1276***	0.0672	0.1250***	4.4964***	-1.4742**
	(0.1482)	(0.0535)	(0.0457)	(0.0295)	(1.1457)	(0.7019)
Stock return SD	-0.7149**	-0.3832***	-0.1630*	-0.0153	-11.4930**	2.1928***
	(0.3140)	(0.0953)	(0.0866)	(0.0367)	(5.2823)	(0.8312)
Tobin's Q	-0.0129	0.0338***	0.0044	-0.0019	0.0818	0.2174***
	(0.0242)	(0.0041)	(0.0034)	(0.0016)	(0.1120)	(0.0418)
CEO chair duality	0.0210	0.0223*	0.0019	0.0114**	0.7593***	0.2981***
	(0.0410)	(0.0119)	(0.0074)	(0.0045)	(0.2590)	(0.1016)
High CEO ownership	0.0408	0.0044	-0.0132	0.0460**	2.6251**	0.3568
	(0.0730)	(0.0511)	(0.0201)	(0.0193)	(1.2901)	(0.4320)
CEO tenure	-0.0016	0.0009	0.0028**	0.0010	-0.0726**	0.0126
	(0.0035)	(0.0020)	(0.0011)	(0.0008)	(0.0345)	(0.0175)
CEO tenure^2	-0.0001	0.0000	-0.0002***	-0.0000	-0.0009	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0010)	(0.0006)
Insider ownership	1.2959***	0.7266***	0.0512	-0.2770***	25.9898**	-9.7013***
	(0.4281)	(0.2211)	(0.0688)	(0.0811)	(11.5478)	(1.8922)
Insider ownership^2	-2.1874**	-1.5356***	-3.9502***	0.0263	-50.5498**	19.8598***
	(0.8763)	(0.4725)	(1.2680)	(0.1775)	(23.7435)	(4.0049)
Number of VP	-0.0067	-0.0037	0.0047**	0.0097***	-0.1459	0.0196
	(0.0104)	(0.0043)	(0.0018)	(0.0016)	(0.0998)	(0.0385)
Constant			0.3255***	0.1321***		
			(0.1049)	(0.0237)		
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.279	0.569	0.282	0.156	0.047	0.085
Observations	3,518	3,074	3,518	3,074	3,055	2,858

3.5.2. A Quasi-Natural Experiment

My second identification strategy is to utilize large U.S. import tariff reductions as a quasi-natural experiment. The logic behind this is that as trade barriers are lowered after large import tariff reductions, PMC will intensify from increased foreign competition. Hence, the import tariff reductions exogenously shift the competitive environment in the related industries (Bernard, Jensen and Schott, 2006; Fresard, 2010). Importantly, given that tariff reductions are mainly driven by global economics and politics, as well as being regulated under trade agreements (Huang et al., 2017), these tariff reductions are exogenous to the individual CEO's power.

I employ the propensity-score-matching-difference-in-differences (PSM-DiD) approach to analyze the impact of tariff reductions. Specifically, I follow Huang et al. (2017) in identifying the large import tariff reductions I use in my analysis. They must be three times the median of the tariff rate reductions that took place during my sample period. The tariff rate is computed at the three-digit SIC as the ratio of duties collected by U.S. Customs to the free-on-board value of imports. The U.S. import tariff rate data is compiled by Schott (2010) and Peter Schott's website.[9] The list of 53 industries affected by large tariff reductions is presented in Appendix D. I use propensity scores to match control firms, who have not experienced a tariff cut in their three-digit SIC industry, with treated firms, whose three-digit SIC industry does experience a tariff cut, to ensure I am comparing like-for-like firms. Control and treatment firms are matched for the same period and with a caliper of 1%. To ensure I have a sufficient sample of matched firms, I base the propensity scores on the three-year averages of five key co-variates prior to each tariff cut. These are the four co-variates used for matching in the baseline results (*Firm size*, *ROA*, *Stock return SD* and *Leverage*) plus my CEO power measures (*CPS* and *CEO pay*

[9] http://faculty.som.yale.edu/peterschott/sub_international.htm

gap). The effect of the large tariff reductions on CEO power is then analyzed using Equation 3.1, which is similar to Flammer (2015):

$$\Delta CPS/CEO\ pay\ gap_{i,t} = \alpha + \beta \times TariffCut_{i,t} + \gamma' \mathbf{X_{i,t}} + \theta_i + \theta_t + \varepsilon_{i,t}\ , \qquad (3.1)$$

where ΔCPS ($\Delta CEO\ pay\ gap$) is the differences in firms' average *CPS* (*CEO pay gap*) in the three years after large tariff reductions minus that of the three-year average before the large tariff reductions. $TariffCut$ is a dummy variable that is equal to one for treated firms and zero otherwise. **X** is a vector of control variables, θ_i and θ_t are firm and year fixed effects, respectively. The control variables are identical to those used previously with the addition of including the lagged dependent variable, as suggested by Flammer (2015), to control for the level of *CPS/CEO pay gap* between the treated and control firms before the tariff cut occurs.

Panels A and B of Table 3.4 report the descriptive statistics of the five covariates used to match treatment and control firms used in the DiD regression for *CPS* and *CEO pay gap*, respectively. The matching process was successful, with only *ROA* being different across the two groups in Panel A. There is, however, a cost in using large tariff cuts as an exogenous event in that only 299 firms experience it during my sample period (see Appendix D for details). In addition, I lose a few more firms due to matching process thresholds not being met (with the calipher set at 1%). The end result is that I have fewer than 600 firm observations when combining the treatment and control groups.

Column 1 of Table 3.5 reports the result of the DiD regression of the matched sample between changes in *CPS* and *Tariff Cut*. The coefficient of the *Tariff Cut* is -0.0238 and significant at the 1% level. This implies that three years following a tariff reduction, *CPS* of the treated firms decreases by 0.0238. It is worth noting that this result differs from Dasgupta et al. (2018), where they find that CEO pay gap increases after a tariff cut. However, they only consider firms whose CEOs are not sacked after tariff cuts, so their observations are more likely to be restricted to high-ability CEOs.[10] Given that Panel A of Table 3.4 reveals that *CPS* for the treated firms is 0.3399 preceding the tariff reductions, I can infer that following the tariff cuts, *CPS* of the treated firms reduces by 7% relative to the average *CPS* preceding the large tariff reductions. Column 2 of Table 3.5 shows the relationship also holds when the dummy variable *CEO pay gap* is used, although it is now only significant at the 10% level. Taken together, the results from the PSM-DiD analysis corroborate Hypothesis 3.1 that PMC reduces CEO power.

Table 3.4 Exogenous shock: Descriptive statistics

This table utilizes import tariff reductions as exogenous shocks. Treated firms are firms affected by tariff cuts. Control firms are firms that are not affected by tariff cuts. Panels A and B show the descriptive statistics of the three-year averages of variables used in the propensity matching process. Robust standard errors, clustered by three-digit SIC, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Panel A

	Treated firms			**Control firms**			***Diff in mean***	***Standard error (diff in mean test)***
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**		
CPS	0.3399	0.3390	0.0965	0.3464	0.3362	0.0968	-0.0065	0.0081
Firm Size	6.8929	6.7825	1.6616	6.7789	6.5549	1.4671	0.114	0.1308
Leverage	0.1754	0.1528	0.1390	0.1714	0.1506	0.1449	0.004	0.0119
ROA	-0.0163	-0.0014	0.1084	0.0059	0.0000	0.0813	-0.0222***	0.0080
Stock return SD	0.0968	0.0820	0.0462	0.0991	0.0854	0.0485	-0.0023	0.0040

Panel B

	Treated firms			**Control firms**			***Diff in mean***	***Standard error (diff in mean test)***
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**		
CEO pay gap	0.5556	0.6667	0.4252	0.5501	0.5000	0.4256	0.0055	0.0364
Firm Size	6.9220	6.7995	1.6573	6.9229	6.8049	1.4523	-0.0009	0.1334
Leverage	0.1758	0.1528	0.1382	0.1703	0.1636	0.1306	0.0008	0.0039
ROA	-0.0117	-0.0013	0.1035	-0.0009	-0.0016	0.0768	-0.0108	0.0078
Stock return SD	0.0972	0.0822	0.0469	0.0964	0.0835	0.0430	0.0055	0.0115

[10] There are also differences in the sample used. Dasgupta et al. (2018) use a shorter sample period stretching from 1993-2005 and focus on S&P 1500 firms, whereas I focus on the period 1993-2016 and manufacturing sector firms.

Table 3.5 Exogenous shock: Propensity score matched difference-in-difference (PSM-DiD) regressions

This table presents results of propensity score matched difference-in-difference (PSM-DiD) regressions. I utilize import tariff reductions as exogenous shocks. Column (1) is the regression of the difference between 3-year average CPS following and preceding the tariff reductions of the matched sample. Column (2) reports the regression results when using the change in the CEO pay gap. Robust standard errors, clustered by three-digit SIC, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	ΔCPS	ΔCEO pay gap
Variable	**(1)**	**(2)**
Tariff Cut	-0.0238***	-0.0503*
	(0.0089)	(0.0280)
Lag dependent variable	-1.0919***	-1.0359***
	(0.0954)	(0.0570)
Lag control variables		
Cash holding	-0.0504	-0.2704
	(0.1052)	(0.7459)
Firm size	-0.0423**	0.0275
	(0.0188)	(0.0733)
Leverage	0.1053	0.5223
	(0.1042)	(0.3197)
ROA	-0.0635	-0.7372
	(0.1284)	(0.5694)
Stock return SD	0.5218***	0.2650
	(0.1590)	(1.0363)
Tobin's Q	-0.0001	0.0508*
	(0.0099)	(0.0268)
CEO chair duality	-0.0137	0.1417***
	(0.0178)	(0.0465)
High CEO ownership	0.0149	-1.5674***
	(0.0203)	(0.4993)
CEO tenure	-0.0023	0.0095
	(0.0042)	(0.0146)
CEO tenure^2	0.0000	0.0000
	(0.0002)	(0.0005)
Insider ownership	-0.1626	-5.2580
	(0.5681)	(3.7892)
Insider ownership^2	0.5701	21.7199**
	(1.1335)	(9.5539)
Number of VP	-0.0093	-0.0003
	(0.0100)	(0.0462)
Constant	0.7516***	0.2430
	(0.1468)	(0.6441)
Firm FE	Yes	Yes
Year FE	Yes	Yes
R-squared	0.641	0.7443
Observations	574	546

3.5.3 Alternative proxies of CEO power

Apart from compensation, Finkelstein (1992) and Adams et al. (2005) use the number of formal titles and positions the CEO has as an indicator of CEO power over the board of directors. I calculate *Title distance* to be the difference between the number of titles of a CEO and that of the average number of titles held by other directors and *No. of committees CEO serves on* to be the number of committees of the firm that the CEO is a member of. This includes the audit committee, compensation committee, nominating committee and corporate governance committee. This data is retrieved from ISS.

Columns 1 and 2 of Table 3.6 present the results using *Title distance* as a dependent variable from the matched sample of firms with *High HHI* and *High Lerner Index* being significant at the 1% and 5% levels, respectively. This indicates that firms operating within a high product market competition environment will hold fewer titles when compared to other board members.

In Columns 3 and 4, I show the results from using *No. of committees CEO serves on*. Results show that the coefficients for *High HHI* and *High Lerner Index* are significant at the 5% and 10% levels, respectively. This reveals that CEOs of firms experiencing more intensified product market competition serve on a fewer number of committees. Overall, these results support Hypothesis 3.1 and show that my results are robust.

Table 3.6 Alternative proxies of CEO power

Alternative proxies of CEO power used here are title distance and number of committees that CEOs serve on. Title distance is measured by the difference between a number of title that a CEO has and the mean of a number of title of other directors. No. of committees CEO serving on is the number of committees that CEOs are members, including audit committee, compensation committee, nominating committee and corporate governance committee. Then, I match the sample between low and high HHI and Lerner Index, which is defined by the top and bottom terciles, respectively. Robust standard errors, clustered by three-digit SIC codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Title distance		**No. of committees CEO serves on**	
Variable	**(1)**	**(2)**	**(3)**	**(4)**
High HHI	0.3665***		0.1365**	
	(0.0427)		(0.0531)	
High Lerner Index		0.1092**		0.0428*
		(0.0545)		(0.0244)
Control variables	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.358	0.366	0.115	0.099
Observations	3,224	3,026	3,224	3,026

3.6 Subsample analysis

In this section, I further investigate the relationship between PMC and CEO power through sub-sample analysis, with a particular emphasis in discovering how the relationship is moderated in the presence of potential agency problems that affect firms. Specifically, I examine the impact that firm management entrenchment (i.e. the *E-index*), *CEO ownership*, *Analyst coverage*, and *Luck* have on the relationship in order to test Hypotheses 3.2 – 3.5. I focus on using my baseline regression models to investigate this as I do not have sufficient observations to allow for sub-sample splits using my exogenous shock tariff cut test.

3.6.1 Management entrenchment

Prior literature reveals that PMC can be a moderator of the relationship between corporate governance and a firm's operating performance (Giroud and Mueller, 2010; Chhaochharia et al., 2017) as well as firm value (Giroud and Mueller, 2011). To examine its role as a moderator of CEO power and test Hypothesis 3.2, I split my sample of matched firms between those that have weak and strong corporate governance, based on their *E-index* scores from Bebchuk et al. (2009). The *E-index* consists of six provisions that can be categorized into two dimensions – those that limit shareholders' voting power and those that serve as anti-takeover provisions.[11] The *E-index* score is from 0-6 based on the number of provisions the firm has. The higher the *E-index* score, the more entrenched management is, leading to weaker corporate governance.

I split my firms based on this score following the same schema used by Harford, Humphery-Jenner and Powell (2012) where I classify firms as having a strong governance environment if the *E-index* score is two or less, and categorize firms as having weak corporate governance if the score is greater than two. Table 3.7 presents the subsample regression of CEO power on PMC in firms with weak and strong governance, respectively. I use the same set-up as my earlier baseline regression results shown in Table 3.2.[12] Columns 1 and 2 report the results of the subsample regressions of *CPS* on the *HHI* of firms with a low and a high *E-index* score, respectively. The results show that *High HHI* positively affects *CPS*, with 10% significance, only in firms with a high *E-index* score. Columns 3 and 4 report the results of subsample regressions of *CPS* on the *Lerner Index* of firms. The coefficient of the *High Lerner Index* on *CPS* is positive and significant at the 5% level only in firms with a high *E-index*. *CEO pay gap* is employed as an alternative proxy of CEO power in the analysis shown in Columns 5 – 8. A similar result is obtained for *High HHI*, showing that it is only significant, at the 5% level, when the *E-index* score is high. However, I find no significance for a relationship when examining the *Lerner Index* in Columns 7 and 8.

[11] These six provisions include classified boards, poison pills, golden parachutes, and supermajority voting requirements for charters, by-laws and mergers.

[12] I am unable to run analyses using the exogenous shock test (i.e. Table 3.5) due to a lack of observations when sub-sampling.

Overall, with the exception of the *Lerner Index* with *CEO pay gap*, the results display a consistent pattern showing that PMC does affect CEO power only in firms that have weaker corporate governance, confirming Hypothesis 3.2. My results complement the literature that shows PMC is a substitute for corporate governance in mitigating agency problems (Giroud and Mueller, 2010, 2011; Kim and Lu, 2011; Chhaochharia et al., 2017).

Table 3.7 Management entrenchment subsample analysis

This table presents the subsample regression results where firms are split into two groups based on their *E-index* score. I classify firms with a score of two or less as *Low,* and three or more as *High*. Then, I match the sample between low and high HHI and Lerner Index, which is defined by the top and bottom terciles, respectively. Robust standard errors, clustered by three-digit SIC codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	CPS				**CEO pay gap**			
	E-index				**E-index**			
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
High HHI	-0.0083	0.0126*			1.2545	2.0527**		
	(0.0096)	(0.0075)			(2.0409)	(0.9835)		
High Lerner Index			0.0006	0.0226**			0.2519	0.1203
			(0.0181)	(0.0110)			(0.6207)	(0.2678)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.142	0.167	0.115	0.111	0.102	0.097	0.141	0.065
Observations	1,562	3,384	1,054	3,410	464	1,400	462	1,932

3.6.2 CEO ownership

Some studies consider CEO ownership as a tool to mitigate agency problems (Jensen and Meckling, 1976; Kim and Lu, 2011). Considering that CEO power is associated with agency problems, CEO ownership can control CEOs not to exercise their power to extract rent. This motivates me to investigate how PMC affects CEO power when firms have either low or high CEO ownership. If CEO ownership is less than 10% I classify it as *Low CEO ownership*. Columns 1 and 2 of Table 3.8 show the regression results from this subsample analyses. While no significant relationship is evident between *CPS* and *HHI* firms, there is between the *High*

Lerner Index and *Low CEO ownership*. The coefficient is positive and significant at the 5% level (Column 3). A similar result is obtained when I use *CEO pay gap*. The coefficients for both *High HHI* and *High Lerner Index* are positive and significant (at the 1% and 10% levels in columns (5) and (7), respectively) when there is low CEO ownership.

The results in Table 3.8 provide support for Hypothesis 3.3 that the effect of PMC on CEO power is more pronounced for firms whose CEOs have low share ownership. This complements Kim and Lu (2011), which shows that CEO ownership works effectively to mitigate agency problems when external governance is weak.

Table 3.8 CEO ownership subsample analysis

This table presents the subsample regression analysis by CEO ownership. *High (Low) CEO Ownership* is where the CEO owns at least (less than) 10% of the total number of shares of the firm. Then, I match the sample between low and high HHI and Lerner Index, which is defined by the top and bottom terciles, respectively. Robust standard errors, clustered by three-digit SIC codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	CPS				**CEO pay gap**			
	CEO ownership				**CEO ownership**			
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
High HHI	0.0022	0.0094			1.7364***	0.7525		
	(0.0052)	(0.0174)			(0.6336)	(0.5850)		
High Lerner Index			0.0200**	0.0712			0.4431*	-0.2400
			(0.0095)	(0.0766)			(0.2325)	(0.6718)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.165	0.416	0.099	0.462	0.086	0.225	0.063	0.163
Observations	3,728	350	4,418	172	2,030	150	2,750	148

3.6.3 Analyst following

The extant literature considers that the number of analysts following a firm captures the degree of external monitoring there is of executives and leads to greater stock informativeness (Jensen and Meckling, 1976; Hong et al., 2000; Healy and Palepu, 2001; Chang et al., 2006; Yu, 2008; Dyck et al., 2010). As such, I expect this will influence the effect of PMC on CEO power. I test Hypothesis 3.4 by splitting my sample between firms with high and low *Analyst coverage*. I define firms with a low (high) level of analyst coverage based on whether the number of analysts following a firm is smaller (greater) than the median number of analysts in the same three-digit SIC industry, measured on an annual basis. Table 3.9 reports the regression results. Providing support for Hypothesis 3.4, I find a statistically significant relationship between CEO power and PMC is only present when there is low *Analyst coverage*. Specifically, in columns (1), (5) and (7) for *High HHI* with *CPS* and *High HHI* / *Higher Lerner Index* with *CEO pay gap*, respectively.

Table 3.9 Analyst following subsample analysis

This table presents the subsample regression analysis where firms are split between having either a high, or low, number of analyst coverage. *High* (*Low*) *Analyst coverage* is where the number of analysts is greater (smaller) than the median of the number of analysts that cover firms in the same three-digit SIC as the focus firm for that year. Then, I match the sample between low and high HHI and Lerner Index, which is defined by the top and bottom terciles, respectively. Robust standard errors, clustered by three-digit SIC codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	CPS				**CEO pay gap**			
	Analyst following				**Analyst followings**			
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
High HHI	0.1254**	-0.0075			0.7638**	0.0040		
	(0.0604)	(0.0301)			(0.3399)	(0.4015)		
High Lerner Index			-0.0020	0.0131			1.1960**	-0.5573
			(0.0194)	(0.0161)			(0.4930)	(0.5888)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.156	0.117	0.113	0.105	0.095	0.096	0.139	0.211
Observations	1,192	1,088	1,444	1,242	1,122	1,090	740	618

3.6.4 Luck

Finally, I test Hypothesis 3.5 by following Garvey and Milbourn (2006) and Cheng and Indjejikian (2009) in defining firms experiencing good luck and bad luck in each period. Luck is the performance component that CEOs cannot control. *Luck* is measured as the predicted value of the stock return from the regression of stock returns on the value-weighted market return, 3-digit SIC industry average return, industry and year fixed effects. I define firms experiencing good (bad) *Luck* in each year if *Luck* is positive (negative) in that period. Columns 1 and 3 of Table 3.10 report that *HHI* and the *Lerner Index* increase *CPS*, with 5% significance, only when luck is good. Likewise, columns 5 and 7 show that *HHI* and the *Lerner Index* are positively related to *CEO pay gap* at the 10% and 1% significance, respectively, when *Luck* is positive. My findings support Hypothesis 3.5 that the effect of PMC on CEO power is more pronounced when the firm experiences good luck. Garvey and Milbourn (2006) and Cheng and Indjejikian (2009) argue that good luck is related to agency problems and unbalanced payments, and my results indicate that PMC mitigates this issue.

Table 3.10 Luck subsample analysis

This table presents subsample regression analysis based on splitting firms, on an annual basis, on whether they experience a windfall profit (good luck) or loss (bad luck). Luck is estimated as the predicted stock return from a regression of stock returns on the value-weighted market return, 3-digit SIC industry average return, and industry and year fixed effects. . Then, I match the sample between low and high HHI and Lerner Index, which is defined by the top and bottom terciles, respectively. Robust standard errors, clustered by three-digit SIC codes, are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	CPS				**CEO pay gap**			
	Luck				**Luck**			
	Good	**Bad**	**Good**	**Bad**	**Good**	**Bad**	**Good**	**Bad**
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
High HHI	-0.0008	-0.0119			1.7421**	-0.2067		
	(0.0093)	(0.0166)			(0.7325)	(0.2280)		
High Lerner Index			0.0180*	0.0222			0.5525**	0.9416
			(0.0092)	(0.0305)			(0.2704)	(1.3335)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo-R^2	0.163	0.349	0.101	0.162	0.076	0.254	0.080	0.333
Observations	3,654	896	3,630	906	1,646	148	1,984	174

3.7 Conclusion

My study investigates the effect of product market competition on CEO power. I find robust evidence that CEOs have less power when the product market is more competitive. Further analysis reveals that the effect of PMC on CEO power is more pronounced for firms with greater management entrenchment, lower CEO ownership, less analysts following and when firms experience windfall positive performance. Taken together, my results suggest that PMC works as a substitute for corporate governance, 'reigning in' CEO power in firms that are more likely prone to agency problems.

My findings provide policy implications. In particular, my results indicate that corporate insiders, including shareholders and boards of directors, should monitor CEOs more meticulously when firms operate in a less competitive market to ensure that they are less likely to utilize their power for private benefit. For policymakers, my results show that there are limitations to how much corporate governance, on its own, can resolve agency problems relating to controlling CEO power, highlighting the need to take the market structure into account, as this naturally leads to moderating CEO power.

Chapter 4: The effect of product market competition and corporate complexity on firm performance

4.1 Introduction

In this study, the effect of corporate complexity on firm performance under intensified product market competition is examined. Prior literature has reported mixed evidence on how the complexity of a firm, mainly proxied by business diversification, can impact its performance. For example, Damanpour (1996), Hovakimian (2011), and Kuppuswamy and Villalonga (2015) find that complexity improves innovation and the efficiency of capital allocation. Kuppuswamy and Villalonga (2015) show that complexity provides value added to firms during a financial crisis. In contrast, Berry et al. (2006), Seru (2014), and Skrastins and Vig (2019) document that more complex firms have less effective monitoring of CEOs, less innovation, and poorer loan performance. These variations indicate that the effect of complexity on firm performance is contingent on the circumstances under which firms are operating. In this study, focus will be placed analysis on a natural challenge of every firm, the situation where product market competition is intensified.

The literature on firm complexity uses different proxies of complexity, such as business diversification (Berry et al., 2006; Hovakimian, 2011; Kuppuswamy and Villalonga, 2015) and organizational hierarchy and size (Damanpour, 1996; Guadalupe and Wulf, 2010; Skrastins and Vig, 2019), both of which focus on complexity within an individual firm. Other studies investigate complexity across firms, such as ownership structure (La Porta et al., 1999; Yang and Schwarz, 2016) and the network in a business group (Altomonte and Rungi, 2013). This research departs from these prior studies by investigating complexity from the perspective of the business holding portfolio structure of firms. I consider the number of subsidiaries, the number of subsidiaries weighted by percentage of firm ownership, the number of chains in a business holding portfolio, and the number of levels in a business holding portfolio hierarchy. These measures can be called *corporate complexity*, which provides information regarding both the span and depth of a firm's ownership of other firms in its business holding portfolio.[13]

The hypotheses are developed as follows. On the one hand, it is known that firms are more likely to have lower profitability when they face more intense competition in the product market because they lose their market power (Lerner, 1934; Elzinga and Mills, 2011; Xu, 2012). Thus, firms operating in more intense product market competition must improve their efficiency in resource allocation, communication, and knowledge transference in order to promote a competitive advantage and in order to survive (Lengnick-Hall, 1992; Guadalupe and Wulf, 2010). Complex firms have the advantage of adopting innovation (Damanpour, 1996) and improving the efficiency of their capital allocation (Kuppuswamy and Villalonga, 2015). Under this hypothesis, *corporate complexity* would yield a competitive advantage by buffering the negative effect of product market competition on firm performance. On the other hand, Vijh (2006) argues that complex may impede the capital allocation efficiency of firms. Seru (2014) shows that firms produce less innovation due to the "new-toy effect" once they become more complex. Under this alternative hypothesis, more complex firms will experience a greater decrease in their performance when they operate in a more competitive product market.

To test which hypothesis dominates, novel data on corporate complexity are used, which consist of the number of subsidiaries and the depth and span of the business holding portfolios of U.S. publicly-listed firms in the period of 2012-2016. A propensity-score-matching-difference-in-differences approach (PSM-DiD) is employed, and import tariff reductions as

[13] I focus on the number of subsidiaries not the number of branches. The reason is that firms have full control power over their branches but their control powers over their subsidiaries depend on the percentage of ownership in the subsidiaries, which makes it more difficult to become involved in the strategic decisions of the subsidiaries. Moreover, subsidiaries may operate in different businesses, unlike branches. Therefore, the number of subsidiaries is more relevant to corporate complexity than the number of branches.

exogenous shocks to product market competition, in order to mitigate potential endogeneity problems, including omitted variable bias and reversed causality. It is found that in sharp contrast with firms with more business diversification experiencing a greater increase in firm performance, firms with higher *corporate complexity* experience a greater decrease in firm performance. In particular, these firms suffer a drop of approximately 1% to 9% from the mean of Tobin's Q when facing large import tariff reductions. Moreover, the subsampling analysis shows that the interacting effect of *corporate complexity* and product market competition on firm performance is more pronounced for firms with high levels of financial constraints, opacity, and capital expenditure (CAPEX). These results indicate that while intensified product market competition implies less profitability and stronger need for capital, firms with higher corporate complexity are associated with inefficiency in resource allocation because these firms have more ownership commitments to other firms such that they face inflexibility of funds. Firm performance is even worse for firms with less financial accessibility, such as firms with financial constraints, opaqueness, and high investment.

This research contributes to the literature that examines the effect of corporate complexity on firm performance. Prior literature provides varied results depending on how corporate complexity reacts to external changes. Here the upward shift in product market competition is investigated, which is a natural threat of every firm. Under higher pressure of product market competition, corporate complexity diminishes firm performance. The present findings differ from the evidence of Hovakimian (2011) and Kuppuswamy and Villalonga (2015), which focuses on the influence of complexity under a financial crisis and uses business diversification as a proxy of complexity. A novel and distinct dimension of complexity is considered by taking into account of ownership structure, including the number of subsidiaries and the span and depth of the business holding portfolio structure. The proxy of complexity exhibits a distinct role because it is found that while business diversification enhances firm performance, corporate complexity diminishes firm performance when product market competition becomes more intense.

This study also sheds light on how corporate complexity influences firm performance. The results report that the significant and negative effect of corporate complexity on firm performance under the pressure from product market competition is more pronounced for firms with a high demand for capital but that have difficulty in raising it, which implies that inflexibility and inefficiency of capital allocation explain why corporate complexity adversely impacts firm performance. These findings are in contrast with the results of Slovin and Sushka (1997), which evaluate the ownership in a parent-subsidiary structure as a proxy of complexity. They report that complexity improves financial flexibility. However, the more recent study of Vijh (2006), which uses the same proxy of complexity, presents evidence that complexity does not enhance financial flexibility.

Finally, the findings of this research suggest that corporate complexity yields a competitive disadvantage for firms under the pressure of product market competition. Therefore, firms should consider adjusting their business holding portfolios in response to intensified competition in the product market. For instance, firms should focus more on their core businesses, which is supported by the findings of Thomas (2004) and Bowen and Wiersema (2005). In addition, the negative effect of the hierarchy in a business holding portfolio is the most magnified among the four proxies of corporate complexity discussed in the present study. Here it is proposed that firms should prioritize their adjustment of the hierarchy over the span of their business holding portfolios.

4.2 Prior literature and hypothesis development

4.2.1 Corporate complexity

In biology, a complex system comprises various connecting entities (Wolkenhauer and Muir, 2011). In management, Robson, Katsikeas & Bello (2008) define organizational complexity as the difficulties in enforcing collaboration in the organization due to the diversity in organizational structures, systems, and work procedures. In a spirit similar to that of Altomonte and Rungi (2013), which specified the structure of a business group as an affiliation comprising one headquarter and subsidiaries, here *corporate complexity* is defined from the perspective of a firm's holding portfolio of subsidiaries or affiliates. The span and depth of the business holding portfolios of firms are also considered. The greater the level of hierarchy or the number of chains in the business holding structure of a firm, the more corporate complexity the firm has.

Corporate complexity can be related to resource allocation, and the cost of communication and monitoring. A firm has to allocate its limited resources to operate its own business and to monitor other firms in its business holding portfolio. Hitt et al. (1990) developed a theory claiming that innovation is reduced when firms become more complex from acquisition because firms utilize resources in negotiation rather than committing to promote innovation. The empirical results of Seru (2014) also support this argument since firms use their resources in newly-acquired firms, which favors the new-toy effect. Moreover, corporate complexity can generate higher costs of communication and information transmission, which is supported by the evidence Skrastins and Vig (2019), where it is stated that loan performance is reduced when the hierarchy between bank branches and the central office increases due to information lost in the hierarchical structures. Apart from the notion of resource allocation, corporate complexity can also be seen to lead to difficulty in monitoring (La Porta et al., 1999), which is consistent with the findings of Berry et al. (2006), where it is suggested that CEO turnover is less sensitive to firm performance in diversified firms.[14]

In this research, the pressure from the product market competition (PMC) that every firm must encounter when operating its business is considered. More intense competition in the product market decreases the firm's profitability as the price-demand elasticity of a firm increases (Lerner, 1934; Elzinga and Mills, 2011). The empirical results from the work of Xu (2012) also support the notion that firm profitability decreases when more foreign competitors penetrate the product market, leading to higher financial distress risks, and firms therefore reduce their leverage. This implies that the capital of firms becomes more limited, so firms reduce their business diversity to be able to share common resources or may divest certain businesses to get more funds, which will lead to simpler organizational structures of firms (Lamont, 1997; Bowen and Wiersema, 2005). Guadalupe and Wulf (2010) also find that after an upward shift in product market competition, firm structures become flatter to improve communication processes and operational efficiency, an idea that is consistent with the work of Bruns and Stalker (1961), where it is suggested that organic structure can remain flexible in serving a dynamic environment.

On the other hand, some studies report that complexity benefits firms since they can re-allocate resources between entities, making them utilize resource flexibly and thus leading to potentially producing greater innovation (Damanpour, 1996; Slovin and Sushka, 1997; Hovakimian, 2011; Kuppuswamy and Villalonga, 2015). Specifically, the benefits of complexity are effective under certain circumstances, for example, when affiliates operate in similar businesses (Hoberg and Phillips, 2010) or when the level of complexity is not too high (Altomonte and Rungi, 2013).

[14] La Porta et al. (1999) consider ownership structure as complexity and Berry et al. (2006) explore business diversification.

In line with the above argument, which corporate complexity decreases the efficiency of firm resource allocation and PMC reduces firm profitability, the following is conjectured:

Hypothesis 4.1 Firms with higher corporate complexity experience a great decrease in firm performance when facing more intense product market competition.

4.2.2 Financial constraints, opacity and investment expenditure

The moderating role of financial constraints in the relationships among PMC, corporate complexity, and firm performance is considered. Intensified competition in the product market engenders less firm profitability (Lerner, 1934; Elzinga and Mills, 2011). Corporate complexity decreases efficiency in resource allocation and the communication of firms (Hitt et al., 1990; Seru, 1994; Skrastins and Vig, 2019). Altogether, this results in more limited internal capital of firms and thus firms must seek external capital (Xu, 2012). However, the cost of debt of firms rises when PMC is more intense, which leads to greater default risk for firms (Valta, 2012). In addition, Stern and Henderson (2004) find that complex firms, which are determined by the number of their product lines, have greater failure risk or a higher probability of exiting the market than less complex firms when PMC becomes more intense with more competitors entering the market. Hence, it is argued here that complex firms are more subject to intensified PMC when they are also financially constrained.[15] This leads to the following hypothesis:

Hypothesis 4.2 The interacting effect of corporate complexity and product market competition on firm performance is more pronounced for financially-constrained firms.

[15] Slovin and Sushka (1997) provide counter-evidence, which complex firms allocate their financial resources more efficiently, but the findings of Vijh (2006) do not advise that complex firms have a benefit or disadvantage over less complex firms.

The opacity of firms is another factor that can be considered as a moderating effect. This refers to the asymmetric information between management or controlling shareholders and outside investors, whereby controlling shareholders tend to expropriate outside investors (Anderson et al., 2009; Ma, Ma & Tien, 2017). Furthermore, opaque stocks provide less firm-specific information to the financial markets (Jin and Myers, 2006; Hutton, Marcus & Tehranian, 2009). Thus, opaque firms will have more difficulty raising external capital. Ma et al. (2017) provide empirical evidence indicating that opaque firms have higher cost of debt, and Hutton et al. (2009) present the notion that opaque firms have greater stock price crash risk so these firms are less attractive to both debt and equity investors. When facing more intense competition in the product market, which demands more external capital accessibility, complex firms are more affected if they are also opaque. Thus, the following is hypothesized:

Hypothesis 4.3 The interacting effect of corporate complexity and product market competition on firm performance is more pronounced for opaque firms.

Another moderating effect considered is investment expenditure. Investment-intensive firms refers to firms spending more on capital expenditure (CAPEX) relative to their rivals in the same industry. Investment-intensive firms have fewer available resources and may also need more funds to maintain their investment scale. As such, when they face an upward shift in product market competition, they have more limited access to capital due to less profitability from the pressure of product market competition and corporate complexity (Xu, 2012; Seru, 2014). Thus, complex firms are more subject to intensified PMC if they are also investment-intensive. This leads to the following hypothesis:

Hypothesis 4.4 The interacting effect of corporate complexity and product market competition on firm performance is more pronounced for investment-intensive firms.

4.3 Method

4.3.1 Sample

Data from U.S. firms during the period 2012-2016 were used.[16] The data on corporate complexity, which include information of subsidiaries, were from Bureau van Dijk (BvD). Firms' financial, governance, and analyst data were also retrieved from Compustat, Institutional Shareholder Services (ISS), and IBES databases, respectively.

4.3.2 Measures

Three-digit SIC industry-adjusted Tobin's Q (*Tobin's Q*) was used to measure firm performance. The variable of interest was the interaction term between *corporate complexity* and product market competition. *Corporate complexity* in terms of the number of subsidiaries (*Nsub*), the number of subsidiaries weighted by percentage of the firm's ownership (*Nsub_weight*), the number of chains in the firm's business holding structure (*Nchain*), and a dummy variable that indicated whether a firm had more than one level in its business holding structure (*Dlevel*) was considered. This is consistent with Altomonte and Rungi (2013), where a business group structure contains one headquarter and its affiliates. It should be noted that *Nchain* can represent the span of a firm's business holding portfolio and *Dlevel* represents the depth of the firm's holding portfolio.

[16] The sample period in this chapter was only four years due to the data availability on corporate complexity.

Large U.S. tariff reductions as an exogenous upward shift in PMC were utilized because reducing the import tariff rate decreases trade barriers and increases pressure from foreign competitors (Bernard, Jensen and Schott, 2006; Fresard, 2010). Moreover, large import tariff reductions can be considered as exogenous shocks in a quasi-natural experiment since they are regulated under trade agreements and primarily influenced by global economics and politics (Huang, Jennings and Yu, 2017). Huang et al. (2017) were followed in calculating large tariff reductions defined as three times the median of tariff rate reduction during 2013-2015 within the three-digit SIC. Reductions in the preceding and following years that are greater than 80 percent of the current reduction were eliminated in order to ensure that large tariff reductions were not temporary changes. The tariff rate was calculated as the ratio of duties collected by U.S. Customs to the free-on-board value of imports, which was provided on Peter Schott's website.[17] Based on this method, my sample contained 163 firms in 10 industries experiencing large tariff reductions, as reported in Appendix E.

Three moderating effects were investigated, including financial constraints, opacity, and investment expenditure by subsampling the data into high and low groups of moderating effects. First, high financial constraint firms were defined as firms having a KZ index (Kaplan and Zingales, 1995; Cleary, 1999; Hovakimian, 2011) greater than the industrial median in each year.[18] Next, a group of high-opaque firms contains firms with an opacity index greater than the annual industrial median. The opacity index contains four dimensions of trading volume, bid-ask spread, and analyst following and analyst forecast errors (Anderson et al., 2009). Lastly, high investment expenditure firms were specified as firms spending on CAPEX, determined by the CAPEX/book value of total assets, more than the industrial median in each year.

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[17] http://faculty.som.yale.edu/peterschott/sub_international.htm. Schott (2010) also used the data.
[18] KZ index is calculated as -1.002×(cash flow/net capital$_{-1}$) + 0.283×(Market-to-book) + 3.139×(long-term and short-term debts/total assets) – 39.368×(dividends/net capital$_{-1}$) – 1.315×(cash/net capital$_{-1}$).

The control variables consisted of firm characteristic variables, including the number of business segments, CAPEX, cash holdings, firm size, firm age, leverage, ROA, and standard deviation of stock returns. The number of business segments was included as a control, which prior literature has considered a proxy of organizational complexity (Berry et al., 2006; Hovakimian, 2011; Kuppuswamy and Villalonga, 2015), in order to control the influence from complexity within a firm which was different from what was examined in this research. Corporate governance control variables included the number of analysts following a firm and institutional ownership. These variables are related to product market competition, corporate complexity, and firm performance, and used in related literature (for example, Bushman, Chen, Engel & Smith, 2004; Stern and Henderson, 2004; D'Mello, Krishnaswami & Larkin, 2008; Kuppuswamy and Villalonga, 2016). The definitions of the variables are presented in Appendix C.

4.3.3 Analysis

Potential endogeneity problems were acknowledged in this study, and one potential issue was omitted variable bias, which can lead to biased estimation in the relationships among firm performance, PMC, and corporate complexity. Another potential problem was reverse causality. For example, high profitability industries may attract more competitors to join or high profitability firms may have more access to capital, and decide to acquire other firms, which results in higher corporate complexity.

Propensity-score-matching-difference-in-differences (PSM-DiD) was employed with exogenous shocks to PMC in order to mitigate endogeneity problems. Firms experiencing large tariff reductions (treated firms) were matched to firms not experiencing large tariff reductions (control firms) with a one-to-five nearest-neighbor propensity score. The propensity score was computed from one-year preceding large tariff reductions of CAPEX, cash holdings, firm size, leverage, and the standard deviation of stock returns. This method follows Flammer (2015) and the empirical specification is as follows.

$$\Delta Q_{i,t} = \alpha + \beta_1 \times TariffCut_{i,t} + \beta_2 \times Complex_{i,t} + \beta_3 \times TariffCut_{i,t} \times Complex_{i,t} + \beta_4 \times Segment_{i,t} + \beta_5 \times TariffCut_{i,t} \times Segment_{i,t} + \boldsymbol{\gamma}'\mathbf{X_{i,t}} + \theta_I + \theta_t + \varepsilon_{i,t} \quad (4.1)$$

where $\Delta Q_{i,t}$ is the difference between one-year *Tobin's Q* of firm i following large tariff reductions in year t and one-year *Tobin's Q* of firm i preceding large tariff reductions in year t. $TariffCut_{i,t}$ is a dummy variable equal to one if firm i experiences large tariff reductions in year t. $Complex_{i,t}$ and $Segment_{i,t}$ are corporate complexity and the number of business segments of firm i one-year preceding large tariff reductions in year t, respectively. $\mathbf{X_{i,t}}$ is a vector of control variables of firm i that are one-year preceding year t. θ_I and θ_t are industry and year fixed effects, respectively.

4.4 Results

Table 4.1 presents the descriptive statistics and correlation coefficients of the variables of interest. Four variables representing corporate complexity (*Nsub, Nsub_weight, Nchain, Nlevel*[19]) were positively correlated and they were also positively correlated with the number of business segments. Tobin's Q was negatively correlated with corporate complexity.

[19] *Nlevel* is the number of hierarchies in a business holding portfolio of a firm.

Table 4.1 Descriptive statistics and correlations

This table shows the descriptive statistics and correlations of the key variables used in the sample between 2012 – 2016. a, b and c indicate the significance at the 1%, 5% and 10% levels, respectively.

	Variable	Mean	Median	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Tobin's Q	5.951	0	37.559	1.000													
2	Nsub	80.384	11.000	186.841	-0.068^{a}	1.000												
3	Nsub_weight	43.047	6.501	96.846	-0.070^{a}	0.935^{a}	1.000											
4	Nchain	37.931	7.000	92.021	-0.067^{a}	0.750^{a}	0.642^{a}	1.000										
5	Nlevel	2.451	2.000	2.297	-0.127^{a}	0.625^{a}	0.681^{a}	0.373^{a}	1.000									
6	Business segment	4.587	3.000	3.585	-0.054^{a}	0.269^{a}	0.287^{a}	0.268^{a}	0.337^{a}	1.000								
7	Analyst	2.003	2.079	0.953	-0.027^{a}	0.284^{a}	0.283^{a}	0.279^{a}	0.317^{a}	0.181^{a}	1.000							
8	CAPEX	0.042	0.023	0.059	-0.008	-0.069^{a}	-0.064^{a}	-0.053^{a}	-0.044^{a}	0.011	0.148^{a}	1.000						
9	Cash holding	0.210	0.109	0.248	0.173^{a}	-0.175^{a}	-0.182^{a}	-0.171^{a}	-0.269^{a}	-0.232^{a}	-0.114^{a}	-0.167^{a}	1.000					
10	Firm age	19.835	16.667	16.956	-0.009	0.259^{a}	0.282^{a}	0.210^{a}	0.305^{a}	0.303^{a}	0.150^{a}	-0.004	-0.209^{a}	1.000				
11	Firm size	6.084	6.481	2.837	-0.408^{a}	0.449^{a}	0.450^{a}	0.409^{a}	0.539^{a}	0.352^{a}	0.607^{a}	0.066^{a}	-0.355^{a}	0.276^{a}	1.000			
12	Institutional ownership	0.482	0.536	0.295	-0.136^{a}	0.231^{a}	0.238^{a}	0.259^{a}	0.369^{a}	0.203^{a}	0.485^{a}	0.081^{a}	-0.117^{a}	0.094^{a}	0.561^{a}	1.000		
13	Leverage	1.176	0.595	3.785	0.703^{a}	-0.059^{a}	-0.061^{a}	-0.058^{a}	-0.111^{a}	-0.037^{a}	0.066^{a}	-0.035^{a}	0.088^{a}	0.024^{a}	-0.421^{a}	-0.154^{a}	1.000	
14	ROA	-0.370	0	1.976	-0.729^{a}	0.100^{a}	0.102^{a}	0.097^{a}	0.175^{a}	0.127^{a}	0.152^{a}	0.018^{b}	-0.171^{a}	0.151^{a}	0.517^{a}	0.243^{a}	-0.779^{a}	1.000
15	Stock return SD	0.098	0.079	0.066	0.006	-0.167^{a}	-0.166^{a}	-0.142^{a}	-0.128^{a}	-0.248^{a}	-0.177^{a}	0.014	0.342^{a}	-0.207^{a}	-0.443^{a}	-0.142^{a}	-0.046^{a}	-0.361^{a}

The results of testing Hypothesis 4.1, which conjectures the negative effect of an upward shift in product market competition and corporate complexity on firm performance, are reported in Table 4.2. The firms in the sample were matched and DiD regressions were employed. The matched sample comprise 120 treated firms and 452 control firms. The results, as expected, reported that the coefficients of the *Tariff cut* on change in *Tobin's Q* were negative and significant across all model specifications. *Corporate complexity* itself does not statistically significantly affect *Tobin's Q*, but it amplifies the negative impact of *Tariff cut* on the change in *Tobin's Q*. For example, the coefficients of *Tariff cut* and *Tariff cut ×Nsub* were -0.5118 at a 1% significance and -0.0006 at a 5% significance, respectively, which implies that *Tobin's Q* was reduced by 9.27% from the mean after experiencing large tariff reductions and *Nsub* enlarged the effect of *Tariff cut* on the change in *Tobin's Q* as it was additionally reduced by 1% from the mean when firms hold more one subsidiary. Among four proxies of corporate complexity, the coefficient of *Tariff cut* × *Dlevel* was the largest, which was -0.4842, meaning that the impact of *Tariff cut* on the change in *Tobin's Q* was stronger as *Tobin's Q* was further decreased by 8.14% from the mean when a firm had more than one level in its business holding portfolio. Interestingly, although corporate complexity and the number of business segments were positively correlated, the number of business segments weakened the negative effect of *Tariff cut* on the change in *Tobin's Q*, which was opposite the effect of corporate complexity.

Table 4.2 Results of PSM-DiD regressions analyzing the effect of large import tariff reductions and corporate complexity on firm performance [a]

	ΔTobin's Q			
Variable	(1)	(2)	(3)	(4)
Tariff cut	-0.5118***	-0.5230***	-0.5026***	-0.2368*
	(0.1461)	(0.1518)	(0.1446)	(0.1369)
$Nsub_{t-1}$	0.0001			
	(0.0002)			
Tariff cut × $Nsub_{t-1}$	-0.0006**			
	(0.0003)			
$Nsub\_weight_{t-1}$		-0.0000		
		(0.0004)		
Tariff cut × $Nsub\_weight_{t-1}$		-0.0011**		
		(0.0005)		
$Nchain_{t-1}$			0.0005	
			(0.0005)	
Tariff cut × $Nchain_{t-1}$			-0.0011*	
			(0.0006)	
$Dlevel_{t-1}$				0.1145
				(0.1286)
Tariff cut × $Dlevel_{t-1}$				-0.4842*
				(0.2536)
Business $segment_{t-1}$	-0.0123	-0.0123	-0.0139	-0.0129
	(0.0132)	(0.0132)	(0.0136)	(0.0118)
Tariff cut × Business $segment_{t-1}$	0.0665***	0.0692**	0.0640***	0.0676**
	(0.0253)	(0.0270)	(0.0238)	(0.0330)
$Analyst_{t-1}$	0.0619	0.0579	0.0585	0.0474
	(0.1126)	(0.1122)	(0.1122)	(0.1047)
$CAPEX_{t-1}$	1.1989	1.2156	1.2950	1.1409
	(1.1193)	(1.1125)	(1.0833)	(1.0933)
Cash $holding_{t-1}$	0.0948	0.0909	0.0963	-0.0157
	(0.2347)	(0.2354)	(0.2324)	(0.2680)
Firm age_{t-1}	0.0021	0.0022	0.0021	0.0015
	(0.0024)	(0.0025)	(0.0024)	(0.0023)
Firm $size_{t-1}$	-0.0408	-0.0323	-0.0465	-0.0389
	(0.0822)	(0.0804)	(0.0821)	(0.0681)
Institutional $ownership_{t-1}$	-0.1493	-0.1705	-0.1410	-0.0990
	(0.2437)	(0.2409)	(0.2540)	(0.2682)
$Leverage_{t-1}$	0.2896	0.2820	0.2986	0.2897
	(0.1887)	(0.1912)	(0.1897)	(0.1940)
ROA_{t-1}	0.0170	0.0047	0.0367	0.0731
	(0.4754)	(0.4804)	(0.4781)	(0.4285)
Stock return SD_{t-1}	-0.7670	-0.7931	-0.7298	-0.7618
	(1.5872)	(1.5998)	(1.5902)	(1.5441)
Tobin's Q_{t-1}	-0.5241***	-0.5236***	-0.5244***	-0.5176***
	(0.0573)	(0.0573)	(0.0575)	(0.0562)
Constant	0.2106	0.1859	0.2279	0.1486
	(0.4749)	(0.4715)	(0.4651)	(0.4413)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.644	0.644	0.644	0.646
Observations	572	572	572	572

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

In order to test Hypothesis 4.2, which posits that the negative effect of an upward shift in product market competition and corporate complexity on firm performance is stronger in financial constraint firms, subsample analysis of high and low financial constraint firms was applied, which was determined by using the KZ index and PSM-DiD. Table 4.3 reports that the coefficients of the interactions between *Tariff cut* and *corporate complexity* were negative and significant only in high financial constraint firms in all proxies of corporate complexity, as expected. Among the four proxies of corporate complexity, *Dlevel* strengthens the negative impact of *Tariff cut* on the change in *Tobin's Q* the most when firms have high financial constraint.

Table 4.3 Subsample analysis of financial constraints [a]

	ΔTobin's Q							
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tariff cut	1.0138**	-0.3458	1.1003**	-0.4000	1.0564**	-0.3029	0.5674	-0.0426
	(0.4970)	(0.4260)	(0.4944)	(0.4303)	(0.4985)	(0.4296)	(0.8201)	(0.4908)
$Nsub_{t-1}$	0.0000	0.0009**						
	(0.0005)	(0.0003)						
Tariff cut × $Nsub_{t-1}$	0.0011	-0.0025***						
	(0.0009)	(0.0004)						
$Nsub\_weight_{t-1}$			0.0003	0.0015**				
			(0.0010)	(0.0006)				
Tariff cut × $Nsub\_weight_{t-1}$			0.0022	-0.0045***				
			(0.0014)	(0.0007)				
$Nchain_{t-1}$					0.0011	0.0035***		
					(0.0009)	(0.0010)		
Tariff cut × $Nchain_{t-1}$					0.0005	-0.0049***		
					(0.0012)	(0.0010)		
$Dlevel_{t-1}$							-0.3655	-0.0579
							(0.4399)	(0.1814)
Tariff cut × $Dlevel_{t-1}$							0.3461	-0.4994**
							(0.5093)	(0.2261)
Business $segment_{t-1}$	-0.0039	-0.0611**	-0.0032	-0.0630**	-0.0101	-0.0630***	-0.0121	-0.0557**
	(0.0248)	(0.0242)	(0.0239)	(0.0249)	(0.0200)	(0.0237)	(0.0188)	(0.0237)
Tariff cut × Business $segment_{t-1}$	-0.0762	0.2107***	-0.0837	0.2248***	-0.0553	0.2034***	-0.0241	0.1815***
	(0.0753)	(0.0339)	(0.0688)	(0.0325)	(0.0584)	(0.0330)	(0.0403)	(0.0376)
KZ index	Low	High	Low	High	Low	High	Low	High
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.5080	0.7667	0.5092	0.7679	0.5075	0.7663	0.507	0.766
Observations	189	224	189	224	189	224	189	224

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 4.4 presents the results of testing Hypothesis 4.3, which postulates that opaque firms have a stronger negative impact of an upward shift in product market competition and corporate complexity on firm performance. Opaque firms are firms whose opacity indexes are greater than the industrial median opacity index in each year. As predicted, the coefficients of the interactions between *Tariff cut* and *corporate complexity* were negative and significant only in high opaque firms. Among the four proxies of corporate complexity, *Dlevel* enhanced the negative impact of the *Tariff cut* on the change in *Tobin's Q* the most when firms had high opacity index.

Table 4.4 Subsample analysis of opacity [a]

	ΔTobin's Q							
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tariff cut	-0.8904*	0.2038	-0.8824*	0.2009	-0.9130*	0.1793	-1.3489	0.2810
	(0.5188)	(0.2820)	(0.4970)	(0.2840)	(0.5318)	(0.3133)	(0.9005)	(0.2636)
$Nsub_{t-1}$	-0.0005	0.0000						
	(0.0011)	(0.0004)						
Tariff cut × $Nsub_{t-1}$	0.0012	-0.0055***						
	(0.0017)	(0.0016)						
$Nsub\_weight_{t-1}$			-0.0005	-0.0001				
			(0.0020)	(0.0007)				
Tariff cut × $Nsub\_weight_{t-1}$			0.0016	-0.0093***				
			(0.0024)	(0.0029)				
$Nchain_{t-1}$					-0.0000	-0.0006		
					(0.0014)	(0.0024)		
Tariff cut × $Nchain_{t-1}$					-0.0001	-0.0093***		
					(0.0016)	(0.0024)		
$Dlevel_{t-1}$							0.6320	-0.0422
							(1.0497)	(0.1551)
Tariff cut × $Dlevel_{t-1}$							0.5049	-0.4090**
							(1.4144)	(0.1738)
Business $segment_{t-1}$	-0.0127	0.0156	-0.0178	0.0156	-0.0268	0.0169	-0.0313	0.0150
	(0.0341)	(0.0174)	(0.0333)	(0.0173)	(0.0338)	(0.0171)	(0.0404)	(0.0174)
Tariff cut × Business $segment_{t-1}$	0.1373**	0.0620***	0.1494**	0.0623***	0.1918*	0.0583***	0.1766	0.0569***
	(0.0562)	(0.0230)	(0.0698)	(0.0225)	(0.1052)	(0.0200)	(0.1229)	(0.0200)
Opacity	Low	High	Low	High	Low	High	Low	High
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC3 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.0528	0.7964	0.0525	0.7964	0.0522	0.7956	0.054	0.797
Observations	194	228	194	228	194	228	194	228

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Lastly, Hypothesis 4.4, positing that the negative effect of an upward shift in product market competition and corporate complexity on firm performance is stronger in firms with high CAPEX, was tested, where the CAPEX is greater than the industrial median CAPEX in each year. Table 4.5, as expected, reports that the coefficients of the interactions between *Tariff cut* and *corporate complexity* were negative and significant only in firms with a high CAPEX. However, only two of the four proxies of corporate complexity—*Nsub* and *Nsub_weight*—were statistically significant.

Table 4.5 Subsample analysis of CAPEX [a]

	ΔTobin's Q							
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tariff cut	-0.2210	-0.1254	-0.2068	-0.1360	-0.3247**	-0.1403	-0.4486	-0.0065
	(0.1893)	(0.1462)	(0.1884)	(0.1480)	(0.1589)	(0.1567)	(0.2743)	(0.1832)
$Nsub_{t-1}$	0.0007	0.0004*						
	(0.0007)	(0.0002)						
Tariff cut × $Nsub_{t-1}$	-0.0005	-0.0007*						
	(0.0006)	(0.0004)						
$Nsub\_weight_{t-1}$			0.0013	0.0006				
			(0.0012)	(0.0004)				
Tariff cut × $Nsub\_weight_{t-1}$			-0.0008	-0.0012**				
			(0.0011)	(0.0005)				
$Nchain_{t-1}$					-0.0001	0.0002		
					(0.0013)	(0.0004)		
Tariff cut × $Nchain_{t-1}$					-0.0003	-0.0009		
					(0.0015)	(0.0006)		
$Dlevel_{t-1}$							-0.4450*	-0.2620
							(0.2407)	(0.1699)
Tariff cut × $Dlevel_{t-1}$							0.3395	-0.2019
							(0.2869)	(0.2013)
Business $segment_{t-1}$	-0.0247	-0.0053	-0.0238	-0.0040	-0.0183	-0.0012	-0.0155	-0.0001
	(0.0230)	(0.0160)	(0.0219)	(0.0163)	(0.0218)	(0.0155)	(0.0198)	(0.0157)
Tariff cut × Business $segment_{t-1}$	0.0747**	0.0725***	0.0745***	0.0729***	0.0762***	0.0698***	0.0447*	0.0605**
	(0.0282)	(0.0235)	(0.0277)	(0.0243)	(0.0182)	(0.0244)	(0.0262)	(0.0261)
CAPEX	Low	High	Low	High	Low	High	Low	High
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.5400	0.6920	0.5404	0.6918	0.5380	0.6913	0.546	0.695
Observations	209	334	209	334	209	334	209	334

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4.5 Robustness check

The robustness of the results was further tested with an alternative proxy of firm performance—that is—sales growth (also used by Baum and Wally, 2003). Table 4.6 shows that the coefficients of the interactions of *Tariff cut* and *corporate complexity* on the change in sales growth were negative and significant with every proxy of corporate complexity and *Dlevel* was the largest amplification of the negative effect of *Tariff cut* on the change in sales growth, which is consistent with the baseline results in Table 4.2 and complements Hypothesis 4.1.

Table 4.6 Robustness check [a]

	ΔSale growth			
Variables	(1)	(2)	(3)	(4)
Tariff cut	0.0437	0.0348	0.0234	0.1889**
	(0.0475)	(0.0465)	(0.0507)	(0.0918)
$Nsub_{t-1}$	-0.0000			
	(0.0001)			
Tariff cut × $Nsub_{t-1}$	-0.0003**			
	(0.0002)			
$Nsub\_weight_{t-1}$		-0.0001		
		(0.0001)		
Tariff cut × $Nsub\_weight_{t-1}$		-0.0005**		
		(0.0002)		
$Nchain_{t-1}$			0.0001	
			(0.0001)	
Tariff cut × $Nchain_{t-1}$			-0.0005**	
			(0.0002)	
$Dlevel_{t-1}$				-0.0259
				(0.0474)
Tariff cut × $Dlevel_{t-1}$				-0.3157**
				(0.1543)
Business $segment_{t-1}$	-0.0044	-0.0043	-0.0049	-0.0059
	(0.0050)	(0.0049)	(0.0055)	(0.0050)
Tariff cut × Business $segment_{t-1}$	0.0179	0.0177	0.0143	0.0172
	(0.0124)	(0.0125)	(0.0127)	(0.0151)
$Analyst_{t-1}$	0.0543	0.0529	0.0562	0.0350
	(0.0372)	(0.0374)	(0.0378)	(0.0310)
$CAPEX_{t-1}$	-0.6693	-0.6530	-0.6595	-0.7005
	(0.8307)	(0.8353)	(0.8366)	(0.8379)
Cash $holding_{t-1}$	0.3134**	0.3069**	0.3039**	0.2207*
	(0.1254)	(0.1238)	(0.1213)	(0.1240)
Firm age_{t-1}	-0.0015	-0.0014	-0.0014	-0.0020
	(0.0016)	(0.0016)	(0.0017)	(0.0020)
Firm $size_{t-1}$	0.0049	0.0071	-0.0023	0.0089
	(0.0227)	(0.0222)	(0.0208)	(0.0225)
Institutional $ownership_{t-1}$	-0.2566	-0.2631	-0.2432	-0.1672
	(0.1967)	(0.1980)	(0.1878)	(0.1548)
$Leverage_{t-1}$	-0.3324*	-0.3342*	-0.3290*	-0.2924*
	(0.1950)	(0.1968)	(0.1906)	(0.1628)
ROA_{t-1}	-0.4440**	-0.4494**	-0.4309**	-0.3711***
	(0.1773)	(0.1792)	(0.1714)	(0.1355)
Stock return SD_{t-1}	-1.6196*	-1.6282*	-1.5734*	-1.5923**
	(0.8430)	(0.8459)	(0.8262)	(0.7730)
Sale $growth_{t-1}$	-0.7251***	-0.7261***	-0.7247***	-0.7410***
	(0.0606)	(0.0613)	(0.0581)	(0.0548)
Constant	0.3669	0.3640	0.3965*	0.3671*
	(0.2260)	(0.2303)	(0.2385)	(0.2060)
SIC3 FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.231	0.231	0.230	0.240
Observations	426	426	426	426

[a] Robust standard errors clustered by three-digit SIC are in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4.6 Discussion

The effect of corporate complexity on firm performance when firms experience an upward shift in product market competition was examined by applying PSM-DiD to analyze this relationship in order to mitigate endogeneity problems. The results confirmed the hypothesis that when firms face intensified product market competition, corporate complexity negatively impacts firm performance, which can be explained by the inefficiency of resource allocation (Hitt et al., 1990; Seru, 1994; Bowen and Wiersema, 2005; Guadalupe and Wulf, 2010; Skrastins and Vig, 2019). In particular, focus was placed on financial resources because internal capital is directly affected by the decline in firm profitability due to the threat of product market competition. This argument is corroborated by subsample analysis whose results suggest that the negative effect of corporate complexity and product market competition on firm performance is statistically significant only in firms with a high demand for capital and that have difficulty in accessing it, such as financial constraint firms, opaque firms, and high investment firms.

Among the four proxies of corporate complexity discussed in this study, the dummy variable of the level of subsidiaries greater than one (*Dlevel*) had the largest impact on firm performance when firms experienced more intense product market competition, which suggests that the hierarchy of the holding structure plays the most vital role, and firms may consider adjusting the level before the span, which is proxied by *Nchain*, of their business holding portfolios. The percentage of ownership in a business holding portfolio was seen to have a partial influence on firm performance, as a number of subsidiaries weighted by the percentage of ownership (*Nsub_weight*) reduced firm performance slightly greater than the number of subsidiaries (*Nsub*) did. Moreover, the proxies had a reverse effect from business diversification, which is used in many studies of complexity (Hovakimian, 2011; Kuppuswamy and Villalonga, 2015). This can be interpreted in the sense that different dimensions of complexity have diverse outcomes.

These results are partially different from the findings of Guadalupe and Wulf (2010). Here it was found that both the span and hierarchy in the firm business holding portfolios reinforced the negative effect of product market competition on firm performance. However, Guadalupe and Wulf (2010) reported that an upward shift in product market competition decreases the hierarchy but increases the span of organizational structure, which implies that firms respond to more intense product market competition by flattening their structure to maintain or enhance their performance. It can be inferred then that the structure of the cross-holding and the structure within a firm have different impacts on firm performance in response to product market competition.

One limitation of this research is that with the limitation of the data, corporate complexity as a separate entity in a firm's business holding portfolio was considered without considering its business relatedness. Future research might discuss how firms adjust their business holding portfolios when the business relatedness is considered in order to respond to certain circumstances when the data are available.

4.7 Conclusion

Using novel data on corporate complexity, including both the depth and span of the business holding portfolios of firms, this research investigates how corporate complexity influences firm performance when firms face more intense product market competition. Hypotheses were developed based on the argument that corporate complexity is associated with inefficiency of resource allocation such that firms with higher corporate complexity experience a greater decrease in firm performance when facing more intense in competition in the product market competition. The PSM-DiD approach was employed in order to mitigate potential endogeneity concerns. It was shown that corporate complexity reinforces the adverse effect of product market competition on firm performance, and this impact is more prominent for firms that have a higher demand for capital but have more difficulty in accessing both internal and external capitals. These findings contribute to the literature on organizational complexity in that how the distinct dimensions of corporate complexity interact with PMC and affect firm performance was investigated. The results suggest the importance of corporate complexity in response to the escalated competitive pressure from the product market.

Chapter 5: Conclusion

This thesis consists of three studies examining the strategic reactions of firms to product market competition, including the incentive dispersion among the TMT, the relative compensation of a CEO to the compensation of other executives within a firm, and corporate complexity. A quasi-natural experiment was carried out and large import tariff reductions were applied as exogenous shocks in order to mitigate endogeneity problems. The findings support the theory in both the finance and management literature, for example the social comparison theory, the agency cost theory, and resource allocation, and suggest strategic implications for firms so that they can maintain their competitiveness when facing more intensified product markets.

The following is a summary of the main findings and contributions, limitations, and avenues for future research of this thesis.

5.1 Summary of the main findings and contributions

The first study, which is presented in Chapter 2, examines the effect of product market competition on TMT incentive dispersion. The results report that more intensified product market competition reduces incentive dispersion in the TMT and this impact is stronger for innovative and diversified firms. These findings contribute to the social comparison theory and TMT incentives, indicating that members of the team do not feel inequity and therefore the incentive distribution between the TMT can be strategically used to promote cooperation in the team (Gartenberg and Wulf, 2017; Ridge et al., 2017). In addition, the results suggest that cooperation in the team is more desirable especially when firms need a quick response to a dynamic environment, such as seen in innovative and diversified market segments.

The second study, reported in Chapter 3, investigates the impact of product market competition on the relative compensation of the CEO to the compensation of other top executives. The results show that the gap in compensation between the CEO and other executives is lower, implying that the CEO becomes less powerful when the firm is pressured by more intensified competition in the product market. These results add to the agency cost theory of powerful CEOs, where it is suggested that powerful CEOs tend to be entrenched (Bebchuk et al., 2011; Vo and Canil, 2019), so firms should implement compensation policy between CEOs and other top executives in order to control the CEO's power. Moreover, firms should balance external governance, such as product market competition, with corporate governance since product market competition serves as a substitute for corporate governance as it diminishes the CEO's power more for firms with weak corporate governance.

The third study in Chapter 4 of the thesis examines the effect of corporate complexity on firm performance under the threat of product market competition. Employing new proxies of corporate complexity, this study finds that corporate complexity reduces firm performance when firms face intense competition in the product market, which is different from the evidence in prior literature (Hovakimian, 2011; Kuppuswamy and Villalonga, 2015). In addition, this study suggests that financial demand and flexibility are mechanisms of this effect since the performance of firms with high degrees of financial constraints, opacity, and investment are more strongly negatively affected by corporate complexity and product market competition. Overall, corporate complexity is related to the inefficiency of resource allocation and firms should consider corporate complexity as one strategy in response to product market competition.

5.2 Limitations

The results of this thesis suggest strategic implementations of the incentive distribution among top management members, the pay gap between the CEO and other executives, and corporate complexity in response to product market competition. This research was not able to evaluate the mechanisms that firms use to readjust these strategies because of data availability. However, various alternative proxies for the dependent variables are considered in each study, such as individual performance awards and the dispersion of compensation complexity for the first study, the probability that the CEO pay gap in firms is higher than for other firms in the same industry for the second study, and sales growth for the third study. HHI, the Lerner index, and large import tariff reductions are used as proxies for product market competition. The results in every study are still robust.

Due to the data availability for executive compensation, the first and second studies focus on firms in the S&P 1500, which leads to a concentration on large firms. However, the evidence on Chinese SMEs from the work of Munir, Kok, Teplova and Li (2017) suggests that powerful CEOs are entrenched, which is in align with the second study. For the third study, the data on corporate complexity were available from the year 2012, so the period for this study is shorter than for the other two.

5.3 Avenues for future research

This thesis examines only three strategic reactions of firms in order to respond an increase of competitive pressure. Firms can also consider other strategies, for example, voluntary disclosure (Huang et al., 2017) and corporate social responsibility (Flammer, 2015), which have negative and positive responses to more intense product market competition, respectively. Therefore, future research can examine the interplay between these strategies when firms are pressured by intense competition in the product market, concerning whether these strategies are complementary or substitute for one another.

Another possible avenue for future research is to consider the business relatedness between affiliates when corporate complexity is investigated. Altomonte and Rungi (2013) report the negative correlation between vertical integration, which is related to the supply chain, and the hierarchical complexity of a business group. This may provide additional implications for firms when they consider readjusting their business holding portfolios to respond to intense product market competition.

Appendix A

Definitions of variables – Chapter 2

Variable	Description
Dependent variables	
Total incentive dispersion (GINI)	The gini coefficient of the proportion of TMT total incentive-based pay, which is calculated from $$1+\frac{1}{n}-\frac{2}{n^2\overline{y}}(y_1+2y_2+\cdots+ny_n)$$ where n is the number of TMT members. $y_1, \ldots, y_n$ is the proportion of TMT total incentive-based pay in descending order. $\overline{y}$ is the mean of the proportion of TMT total incentive-based pay. The proportion of TMT total incentive-based pay is the ratio of the summation of LTIP, restricted stocks and stock options to total compensation.
Total incentive dispersion (CV)	The coefficient of variation of the proportion of TMT total incentive-based pay.
Equity incentive dispersion (GINI)	The gini coefficient of the proportion of TMT equity incentive-based pay where equity incentive-based pay is the summation of restricted stocks and stock options.
Equity incentive dispersion (CV)	The coefficient of variation coefficient of the proportion of TMT equity incentive-based pay.
Pay performance sensitivity (PPS)	The dollar change in granted incentives to an executive for a one-percentage point change in firm value divided by total compensation.
Compensation contract complexity (diversity)	One minus the Herfindahl-Hirschman index (HHI) based on the proportion of each component of compensation to total compensation.
Compensation contract complexity (index)	The number of components determining possible payouts from incentive contracts by considering only short-term cash bonus, long-term cash bonus, restricted stocks (RSU) and stock options. The maximum score is 24.
Compensation contract complexity (no. of incentive package)	All award types including short-term cash bonus, long-term cash bonus, RSU, stock options, unit cash, phantom stocks, reload options and stock appreciation rights.
Dispersion of compensation contract complexity	The Gini coefficient and CV of compensation contract complexity.
Individual performance award (percentage)	$\frac{TargetAward\ of\ individual\ performance \times \%vest}{TotalCompensation}$
Individual performance award (dummy)	Equaling one if firms grant individual performance awards.
Independent variable of interest	
Tariff cut	The large import tariff reductions considered as three times the median of tariff rate reduction during 1994-2011. The tariff rate is computed based on three-digit SIC as the ratio of duties collected by U.S. Customs to the free-on-board value of imports.
Firm financial controls	
Cash/asset	Cash / book value of total assets.

Variable	Description
Firm size	Logarithm of book value of total assets.
Leverage	Long term liability / total assets
Return on assets (ROA)	Earnings before interest and tax / total assets adjusted with the industry median of ROA.
Stock return standard deviation	The standard deviation of monthly stock return
Tobin's Q	Tobin's Q of each firm is calculated from (Market value of equity + book value of total assets – book value of equity – deferred taxes) / book value of total assets. Then, it is adjusted with the median of Tobin's Q in each industry.
Corporate governance controls	
CEO chair duality	The dummy variable equalling one if the CEO also serves as a Chair of the board.
CEO tenure	The number of years that the CEO serves in the position till that fiscal year.
Insider ownership	The fraction of shares owned by the insiders in ExecuComp.
Number of VP	The number of vice presidents among top five executives.

Appendix B

Definitions of variables – Chapter 3

Variable	Description
CEO power:	
CEO pay slice (CPS)	The fraction of CEO total compensation to the top five executive total compensation. Total compensation is obtained from the TDC1 item in ExecuComp.
CEO pay gap	A dummy variable that is equal to one if the firm's CEO pay gap is greater than the 3-digit SIC industry median for the year, and otherwise zero. Pay gap is calculated as the difference between CEO total compensation and the median of the top five-executive total compensation.
Title distance	The difference between a number of titles that a CEO has and the mean of a number of titles of other directors.
No. of committees CEO serving on	The number of committees that a CEO is a member, including audit committee, compensation committee, nominating committee and corporate governance committee.
The product market competition:	
Herfindahl-Hirschman index (HHI)	The sum of the squared market share of firms in each industry.
Lerner index	EBITDA / sales
Firm financial control variables:	
Cash holdings	Cash / book value of total assets.
Firm size	Logarithm of book value of total assets.
Leverage	Long term liability / total assets
Return on assets (ROA)	ROA of each firm is computed from earnings before interest and tax / total assets; then adjusted by the median of the ROA in each industry.
Stock return SD	The standard deviation of monthly stock returns
Tobin's Q	Tobin's Q of each firm is calculated from (the market value of equity + book value of total assets – book value of equity – deferred taxes) / book value of total assets. It is then adjusted by the median of Tobin's Q in each industry.
Corporate governance control variables:	
CEO chair duality	A dummy variable equal to one if the CEO also serves as a Chair of the board and otherwise zero.
High CEO ownership	A dummy variable equal to one if the CEO owns at least 20% of total shares in the firm and otherwise zero.
CEO tenure	The number of years that the CEO serves in the position.
Insider ownership	The fraction of shares owned by insiders.
Number of VP	The number of vice presidents.

Appendix C

Definitions of variables – Chapter 4

Variable	Description
Tobin's Q	Tobin's Q of each firm was calculated from (the market value of equity + book value of total assets – book value of equity – deferred taxes) / book value of total assets. It was then adjusted by the median of Tobin's Q in each industry.
Tariff cut	The large import tariff reductions were considered as three times the median of tariff rate reduction during 2013-2015. The tariff rate was computed based on a three-digit SIC as the ratio of duties collected by U.S. Customs to the free-on-board value of imports.
Nsub	Number of subsidiaries in a business holding portfolio
Nsub_weight	Number of subsidiaries weighted by a percentage of ownership in a business holding portfolio
Nchain	Number of chains in a business holding portfolio
Nlevel	Number of hierarchies in a business holding portfolio
Dlevel	A dummy equal to one if *Nlevel* is greater than one
Business segment	Number of business segments of a firm based on a two-digit SIC
Analyst	Logarithm of number of analysts following a firm
CAPEX	CAPEX / book value of total assets
Cash holding	Cash / book value of total assets
Firm age	The current year minus the year in which a firm was first listed on the CRSP.
Firm size	Logarithm of book value of total assets
Institutional ownership	The fraction of shares owned by institutional investors
Leverage	Total liability / total assets
Return on assets (ROA)	The ROA of each firm was computed from earnings before interest and tax / total assets, then adjusted by the median of the ROA in each industry.
Stock return SD	The standard deviation of monthly stock returns
Sales growth	The percentage change in sales from the previous year

Appendix D

List of industries affected by large import tariff reductions – Chapters 2 and 3

Three-digit SIC	Industry name	Tariff reduction year	Observations
201	Meat Products	2008	6
203	Canned, Frozen and Preserved Fruits, Vegetables, Food Special	1995	2
204	Grain Mill Products	1995	5
206	Sugar and Confectionery Products	2008	3
207	Fats and Oils	2005	1
208	Beverages	1998	8
211	Cigarettes	2000	2
221	Broadwoven Fabric Mills, Cotton.	1995	6
242	Sawmills and Planing Mills	2011	3
261	Pulp Mills.	2004	2
262	Paper Mills.	1995	7
263	Paperboard Mills.	2004	4
265	Paperboard Containers and Boxes	1995	1
267	Converted Paper, Paperboard Products Except Container Or Box	1995	6
271	Newspapers: Publishing, Or Publishing and Printing.	1999	5
275	Commercial Printing	1995	3
281	Industrial Inorganic Chemicals	2007	10
282	Plastics Materials and Synthetics	1995	7
283	Drugs	1995	45
284	Soap, Detergents, Cleaning Preparations, Perfumes, Cosmetics	1995	7
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products.	1996	3
286	Industrial Organic Chemicals	1995	5
287	Agricultural Chemicals	1999	3
289	Miscellaneous Chemical Products	1995	8
291	Petroleum Refining	2000	5
302	Rubber and Plastics Footwear.	2005	3
305	Gaskets, Packing, and Sealing Devices, Rubber/Plastic Hose	1995	1
324	Cement, Hydraulic.	1995	1
329	Abrasive, Asbestos, Misc. Nonmetallic Mineral Products	1996	2
331	Steel Works, Plast Furnaces, and Rolling Andfinishing Mills	2004	11
332	Iron and Steel Foundries	1995	2
333	Primary Smelting and Refining of Nonferrous Metals	1998	4
334	Secondary Smelting and Refining of Nonferrous Metals.	2010	1
341	Metal Cans and Shipping Containers	1995	2
342	Cutlery, Hand Tools, and General Hardware	1996	3
343	Heating Equipment Except Electric, Warm Air, Plumbing	1998	1
345	Screw Machine Products, Bolts, Nuts, Screws, Rivets, Washers	1999	1
348	Ordnance and Accessories, Except Vehicles and Guided Missile	1995	2
354	Metalworking Machinery and Equipment	2009	3

Three-digit SIC	Industry name	Tariff reduction year	Observations
355	Special Industry Machinery, Except Metalworking Machinery	1995	4
356	General Industrial Machinery and Equipment	1999	13
358	Refrigeration and Service Industry Machinery	1995	6
362	Electrical Industrial Apparatus	1995	4
366	Communications Equipment	1998	18
369	Miscellaneous Electrical Machinery, Equipment and Supplies	1995	3
375	Motorcycles, Bicycles, and Parts.	1995	2
376	Guided Missiles, Space Vehicles, Parts	1999	2
381	Search, Detection, Navigation, Guidance, Aeronautical, Naut	1997	3
382	Lab Apparatus and Analytical, Optical, Measuring, Controls	1997	14
384	Surgical, Medical and Dental Instruments and Supplies	1995	29
387	Watches, Clocks, Clockwork Operated Devices and Parts	2006	1
394	Dolls, Toys, Games and Sporting and Athletic Goods	1995	5
399	Miscellaneous Manufacturing Industries.	1995	1

Appendix E

List of industries affected by large import tariff reductions – Chapter 4

Three-digit SIC	Industry name	Tariff reduction year	Observations
208	Beverages	2014	10
211	Cigarettes	2013	4
242	Sawmills and Planing Mills	2014	3
278	Blank books, Loose-leaf Binders, Bookbinding and Related Work	2015	2
283	Drugs	2015	103
301	Tires and Inner Tubes	2013	1
329	Abrasives, Asbestos, Misc. Nonmetallic Mineral Products	2013	4
341	Metal Cans and Shipping Containers	2014	3
353	Construction, Mining, and Material-Handling Machinery	2015	19
372	Aircrafts and Parts	2013	14

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