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Getting down to brass tacks: Is your organization really aligned?
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Chapter 1

Introduction

1.1 Motivation

Over the last decades, the complexity and challenges of managing global supply chains have increased the prominence and importance of supply chain and operations management (SCOM), which are now considered key management functions (Hendricks et al., 2014). Companies such as Amazon.com, Inc. and Federal Express Corporation Inc. have been able to distinguish themselves from the marketplace by superior SCOM practices, and firms such as Apple Inc., which were initially not considered supply chain leaders, are receiving more and more recognition for their excellent SCOM capabilities (Van Mieghem and Allon, 2008). These are just a few examples of the various firms that have proven that SCOM can serve as a "competitive weapon." A detailed analysis of these firms would further reveal that the drivers for their success are not simply rooted in operating more efficient, cost-effective supply chains. Instead, a company’s ability to respond quickly to changes in demand or supply without stockpiling unnecessary inventory is what needs to be complemented by cost efficiency to achieve a sustainable competitive advantage (Lee, 2004). However, this makes the careful consideration of the plans and actions of the demand-side functions of an organization (i.e., sales and marketing) in the management of supply chain and operations inevitable.

While many firms have focused on the aspect of cost efficiency for improving SCOM performance and adopted concepts such as inventory pooling or lean manufacturing over the last centuries, the integration of other organizational functions into SCOM has received less attention (Chen et al., 2005, 2007; Roth, 2007; Oliva and
It seems paradoxical that although the overall objective of SCOM is commonly stated as “matching demand with supply” (even SCOM textbooks bear this title), to date considerations related to the management of demand play only a minor role in most SCOM departments, models and theories. But the plans and decisions undertaken by the sales and marketing team (pricing, promotions, salesforce size, salesforce incentives, market expansion, etc.) in particular affect mean demand and demand variability, which are essential factors for effective and efficient supply chain configuration and for operations. As a consequence of insufficiently considering the demand-side aspects in the management of supply, many firms suffer operational and financial performance losses (Hendricks and Singhal, 2005a,b, 2009; Hendricks et al., 2014).

Forbes Magazine (2015) stated recently that although firms have worked over 35 years on the issue of aligning sales and marketing with their operational supply processes, only two out of five companies believe that their alignment processes are effective. Wagner et al. (2014), who develop a holistic sales and operations planning (S&OP) maturity model and present case study and survey results, conclude with a similar industry assessment. And based on our own discussions with several managers, we observe that cross-functional alignment and the coordination of processes across and beyond functional silos still tends to be underdeveloped. The following statement of a CEO from a Swiss-based pharmaceutical company illustrates the kinds of issues that arise from a lack of cross-functional integration, resulting in particular from the divide between the demand- and supply-side functions of an organization: “The Sales department saw that a product was selling well, but their colleagues in Production did not. Meanwhile, the sales teams had no inkling that the goods were not ready on the production floor. Eleventh-hour efforts could prevent stock-outs, but this was not the most efficient way to work” (Wagner et al., 2014, p. 190). And according to a recent McKinsey & Company study, only the “leading companies have made strategic investments in their supply chain capabilities and set up efficient and effective organizations that overcome functional silos. [...] [T]he right supply chain capabilities are playing a critical role in allowing companies to
exploit emerging opportunities to boost growth and improve profitability” (Glatzel et al., 2014, p. 1). All of these observations imply that despite increasing recognition of the importance of intra-organizational coordination for gaining a competitive advantage through SCOM on the part of managers and academics, the process of “aligning the organization” remains a severe problem for many companies. As a consequence, firms frequently suffer from a mismatch of demand and supply.

Demand and supply mismatches (DSMs) have severe implications for a firm’s financial performance as they can affect both the revenue and cost sides of an earnings equation. In particular, on the revenue side of the earnings equation DSMs can lead to lost sales due to the unavailability of products, lower realized gross margins due to markdowns of excess inventory, and poorer customer service, satisfaction and loyalty if the products that customers demand are not available at the right time and place. On the cost side of the earnings equation, DSMs can lead to an increase in expenditures due to penalties paid to customers, expedited shipments, obsolete inventories and write-downs. Moreover, the loss of credibility towards customers may require firms to increase marketing and other public relations-related expenditures, increase the costs of raising capital because investors ask less credible firms for premiums, and decrease employee productivity and machine utilization as a result of volatile workloads (e.g., Hendricks and Singhal, 2005a; Kesavan and Mani, 2013). Accordingly, it is not surprising that scholars find empirical evidence for the negative economic consequences of DSMs; among others, Hendricks and Singhal (2005a,b, 2009, 2013) show that DSMs can have both negative short- and long-term effects on operational and financial metrics.

Interestingly, silo thinking and silo mentality are also observable in much academic work. Traditionally, for example, operations management and marketing have been studied separately in management research (Karmarkar, 1996). While marketing scholars frequently focus on the creation of customer demand and the effect of marketing instruments on company performance, most SCOM research focuses on the efficient management of supply and its implications. For example, there is extensive academic marketing science literature concerning the design of
salesforce compensation contracts for sales agents. Many of these studies address the moral hazard problem that arises from the fact that the principal (firm) cannot observe the agent’s (salesperson’s) effort and therefore the agents may not exert the optimal amount of effort to maximize firm profits if the appropriate incentives are not in place. Most of this research assumes that realized demand can always be fulfilled, and accordingly, demand can be used as a contracting parameter. Yet as past research shows and many managers will attest, this assumption is not realistic. In particular, stock-outs are a severe problem in many organizations (e.g., Campo et al., 2000; Anderson et al., 2006) and especially in industries that operate in competitive environments where product substitutes exist, customers are unwilling to wait for inventory replenishment. Instead, they buy from other vendors or cancel their purchases. In these cases, unfulfilled demand results in lost sales, meaning that demand is censored by the quantity in stock. But how should firms evaluate the effort exerted by sales agents if actual demand cannot be observed? This questions the effectiveness of classical salesforce compensation models that generally assume no availability constraints because sales agents cannot be punished by withholding bonus payments if the firm runs out of stock. In addition, the operations management perspective says that stocking decisions should be contingent on the level of effort that the firm seeks to induce from its agents, making the simultaneous determination of compensation parameters and stocking quantities inevitable. Therefore, the existing salesforce compensation models without realistic supply considerations will lead to suboptimal outcomes, since they do not account for the interdependence between salesforce compensation schemes and inventory decisions.

This is just one example that underlines the necessity of an integrated sales and operations planning and substantiates the broad spectrum of research opportunities that emerge at the interface between SCOM with other disciplines.
1.2 Scope of the Thesis

A multitude of factors is responsible for managers’ failure to jointly consider demand- and supply-side aspects in their decision-making, which ultimately leads to a frequent mismatch between demand and supply with several undesirable consequences. Based on conversations with managers and our research, we believe these are the most crucial ones: (i) most research isolates SCOM and sales/marketing topics from each other, leaving managers unaware of the myriad organizational dynamics that emerge from the interconnectedness of business processes over and beyond functional silos, (ii) the empirical evidence regarding the bottom-line implications of demand-supply mismatches is scarce, causing managers to underestimate the benefits associated with integrated sales, marketing, and operations planning, and (iii) even if managers strive for a better aligned organization, there is very little concrete help available to them. Rooted in these factors, the objectives of this doctoral thesis are manifold but can roughly be classified into three main areas:

First, this thesis aims to raise managers’ awareness of the necessity and value of integrating demand- and supply-side aspects in their decision-making. We highlight some of the dynamics that emerge from such considerations and their implications in the contexts of CEO compensation and its effect on the various drivers of stocking decisions, salesforce compensation with supply chain considerations, stock market anomalies related to DSMs, and S&OP. As such, the presented work helps practitioners to appreciate the value of cross-functional integration, promote the SCOM function and put it on the executive agenda, which would facilitate the acquisition of financial and other resources for continuous improvement. In addition, by substantiating the need for integrated sales/marketing and operations planning, we hope to encourage the managers of these departments to share information and plans (with the underlying assumptions) openly within their organizations to provide a better basis for developing a consensus forecast. Moreover, as prior research that considers cross-functional aspects is rare, we provide several novel insights for theory and hope to encourage more academics to jointly consider both demand- and
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Second, we are deeply convinced that for superior SCOM, the consideration of decisions made by other functions of the organization is inevitable. We are also convinced that there is not only one research approach or methodology for addressing the related issues. There is an ongoing call for SCOM scholars to strengthen the empirical basis of SCOM research, identify and verify new phenomena, validate models and assumptions that prior research has made and establish the relevance of SCOM research by empirically reconciling variations in inventory metrics with inventory theory (Fisher, 2007; Roth, 2007; Roth et al., 2013). Because in part, theory makes contrary predictions regarding the effects that we will be analyzing throughout this thesis, the majority of the subsequent chapters are of empirical nature and leverage econometrical methods applied to real-world (financial) data whenever possible. In general, empiricism in SCOM research first became popular during the 1980s, when modeling approaches could not adequately explain the differences in competitiveness between U.S. firms and Japanese manufacturers (Roth, 2007). Since then, empirical research in SCOM has continuously attracted interest and acceptance as underlined by the constantly increasing number of empirical papers published in top-tier SCOM journals (Manufacturing and Service Operations Management, Production and Operations Management, Management Science, Journal of Operations Management, and Decision Science) over the past years (Roth, 2007; Roth et al., 2013). This thesis aims to further strengthen and complement the empirical dimension of SCOM research. In addition, since everyone knows that "cash is king," tying some of our analyses to objective secondary financial data will encourage managers and scholars to raise their awareness of and interest in including aspects that traditionally do not fall into their domains of responsibility in their decision-making processes.

Third, the evidence that many companies face the challenge of establishing a comprehensive game plan for each business function to guide the organization in one direction is growing. The difficulty arises from the lack of a structured, iterative process for building a single consensus forecast as the basis for all further
activities leading to DSMs and the associated negative consequences (Muzumdar and Fontanella, 2006; Wagner et al., 2014). S&OP, which is an ongoing process of monthly planning, reviewing, and evaluating to generate one set of integrated plans by ensuring the involvement of all key stakeholders, has been proposed as a top management tool for tackling these issues. S&OP is enjoying a renaissance because even though the process was developed more than three centuries ago, many firms still underperform due to their ineffective planning process (Wagner et al., 2014; Forbes Magazine, 2015). Because the premise of this dissertation is that understanding and appreciating the value of cross-functional considerations is not enough to distinguish a company from the marketplace, we provide hands-on guidance for managers in the form of a holistic S&OP maturity model that firms can use to assess their internal S&OP processes. It also points the way to an integrated S&OP approach for achieving better organizational alignment.

Figure 1.1 summarizes the three key contributions that the thesis aims to make, all of which are derived from studies that explicitly consider the interdependence between organizational functions. Obviously, all functions within an organization are interdependent to some extent, but throughout this work we place particular
emphasis on issues at the SCOM–sales/marketing interface, with a focus on the financial implications.

1.3 Outline

This dissertation is manuscript-based and comprises six chapters, of which Chapters 2 to 5 are self-contained and can be read independently. Chapters 2 to 5 have been published in or are submitted to peer-reviewed academic journals. It should be noted that Chapter 2 is the outcome of a collaborative work with prof. dr. Stephan M. Wagner and prof. dr. Sandra Transchel. Chapter 4 presents joint research with prof. dr. Sandra Transchel, prof. dr. Ruud H. Teunter, and dr. Jasper Veldman, and Chapter 5 was co-authored by prof. dr. Sandra Transchel. In the following section, we provide a detailed outline of the subsequent chapters.

A better balance between demand and supply brings tangible benefits to firms. However, as highlighted in the introduction, departments in firms often operate without vertical and horizontal alignment. The outcomes are delays and amplification of the information flow, suboptimal corporate plans, uncoordinated reactions within the business, insufficient operational flexibility, and discrepancies in demand and supply. S&OP can circumvent these negative consequences and align organizations. As defined by Cox and Blackstone (2004, p. 103), the purpose of S&OP is: “[t]o develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans.” Even though the process was developed more than three centuries ago, S&OP is experiencing a renaissance because many firms are still hindered by ineffective planning processes (Forbes Magazine, 2015).

In Chapter 2, we present multi-method research that develops a holistic S&OP maturity model derived from the existing S&OP literature and expert interviews.
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It points the way to an integrated S&OP approach for the achievement of better-aligned organizations and firms can use it to assess their internal S&OP processes. We also present the case study of a medium-sized, Swiss-based pharmaceutical company that has recently implemented S&OP. It highlights why companies implement S&OP, the prerequisites and roadblocks they encounter during implementation, and the benefits envisioned and achieved. Finally, we reveal the crucial relevance of the topic by means of a survey showing that organizations’ current S&OP performance is underdeveloped and they must implement many improvements in order to enjoy all the benefits associated with the alignment process. We provide empirical evidence that even though S&OP is not new, the process is still only rudimentary implemented in many organizations, so there is ample room for improvement and potential for firms to distinguish themselves from the competition. For these reasons, we urge and expect top managers to realize the importance of a well-implemented S&OP process and take the appropriate steps to balance demand and supply. The maturity model provides hands-on guidance of what firms need to do in order to progress from a low level to a high level of S&OP proficiency. While Chapter 2 has primarily been designed to serve as a “S&OP toolbox for practitioners,” it also hints at the need for more SCOM research that explicitly considers the interconnectedness of business processes over and beyond functional silos and highlights the great managerial relevance of the topic; as such, Chapter 2 facilitates the embedding of later chapters of this dissertation in a broader context. A shorter version of Chapter 2 is published as: Wagner S.M., Ullrich K.K.R. and Transchel S.: 2014, The game plan for aligning the organization, Business Horizons 57(2), 189-201.

Inventory investment is a key asset for most firms, and its strategic and operational importance has been extensively discussed in the literature. Recent empirical SCOM research shows that a company’s inventory investment is a function of sales and gross margin, which in turn are functions of price (Kesavan et al., 2010; Kesavan and Mani, 2013; Jain et al., 2014). In Chapter 3, we propose that all of these variables are also affected by sales efforts and may affect them in turn. We conceptualize the interdependence of these variables as an “inventory rhombus” and propose an
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econometric method to address the simultaneity arising from the fact that between these variables, causality is likely to run in both directions.

Chief executive officers (CEO) typically approve decisions regarding budget allocation to and prioritization of each of the variables that comprise the inventory rhombus. Prior research shows that the structure of CEO compensation schemes has an effect on CEO risk preferences, which in turn affect company investment decisions regarding market expansion, sales effort, promotions, etc. (e.g., Guay, 1999; Core and Guay, 2002; Coles et al., 2006; Currim et al., 2012). Interestingly, to date no one has asked whether CEO compensation might be a driver of inventory investment. This relationship is plausible because determining the amount to invest in inventory always necessitates a judicious trade-off between the risk of obsolescence and the risk of missing sales opportunities. Moreover, inventory investment is contingent on decisions regarding mean sales, gross margins, and sales effort such that aside from the direct effect of CEO compensation on inventory investment, several indirect effects may exist. There are well-established but competing arguments in the literature that imply a relationship between executive compensation and inventory investment, but we are the first to investigate whether this relationship indeed exists, although particularly the emerging stream of behavioral operations addresses human nature in decision-making processes.

In Chapter 3, we provide empirical evidence of a relationship between the structure of executive compensation and inventory investment. The compensation characteristics we consider are the sensitivity of CEO option portfolios to stock price (SSP) and the sensitivity of CEO option portfolios to stock return volatility (SSV), both of which are frequent subjects of media discussion. The results that we obtain from analyzing the secondary financial data of public U.S. firms in the manufacturing and construction industries demonstrate that CEO compensation has an impact on inventory investment directly and in multiple indirect ways. In particular, we find that a 20% increase in SSP is associated with a reduction of capital invested in inventory of approximately US$ 1.652M and that moving from the 20th to the 80th percentile in terms of SSP is associated with a reduction of capital invested
in inventory of approximately US$ 22.6M. This finding confirms that CEOs whose compensation is more dependent on the stock price follow less risky strategies. We also show that a 20% increase in CEO SSV is associated with an increase of capital invested in inventory of approximately US$ 0.873M. This association corresponds to an increase of US$ 12.5M in capital invested in inventory when shifting from the 20th to the 80th percentile in terms of SSV, confirming that SSV motivates risk-seeking behavior.

These findings provide valuable insights into the complex dynamics in organizations and the effects of managerial incentives on inventory investments. Our analyses indicate that the two elements of CEO compensation, the SSP and the SSV, both have a high economic impact on inventory investments. Therefore, operations managers, CEOs themselves, researchers, and compensation committees must all be aware of this impact and be able to estimate and manage it. Moreover, the finding that inventory, COGS, gross margin, and sales effort all affect each other underlines the importance of combined sales, marketing, and operations planning. We urge and expect top managers to realize the importance of aligning their organizations across and beyond functional silos to improve the match between demand and supply. The results of this study are also of interest to supply chain and operations managers. If their bonuses depend on inventory metrics, they should be aware of the fact that several of the causes of inventory buildup – and in particular the human one – lie outside their direct sphere of action. Instead, they emerge from the design of CEO compensation schemes and their interconnection with the variables that comprise the inventory rhombus.

Chapter 3 also provides valuable insights for theory. We show that the triangular interdependent association between inventory investment, gross margin, and cost of goods sold as proposed by Kesavan et al. (2010) and Kesavan and Mani (2013) in retailing contexts also holds for firms in the manufacturing and construction industries. By including the sales effort measure in this framework and conceptualizing the inventory rhombus, we respond to the frequent call to strengthen the empirical basis of SCOM research. Our work might also motivate more (empirical) SCOM
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scholars to stop considering demand as purely exogenous. Finally, our study is the first to provide empirical insights into the effects of CEO compensation on inventory investment, a relationship that has been argued to exist in the context of phenomena such as “window dressing” and the “hockey stick effect” (e.g., Lai, 2007).

In Chapter 4, we study salesforce contracting for a firm that employs multiple sales agents. U.S. firms spend 10%-40% of their sales revenues on salesforce expenditures to promote their products (Albers and Mantrala, 2008). To ensure high returns on this significant investment and because it is difficult for managers to monitor sales efforts, firms design incentive contracts to induce salespeople to exert the optimal amount of effort. However, most of the research on salesforce compensation assumes that supply perfectly matches demand or allows infinite backlogging without customer attrition. In these models, realized demand can always be fulfilled and accordingly, demand can be used as a contracting parameter. However, as past research shows and many managers will attest, this is not realistic. In particular, stock-outs are a severe problem in many organizations and are known to be detrimental to company financial performance (e.g., Campo et al., 2000; Anderson et al., 2006). Especially in industries that operate in competitive environments where product substitutes exist, customers are unwilling to wait for inventory replenishment and instead buy from other vendors, buy other brands or cancel purchases.

Although it is widely acknowledged that sales and operations planning should be integrated (e.g., Shapiro, 1977; Wagner et al., 2014), research in the context of salesforce compensation that considers operational aspects is very rare. Only in recent contributions, Chu and Lai (2013) and Dai and Jerath (2013) account for the possibility of stock-outs and demand censoring in their research on salesforce compensation. The authors derive optimal compensation characteristics and stocking quantities, but they restrict their analyses to cases in which the firm employs only one sales agent. However, in practice companies frequently employ more than one salesperson and pool inventories in a central warehouse, making inventory available to each individual sales agent, contingent on the other agents’ effort decisions and selling success. As a result, two competing effects must be considered in the
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design of multi-agent salesforce compensation schemes with supply chain considerations. On the one hand, anticipating that some agents exert great effort, it may be rational for the other agents to reduce their levels of effort (i.e., to shirk) if the inventory for all agents is stocked in a central warehouse. This dilemma is called the “free-riding problem" and is known for its adverse effects on firm profits (Holmstrom, 1982; Nalbantian and Schotter, 1997). On the other hand, a potential inventory pooling effect could occur if the stocking quantities for multiple sales agents are stored in a central warehouse. Inventory pooling is generally positively associated with firm profits (Eppen, 1979; Corbett and Rajaram, 2006).

To narrow this gap in the literature, in Chapter 4 we study the problem of integrated salesforce compensation with supply chain considerations for a firm that employs multiple sales agents. We assume that each sales agent exerts an unobservable effort to increase the level of (uncertain) demand in an environment in which demand is censored by the stocking quantity. The firm makes a stocking decision contingent on the supply chain design (i.e., joint inventory pool or decentralized inventories for each agent/market) and designs an incentive contract on the basis of which sales agents determine their effort levels.

We show that under inventory pooling, sales agents tend to exert less efforts than under decentralized inventory levels. This “free-riding” effect is driven by the fact that under demand censorship, the agents’ expected bonus payments are linked by the pooled inventory. Therefore, in some situations, forgoing the operational efficiency gains from inventory pooling and instead “pushing” inventory to each agent to prevent shirking is optimal for the firm. We identify the market conditions (profit margin and demand uncertainty) under which each supply chain design is dominant. Moreover, prior research suggests that the optimal inventory and service levels under demand censorship are equal to the first-best (FB) inventory and service levels or exceed these because “overstocking” might improve the quality of actual sales as an indicator of demand and effort. In the presence of multiple sales agents, we identify cases under demand censorship in which the optimal stocking quantity and the service level are lower than in the FB scenario. In addition, we show
that both inventory decisions and the effort equilibrium are both affected by the contracting parameters of the incentive contracts, and vice versa. Because of this interdependence, the optimal stocking quantity under inventory pooling may exceed the sum of the decentralized inventories under certain market conditions. We derive the optimal contracting parameters for sales-quota-based bonus contracts that lead to the optimal company profit and identify the market conditions under which the sales-quota-based bonus contract leads to the FB profit. With several theoretical and practical implications, Chapter 4 highlights the importance of combined sales and operations planning.

In the retailing industry, inventory accounts for, on average, 34% of total assets and 60% of current assets and has a mean value of US$ 519.7M. There, inventory has been established as a key factor that needs to be managed with the greatest caution. Excessive inventory may lead to liquidity problems and future markdowns, whereas insufficient stock will lead to lost sales, customer dissatisfaction (with all of its negative consequences), and premium freight charges resulting from expedited shipments (Kesavan and Mani, 2013). Therefore, in recent decades, retailers have striven to continuously improve their inventory management practices and adopted paradigms such as inventory pooling, quick response, information sharing, responsive supply chains, and revenue management (e.g., Chen et al., 2007). In fact, Rajagopalan and Malhotra (2001) and Chen et al. (2007) provide empirical evidence that firms have improved their inventory productivity over time by means of these practices. Despite these practical advances that have been shown to improve firms’ financial performance, Sloan (1996), Kesavan et al. (2010), and Kesavan and Mani (2013) note that there is growing evidence that Wall Street investors do not leverage all of the information that inventory and SCOM performance contains. In addition, managerial incentives are usually tied to stock market performance rather than to operational metrics because stock performance information can be accessed easily and accurately (Currim et al., 2012; Alan et al., 2014). Accordingly, whether or not inventory management is systematically related to stock market performance is of great interest to both shareholders and managers.
In Chapter 5, we apply portfolio-based asset pricing methods to analyze whether retailers’ capability to manage inventory effectively (i.e., minimizing demand-supply mismatches) predicts future stock returns. Driven by the fact that demand and supply variability are the primary factors responsible for supply chain inefficiency (e.g., Lee et al., 1997; Warburton, 2004; Chen and Lee, 2012; Cui et al., 2015), we develop a new key performance indicator (KPI), entitled DSM (demand-supply mismatch), which measures a firm’s relative inventory productivity volatility. DSM contains valuable and distinct information on firm operations because high volatility in inventory productivity may imply that a firm faces periods with excessively high inventories and other periods with stock-outs, although the average inventory productivity might imply that its operations are well managed. Knowing that higher demand volatility causes higher inventory volatility, we normalize the volatility of inventory productivity by the volatility of demand. As such, DSM captures the fact that a low variation in inventory productivity relative to a given level of fluctuation in demand is indicative of the superior synchronization of demand- and supply-side operations. As a consequence, a firm that experiences greater volatility in terms of inventory productivity relative to demand volatility suffers from a greater mismatch of demand and supply.

We show that the volatility of inventory productivity relative to the volatility of demand is a predictor of future stock returns in a sample of publicly listed U.S. retailers in the period 1985-2013. Applying the Fama and French (1993) three-factor model augmented with a momentum factor (Carhart, 1997), we find that zero-cost portfolios formed by buying the two lowest and selling the two highest quintiles of DSM stocks yield abnormal stock returns of up to 1.13%. These strong market anomalies related to DSM are observed over the entire sample period and persist after controlling for alternative inventory productivity measures and firm characteristics that are known to predict future stock returns. We also show that DSM is indicative of lower future earnings and lower sales growth, and provide evidence that the observed market inefficiency results from investors’ failure to incorporate all of the information that inventory contains into the pricing of stocks.
The results presented in Chapter 5 are relevant to the audience of (i) investors/stock analysts, (ii) managers, and (iii) researchers. We encourage investors and stock analysts to leverage quarterly financial information in addition to annual financial reports to gain a more comprehensive understanding of operational processes. Based on our measure of DSM, we identify a market inefficiency – and investors can capitalize this knowledge. Operations managers may also benefit from our results because we reveal a strong correlation between SCOM and stock market performance, thus providing empirical support for budget negotiations. CEOs may place greater emphasis on improvement projects with an operations management focus, as our results clearly imply a relationship between DSMs and stock market performance. In addition, the DSM KPI serves as one example of how the dependence between operations and sales/marketing can be incorporated into measurement systems and may be employed for benchmarking purposes while avoiding average measures that can smooth out important information. Our results have implications for research and they also complement the empirical SCOM literature that links business practices to financial data. Future research may employ the DSM measure for use in a broad spectrum of analyses. Whereas relative volatility measures are quite commonly employed in the context of the bullwhip effect, for example, we hope to encourage scholars to also consider such relative volatility measures to a greater extent on the firm-level. Chapter 5 has recently been accepted for publication in Production and Operations Management as: Ullrich K.K.R. and Transchel S.: 2017, Demand-supply mismatches and stock market performance: A retailing perspective, Production and Operations Management, In press.

Table 1.1 summarizes the titles, purposes, methodologies, findings, co-authors, and the publication progress of Chapters 2 to 5 at the time of submitting this thesis. Chapter 6 concludes the thesis by summarizing our main findings and highlights some directions for future research.
### Table 1.1: Summary of Chapters 2 to 5

<table>
<thead>
<tr>
<th>Chapter 2</th>
<th>Chapter 3</th>
<th>Chapter 4</th>
<th>Chapter 5</th>
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<tbody>
<tr>
<td><strong>Titles</strong></td>
<td><strong>You Get What You Pay for: CEO Compensation and the Inventory Rhombus</strong></td>
<td><strong>Multi-Agent Salesforce Compensation with Supply Chain Considerations</strong></td>
<td><strong>Demand-Supply Mismatches and Stock Market Performance: A Retailing Perspective</strong></td>
</tr>
<tr>
<td><strong>Purposes</strong></td>
<td><strong>Development of a maturity model for S&amp;OP processes</strong></td>
<td><strong>Conceptualization of the inventory rhombus, which captures the interdependence between inventory investment, demand, gross margin, and sales effort</strong></td>
<td><strong>Study of salesforce contracting for a firm that employs multiple sales agents</strong></td>
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<tr>
<td></td>
<td><strong>Industry assessment with respect to S&amp;OP</strong></td>
<td><strong>Analysis of the effect of CEO incentives on inventory investment</strong></td>
<td><strong>Development of a novel KPI that measures DSMs</strong></td>
</tr>
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<td></td>
<td><strong>Implementation and improvement guidance (toolbox for managers)</strong></td>
<td><strong>Analysis of implications for and of the supply chain design</strong></td>
<td><strong>Analysis of the drivers for the detected market anomaly</strong></td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td><strong>Simultaneous equation models (EC2SLS, 3SLS, G2SLS, RE, FE)</strong></td>
<td><strong>Stochastic optimization, Game theory</strong></td>
<td><strong>Portfolio asset pricing models, Fama-MacBeth regressions, First-order autoregressive models</strong></td>
</tr>
<tr>
<td><strong>Findings</strong></td>
<td><strong>CEO compensation affects inventory investment directly and in multiple indirect ways</strong></td>
<td><strong>Agents “free-ride” if inventory is pooled in a centralized warehouse</strong></td>
<td><strong>DSM is a strong predictor of future stock returns</strong></td>
</tr>
<tr>
<td><strong>Co-authors</strong></td>
<td>None</td>
<td><strong>Inventory pooling is not always superior to decentralized inventory stocking</strong></td>
<td><strong>Investors fail to incorporate all of the information that DSM contains into the pricing of stocks</strong></td>
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<td></td>
<td><strong>Provision of hands-on guidance for managers to improve S&amp;OP processes and to judge current S&amp;OP performance</strong></td>
<td><strong>Sales-quota-based bonus contracts can lead to FB profits</strong></td>
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<tr>
<td><strong>Publication progress</strong></td>
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<td><strong>Under review (Journal of Operations Management)</strong></td>
<td><strong>Accepted (Production and Operations Management)</strong></td>
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**Note.** EC2SLS: Error component two-stage least squares, 3SLS: three-stage least squares, G2SLS: Generalized two-stage least squares, RE: random effects, FE: fixed effects.