MANAGING RISK AND UNCERTAINTY IN SUPPLY CHAINS IN THE FACE

OF THE CURRENT GLOBAL REALITIES

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ABSTRACT

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For the last two decades, there has been an increasing academic and practitioner interest in understanding uncertainty and risks, identifying their sources, and managing, reducing and mitigating them in supply chains (SCs). Many sources of risk are already identified and grouped, and some good methods to reduce or cope with them have been described as well. However, literature has not been profound yet. Indeed, certain types of risk sources lack practical definitions and/or effective management techniques (Prater, 2005; Simangunsong et al., 2012).

The financial crises of national economies in the late 2000s followed by a global recession (2008-2012) have escalated the uncertainty and risk in SCs and meant further struggles for them in managing customer and financial flows. The development of information and communication technologies (ICT) eased the transmission of such risks from one SC entity to another. Consequently, the intensified global competition coupled with increased uncertainty and risk in SCs created a constant need to focus on financial and customer flows. This thesis has two main goals:

- to assess the current supply chain literature and how certain supply chain risks particularly in customer and financial flows need to be changed and expanded in the face of the current global realities

- to research and apply some of these recommended changes.

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CHAPTER 1

INTRODUCTION

1.1   Research Agenda

During the last decades, there has been an increasing awareness and interest among practitioners and academicians in supply chain risk management (Colicchia & Strozzi, 2012; Jüttner et al., 2003). Despite this, the research is far from being complete particularly in understanding, reducing, managing, and mitigating uncertainty and risk in supply chains (SCs) (Tang, 2006). Many risk sources are identified and categorized, and some good reduction, mitigation and management methods have been described. However, certain types of risk sources still lack practical definitions and effective management techniques in literature (Prater, 2005; Simangunsong et al., 2012). Similarly, many earlier risk management methods potentially have become obsolete or ineffective in the light of new and ongoing developments in customer expectations, business-customer relations, financial markets, and the global economy due to their implied assumptions of stability (Christopher & Holweg, 2011; Tang & Tomlin, 2008). Having eased the transmission of risks from one SC entity to another, the development of information and communication technologies (ICT) and ongoing economic globalization evidently aggravated vulnerability of global supply chains (Bogataj & Bogataj, 2007; Overby & Min, 2001). Likewise, the financial crises of the late 2000s followed by a global recession (2008-2012) has escalated many risks in SCs and meant further struggles for SC management (SCM) (Bentley, 2011; Blome & Schoenherr, 2011).

Even though the development of ICT and better management techniques improved SCM in managing material and information flows (Gunasekaran & Ngai, 2005), the aforementioned changes (global crises, ICT development and globalization) complicated management problems, particularly in financial and customer flows (customer interaction with the service provider) of SCs (Seth et al., 2005). The intensified global competition coupled with increased uncertainty and

volatility in SC created a constant need to focus on financial and customer flows because of the lower profit margins than before (Overby & Min, 2001). Being at the center of any supply chain, operations management needs to step in and develop better methods to manage the risk in collaboration with finance and marketing fields. Because the direction of the new research should be in line with today's needs, understanding the changes of uncertainty and risk in financial and customer flows of SCs and how to reduce, manage, and mitigate them more effectively will be the thesis focus. In summary, this thesis has two main goals:

- to assess the current supply chain literature, and to examine how certain supply chain risks in financial and customer flows need to be changed and expanded in the face of the current global realities

- to bring managerial insights by analyzing and working on case studies, mathematical models and empirical research *1.1.1 Supply Chain Flows*

A traditional definition of supply chain management includes managing three major types of flows (Rai, Patnayakuni & Seth, 2006):

- Material/Physical flows (goods, equipment, and supplies)

- Information flows

- Financial flows

Each of these flows can move in both directions, upstream and downstream. Generally speaking, however, materials move toward the customer (downstream), financial flows move upstream and information moves in both directions. In the last two decades, the first two flows (material and information) saw major improvement by applying the latest developments in computing, the Internet, and ICT. For instance, the adaptation of RFIDs helped SC managers to track flows of materials and inventories in a matter of seconds (Reyes, Frazier, Prater & Cannon, 2007). The picture is more blurry on the financial flows (Hofmann, 2005). First, similar to material and information flows, there were improvements in managing financial flows of SCs, through cooperation of financial institutes and firms, and again through the efforts of practitioners and

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academic researchers. However, global financial crises of 2000s and developments in ICT meant more volatility and uncertainty, consequently more risk in financial flows.

Customer flows, which include any interaction between service providers and customers, should be considered as the fourth frontier for SCs. If right market signals cannot be recognized, a SC fails to be responsive to changing market trends and customer preferences (Christopher & Lee, 2004). Often, any relationship of the service provider with the customer usually is considered as a responsibility of the marketing department only. However, a failure in fulfilling customer expectation in service and/or product delivery creates negative word-of-mouth (NWoM), which would eventually reduce customer inflow to the business (Richins, 1983). Once again, developments in ICT created a challenge for SCs by enabling fast and severe transmission of any such NWoM (Peres, Muller & Mahajan, 2010). Today's individual customers as a source of fast NWoM can have devastating effects on the survival of any business. Meese-Roog and Davidson (1999) described this as being the sovereign individual, which literally means customers became as powerful as a national sovereign entity. Another way of viewing this is that the customer now has increased their channel power. Hence, here are the updated flows:

- Material flows
- Information flows
- Financial flows
- Customer flows

1.1.1 Thesis Organization

In order to understand new challenges in financial and customer flows, a few representative areas will be chosen for research in this thesis. Presenting an understanding of all financial and customer flows of SCs are beyond the scope of this thesis. So working on representative research areas will bring a more manageable scope. In selecting these risk areas, the severity of the potential vulnerability of SCs as a result, the extent of changes in recent years, and literature gap in definition and management methods are some factors that are considered.

These areas are currency and trade risk in financial flows and word-of-mouth (WoM) in customer flows.

In terms of financial risks, currency risk has increased more significantly along with a few other financial risks in recent years. Today, more than ever, economies are integrated and interrelated (Christopher, 2000). Companies have become more global, working in multiple countries and currency zones, and more countries and trade blocs have signed free trade agreements (Christopher, 2000; Houlihan, 1993). Furthermore, for the last few decades, international trade particularly in manufacturing has been growing faster than the growth of global GDP (Braithwait & Wilding, 2003). As a result, currently there are fewer companies that deal with a single currency across their entire supply chain than previously. One way to handle currency exposure is through operational measures. For instance, certain companies may move to currency zones that enable them to decrease their cost to produce goods. Other companies may prefer to do their transactions on a hard currency basis only, even though working in multiple countries (Huchzermeier & Cohen, 1996). However, during and after the global crisis of the 2000s, defining certain currency as hard currencies became problematic. The US dollar has become weaker and more volatile against many world currencies (Engel & West, 2010). As a result, the assumption that the US dollar is a safe haven became an interesting question. In the second chapter, the assumption of the US dollar as a hard currency will be tested, and better ways to deal with currency exposure using operational measures in SCs will be discussed. Considering currently that the option for a firm to sell or transfer currency risks to financial institutes is more problematic and expensive, if not impossible, there is a need to better understand the risk management options for global supply chains.

The nature of the risks associated with customer flows also has changed during the last two decades (Khan et al., 2009; King & Burgess, 2008; Krasnikov et al., 2009; Lambert, 2009; Smith, 2009; Xie & Shugan, 2001). In today's tight economic times, many manufacturing operations moved to the East from industrialized economies creating a global economy with more service orientation and highly competitive (Lambert & Cooper, 2000; Pan & Lee, 2003). Similarly,

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global competition is more widespread than before with lower trade barriers and an ease in international transportation and communications (Christopher, 2000; Pan & Lee, 2003). Not only are firms facing intense competition, they are under pressure of cutting costs after the global financial recession of the late 2000s (Acemoglu, 2009). Some firms (i.e., Circuit City, Linens and Things) have perished. Other firms have had to lay off their workers and close stores in hopes of surviving the economic crisis. Now, surviving firms are operating with fewer resources and are more closely managing their budget reserves (Acemoglu, 2009). Considering such heavy external pressure, operational decisions in supply chain management need to accompany and enhance marketing decisions (Craig & Douglas, 1996; Dixon & Verma, 2010). Marketing operations interface has continually been getting more attention especially in trying to initiate collaboration between the two sides instead of difficult clashes. No longer can a majority of firms have the luxury of stable markets, but rather have volatile, a highly competitive, a heavily customer centered and chaotic. In general, marketing efforts generates sales, while operations try to fulfill them. Any mismatch would result in negative WoM and loss of revenue.

The effects of developments of ICT on customer flows and how SC should react are relatively untapped in terms of academic research (Overby & Min, 2001). With the introduction of social networks, and the increase in dependency on the Internet and e-mails as personal communication, the speed of the consumer's opinion transmission and the effectiveness of a negative WoM has become even stronger (Bruyn & Lilien, 2008; Ferguson, 2008; Godes & Mayzlin, 2009; Trusov et al., 2009; Xie & Shugan, 2001). Specifically, any negative or insufficient customer experience would result in NWoM, while the opposite would result in positive word-of-mouth (PWoM). The global crisis resulted in shrinking or not growing markets, and caused customers to look more for getting the most out of their money. Hence, WoM becomes an even bigger issue. So, managing customer expectations and word-of-mouth, and bringing the right customers should be the top priority for any service-oriented supply chain. In reality, it is not misleading to think that marketing and operations departments are sharing a limited amount of the budget for advertising or quality improvement projects (Weber, 2002). A certain advertising

initiative means less money for any quality improvement. Firms invest in quality in order to sustain and/or increase their competitiveness and to create positive word-of-mouth. A balanced approach for a shared budget will be investigated between marketing and operations with a focus on WoM and viral marketing. This research is unique and valuable in the sense that it is relatively a new area and understanding the marketing and operations interface has a lot of potential for service-oriented supply chains. The research on WoM and viral marketing as part of budget decisions between marketing and operations is rather limited. For better understanding and management of WoM from the operations/supply chain management perspective, this thesis includes both a closed-loop and an open-loop model of this phenomenon(chapters 3 and 4). This research will bring new insights in this area.

Finally, because of the global financial crisis, credits to the real sector from financial institutes have become expensive or impossible to obtain. According to a survey conducted in UK from 2008 to 2010 among a group of logistics and supply chain practitioners, 80% of the companies had moderate to severe impact on the overall level of activity during the period of financial crisis (Bentley, 2011). The same study includes payment delays, a decrease in income, and higher saving targets as some of the impacts of the crisis (Bentley, 2011). Some of the operational ways for companies to manage the lack of credit is through using trade credits or delaying payments to suppliers. Here, trade credit is the amount temporarily lent to buyers from suppliers in order to sell a particular product. Resource-based theory implies that it is better for the buyer to pay as late as possible if the consequences of doing so are less than the benefit of holding the payment longer. According to Peterson and Rajan (1997, p.1), "firms use more trade credit when credit from financial institutions is unavailable". There are potential costs and benefits to suppliers to offer trade credits to buyers compared to what financial institutes can offer them. Suppliers have better information acquisition potential, have more management tools and potential power in controlling the buyer, and have more ability to liquidate the buyer assets in case of nonpayment. Better information acquisition refers to the ability to assess the financial strength of the buyer more accurately because of having more ties to the supplier. In this way, the

supplier has better information than an outsider financial institution that might otherwise offer credit to the buyer. Controlling the buyer refers to the extended power of certain suppliers to cut strategic supplies from the buyer in the case when there is nonpayment. A financial institution may also impose sanctions. However, this practice usually takes more time as it might result from a court order. On the other hand, a supplier can simply stop sending more of their products; this has an immediate impact on buyer behavior. Lastly, since the supplier is closer to the buyer and its network, a supplier can sell the buyer's assets faster than a financial institution can. Our focus is on the trade credit between SC entities, such as suppliers and buyers, not that between retailers and customers. Secondly, the effect of the global crises on the trade credit structure between SC entities will be covered. It is anticipated to have longer terms in trade credit. The effects of industry, location (country) or size of the firm on TC levels are to be investigated. The goal is to determine more risky suppliers/buyers who would ask more trade credit or would have more financial problems as early as possible. For this purpose, a secondary data collected from certain Eastern European countries on the firm and industry level about trade credit during the recent recession is used.

<u>1.2</u>　　<u>Literature Review</u>

1.2.1　　*Evolution of Supply Chain Definition*

As early as 1961, researchers indirectly described supply chains without coining the term. Forrester (1961) stated that there need to be interactions among "flows of information, materials, manpower, and capital equipment". However, "the actual term 'supply chain management' did not materialize until the early 1980s, and only a handful of articles mentioned the phrase 'supply chain' between 1985 and 1997" (Giunipero et al., 2008, p.67). In the 1990s, the terms supply chain and SCM have been used more extensively and the definition has evolved into the "flow of goods, management of relationships, and a concept that extended from a supplier to the ultimate customer" (Giunipero et al., 2008, p.67). Yet, Croom et al., as recently as 2000, claimed that there is a need for a clear definition of constructs and conceptual frameworks for SCM. A common definition of SCM is

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"The systematic, strategic coordination of the traditional business

functions and the tactics across these business functions within

a particular company and across businesses within a supply

chain, for the purposes of improving the long-term performance

of the individual companies and the supply chain as a whole."

(Mentzer et al., 2001, p. 18)

Within this definition, a supply chain is defined as ''a set of three or more entities (organization or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer'' (Mentzer et al., 2001, p. 4). As a result, a study in managing supply chains often falls into multiple intersections of directly or indirectly related areas. For instance, researchers may find the information management and supply chain management intersection as a good field for research, while others find finance and marketing areas worthy of a research study. SCM is definitely one of the areas in which interrelated and interconnected research is the norm for the success of the entire SC.

1.2.2 Declining Domestic Supply Chains

There is little debate on one aspect of supply chains. There are fewer and fewer cases of truly domestic supply chains. It is more of a standard for a supply chain to have global operations with either suppliers, manufacturers, service providers, or customers outside the borders (Cohen et al., 1989; Dasu et al., 1997; MacCarthy & Atthirawong, 2003; Prasad & Babbar, 2000). Many organizations consider being a global organization is no longer a choice but a requirement for a business' very existence. Even though, a certain service firm may opt not to have any foreign market clients while the domestic market is adequate, it is very likely that even such a firm can have many suppliers outside its country's borders (Brush et al., 1999; Dornier et al., 1998; Trent & Monczka, 2003). Many firms operating in larger markets, such as in the United States, with only a limited number of suppliers abroad, but the rest of the operations within the country, may mistakenly consider themselves as a fully domestic supply chain (Ferdows, 1997; MacCormack et al., 1994). Even though, the degree of dependency and engagement in a global

event/crisis of such a company is limited compared to the ones with more international operations, the dependency cannot be assumed as zero because of the complex nature of supply chains (Chopra & Meindl, 2004; Meixell & Gargeya, 2005). For instance, all companies using oil and petroleum products, which are mostly imported from overseas, are actually vulnerable at different levels to international political and economic events. Moreover, the global crisis of the late 2000s shows that supply chains are even more integrated and interrelated (Acemoglu, 2009; Christopher, 2000; MacCarthy & Atthirawong, 2003).

1.2.3   Risk, Uncertainty, and Vulnerability in Global Supply Chains

Many researchers correctly have identified that the next stage in SCM research is in understanding and managing/mitigating/reducing contingencies. With better understanding and management of uncertainty and risk, there would be a decrease in the vulnerability of a firm and even a benefit from the situation (Simangunsong et al., 2012). Clearly, the earlier focus on single goals, such as profit maximization, or cost minimization should no longer be sufficient and comprehensive for today's SCs. It is the very survival of the firm that depends on managing risk and uncertainty (Shankar et al., 2012). Moreover, there is still confusion in even defining fundamental concepts including " risks, uncertainties, vulnerabilities, and sources of risk" (Manuj & Mentzer, 2008, p. 2).

1.2.3.1   Definition and Difference among Risk, Uncertainty and Vulnerability in Global Supply Chains

The words "risk" and "uncertainty" are often used interchangeably in supply chain literature; though, a weak separation does exist in usage among researchers (Peck, 2006; Ritchie & Brindley, 2007). Risk definitions include three related dimensions:

- the probability of having certain event or outcome realized
- consequences of having those events or outcomes
- the causal pathway for reaching such result

Sitking and Pablo (1992) defined risk as "the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized" (p. 10).

This particular definition precludes the positive outcome of having a higher risk. A higher risk may bring higher returns on investment as well. Another earlier definition by March and Shapira (1987, p. 1404) determined the risk as "the variation in the distribution of possible outcomes, their likelihood, and their subjective values". This definition includes both positive and negative outcomes. However, in literature, the term "risk" often has a singular connotation of being uncertain and negative. Based on the definition by Manuj and Mentzer (2008), the term "risk" in this paper has two dimensions:

- the size of potential losses
- the likelihood of those losses

Uncertainty, on the other hand, when differentiated from the risk in literature, is defined as a case with insufficient information, knowledge, or understanding to identify fully the outcomes (Ritchie & Brindley, 2007). In the case of outcomes of events with certainty, risk discussion is unnecessary. Instead, a discussion of preparation for the known outcome of the event is necessary. In other words, uncertainty prepares an environment for any risk to exist or occur. On the other hand, a special case of risk occurs when there is perfect or near perfect information about the distribution of a probabilistic or deterministic event. In this case, there is certainty but also risk because there is a distribution of outcomes. When some of these outcomes of such probabilistic or deterministic events are less desirable or not desirable at all, that represents a negative risk. Many financial instruments such as currency options convert uncertain risks into risks with certain outcome distributions by offering a predetermined set of outcomes for the probabilistic event.

Svensson (2002) defined vulnerability as "a condition that affects a firm's goal accomplishment dependent upon the occurrence of negative consequences of disturbance" (p. 112). It is noteworthy that Svensson used the term "disturbance" instead of the more common term "risk". SC managers not only need to identify and describe risks but also need to analyze the vulnerability of the system. Risk factors that do not have a potential of disturbance or have

manageable disturbances do are not necessarily create vulnerability for SCs. Hence, a preparation for such a situation may not be necessary.

1.2.3.2   Categorizing the Sources of Uncertainty and Risks in Supply Chain Management

There have been many attempts to categorize the sources of risk in global supply chains with various success rates. In an early attempt, Ghoshal (1987) categorized risk into four categories:

- macroeconomic risks, which are external and outside of their control such as volatility in wage rates, interest rates, exchange rates and commodity prices

- policy risks resulting from the political decisions made by national or sub-national entities

- competitive risks arising from the uncertainties of competitors' behaviors

- resource risks that include any uncertainty in receiving or acquiring resources that the firm does not hold

Based on interviews held among certain global supply chain managers, "currency, transit time variability, forecasts, quality, safety, business disruption, survival, inventory ownership, culture, dependency and opportunism, oil price fluctuation and environmental disasters are important risk factors" (Manuj & Mentzer, 2008, p. 6). Here, the term "safety" refers to possible safety hazards on carrying goods, while the term "survival" refers to the firm's resistance against going out of business or bankruptcy. The term "opportunism" refers to the ability of suppliers and customers to behave opportunistically. Gupta and Maranas (2003) separate uncertainty into short-term and long-term: short-term uncertainty includes "day-to-day processing variations, cancelled/rushed orders, and equipment failures", while long-term uncertainty includes "unit price fluctuations, seasonal demand variation and production rate changes occurring over longer time frames".

Simangunsong et al. (2012) effectively categorized literature into two parts: models and management of uncertainty at the top level (see Figure 1.1). A definite conclusion in identifying/defining all potential uncertainty sources is yet to reach. Simangunsong et al. (2012) group uncertainty into early models, uncertainty circle models, complexity models, contingent models and risk models (see Figure 1.2). Some of the earlier noteworthy papers are Davis (1993), van der Vaart et al. (1996) and Gupta and Maranas (2003) papers. Three sources of uncertainty are identified as demand uncertainty, uncertainty related to the manufacturing process, and supply uncertainty in the Davis paper (1993). All of these earlier three papers suggest that demand uncertainty is the most severe type arising from volatile demand or inaccurate forecasts.
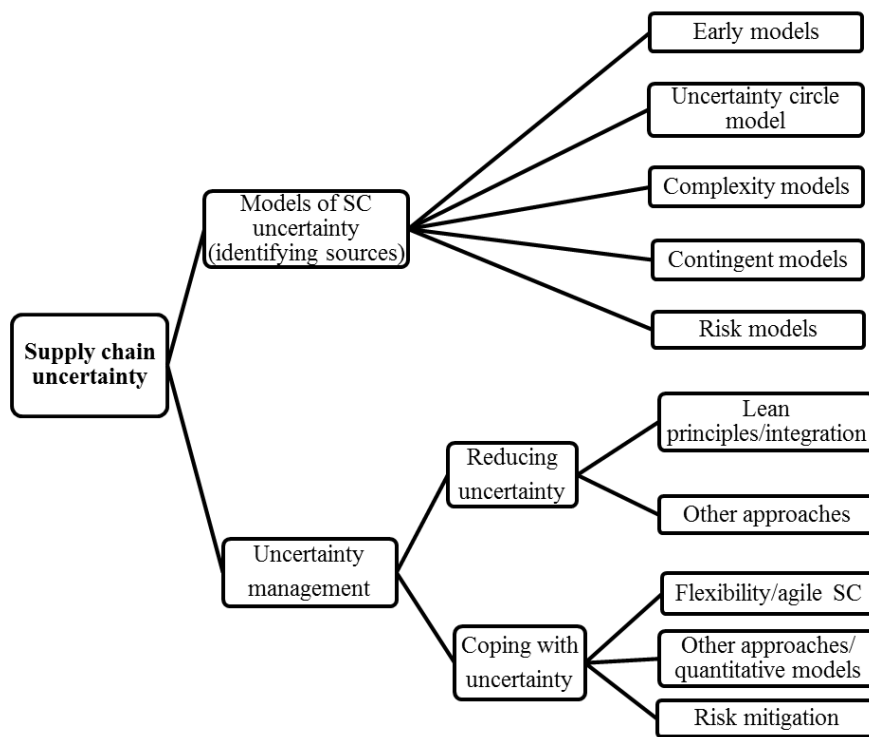
Figure 1.1: A general view for the supply chain uncertainty (Simangunsong et al., 2012)

In the uncertainty circle model an additional dimension of uncertainty is included as control uncertainty, which is related to "the capability of an organization to use information flow and decisions to transform customer orders into a production plan and raw material requirements"

(Geary et al., 2006; Simangunsong et al., 2012). The complexity model proposed by Wilding (1998) adds one more dimension as the "parallel interaction," which can be thought to be a potential chaos because of a customer's concurrent interaction (order/cancelation) with multiple competing suppliers. Prater (2005) further iterated the model by including macro and micro uncertainties. The next grouping of contingent models includes models for specific purposes. Simangunsong et al. (2012) provided van der Vorst and Beulens' (2002) study of uncertainty and supply redesign in the food industry. The last grouping of risk models includes the papers of Miller (1992, 1993), which develops an integrated risk management framework for international models, Juttner et al. (2003), and Christopher and Peck's (2004) papers, which divide uncertainty into three large areas of internal, external, and network related.
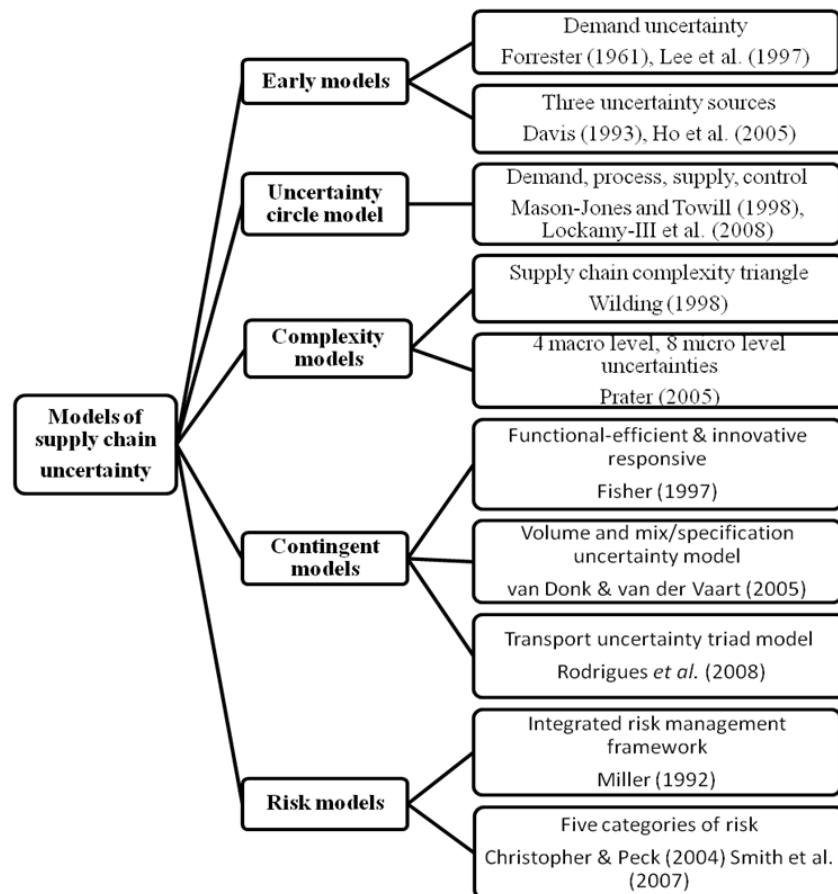
Figure 1.2: Models of supply chain uncertainty (Simangunsong et al., 2012)

1.2.3.3   Categorizing Uncertainty and Risk Management Aims in Supply Chain Management

According to Simangunsong et al. (2012), there are two broad objectives for uncertainty and risk management in literature:

- eliminating/reducing the uncertainty
- coping with uncertainty

In Simangunsong et al. (2012) (see Figure 1.3) uncertainty reducing refers to any attempt at reducing uncertainty at the source, while coping refers to an attempt to adapt to the consequences of uncertainties.

Under reducing uncertainty in Simangunsong et al. (2012), there are 10 main categories in literature:

- lean operations
- product design
- process performance measurement
- good decision support system
- collaboration
- shorter planning period
- decision policy and procedures
- ICT systems
- pricing strategy
- redesign of chain configuration and/or infrastructure

Lean principles

Seamless supply chain
Geary et al. (2002) Lockamy-III et al. (2008)

Reducing uncertainty

Other approaches

Process performance control
Davis (1993), Geary *et al.* (2002) New product design
Davis (1993), Gerwin (1993)
Chain infrastructure redesign
van der Vorst & Beulens (2002), Bhatnagar & Sohal (2005)
ICT System
Greg (2006)

Uncertainty

Flexibility/ Agility

Flexible supply chain
Prater et al. (2001), Sawhney (2006), Gosling et al. (2010)

Other approaches

Postponement
Yang et al. (2004), Yang & Yang (2010)
Lead time management
Prater et al. (2001)
Advanced analytical techniques
Davis (1993)
Buffer stock
Davis (1993), van der Vorst & Beulens (2002), Wong & Arlbjorn (2008)
Simulation Model
Kwon et al. (2007)

Coping with

Risk

Disruption risk management
Kleindorfer & Saad (2005), Tang (2006), Ritchie & Brindley (2007)

Figure 1.3: Uncertainty management in supply chains (Simangunsong et al., 2012)

The presumption with lean operations is that the leaner the operation is the lesser the inherent uncertainty (Hines et al., 2004; Tracy & Knight, 2008; Taylor, 2006). Product design refers to any initial design of a good or design resulting after making the existing design fit the new requirements and/or challenges better (Davis, 1993). Process performance measurement means improvements in measuring the performance, quality, and techniques (Geary et al., 2002). Good decision support systems are related to developing and using advanced decision methods (Muckstadt et al., 2001; Shim et al., 2002). Collaboration refers to collective works of multiple entities in the same supply chain (Christopher & Peck, 2004; Holweg et al., 2005; Muckstadt et al., 2001; Miller, 1992; van der Vorst & Beulens, 2002). Certain authors have also suggested shortening the planning period in order to reduce the number of unexpected changes in the

supply chain (Fisher, 1997). Decision policy and procedures imply reducing uncertainty by keeping the bureaucracy in decision making as limited as possible (van der Vorst et al., 1998; van der Vorst & Beulens, 2002). Better information and communications technology (ICT) is influential in reducing uncertainty and complexity in SCs (Bandyopadhyay et al., 1999; Greg, 2006; Gunasekaran & Ngai, 2004). Pricing strategy is related to incentives to reduce the uncertainty; early booking perhaps is a good example (Gupta & Maranas, 2003; Miller, 1992). Redesign of chain configuration and/or infrastructure refers to fundamental changes in supply chains to reduce uncertainty (Harrison, 2001; Lee, 2002; Sun et al., 2009).

In terms of coping with uncertainty, literature lists following 11 general methods to cope with (Simangunsong, 2012):

- postponement

- volume/delivery flexibility

- process flexibility

- customer flexibility

- multiple suppliers

- strategic stocks

- collaboration

- ICT systems

- lead time management

- financial risk management

- quantitative techniques.

Postponement refers to delaying activities or processes in order to make decisions with as much information as possible (Yang et al., 2004). Flexibility is having capacity in multiple dimensions such as in volume, process, customer, or supplier to better combat uncertainty (Braunsheidel & Suresh, 2009; Miller, 1992; Sawhney, 2006; Ulrich, 1995; van Donk & van der Vaart, 2005). An inventory buffer solution can be used against uncertainty, which is called

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strategic stocks (Davis, 1993; Helms et al., 2000; Wong & Arlbjorn, 2008). Collaboration refers to any collaboration effort among various supply chain entities (Muckstadt et al., 2001). Lead time management refers to extending the lead time to give more time to deal with uncertainty (Prater et al., 2001). Financial risk management refers to using any financial method to mitigate and sell the uncertainty to a third party (Ritchie & Brindley, 2007; Tomlin, 2006). Lastly, any quantitative method such as operations research, forecasting, simulation, modeling is used to better combat uncertainty (Peidro et al., 2009).

1.2.4   Global Supply Chain Design, Literature Review of the last 20 years

A frequent phenomenon of the late 20th century was expanding domestic supply chains into international and global ones (Dornier et al., 1998; Taylor, 1997). According to Prasad and Babbar (2000), the number of articles published related to international and global supply chains are significantly increased. Researchers who have examined this period take a defensive position and have tried to promote thinking from a SC perspective. Stevens in his article "Integrating the Supply Chain," talked about the need to control the flow of material from suppliers through manufacturing and distribution to the customer at the level of SCs, not only at the operational level (Stevens, 1989). The term SC was not necessarily used universally; researchers such as Cohen and Lee (1988) often used terms such as "integrated production-distribution systems".

Chopra and Meindl (2004) group SC problems into

- the number and the location of production facilities
- capacity decisions
- assignment decisions of markets and production capabilities
- supplier-component-material decisions

The consensus among researchers and practitioners is that managing international, multinational and global supply chains are more challenging than managing purely domestic supply chains (Dornier et al., 1998; MacCarthy & Atthirawong, 2003; Manuj & Mentzer, 2008; Meixell and Gargeya, 2005; Wood et al., 2002). According to Meixell and Gargeya (2005, p. 533),

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"substantial geographic distances", "different local cultures, languages, and practices", "infrastructural deficiencies", potential lack of international labor quality in human resources-materials-equipment are among some of the factors that make the GSC more demanding. Furthermore, there is inherently more risk, variability, and uncertainty due to unpredictable exchange rates, unforeseen economic and political changes (Meixell and Gargeya,2005; Dornier et al., 1998). According to Meixell and Gargeya (2005), one of the key emerging areas of research is integration of decisions across the supply chain; hence, a decision in marketing or finance is actually a decision for the entire SC.

Many research papers during the period from the 1980s to 2005 include decision variables such as facility and supplier selection/location and production/shipment amounts (Meixell & Gargeya, 2005). In addition to these three major variables, Meixell and Gargeya (2005, p. 536) includes "financing patterns, capacity expansion, production allocation, production shifting, inventory stock levels, transfer prices, transportation modes, capacity", etc. Because there are just a handful of decision variables, arguably many researchers are actually answering similar questions in different parts of the SC. Performance measures, on the other hand, are more comprehensive. In addition to traditional operation management approaches to maximize and minimize goals, there have been other measures, which are harder to quantify such as robustness across pre-defined scenarios and flexibility.

1.2.4.1   The Period of the pre-1990s

Pre-1990 was an early period of SC research. The main aim during this period was to identify problems and opportunities in thinking collectively as a SC compared to a single firm. During this period, research topics included facility location, inventory management, maximizing after tax profit, the impact of policy changes in taxation and governmental subsidizations, and tariffs(Breitman & Lucas, 1987; Cohen & Lee, 1989; Hodder & Dincer, 1986; Meixell & Gargeya, 2005). From the very beginning, there was some interest on the international side of SCs (Houlihan, 1985 & 1987). In SC problems during this period, financial flows such as currency exchange movements, were included but were often treated as a static factor not as a source of

uncertainty and as a small side problem of a larger issue. Customer flow factors such as WoM are also included, but the speed of the dispersion was considered much slower. The general lack of powerful computers in the early years often limited researchers in using data intensive methods. As a result they had limited possibilities to extend data research. They were forced to research and come up with simple but intuitive models to explain and develop insights in SCs.

1.2.4.2   The Period of 1990 – 1995

During this period, the discussion of potential benefits of SCM continued. In the meantime, as Lee and Billington (1992) pointed out, researchers were quick in finding pitfalls of SCM: supply chain metrics were not defined or clear, the definition of customer service was not well defined, inaccurate delivery status data, inefficient information systems, simplistic inventory stocking policies, exclusion of SC consideration from the product-process design, separation of SC design from operational decisions, incorrect assessments of inventory costs, poor coordination and organizational barriers, and ignoring uncertainties. Attempts to further define the field and show the differences from related fields continued such as discussed in Cooper and Ellram's 1990 paper, "Characteristics of SCM and the implications for purchasing and logistics strategy".

In contrast to the earlier period, during this time, globalization and international SCs received more attention. During this period, the Eastern Bloc collapsed and large markets such as China and Russia became more accessible. Haug (1992) developed a multicounty global sourcing problem albeit limited to certain high tech firms with variable costs (Meixell & Gargeya, 2005). Kogut and Kulatilaka (1994) introduced a stochastic model with currency exchange to study the right production mix and switch for companies with global production capacities. Their model treats exchange rates as static variables, rather than volatile subjects. Powerful computers helped researchers to work on large-scale supply chain design problems. Financial flows and customer flows received more attention in research compared to the previous period, but again more likely as a static variable rather than a continuously changing dynamic variable. Hence, managing material flows was the dominant area of research during this period.

1.2.4.3 The Period of 1995 – 2000

At this time, a general classification of decisions and models into strategic, tactical, and operational was used extensively(Gupta & Maranas, 2003). A strategic period is a long-term horizon ranging from 5 to 10 years which covers decisions, such as identification of optimal timing, location, and the extent of additional investments (Gupta & Maranas, 2003). On the other hand, operational may only cover one- to two-week intervals, and cover decisions such as sequencing of the manufacturing tasks (Gupta & Maranas, 2003). Finally, tactical covers anything in-between these two extremes (Gupta & Maranas, 2003). It was customary for researchers to start their research by defining their time frames.

1.2.4.4 The Period of the 2000s

The key development in this period is the increase in interest of multidisciplinary research. Research in this era also becomes significantly diverse. Researchers focused on solving multipurpose optimization problems such as using "the weighted sum method, the epsilon-constraint method, the goal programming method, and fuzzy methods" (Azapagic & Clift, 1999; Chen & Lee, 2004; Cheng-Liang et al., 2003; Shankar et al., 2012; Zhou et al., 2000). Similarly, one of the key issues was "the determination of policies that optimize the performance of the supply chain as a whole while ensuring adequate rewards for each participant" (Gjerdrum et al., 2001, p. 1650). Gjerdrum et al. proposed an equilibrium-type optimization, subject to given minimum profit requirements (2001). Such an effort of using theories of well-established areas of research was common during this period. Uncertainty and risk management became a significant area of research.

1.2.5 Uncertainty and Risk in Global Supply Chains

According to Chopra and Sodhi's paper in 2004, there are nine categories of risk. These nine categories are

- disruptions
- delays
- systems

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- forecasts

- intellectual property

- procurement

- receivables

- inventory

- capacity

Many of these risk categories have been addressed for decades and have been overly researched and analyzed while some of them have received less attention. For instance, currency risk, which is not listed as one of the nine major categories, finds its place only under procurement in their paper with less attention. Unfortunately, some of the risks that received less attention traditionally have recently been aggravated because of globalization, the growth of the Internet and social networks, and finally a prolonged global financial crisis. In this part of the thesis, the aim is to have a general view of uncertainty.

Globalization leads to the interrelation and interconnection of physical and information systems that ease the transmission of risk from one SC entity to another one. As a result, the increasing pressure of global competitiveness along with the recent and significant developments in information technology SC planning, are very important areas for the most of the manufacturing and service organizations (Gupta & Maranas, 2003). Global supply chains that fail to respond to these newly arising risk challenges are exposed in the short-term to disruptive shocks, or in the long-term to changing environments that can end their business. The researcher is interested in taking a closer look into risk factors that have changed in the last two decades in terms of significance and potential detriment, and investigating whether or not the current techniques in dealing with such risk factors are still effective.

The categories of Chopra and Sodhi (2004), "disruptions, delays, systems, forecasts, intellectual property, procurement, receivables, inventory, and capacity", can be named differently or grouped under different names by other researchers. Some of the other research papers use

different categories to name the same disruptions, complemented by new ones, or grouped under larger sections. For instance, in a later study by Simangunsong et al. (2012) there are only three larger groups of uncertainty: uncertainties that come from the focal company, internal supply chain uncertainty that arises within the realm of control of the focal company or its supply chain partners and companies, and external uncertainties from factors outside the supply chain, which are outside of the company's direct areas of control. Under these three major categories, they have listed 14 factors: product characteristic, manufacturing process, control/chaos uncertainty, decision complexity, organization/behavioral issues, IT/IS complexity, end-customer demand, demand amplification, supplier, parallel interaction, order forecast horizon, chain infrastructure, environment, and disaster (Simangunsong et al., 2012).

1.2.5.1 Risk of Disruptions

The first area Chopra and Sodhi (2004) described in their paper is disruptions. Some of the examples they provide are natural disasters, labor disputes, supplier bankruptcy, and war and terrorism. Natural disasters are external uncertainties in Simangunsong et al.'s (2012) paper, while labor dispute is related to a focal company. During the period after Chopra and Sodhi's contributions, supply chain management for humanitarian aid efforts became an important area of research (Balcik et al., 2010; Kovács & Spens, 2007; Oloruntoba & Gray, 2006; Van Wassenhove, 2005). What makes this particular area interesting and different from many SCM subject areas is that there is a nonprofit goal/humanitarian goal, a need for rapid deployment of resources and people in large distances with potentially very limited accessibility because of an already dysfunctional infrastructure or a severely damaged one after the initial disaster and large scale human factor involvement (Balcik et al., 2010; Van Wassenhove, 2005). Moreover, the need for a humanitarian supply chain does not necessarily end just a few days after the disaster, but often it rapidly turns into a more complicated and long-term project as time passes (Kovács & Spens, 2007). This area is definitely promising, and there is already substantial research. Oloruntoba and Gray (2006, p. 117) described the international humanitarian supply chains as "clearly unpredictable, turbulent, and requiring flexibility". They considered humanitarian supply

chains as good candidates for agile supply chains. Wassenhove (2006) stated that even though there are differences from private sector logistics, humanitarian supply chains can and should use the long history of advancement in their private sector counterpart. Kovács and Spens (2007) proposed three phases of humanitarian supply chains: preparation, immediate response, and reconstruction. Their paper shows an early stage of literature development, because it is mostly descriptive. Balcik et al. (2010) focused on the need for coordination of private and humanitarian supply chains and between nongovernmental organizations' capabilities for better results.

1.2.5.2 Risk of Delays

The second area Chopra and Sodhi (2004) described in their paper is delays. According to their paper, when suppliers are not able adjust themselves fast enough to ever-changing demand requirements of customer, there are inevitable delays in material flows. Some of the reasons include high capacity utilization of supplies, or inflexibility of strategic resources, or transportation problems. The theory of constraints to manage bottlenecks also explains the possibility of delays. Delays can lead to potential problems in customer satisfaction or cancellations of orders. The main issue with the definition of delays as risk category, they only consider delays in material flows. A larger definition that includes problems in information and financial flows should be considered. Especially during economic turmoil, delays in payments and trade credits can be another important issue. When firms are financed by their suppliers, in a role similar to that in financial institutions, this is called trade credit (Petersen & Rajan, 1997). In fact, some authors highlight that trade credit is the single most important short-term external financial factor for the firms in the United States. According to the World Bank Group report (2010), during the period of the global crisis, trade credit offerings of suppliers in certain emerging countries actually increased for the suppliers who were actually in financial difficulty themselves (Klapper & Randall, 2010). This may be explained by Wilner's article (2002), in which he showed that firms with high dependency on their buyer often offer more deduction in price or better payment options than the firms with less dependency. A particular article from France (2011) focused on the Middle East and North Africa countries and empirically showed based on a large scale database

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of firms, those companies having difficulty gaining access to bank credit are likely to use trade credits (Couppey-Soubeyran & Hericourt, 2011). The amount of literature on trade credit, emerging countries, small- to medium-sized firms and financial crises is limited, and it is interesting. Chopra and Sodhi (2004) might have preferred to list delays in trade credit under another category such as receivables, but the issue is not necessarily the financial strength of making payments to the supplier, but rather how suppliers need to behave in situations in which the buyer has more power. So, this is listed here under delays.

1.2.5.3   Systematical Risk

The third area Chopra and Sodhi (2004) described in their paper is systems, which they use interchangeably with information systems. This particular category is directly related to information flows. Even though information systems make business entities more efficient, they may be the source of failure as well. As Chopra and Sodhi (2004) pointed out, the deeper integrated and interrelated information system is, the more likely to spread a local failure to entire network. According to Gunasekaran et al. (2004), IT, in fact, is a key for a successful business by integrating suppliers and other supply chain entities. As they pointed out, the large scale use of outsourcing and virtual enterprises in an effort to make the companies more flexible and responsive led this increased need. In a later paper, Closs et al. (2005, p. 258) tested and confirmed that IT development "fully mediates the relationship between flexible logistics programs and asset productivity and partially mediates the relationship between flexible logistics programs and delivery competence". So having flexibility in SC is closely related to having a good IT infrastructure.

Pereira (2009) expanded the idea further by asserting that IT is actually one of the potential areas to "make the supply chain robust" and resilient against disruptions without requiring usual solutions such as having "larger inventories and employing multiple sources". Though, he still recognized that IT itself can become another source of instability. However, without an improvement in the quality of shared information within the SC, simply investing in IT would not necessarily lead to improvements in overall firm performance (Hartono et al., 2010).

1.2.5.4   Forecasting Risks

The fourth area is forecasting. Chopra and Sodhi (2004) described forecasting risk as a "mismatch between a company's projections and actual demand". It is certainly true that better forecasting leads to better firm and supply chain performance. Traditional SC issues such as "long lead times, seasonal demand, high product variety, and smaller product life cycles" are examples that Chopra and Sodhi (2004) used in their paper. Even though this particular subject area is well studied, there are still many new research areas, for instance, efficiency of investment of forecast spending. The positive result of ceasing investment increments is an important question for many firms. Shin and Tunca (2010, p. 1606) showed that in a "decentralized supply chain, under common contracting schemes, such as wholesale price contracting and two-part tariffs, competition among downstream parties causes over-investment in demand forecasting". Ozer et al. (2011) investigated trust in forecast information sharing in another paper .

1.2.5.5   Intellectual Property Risks

Intellectual property, as Chopra and Sodhi (2004) correctly, identified has become a rapid and important area by itself. Specifically they highlighted that the possibility of more than one competing companies outsource to the same manufacturer is increased which would mean more intellectual property risk than before. Most of the studies on outsourcing are based on single company case studies or anecdotal evidence. Jiang, Frazier and Prater (2006), however, conducted empirical tests to investigate the effect of outsourcing on performance. Interestingly enough, their data demonstrate that outsourcing may not necessarily improve a firm's productivity and profitability. Holcomb and Hitt's (2007) paper is important in the sense that they approached and explained the reasons for outsourcing from a truly transaction-cost theory and resource-based view. Bustinza et al. (2010) claimed and empirically tested that success of outsourcing actually depends on successful knowledge management.

1.2.5.6　Procurement Risks

The next area is procurement, which includes "unanticipated increases in acquisition costs" due to" fluctuating exchange rates or supplier price hikes" (Chopra & Sodhi, 2004). It is noteworthy that Chopra and Sodhi (2004) did not list currency risk under a separate category by itself and considered only an issue of procurement. In fact, companies have currency risk in receivables as well. The profits of international markets fluctuate depending on the currency exchange rate between home and that specific market. It is noteworthy that Chopra and Sodhi (2004) missed this and only focused on the procurement side of the currency risk. Currency risk and exposure starting from the 1990s has been an important aspect of the supply chain literature. Huchzermeier and Cohen (1996) proposed operational flexibility as a solution to adverse effects of exchange rates. As they suggest, firms can continue producing in another country with more favorable exchange rates, given that the flexibility of doing so exists. Firms not only have operational risks from lower profits or higher costs, they also have what is called translation costs. The firm's value correlates highly with total assets held in a foreign land and domestically. Public companies may find it necessary to cover themselves against such risks. Hagelin (2003), however, based on an empirical study of certain firms, found no evidence to support there is a usage of hedges to increase firm value. Kazaz et al. (2005) separated flexibility into production hedging and allocation hedging. Exchange-rate exposure certainly is an interesting and promising research area as it is an external and volatile factor. The global crisis of late 2000s also played an important role in making this area even more interesting. This area will be covered in the first paper.

1.2.5.7　Risks of Receivables

The next item in Chopra and Sodhi's (2004) list is receivables, which includes "the possibility of being unable to collect on receivables". Here, the definition is extended to include the possibility of changes in the amount of incoming funds. The number of customers and profit per customer has always been a weak spot for risk management because a company has limited potential to control it fully. It is an external thread that the company tries to stabilize. According to

Rust (2006), by managing services offered and customizing them according to the needs of customers, firms may change their customer satisfaction and relationships, which in turn affect financial measures. In other words, managing customer flows in order to stabilize receivables in fact can be a good strategy. Godes and Mayzlin (2009, p. 721) further investigated the effectiveness of "proactive management of customer-to-customer communication" (aka word-of-mouth). They empirically showed that "exogenous WOM is associated with higher week-to-week sales" (Godes and Mayzlin, 2009, p. 737). According to Ferguson (2009), even though marketing investments are not always productive under all conditions, certain well-placed, calculated and proactive campaigns can be effective for a long term thanks to the Internet. Another empirical study shows that referred customers create more value in both short and long terms, and have more retention rate (Schmitt et al., 2011). The need for supply chain management to include WoM and customer referral results is essential. This area will be covered in this thesis.

1.2.5.8 Capacity and Inventory Risks

The next two areas in Chopra and Sodhi's paper (2004) are capacity and inventory, both of which are very traditional areas of supply chain management research. Having excess inventory and capacity hurts companies in general. In case of capacity, the changes are more long-term, whereas inventories can be short-term. Both areas are within the scope of material flows. Changes such as RFID development helped companies to improve their oversight of capacity utilization and inventory management. What can be interesting though is testing previous theories in new realities. For instance, capacity planning under exchange rate risk is more interesting and fruitful as research agendas. For instance, the timing of capacity increments with currency exchange consideration can also be an interesting question.

1.3   Conclusion

The general area of the thesis is uncertainty and risk management in financial and customer flows. The aim is to understand the recent changes and to develop managerial responses in a highly global and competitive business environment. Financial and customer flows are least focused in SC research compared to two more established flows of material and

information. However, the recent changes in ICT, further globalization of economies, and the prolonged financial crisis made difficulty to manage uncertainty and risk in supply chains. In order to understand the nature of these difficulties, this thesis is organized into four essays in three subjects. First currency risk management, secondly customer WoM management and lastly trade credit management will be the subjects. Customer WoM management will be investigated in an open model and closed model settings. In the first chapter, the earlier works in SC management literature and uncertainty/risk issues in SC are discussed.

CHAPTER 2

MANAGING CONTEMPORARY SUPPLY CHAIN CURRENCY RISK

2.1   Introduction

The management of currency exposure in supply chains (SCs) has long enjoyed both practitioner and academic interest (Meixell & Gargeya 2005; Prasad & Babbar, 2000). This is due to the complexity of relationships between global companies and their customers and suppliers. Rapid globalization of economies during the last decades further escalated this complexity particularly in managing currency exposure. Nowadays, the majority of supply chains have evolved into much larger global networks of multiple countries and currency zones (Dornier et al., 1998; Taylor, 1997). According to a surveyed by the Economist, exchange rate uncertainty was ranked as the second most important risk factor in 2009 and the number one risk concern in 2010 among 500 multinational executives who are responsible for risk management (The Economist Intelligent Unit, 2009). This clearly shows that the need of better currency risk management in SC is indeed increased during the financial crisis of 2008-2012.

In response to escalating challenges, academicians developed state-of-the-art theories/management methods while financial institutes introduced new products in order to mitigate and/or reduce currency risk and uncertainty. A major assumption of early theories and management methods of the 1990s and the 2000s is the existence of a major global hard currency, a currency that able to maintain a stable value, more specifically the continuation of the status of the US dollar. During the same period, researchers and financial institutes alike considered currency risks are primarily the problems of developing countries, unlike developed countries. There was a confidence among multinational firms to have financial counterparts ready, who were willing to accept currency risk in exchange for a profit. On the other hand, financial institutes assumed that volatility between major currencies is minimal and/or manageable. Local national crises and the global crisis of 2008-2010 challenged all these

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assumptions. Major currencies were much more volatile than before, and financial institutes either sought excessive returns in exchanging currency risk or simply no longer were able to provide effective hedge products. In this paper, first, starts with research if the US dollar is able to keep behaving like a hard currency, and later brings managerial insights in managing SCs through operational measures in where there is a question of having any hard currency to use in SCs of volatile times. From the analysis, the US dollar is still trusted over other currencies, and countries with weaker economies provide better opportunities to locate facilities and operations if a global or regional crisis is expected.

<u>2.2   Theoretical Background</u>

2.2.1   Global Supply Chain Management

Certain international locations may offer cheaper manufacturing options compared to domestic ones due to depreciated exchange rates of the local currency (Ferdows, 1997). Substantial geographic distance, receivables and payments in multiple currencies, various international, domestic and custom regulations are only a few additional complicating items for global supply chains compared to domestic ones (Meixell & Gargeya, 2005). In the meantime, developments in the information and communication systems in the last two decades such as real-time tracking of shipments, inventory control systems using RFIDs, fast email communication enabled better and easier management of materials and information flows. However, global events of the same period, including the collapse of the eastern bloc, globalization of economies, introduction of the single largest currency zone: the Euro, and currency/financial crises in developing countries made managing financial flows, particularly currency risk management a bigger challenge (Meixell & Gargeya, 2005). The level and the amount of foreign currency usage in an ordinary supply chain are significant enough for many companies to use financial derivatives and operational measures. Huchzemeir and many prominent researchers in the early 90s proposed many operational solutions to currency exposure, and considered currency exposure as an opportunity to lower the total cost of production (Huchzermeier & Cohen, 1996; Kogut & Kulatilaka, 1994). Many of these earlier academic works are mostly suitable only in static

currency exchange rate environments, but not in volatile environments. However, during and after the global crisis of 2008, an extreme volatility between major currencies occurred. Such volatile environment made earlier operational methods such as having a large set of production sites and/or suppliers inadequate to manage currency risks (Neely, 2009). If the volatility is high and fast moving, a site that is cheaper to produce becomes not cost effective one in a matter of days that production scheduling cannot follow that pace. As a result, long term currency predictions become even more important. In this paper, first if the US dollar continues being treated as a hard currency is examined, and later how SC manager need to react during such volatile times is discussed.

2.2.2 New Financial Challenges in Managing Currency Risk in Global Supply Chains

After the beginning of the global financial crisis in 2007, it has become more difficult to get credit lines, currencies have become more volatile, economies have shrunk, and customer confidence has dropped (Acemoglu, 2009). Traditionally, operational measures along with financial hedge methods are used to mitigate certain financial risks. As an example, Huchzermier and Cohen (1996) in their paper "Valuing Operational Flexibility under Exchange Rate Risk" indeed identified the possibility of managing currency risk through operational methods by having a production capacity in multiple currency zones, which allows a quick change in production location when the local currency is favorable (Huchzermeier & Cohen, 1996). They described such potential as manufacturing flexibility. Their model is based primarily on predictable correlations between major currencies. Excessive volatilities and/or unpredictable correlations between currencies are not included in their model. Such adverse conditions make the management of supply chain decisions more difficult. For instance, a change in currency may mean more logistics costs in a region with appreciated currency, whereas a depreciated currency might have already absorbed small profits, if the firm happens to accept that currency as a payment base. Similarly, unpredictable and excessive moves make the financial methods of risk management more expensive, if not impossible. Chopra and Sodhi (2004) in their paper "Managing risk to avoid supply-chain breakdown", emphasized exchange rate risk briefly under

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procurement risk, but not as a separate risk category (Chopra & Sodhi, 2004). Before 2007, companies have underestimated this risk. Many companies considered currency risk as something to be hedged easily with buying a financial product as a cost of doing business overseas. However, nowadays currency risk is a headache for many firms as they have less hedging possibilities because of highly volatile markets after the global financial crisis.

2.2.3   An In-Depth Look at Currency Risk

In terms of financial risks; currency risk has increased more significantly than any other financial risk in recent years. Today, more than ever, economies are integrated and interrelated (Christopher, 2000). More and more companies have global operations, working in various countries and multiple currency zones (Christopher, 2000; Houlihan, 1993). Moreover, for the past few decades, international trade has been growing faster than the growth of the global GDP (Bariel & Dean, 2004). Also, more countries and trade blocs signed free trade agreements (Dean & Bariel & Dean, 2004). As a result, currently, only fewer companies have single currency across their entire supply chain. Attempts to decrease currency risks by creating single currency zones were not successful so far. The best example of such an attempt is the eurozone. Today, the euro is more volatile than most stable currencies she has replaced. The German mark/US dollar and French franc/US dollar exchange rates were less volatile than the euro/US dollar exchange rate. Currency exposure has been traditionally hedged by using financial instruments and operational methods (Bartram et al., 2010). An example of a financial instrument is currency forward, where both sides agree to buy and sell currencies at a predefined future date on the agreed price. When there is too much fluctuation in exchange rates, it becomes problematic to agree on the price or the risk associated with taking a short or long position is too high even for a large financial organization. The second commonly used financial instrument is financial options, which are priced according to the Black-Scholes formula (Black & Scholes, 1973). According to this formula, an option to buy or sell an underlying asset, currency, is priced more when the potential volatility rises. Hence, when there is more volatility in currencies, hedging the risk through financial methods can be expensive and/or not available.

Even though, currency exposure is actually an umbrella term that includes related but different type of business problems. Traditionally, currency risk has four dimensions:

- translation

- transaction

- operational and

- tax related

Translation exposure refers to the problems in reporting and consolidating foreign earnings and spending, when the actual transaction does not take place. An American company with a large portion of its sales in the eurozone may lose equity value in a few days because of simple depreciation in the euro/US dollar exchange rate, even though there have been no critical changes in its business operations, and no foreign currency transaction conducted by a firm. Often this translation exposure used to be ignored because it is written only on the paper. However, with an extensive fluctuation in recent years, such exposure can be detrimental to the investor's confidence and company spending on borrowing. Transaction exposure occurs during the actual transaction and transfers of a currency (Hagelin, 2003). When a certain international company decides to transfer their foreign currency earnings in overseas markets to domestic market; there is inevitably exchange rate risk. The amount of domestic currency depends on the exchange rate between foreign and domestic currency. Considering there are many firms whose earnings are in single-digit, any small change in the exchange rate may nullify all the earnings and turn profits into a lost. Firms are well aware of this problem and try to cover themselves by using hedging methods. Operational measures to solve such transaction issues can be employed. For instance, instead of a single supplier in a different country where currency exchange is necessary, having a local supplier, which would accept the same currency that the firm earns, will reduce the amount of foreign transaction.

When fluctuations in foreign currency start to affect long-term profitability of a firm, it becomes a part of the operational exposure (Choi & Jiang, 2010). For instance, a certain oil

producing country with excessive trade surplus may experience appreciation of the local currency. In this situation, earnings from that country convert into a bigger amount of the domestic currency of the international firm, while spending in this country is alleviated due to the appreciation of the local currency. In such circumstances, financial measures can be useful in a short term, while operational measures are more needful. If financial firms realize the trend in exchange rate, they adjust their prices accordingly. All financial hedge methods are based on pricing uncertainty. So, when the direction of the exchange rate becomes clear, financial hedging does not help in getting back the earning loss due to appreciate in exchange rate. In terms of global supply chain management, such countries should be considered as primarily customer markets, but having production and suppliers should be limited. Similarly, certain companies may move to weaker (small countries with trade and budget deficit) or undervalued (China, etc.) currency zones enabling them to produce cheaper. On the other hand, the remaining ones do their all transactions (receivables and payments) on a hard currency on their international operations (Huchzermeier & Cohen, 1996).

During and after the global crisis of the 2000s, assumptions on hard currencies became problematic. The US dollar became weaker and more volatile against many world currencies (Engel & West, 2010). As a result, the assumption that the US dollar is the safe haven became an interesting question. The option for a firm to sell or transfer risks in the currency to have security in a hard currency and/or the home currency becomes more problematic and expensive, if not impossible. Thus, there is a need to understand better the risk management options of this global supply chain problem, which this paper mostly is about. So, the main focus on this paper is managing operational exposure in the light of new challenges. Next, there will be a discussion on defining what a hard currency is.

2.2.4   Currency Substitution as a Measure of the US dollar being a Hard Currency

Currency substitution develops when domestic currency loses some of its primary functions such as being a medium of exchange, a unit of account and a store of value against a stronger currency, a hard currency (Feige, 2003). The term "US dollarization" is also used

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commonly to describe currency substitution. Currency substitution occasionally starts unofficially by switching to another currency as a unit of account and as a store of value instead of the local currency (Calvo & Végh, 1992). Some of these countries may officially opt to adopt foreign currency as the legal tender in the final phase of currency substitution. For instance, Ecuador in 2000 and El Salvador in 2001 switched to the US dollar from their local currencies (Salvatore, 2001). This process can be a voluntary political decision in countries with the stable economy and low inflation in order to join a larger economic zone such as in expanding the eurozone, or as a last option for less developed or developing countries with hyperinflation or unstable governments. For instance, Zimbabwe switched to the US dollar in 2009 after a long period of hyperinflation. Business owners and residents of countries with high inflation, politically unstable governments or small economies that are integrated closely with a stronger neighbor economy may choose to accept foreign currency for payments in addition to local currency. They can also save their wealth in foreign currency in order to protect their savings from depreciation or a possible devaluation of local currency.

Unless the size of the economy is relatively small and hence the dependency on a certain foreign currency is inevitable, and/or currency substitution is a political decision to gain access to a larger market region, currency substitution has negative consequences. Under currency substitution, following an independent monetary policy becomes problematic, if not obsolete. In such cases, the monetary authority cannot effectively control money supply while inhabitants of the country prefer and use a foreign currency. As a consequence, currency substitution is a matter of health of the entire economy unless the economy is small or the decision was based on joining a larger currency zone.

After the end of the cold war, most Eastern Bloc countries moved to open economies immediately, including Baltic Countries, Ukraine and Russia. Moreover; some of these countries adopted the euro such as the case of Slovakia in 2009 and Estonia in 2011. These new countries chose to do this n order to join a larger market, the eurozone, or pegged their currency against the euro in order to stabilize their economies or to make a transition to adopting the euro. Ukraine

and Russia, on the other hand, did not intend to join the eurozone and followed more independent currency policies along with economic liberalization. Similarly, Turkey, not a former Eastern Bloc country, located geographically very close to these two countries has never pegged its currency to the euro or the US dollar. All of these three economies in Eastern Europe had a strong financial crisis, inflation, devaluations, and weak governments in the last two decades of the 90s and the 2000s (Lissovolik, 2003). For instance, Turkish lira depreciated from 13 TL/$ in 1973 to 1.5 million TL/$ in 2004 (Bahmani-Oskooee, 1996). As a result, of these negative experiences, local people of these countries developed a tendency to keep at least a portion of their savings in a foreign currency (Civcir, 2003). In the case of Turkey, the ratio of reserves held in the foreign currency over the local currency, which is a de facto measure of US dollarization, showed a steady rise during the period from 1983 to 1993, remained steady high around 50% till 2001, and decreased afterwards (Metin-Özcan, 2009). In short, these countries are examples of highly US dollarized countries (Havrylyshyn & Beddies, 2003; Kaplan, 2008).

This paper is to investigate the changes in the currency substitution during and after the global financial crisis between 2007 and 2010 in Russia, Turkey and Ukraine. These three countries with relatively independent monetary policies, large economies, recent strong US dollarization experience in the last two decades and relatively open markets, provide good cases for understanding the global trend in the currency substitution and the faith of the US dollar as a reserve currency. If foreign, non-US based, investors lose their trust in holding and investing in the US dollar, there will be strong consequences for the US economy. If these three countries show significant drops in US dollarization, it may be a sign of a trouble for the US dollar as a reserve currency in the future. This study is unique in the sense that there is limited or no research in literature on changes in the currency substitution in the current financial crisis. It is also unique that these three countries are included in a common comparative study. What is also interesting is that all these countries also had local financial crises after the initial crisis in the US.

The global crisis started with troubles in some of the largest financial institutions in the United States and resulted in widespread recessions in many countries. In this paper, however,

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there is no attempt to define the start or the end of the financial crisis in the US, nor analyzing the reasons. Instead, a general accepted definition of a recession will be used. Thus, recession can be defined as having two consecutive quarters of a negative growth, which is also a vivid sign of a financial crisis. Based on this definition, the financial crisis in the US was from December 2007 to June 2009. Following the same definition, the crisis in Ukraine and Russia was from October 2008 to December 2009, and in Turkey – from October 2008 to September 2009. Clearly, there is a mismatch between the periods of financial crisis: the US one was earlier, while in those three countries it occurred later. However, it would be misleading to consider that the effects of the financial crisis were over just after those aforementioned periods. Obviously, there is a continuation of the global crisis after these periods in the US as well as in other countries.

Before the crisis, in 2006, percent of foreign currency accounts over all accounts was roughly 24% in Russia, 35% in Turkey and 37% in the Ukraine. During the local financial crises, these ratios jumped to 34% in Russia, 39% in Turkey and 50% in the Ukraine (Central Banks of Russia, Turkey, and Ukraine). There is an increase in the currency substitution in terms of the store of value function of money. However, this paper is more focused on the effects of the financial crisis in the US on the currency substitution in these countries. It is expected to have a negative impact on currency substitution. In other words, the crisis in the US decreases the currency substitution. Results indicate a moderate but a significant negative effect of the crisis in the US on the currency substitution in all three countries. This effect continued after the period defined as the crisis in the US, but with less strength. On the other hand, the overall picture is different. Local crises were much stronger and they increased the currency substitution.

<u>2.3   Data</u>

The data were collected from the Central Banks of Russia, Turkey and Ukraine covering the period from January 2006 to August 2010. January 2006 is the earliest date when the public data of all three countries were available. This period covers 56 months including the period before, during and after the financial crisis in the US and aforementioned countries. There are four sets of data used from each country in the analysis. These are interest rates on local

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currency, interest rates on the US dollar accounts, exchange rates, and deposits in foreign and local currencies. Deposits in foreign and local currencies are used in calculating the ratio of foreign currency deposits over total currencies. This ratio is a good proxy for the currency substitution.

The preference of foreign currencies over national currencies occurs because either of changes in relative interest rates between foreign and national currencies, changes in exchange rates, or the lack of investor confidence in the national currency. Some countries with high trade deficits may have high interest on foreign deposits to attract investors. Investors may also use currency as an investment vehicle, if exchange rates show an upward trend against a local currency. For all of these three countries, deposits in foreign currencies are stated in terms of their local currency equivalent. In other words, because of a sudden change in exchange rates, the value of foreign deposits in a local currency can be inflated or deflated without a change in the amount of foreign deposits. Exchange rates are included in the study to control these effects of exchange rates over the ratio of foreign deposits. In terms of exchange rates, the US dollar exchange rates over local currencies are used. For these aforementioned three countries, historically the natural choice for a foreign currency has been the US dollar with a slight new interest in the euro. However, the US dollar still overwhelmingly dominates over the euro as the currency of foreign deposits. Therefore, in this study only the US dollar exchange rate is included.

In calculating of the US dollar exchange rate, the average exchange rates over a month from the end-of-day rates are used Average exchange rates better reflect investors' behavior in holding foreign deposits. Average rates also better show the changes in exchange rates occurring during the month but then disappearing towards the end of it. The usage of simple the end-of-month exchange rate can be misleading since the calculation ignores the movement of exchange rates within the month. Another important factor in exchange rates is that in this paper, indirect rates are used for American investors, while direct rates are used for local investors. Local investors prefer using direct rates in order to understand how much 1 US dollar is worthy in terms of the local currency. As a result, since the health of the local economies is interested, it is better

to use direct rates for local investors. Exchange rates are official central bank exchange rates that are calculated based on bid and ask rates on each business day.

In general, this paper is concerned about interest rates on individual accounts and deposits in individual accounts rather than interbank interest rates or corporate deposits. Since changes in the currency substitution are interested during and after the financial crisis, compared to what was before, individual investors rather than corporations are more concerned. Especially in Russia, there are larger export firms, including oil-gas industries that are earning large amounts of foreign deposits mostly in the US dollars. For instance, an increase in international oil prices may abruptly change the amount of the US dollar deposits for these corporations. However, this does not show a real change in the preference of the US dollar against a local currency. Individual interest rates on the US dollar and local currency accounts show how attractive each instrument becomes for local investors. An increase in interest rates on the US dollar accounts may increase the US dollarization ratio. In this study short-term interest rates are used that are less than or equal to 1 year. Investors in these countries have less trust in the local banks and less likely to consider any periods longer than a year for investment. Central banks of the aforementioned countries provided local and foreign interest rates.
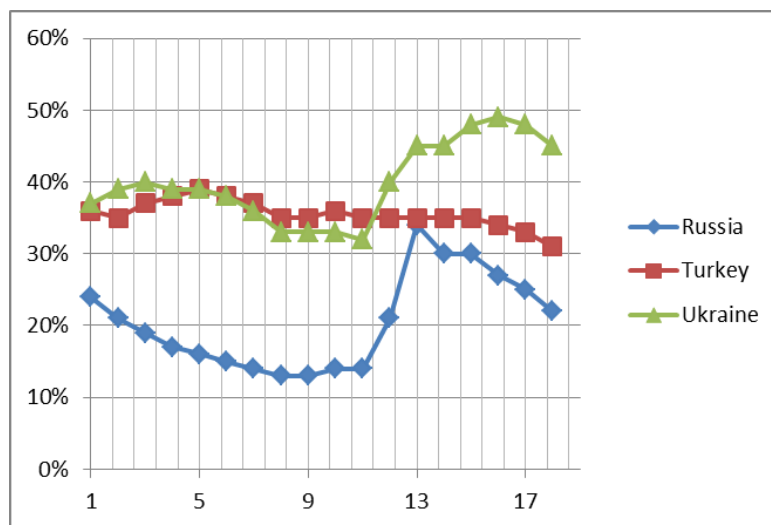

Figure 2.1: Percentage of deposits of the US dollar accounts over all deposits

Figure 2.1 shows percent of foreign currency accounts in the US dollar over all deposits for Russia, Ukraine and Turkey. On the x axis, there are quarters from 2006 to the second quarter of 2010. Before the crisis in the second quarter of 2008, the foreign currency ratio was 13.71 % for Russia, 32.23% for Ukraine and 34.93% for Turkey. During the crisis period, this ratio jumped to 33% in the first quarter of 2009 in Russia, 44.60% in Ukraine and 35.40% in Turkey. In general, however, there is a small decline in Turkey and a significant increase in Russia and Ukraine. Russia later had lower rates towards 2010.

Table 2.1: US dollarization rate in Russia and Turkey

Russia	Q1	Q2	Q3	Q4	Turkey	Q1	Q2	Q3	Q4
2006	0.24	0.21	0.19	0.17	2006	0.36	0.35	0.37	0.38
2007	0.16	0.15	0.14	0.13	2007	0.39	0.38	0.37	0.35
2008	0.13	0.14	0.14	0.21	2008	0.35	0.36	0.35	0.35
2009	0.34	0.30	0.30	0.27	2009	0.35	0.35	0.35	0.34
2010	0.25	0.22			2010	0.33	0.31		

Table 2.2: US dollarization rate in Ukraine

Ukraine	Q1	Q2	Q3	Q4
2006	0.37	0.39	0.4	0.39
2007	0.39	0.38	0.36	0.33
2008	0.33	0.33	0.32	0.4
2009	0.45	0.45	0.48	0.49
2010	0.48	0.45		

Table 2.1 and Table 2.2 show the trends in US dollarization rates among three countries. Exchange rates show similar trend with the ratio of foreign currency deposits. During the period from 2008 to 2009, Russian ruble jumped from around 24 rubles to 34 rubles per 1 US dollar; Ukrainian hryvnia jumped from 4.847 hryvnia to 7.91 hryvnia per 1 US dollar; Turkish lira jumped from 1.2 liras to 1.65 liras per 1 US dollar. Similar trends are observed in interest rates during this period. Interest rates on local currencies jumped from 6.97% to 10.80% for Russia and 13.63% to 20.67% for Ukraine. Whereas, in Turkey, after a short increase to 19% from 18.50%, interest rates on local currency dropped to 9.73% in the first quarter of 2010. Interest rates on the US

dollar accounts mostly increased during the defined crisis period for these three countries. In Russia, this rate jumped from 5.07% to 5.97%, in Ukraine it jumped from 8.73 % to 11.50%. In Turkey; however, interest rates on US dollar accounts remained stable around 4.5% and later dropped to 2.63% in 2010.

<div align="center">2.4   Methodology</div>

This study is a continuation of earlier studies in the currency substitution of Arango-Nadiri (1981) and Bahmani-Oskooee (1996) (Arango & Nadiri, 1981; Bahmani-Oskooee, 1996). In their studies, they developed a model based on exchange rates, interest rates and GDP. In their model, M2 (Money Supply 2) is defined as the dependent variable against independent variables of exchange rates, interest rates and GDP. M2 includes currency in circulation demand deposits, time deposits. Therefore, deposits in individual accounts are also the part of M2. If M2:

$$M2 = a + b*\log i + c*\log E + d*\log GDP + e$$

Here M2 represents the money supply, "i" represents interest rates, E represents exchange rates, and GDP is the gross domestic product. Interest rates are nominal rates for short-term deposits. In some models in literature, another term for inflation is used in the model. Inflation has definitely a strong relationship with the currency substitution; countries with high inflation are more likely to have the currency substitution. As nominal interest rates and inflation show a strong positive relation, a parameter for inflation was not added. Moreover, a recent study did not find any significant relationship between money demand (M2) and inflation in Russia from 1999 to 2006 (Korhonen & Mehrotra, 2007). Then money supply is separated into money supply in a foreign currency (the US dollar) and in a domestic currency.

$$M2(\$) = a + b_1*\log i(\$) + c_1*\log E + d_1*\log GDP + e \text{ and}$$

$$M2(Local) = a + b_2*\log i(Local) - c_2*\log E + d_2*\log GDP + e$$

Two different interest rates are used as local and US dollar interest rates. Also exchange rates have opposite effects on domestic and US dollar money supplies. For US dollar deposits, a depreciation in exchange rates for local investors (E goes up) causes US dollar deposits to grow. In other words, when the US dollar appreciates against the local currency, the US dollar deposits

go up as well as M2. On the other hand, exchange rates have negative effect on local currency deposits. GDP is positive for both domestic and foreign deposits. The ratio of the US dollar deposits over total deposits is calculated as follow:

$$\frac{M2(\$)}{M2(\$)+M2(Local)} = a + b_1*\log i(\$) - b_2*\log i(Local) + c*\log E + e$$

GDP is excluded at this point as a result of an assumption that a change in GDP will result in equal percent changes in M2($) and M2(Local). In other words, a change in GDP will not result in the composition of monetary supply even though it is expected to change monetary supply levels. Interest rates on the US dollar accounts positively affect the ratio while local interest rates are expected to have negative influence. Exchange rates are expected to be positively affecting the ratio. As it is mentioned earlier, individual deposits are good proxies for M2 since they are also a part of M2. If R is defined as the ratio of individual US dollar accounts over all accounts, following equation can be written:

$$R = a + b_1*\log i(\$) - b_2*\log i(Local) + c*\log E + e$$

During the late 2000s financial crisis, there were possible changes on this ratio since the US economy first and local economies secondly experienced a downturn. While the effects of the crisis in the US and in local economies are investigated, it is necessary to separate them into two parts. Following are the hypotheses:

H1: The crisis in the US negatively affected the US dollarization rate during and after the defined period of the crisis (December 2007 – June 2009).

H2: The local crises in aforementioned countries had positive effects on US dollarization rates in these countries during and after the defined periods of local crises.

In order to test these hypotheses, additional four dummy variables are added to the model. First dummy variable is US_d, which shows if the month of analysis falls into the period of crisis in the US. This dummy variable is 0 for months other than December 2007 to June 2009, and it is 1 during those months. The second dummy variable is US_a, which shows the period

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after the period defined. Variables L_d and L_a are added finally for during and after periods of local crises. So the model becomes:

$$R= a + b1*\log i(\$) - b2*\log i(Local) + c*\log E+ f*US\_d + g*US\_a+ h*L\_d + j*L\_a+ e$$

If there is no effect of the crisis in the US, f and g need to be close to 0 and similarly h and j need to be close to 0, if there is no effect of the local crises on US dollarization rate. However, there are, expected changes in interest rates and exchange rates because of the crisis in the US and local crises as well. In order to eliminate multicollinearity, it is necessary to "clean" the effects of the US crisis and local crises on interest rates and exchange rates. This is done by the first running individual regressions of interest rates and exchange rates where they are dependent variables while dummy variables are independent variables. The second step is the calculation of the residuals from these regressions for each interest rate and exchange rate from three aforementioned countries. In other words, the model uses adjusted interest rate on the US dollar accounts, adjusted interest rate on accounts in local currency, and adjusted exchange rates based on calculated residuals left after running individual regressions.

<u>2.5   Results</u>

In this part, country specific analyses are conducted followed by a general comparison of three countries. First, Russia's results are investigated. In general, in the model there is a significantly high R-square of 97%, using 7 variables that have already described interest rates on local deposits, US dollar deposits, exchange rates, and four dummy variables showing the effects of the local crisis and the crisis in the US during and after the periods defined. It is important to notice exchange rates and interest rates are cleaned from the effects of crises. Moreover, it is worthy to look at the effects of the crisis in the US and local crises on interest rates and exchange rates. There is a significant appreciation of the ruble against the US dollar due to the crisis in the US (-4%, t-statistics= -4.38). This will continue after the official definition of the crisis (-5%, t-statistics= -3.29). The local crisis, on the other hand, led to the significant depreciation of the ruble against the US dollar (11%, t-statistics= 10.17) and this effect continued after the defined period of the local crisis (11%, t-statistic= 6.38). Therefore, the crisis in the US and crisis in

Russia had opposite effects on the exchange rate. This was expected, as usually the crisis in a country leads to decrease in investor confidence in that currency. In case of the crisis in the US, a decrease in value of the US dollar against other currencies was expected.

The picture for interest rates is not as clear as for exchange rates. The crisis in the US had no significant effect on local interest rates for Russia. However, during the local crisis, there was an increase in local interest rates (14%, t-statistics= 9.47), which did not continue afterwards. These results were expected, as almost all financial crises led to an increase in interest rates and Russia was not an exception. US dollar interest rates show similar pattern with local interest rates that during the local crisis there was a significant increase (4%, t-statistics= 2.49). However, after the period of the crisis in the US and after the period of the local crisis, the US dollar interest rates dropped significantly (-9%, t-statistics= -3.47%; -6%, t-statistics= -2.27). On the other hand, during the local crisis this rate went up.

Next, the relationship of exchange rates and interest rates with the currency substitution ratio will be discussed. An increase in the exchange rate (depreciation of the local currency) significantly increased the substitution ratio/ US dollarization rate (1.05% increase for every 1% increase in exchange rates, t-statistics=12.24). It can be caused by the increase in value of foreign deposits in terms of local currency after depreciation of the ruble. Also it may be caused by the increase in investor preference in the US dollar against the ruble. Interest rate on US dollar accounts also shows a positive relationship with the US dollarization rate (0.159% increase for every 1% increase in interest rates, t-statistics=3.21). No surprise, as the increase in interest rates on the US dollar makes it more attractive to investors. However, the relationship between interest rates on local currency with the US dollarization rate is surprising. There is also a positive relation between local interest rates and US dollarization rate in Russia (0.409% increase for every 1% increase in interest rates, t-statistics=6.24). In other words, investors prefer investing in the US dollar even though there is an increase in interest rates in local currencies. A good explanation might be related to investor confidence. When investors see an increase in interest

rates, they may expect an increase in inflation and depreciation of a local currency. Therefore, the investors might choose the US dollar as a safer investment tool.

Lastly, the effects of the local crisis in Russia and the crisis in the US on US dollarization rate are investigated. As it is hypothesized earlier, the crisis in the US had a negative impact on US dollarization rate (-3.7%, t-statistics=-8.05), while the local crisis had a positive effect (14.75%, t-statistics=26.32). Both of them are highly significant. In terms of weight comparison, the local crisis had a stronger effect than the crisis in the US. Local investors react more heavily on local changes than the global changes, which was expected. After the defined crisis in the US and Russia, their effects continued. The US crisis had a negative effect (-3.4%, t-statistics=-4.37), while the local crisis had a positive effect (9.1%, t-statistics=10.54) after the defined periods.

Turkey's case is to be investigated next. Turkey has some similarities and differences with the results in Russia. General R-square is 87%, which is less than the Russia's R-square, but it is still highly significant. In terms of exchange rate, similar to Russia, the crisis in the US had a negative effect on the exchange rate (-6%, t-statistics=-5.81), while the crisis in Turkey had a positive effect (12%, t-statistics=10.40). In other words, during the US crisis local currency in Turkey appreciated and during the local crisis it depreciated. Similar to Russia, the local currency appreciated after the crisis in the US (-8%, t-statistics=-4.24) and depreciated against the US dollar after the local crisis (12%, t-statistics=6.21).

The interest rate on local currency shows the different from the Russia's result. Interest rates on the lira did not increase during either the local crisis or the crisis in the US. More strikingly, after the both crises in the US and Turkey, interest rates went down in Turkey (-13%, t-statistics=-6.15 for the US crisis; -11%, t-statistics=-5.06 for Turkey). This shows that Turkey responded better than Russia on the crises. The reasons why Turkey had a better response are not in the scope of this paper. It is also interesting to notice that Turkey did not experience an increase in interest rates on US dollar accounts as well. Neither the crisis in the US nor the crisis in Turkey led to an increase in interest rates on US dollar accounts (-16%, t-statistics= -4.34). After the local crisis passed, however, there was even a decrease in interest rates on US dollar

accounts. So Turkey resisted well to raising interest rates during the crisis, and after they passed, interest rates went down.

The relationship between exchange rates and interest rates with US dollarization rate was similar to Russia. Exchange rate had a positive relationship with currency substitution ratio (US dollarization rate) (0.158% increase for every 1% increase in interest rates, t-statistics=3.03). This is similar to Russia; this may be due to a simple appreciation in values of foreign deposits against domestic currency or due to a change in investor preferences. Available data is not enough to diagnose the root reasons. Interest rates on the US dollar deposits also had a positive relationship with currency substitution ratio (0.150% increase for every 1% increase in interest rates, t-statistics=5.19). This is again similar to Russia's case. What is different between Russia and Turkey is that the fact that Turkey did not have a significant relationship of local interest rates and the currency substitution ratio, whereas Russia had it.

In terms of direct effects of the crises in the US and Turkey on the currency substitution rate, there are some differences from Russia. The crisis in the US again negatively affected the currency substitution rate during and after the defined period (-1.6%, t-statistics= -5.60 during; -1.6%, t-statistics= -2.70 after). However, the local crisis in Turkey did not have the same effect as Russia's crisis. During and after Russia's local crisis, the currency substitution rates went up; however, in Turkey's crisis there was no significant increase in currency substitution. Moreover, there was a decrease in the currency substitution after the crisis in Turkey (-2.6%, t-statistics= -4.170). This shows that Turkish investors had more confidence during and after the crisis, while Russian investors had not.

Finally, Ukraine's case is investigated. In general, Ukraine had the worse response in terms of exchange rates, interest rates, and currency substitution rates. General R-square for Ukraine is 91%, which is again highly significant. During the crisis in the US, Ukraine did not experience a currency appreciation against the US dollar, which was different from the cases in Russia and Turkey. Instead, there was the currency depreciation after the crisis in the US (3%, t-statistics=2.18), and during and after the local crisis (17%, t-statistic=12.81 during; 17%, t-

statistics=8.41). So Ukraine's currency did not benefit from the crisis in the US. Interest rates on local currency increased significantly during all that period during and after both crises in the US and Ukraine (11.6%, t-statistics=9.59 during local crisis; 7.3%, t-statistics=3.89 after local crisis; 3.8%, t-statistics=3.63 during the crisis in the US; 6.3%, t-statistics=3.63 after the crisis in the US). In comparison, Turkey was able to reduce interest rates on local currency after both financial crises were over in definition. Russia had only an increase in interest rates during their local crisis but not for another period. Interest rates on US dollar accounts also increased in Ukraine during and after the crisis in the US and during the local crisis, but not after the local crisis (9.2%, t-statistics=8.07 during local crisis; 4.2%, t-statistics=4.36 during the crisis in the US; 4.3%, t-statistics=2.7 after the crisis in the US). As a result, Ukraine's currency depreciated, interest rates went up during this entire period.

The relationship of exchange rates and interest rates with the currency substitution rate in Ukraine has similarities and differences with the ones in Russia and Turkey. Similar to Turkey and Russia, the exchange rate had a positive relation (0.459% increase for every 1% increase in interest rates, t-statistics=4.65). An increase in exchange rates leads to an increase in currency substitution rates. However, interest rates on both the local currency and the US dollar accounts had no significant relation with the currency substitution rate. This might be a result of investors' skepticism about interest rates in Ukraine or interest rates were not attractive enough to convince investors to invest in local money or foreign deposits.

The most significant result for Ukraine is that similar to Russia and Turkey, the currency substitution rate dropped during the crisis in the US (-4.6%, t-statistics=-3.56). However, unlike Russia and Turkey this did not continue after the defined period (December 2007-June 2009) of the crisis in the US. Similar to Russia, Ukraine increased the currency substitution rate during and after the local crisis (9.4%, t-statistics=9.02 during; 7.2%, t-statistics=5.22 after). This is in contrast to Turkey where the currency substitution dropped afterwards. Ukraine as a result had a net increase in the currency substitution rate due to a stronger local crisis effects compared to the effects of the crisis in the US. Next Table 2.3 summarizes all the information up to this point.

Table 2.3: Summary table for currency substitution rate regression

		Intercept	Local Crisis	Crisis in US	After Local Crisis	After Crisis in US
Russia	Mean	0.1721	0.148	-0.037	0.091	-0.034
	t-statistic	70.87	26.32	-8.050	10.54	-4.370
Turkey	Mean	0.369	0.001	-0.016	-0.026	-0.016
	t-statistic	225.630	0.360	-5.650	-4.170	-2.700
Ukraine	Mean	0.373	0.094	-0.046	0.072	0.014
	t-statistic	84.78	9.020	-3.560	5.220	0.700

		Adj Log Exchange	Adj Log Local Int	Adj Log Dollar Int	R square
Russia	Mean	1.055	0.409	0.159	97%
	t-statistic	12.24	6.240	3.210	
Turkey	Mean	0.158	0.068	0.150	87%
	t-statistic	3.030	1.200	5.190	
Ukraine	Mean	0.459	0.136	-0.001	91%
	t-statistic	4.65	1.090	-0.010	

2.6   Managerial Insights and Conclusions

In this study, the effects of the crisis in the US and the local crises over the currency substitution during and after crises periods are investigated. If to compare three countries all together, here are following conclusions. Both hypotheses that the crisis in the US had a negative effect and local crises had positive effects on currency substitution rates are supported in all three countries. The only exception is Turkey that did not have a significant increase during the local crisis. The negative effect of the crisis in the US continued after the defined period of the crisis was over. The only exception is Ukraine, in which the negative effect did not continue. Local crises also continued and positively influenced Russia and Ukraine; on the other hand, Turkey had a negative result in the currency substitution after the local crisis was over. Exchange rates in all three countries had a positive significant relation with the currency substitution. Only in Russia, interest rates on local currency had a positive impact in currency substitution. This was the most surprising result in the study. The US dollar interest rates had a positive impact on the currency substitution rate except Ukraine.

This study successfully shows that the US dollar will remain as safer currency for the foreseeable future unless another stronger currency is largely accepted. The large-scale hopes for the euro are still in the distant future, while Europeans need to take care of their domestic issues first. The currencies, which are not even directly tied to these major currencies such as Turkish lira, Russian ruble, or Ukrainian hryvnia may actually show much larger depreciation compared to a hard currency such as the US dollar because of investors' expectancy of possible large-scale domestic economic problems. In terms of production capability, companies may opt to produce in such weaker-economy countries to lower their total cost. Companies may need to cut their sales in such risky economies or be ready to accept reductions in profits from sales due to depreciation of the local currency. The rule of a thumb is that the strongest convertible currency remains strong even after a large-scale domestic crisis due to investor relative risk comparison with smaller economies.

Since global crises are large-scale external events, when there is an anticipation of such events, SCM should not necessarily close production facilities in economies with crisis but rather direct them to export from that country and benefit the potential currency devaluation. In terms of payments to suppliers, it is also beneficial to pay in local currencies, even if this means bearing more volatility in payment amounts. This volatility is around a decreasing trend of local monetary value against a hard currency. The US dollarization rate is a good measure in identifying potential risk and the current economic strength of the local economy. As a SC manager, seeking suppliers with highly US dollarized countries can be better to benefit potential depreciation and devaluations of the local currency.

From the suppliers point of view this brings interesting results. US dollar continues to be a safer instrument for managers to store the value of earnings. A supplier should still prefer receiving US dollar from buyers over local currencies, especially the ones with a long history of volatility. A multinational corporation may prefer working with suppliers located in countries with history of financial and economic crises. These countries are more vulnerable than major countries, which makes their local currency a candidate for devaluation risk. This risk is not

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reduced even if the crisis has started outside of the country such as in the USA. Because the residents of risky countries predict that a crisis started in a large economy would also have an impact on them, they invest less on their currency, which in return, alleviates the risk of a potential devaluation. A country with potential and recent devaluation is a good candidate for import purposes / buying goods. With the same amount of foreign currency, supplier is able to produce more goods due to devaluation of the local currency. In other words, global supply chain managers should continue trusting US dollar as the reserve and storage of the earnings while looking for countries with higher potential of financial turmoil even in the light of the crisis of the US economy.

CHAPTER 3

ALLOCATING MARKETING AND QUALITY SPENDING

IN THE PRESENCE OF WORD-OF-MOUTH EFFECTS:

CLOSED MODEL

3.1   Introduction

In a typical business, there are two key functions that compete for resources, they are marketing and operations. While the role of marketing is to generate demand by attracting customers, it is the role of operations to ensure supply via efficient service delivery processes. In those service delivery processes, with moderate to high levels of customer contact, aspects of the process, environmental aspects of the firm (i.e. layout, lighting, etc.), and employee attitudes can have an impact on customers' perception of the quality of a service as well as their overall evaluation of the service (Chase, 1981). With customer perceptions affecting repeat business and referrals (Heskett et al., 1994), it is important to consider investments in the quality improvement by the operations group when making budget allocations between marketing and operations. Past literature has shown that both marketing and operational efforts have an influence on customer acquisition, customer retention, customer duration, product awareness, market share, and profitability (Bolton, 1998). From these, new customer acquisition and retention are typical customer flows of supply chains. Involvement of operations management techniques in marketing decisions would open new opportunities in the current business environment, which is highly competitive, low in profit margins, and highly uncertain.

There are multiple marketing and operational concepts to consider within the service-profit chain model. One concept related to both marketing and operations is customer loyalty. A customer delivery process with a high level of the service quality, for which operations are responsible, will increase customer satisfaction, in turn increasing customer loyalty (Heskett et al., 1994). "In fact, the lifetime value of a loyal customer can be astronomical, especially when

referrals are added to the economics of customer retention and repeat purchases of related products" (Heskett et al., 1994, p. 164). This brings the concept of customer referrals that result from customers who were pleased with their service encounter in a firm to the point that they become "apostles" and start recommending the firm to others (Heskett et al., 1994). As such, customer referrals are a form of "a free advertising" resulted from positive word-of-mouth (WoM). However, customer satisfaction or dissatisfaction with the service encounter is a precursor to WoM. Furthermore, the level of satisfaction and dissatisfaction will drive the volume of WoM (Anderson, 1998). Also, customers who are extremely dissatisfied with their encounter engage in higher WoM than those customers who are extremely satisfied (Anderson, 1998). This explains the importance of service firms taking both a proactive approach to ensure delivery outcomes with the high quality of the customer service and a reactive approach in handling customers, who are less than pleased with their service.

Along with the service-profit chain model (Heskett et al., 1994), other models such as the satisfaction-profit chain (Anderson & Mittal, 2000) and the return on quality model (Rust et al,. 1995, 2002) have emerged. In essence, these models discuss how a firm can improve its financial performance by reducing cost, by increasing revenue, or by doing both (Rust et al., 2002). Costs are reduced by having more efficient processes, which can result from investments in internal service aspects such as workplace design, job design, employee selection and development, and employee rewards (Dunne & Barnes,2000). Revenues are increased through improvements in internal and external quality of a service, associated with the service encounter, which results in increased customer satisfaction and customer loyalty (Heskett et al. 1994). That said, financial performance of a service firm can be improved using a variety of options involving investments in advertising and operational processes. The task now is to determine how to allocate resources to advertising and operations best to achieve the desired financial performance.

One objective of this research is the creation of a mathematical model that maximizes customer flow by optimizing budget allocations in advertising and quality improvement efforts for

a given planning horizon. Further analysis of this model provides insights into the relationships of various parameters related to customer service, retention, and referrals. In the next section, literature related to the customer flow model will be presented followed by a discussion of the mathematical model and related propositions. For further understanding, a numerical example using parameter values representing real world scenarios will be presented and lastly managerial insights and possible research extensions will be discussed.

<div align="center">3.2   Model Motivation and Related Literature</div>

While ways to entice new customers or retain prior customers have been researched, WoM has not received as much attention (Wangernheim & Bayon, 2007) although it is considered a key research area (Zeithaml, 2000). This is particularly interesting given that a strong level of a positive WoM has a significant impact on the success of a new product launch (Dodson & Muller, 1978). If WoM affects new product sales, then intuitively, it should also affect sales in service firms. However, it is important not to overlook the consequences of negative WoM. Thus, within a service context, Archer and Wesolowsky (1994) developed a model consisting of transient states in which customers are grouped based on their customer encounter experience and WoM. In their model, all customers transit from the state of being unaware of the firm to one of two states: positively aware of the firm or negatively aware of the firm. In part, these transitions are a function of probability of the customer becoming negatively aware based on hearing negative WoM, and probability of the customer becoming positively aware based on hearing positive WoM. Their results indicate that entrepreneurial firms relying more on WoM than advertising should ensure a high level of the quality of a service from the opening day, especially as negative WoM is hard to overcome.

Using a different perspective, Rust et al. (1995) proposed the return on quality framework. In this framework, shown in Figure 3.1, they posited that a firm focusing on service quality improvement would ultimately be more profitable through three means: attraction of new customers through WoM, higher customer retention through service quality encounters, and cost reductions (Rust et al., 1995). Customers who are pleased with their service encounter are more

<div align="center">53</div>

likely to spread positive WoM resulting in the attraction of new customers. The same customers who have enjoyed prior service encounters in the firm are more likely to have repurchase intentions. Given their familiarity with the firm's delivery process, the cost of serving these customers is about 20% of the cost to service a new customer (Rust et al., 1995). Thus, the firm enjoys higher revenue through repeat business and lower transaction costs.
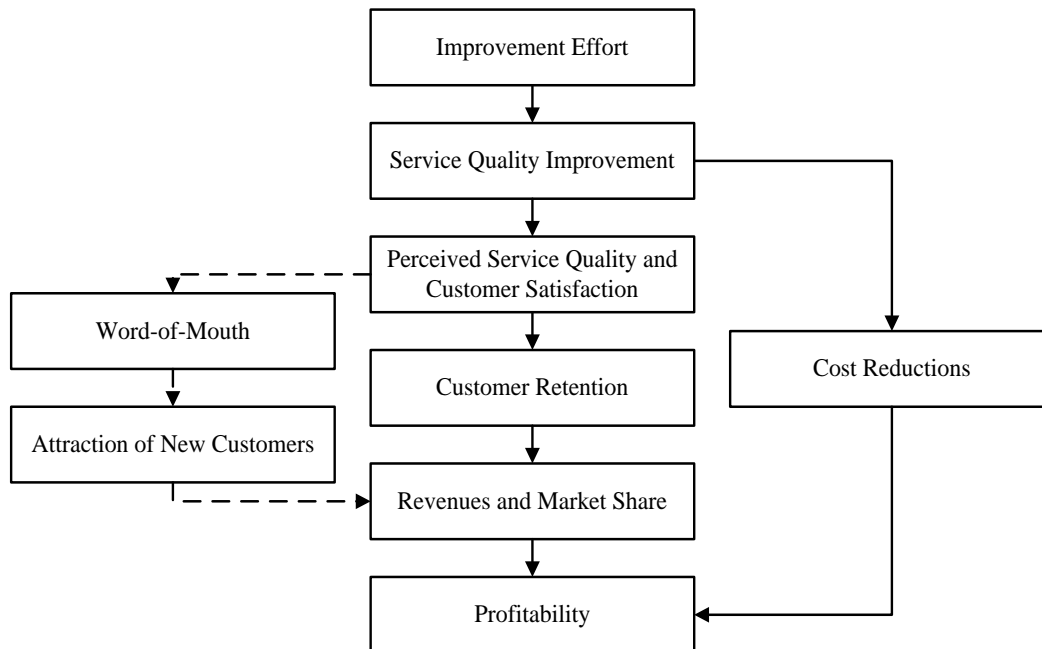
Figure 3.1: Model of service quality improvement and profitability (Rust et al., 1995)

Drawing upon these models, a theoretical closed loop model is presented, shown in Figure 3.2, consisting of different concepts affecting customer flow. This model blends aspects of these models such as the effectiveness of the firm's advertising efforts, its ability to retain customers from providing service quality, and its ability to enjoy customer referrals as a result of providing the quality of a service. Unlike the model by Archer and Wesolowsky (1994), the parameter of the quality level of a service in the model is dynamic thus changes throughout the planning horizon in accord with quality improvement budget allocations. To begin, customers are first attracted to the firm. Then, customers will either be satisfied or dissatisfied with their service encounter. If the customer is satisfied, he or she is more likely to be a repeat customer in the

future and spread positive WoM, labeled WoM1, about the firm to friends and families. If the customer is not satisfied, one of two events will happen. First, the customer will leave the firm without voicing their dissatisfaction and may spread negative WoM, labeled WoM2, about the service encounter and the firm. Second, they will voice their dissatisfaction thus giving the firm a chance to address the issue and possibly retain them as a future customer. In this second event, the firm may be able to successfully address the customer's complaint and thereby may be able to retain the customer and enjoy potential positive WoM, labeled WoM3. Now, the mathematical model is as follows.
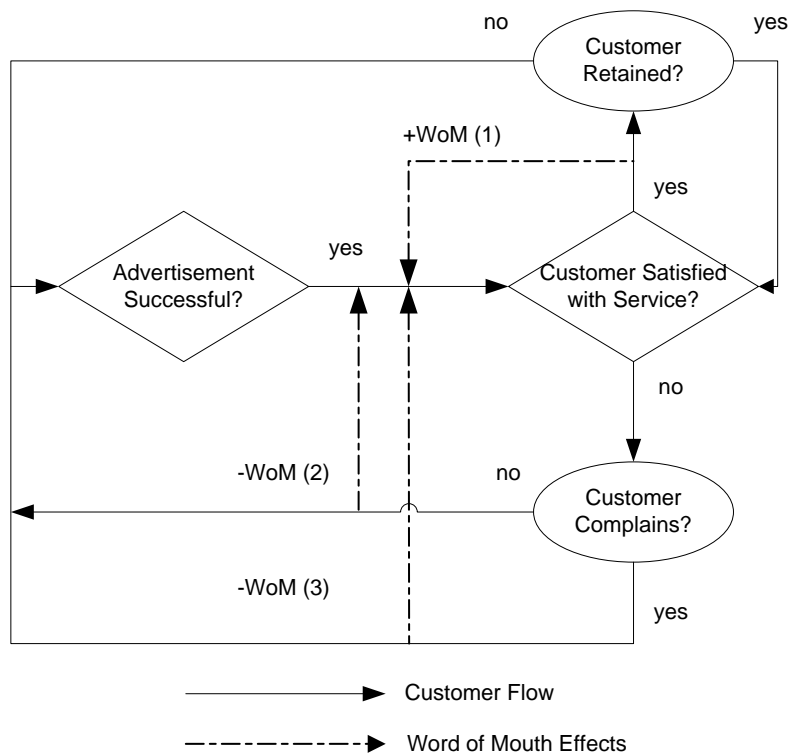

Figure 3.2: Customer flow with retention efforts and WoM effects

3.3   Model Formulation

To address the dynamic nature of the service quality and WoM effects, the system is modeled as a deterministic model with a specified planning horizon consisting of a number of distinct time periods (i.e. weeks, months, etc.). Each time period, k, represents the expected time

before a customer will need the service again. This time period can be longer or shorter depending on the nature of the firm. For example, the time period can represent a week for a fast food restaurant, whereas it may represent three months for an automotive business providing oil changes. Given parameter values, the model determines optimal budgets for advertising and operations in each period of time within the specified planning horizon with the objective of maximizing customer inflow to the firm. Next, here are the objective and constraints.

3.3.1 Objective

This analysis addresses WoM effects, advertising effects, and retention effects of the budget allocation decisions. Because revenue is based on the sales price and because different services will have different prices; objective of the model is to maximize customer inflow in order to have a general model. This same objective maximizes the number of customer transactions. Considering the elements in the model, customer inflow is the composite of those customers attained through advertising, those returning customers who were satisfied with their prior customer encounter, and those customers affected by WoM.

In the model, advertising reflects the monetary spending the firm makes each time period to attract new customers. In the presence of a large potential customer pool, the monetary spending necessary to attract all potential customers is so large that an increase in advertisement spending can be modeled as being linear. Since it is assumed the presence of a relatively large target market, the effects of advertising are treated as a linear function of monetary spending. The number of new customers, $ad\_flow_{[k]}$, as a result of advertisement spending, is represented as:

$$ad\_flow_{[k]} = \frac{A_{[k-1]}}{A_{Max}} * X \tag{1}$$

where k is the current time period, $A_{[k-1]}$ is the monetary advertising spending in time period $k-1$, X is the number of potential customers in the target market, and A_{Max} is the theoretical monetary spending on the advertisement needed to attract all potential customers. With the ratio of $A_{[k-1]}$ to A_{Max} representing advertisement market share, the same equation can be written as:

$$ad\_flow_{[k]} = a_{[k-1]} * X, \quad where \; a_{[k-1]} = \frac{A_{[k-1]}}{A_{Max}}. \tag{2}$$

The different indices for *ad_flow,* "*k*" indicates the presence of one unit time lag effect between advertising and actual customer arrival. Thus, advertising spending in one time period increases customer inflow in the next time period.

Next, service level spending which represents the investment in improving the customer satisfaction levels of the service encounters will be discussed. These types of investments increase revenue by increasing customer retention, they also decrease costs associated with the transaction. Unfortunately, "Improving quality helps up to a point, but past that point further expenditures on quality are unprofitable (Rust et al., 1995: p. 58)." Since investments in operational aspects such as training, use of technology, and process improvements often have diminishing returns, they are modeled as concave. Adding this aspect of concavity, satisfied customers, $s_{[k-1]}$, is as follows:

$$s_{[k-1]} = (\frac{S_{[k-1]}}{S_{Max}})^h \tag{3}$$

where $S_{[k-1]}$ is the monetary spending on the quality level during time period *k-1*, S_{Max} is the theoretical monetary spending on service needed to satisfy all customers, and *h* is the rate of concavity between the limits of 0 and 1. As with advertising, there is potential a time lag between investment and its impact on customer flow.

There are strong ties between positive service encounters and customer retention (Reichheld, 1993). Thus, the firm will retain those customers who are satisfied with their service encounter, while all other customers will return to the general public, which is targeted with advertisement spending. However, with Ret_A representing the retention rate of those satisfied with the encounter, Ret_A, customer flow in the time period k resulting from retention, $ret\_flow_{[k]}$, is as follows:

$$ret\_flow_{[k]} = s_{[k-1]} * flow_{[k-1]} * Ret_A \tag{4}$$

where $flow_{[k-1]}$ represents the total flow in time period *k-1*. Since Ret_A is deterministic in our model, $ret\_flow_{[k]}$ changes as a function of the service level in the prior period of time. This constraint has two implicit assumptions. First, it is assumed that all customers who are satisfied with their encounter in time period *k* will return in time period *k+1*. Second assumption is that dissatisfied customers may return to the firm based on advertising effects on the overall target market to which a dissatisfied customer belongs.

As earlier stated, both positive WoM and negative WoM effects in the model is included. Specifically, positive WoM effects occur within time period *k+1* as a result of customers satisfied with their service encounter in time period *k*. Just as one may recommend the firm after a good encounter, one may recommend not patronizing a firm after a poor encounter. Unfortunately, there are two scenarios, which can result in negative WoM. First, when a customer is not satisfied with the encounter and leaves the firm without complaining, however does tell others of the poor experience. Second; when a customer voices his/her dissatisfaction and is not satisfied with how the complaint was addressed, and then leaves and tells others about the poor experience. Since negative and positive WoM impact customer flow, these impacts are represented as $pos\_wom\_flow_k$, and $neg\_wom\_flow_k$:

$$pos\_wom\_flow_{[k]} = s_{[k-1]} * flow_{[k-1]} * E_{WOM1} \quad \text{and} \tag{5}$$

$$neg\_wom\_flow_{[k]} = s_{[k-1]} * flow_{[k-1]} * (c * E_{WOM2} + (1-c) * E_{WOM3}). \tag{6}$$

Here, *c* represents the ratio of dissatisfied customers to all customers while E_{WOM1}, E_{WOM2}, E_{WOM3} represents the WoM effects on customer inflow while E_{WOM1} being positive WoM and E_{WOM2} and E_{WOM3} being negative WoM.

In summary, the objective of the model is to maximize customer flow during the planning horizon and is represented in general form as:

$$Max \sum_{k=1}^{k=T} flow_{[k]} \quad where \tag{7}$$

$$flow_{[k]} = ad\_flow_{[k]} + ret\_flow_{[k]} + post\_wom\_flow_k - neg\_wom\_flow_k. \tag{8}$$

3.3.2 Constraints

The constraints considered in the model are a budgetary constraint, a net new customer constraint, a flow constraint, a non-negative quality service level constraint and a non-negative advertisement constraint. The budget constraint for each time period in the planning horizon, using the prior notation, is represented as:

$$A_{[k]} + S_{[k]} \leq Budget_{[k]} \; for \; every \; k \; from \; 1 \; to \; T. \tag{9}$$

Because there are negative effects on customer inflow from negative WoM, it is mathematically feasible for customer flow in a time period to be negative. However, the assumption is that WoM and advertising will influence only those customers in the target customer base, not those who have been retained by the firm. As a result, the net flow of new customers has to be non-zero and the corresponding constraint is:

$$ad\_flow_{[k]} + post\_wom\_flow_k - neg\_wom\_flow_k \geq 0 \; for \; every \; k \; from \; 1 \; to \; T. \tag{10}$$

Since most service firms seek to grow, it is assumed that the firm is making decisions to ensure a growing customer base, or at least, remains the same size. As a result, customer flow in time period k has to be bigger or equal to the flow in the previous time period; thereby the inclusion of the following constraint:

$$flow_{[k]} \geq flow_{[k-1]} \; for \; every \; k \; from \; 1 \; to \; T \tag{11}$$

Also, advertising in a time period will be strictly less than or equal to the advertising needed to attract all potential customers in the target pool. In a similar manner, investments in improving the level of the quality of a service will be no larger than the investment needed to satisfy all customers in the customer base. These assumptions are reflected within last constraints as:

$$0 \leq A_{[k]} \leq A_{Max} \; and \; 0 \leq S_{[k]} \leq S_{Max} \; for \; every \; k \; from \; 1 \; to \; T. \tag{12}$$

3.4   Mathematical Results

Now, here are several propositions and their associated insights concerning the relationships within the model. First, the effect of the quality of a service on customer flow when advertising and WoM effects are absent will be discussed.

Proposition 1: This proposition confirms that the quality of a service, by itself, in the absence of advertising and WoM effects, is not enough to increase customer flow. In other words, in the scenario of net zero advertising and WoM effects, the net flow of customers will remain constant or diminish regardless of the quality of the service provided. In mathematical terms, this scenario is represented as:

$$If A_{[k-1]} = 0, E_{WOM1} = 0, E_{WOM2} = 0, E_{WOM3} = 0 \ then \ Max\left(\frac{flow_{[k]}}{flow_{[k-1]}}\right) = 1. \qquad (13)$$

Thus, the flow of customers is equal to the flow of customers retained from the prior time period. The proof of this result begins by noting that equation 8 with the above-specified parameters reduces to:

$$flow_{[k]} = ret\_flow_{[k]} = s_{[k-1]} * flow_{[k-1]} * Ret_A. \qquad (14)$$

By rearranging flow terms on the right side of the equation, flow becomes:

$$\frac{flow_{[k]}}{flow_{[k-1]}} = s_{[k-1]} * Ret_A. \qquad (15)$$

However, the quality level of the service is a variable between 0 and 1 represents the average customer satisfaction with a value of 1 if all customers are satisfied, and a value of 0 if none of the customers is satisfied. In a similar manner, the retention rate of satisfied customers represents the average customer retention and again takes on values between 0 and 1. Thus, the product of the quality level of the service and retention rate is less than or equal to 1. As a result, the ratio of current flow against the previous flow is less than or equal to 1.

$$If \ 0 \le s_{[k-1]} \le 1 \ and \ 0 \le \ Ret_A \ \le 1; \ then \ 0 \le \frac{flow_{[k]}}{flow_{[k-1]}} \le 1. \qquad (16)$$

Since customer flow is a variable between 0 and 1 from equation 16, so the following needs to be true:

$$If\ 0 \leq \frac{flow_{[k]}}{flow_{[k-1]}} \leq 1\ \ then\ Max\left(\frac{flow_{[k]}}{flow_{[k-1]}}\right) = 1. \tag{17}$$

Equation 17 indicates that if there is no advertisement spending and zero WoM effects then customer flow is non-increasing regardless of the level of the service was provided. Thereby, for those firms where the WoM effects are negligible, the only way to increase customer flow is through advertisement spending. However, if there are considerable positive WoM effects, the firm can neglect advertisement spending and still sustain the firm. While one expects that a firm must invest in advertising to sustain or grow, this result is important for two reasons. The first reason is that its presence adds credibility to the model. And the second one is that it illustrates the importance of the firm to consider investments for the quality of the service given their tight tie to WoM effects.

In the next proposition, it is still assumed to have zero advertising spending, but also with non-zero WoM effects. This scenario is appropriate for small local firms such as legal or medical offices that have small advertising budgets that essentially reflect a non-advertising strategy. As an alternative strategy, these firms may focus their efforts on ensuring customer satisfaction and customer loyalty to keep repeat business with prior customers and garner new business from customer referrals. Naturally, a key foundation of this strategy and its success is to pay more attention to the service level. But what should be the service level? In other words, what is a good ratio of satisfied customers to the overall population? The following proposition introduces this ratio.

<u>Proposition 2</u>: In the case of zero advertisement spending, WoM can generate an increasing customer flow only if the service level satisfies the following constraint:

$$s_{[k-1]} \geq \frac{\left(1 + E_{WOM2} + c * (E_{WOM3} - E_{WOM2})\right)}{\left(Ret_A + E_{WOM1} + E_{WOM2} + c * (E_{WOM3} - E_{WOM2})\right)}. \tag{18}$$

As advertisement spending is zero, customer flow consists of customers retained from the previous period and customers resulting from positive and negative WoM.

$$flow_{[k]} = s_{[k-1]} * flow_{[k-1]} * Ret_A + s_{[k-1]} * flow_{[k-1]} * E_{WOM1}$$

$$- \left(1 - s_{[k-1]}\right) * flow_{[k-1]} * \left((1-c) * E_{WOM2} + c * E_{WOM3}\right). \qquad (19)$$

If to put flow terms on the left side, the following equation appears:

$$\frac{flow_{[k]}}{flow_{[k-1]}} = s_{[k-1]} * \left(Ret_A + E_{WOM1} + \left((1-c) * E_{WOM2} + c * E_{WOM3}\right)\right)$$

$$- \left((1-c) * E_{WOM2} + c * E_{WOM3}\right). \qquad (20)$$

Since a non-decreasing flow is interested, the ratio between flows has to be at least greater than 1. As a result, the right side of the equation has to be greater than 1:

$$s_{[k-1]} * \left(Ret_A + E_{WOM1} + \left((1-c) * E_{WOM2} + c * E_{WOM3}\right)\right)$$

$$- \left((1-c) * E_{WOM2} + c * E_{WOM3}\right) \geq 1. \qquad (21)$$

Rearranging terms by putting the service level variable on the right side, then this ratio appears:

$$s_{[k-1]} \geq \frac{\left(1 + E_{WOM2} + c * (E_{WOM3} - E_{WOM2})\right)}{\left(Ret_A + E_{WOM1} + E_{WOM2} + c * (E_{WOM3} - E_{WOM2})\right)}. \qquad (22)$$

Observed that when there is a higher retention rate, $RetA$, or a higher positive WoM, E_{WOM1}, the required service level is lower. However, if there is an increase in negative WoM effects, E_{WOM2} and E_{WOM3}, the service level must increase. In case of a positive turn of events, all of the parameters are on the right side of the inequality, while the variable is on the left side. Thus, this ratio becomes a useful tool for determining the minimum threshold for a firm's service level. From prior data and additional survey data collection and analysis, most firms can estimate values for the parameters in equation 22; thereby they can calculate their ratio to see if their current service level supports long-term sustainability.

If it is assumed that the effect of negative WoM from customers who complain, and the effect of negative WoM from customers who do not complain are equal; then E_{WOM2} equals E_{WOM3} thus equation 18 becomes:

$$s_{[k-1]} \geq \frac{(1 + E_{WOM2})}{\left(Ret_A + E_{WOM1} + E_{WOM2}\right)}. \qquad (23)$$

In this case, the service level ratio contains only three parameters: the negative WoM effect, the positive WoM effect, and the retention rate. Based on their circumstances, firms can use either equation 22 or 23 to check if their current level of the service provides a sustainable or growing customer flow. If their current level of the service is less than this ratio, they will need to increase their service level to sustain the customer flow. However, if it is unpractical to change the service level, they can implement new policies to increase the retention rate, increase positive WoM effects, or decrease negative WoM effects. For instance, they may offer lower prices to customers carrying "loyalty" cards or fine-tune their customer recovery process through training and increased compensation. The next proposition is an extension of proposition two by considering a specific scenario.

Proposition 3: Based on equation 23, if the sum of the retention rate for satisfied customers and the positive WoM is smaller than 1, then the service level ratio is required to be bigger than one; however, this is not feasible (service level is a variable between 0 and 1). In mathematical terms:

$$If \ Ret_A + E_{WOM1} \leq 1 \ then \ \frac{(1 + E_{WOM2})}{(Ret_A + E_{WOM1} + E_{WOM2})} \geq 1. \tag{24}$$

The proof of this proposition is:

$$If \ Ret_A + E_{WOM1} = 1 - x \ then \ \frac{(1 + E_{WOM2})}{(1 - x + E_{WOM2})} = \frac{1}{\frac{(1 - x + E_{WOM2})}{(1 + E_{WOM2})}}$$

$$= \frac{1}{\frac{(1 + E_{WOM2})}{(1 + E_{WOM2})} - \frac{x}{(1 + E_{WOM2})}} = \frac{1}{1 - \frac{x}{(1 + E_{WOM2})}} \geq 1$$

$$thus \ \frac{(1 + E_{WOM2})}{(Ret_A + E_{WOM1} + E_{WOM2})} \geq 1. \tag{25}$$

This proves that if the retention rate for satisfied customers plus positive WoM effects are smaller than 1, then the service level alone is not enough to sustain the current customer flow. As a managerial insight, service based firms with low customer loyalty and low WoM must rely on

advertising to sustain or increase their customer flow. Again, the next proposition builds on proposition two by considering the presence of both WoM and advertising effects.

Proposition 4: The impact of the advertising effect parameter on the service level is investigated. The following equation which is a non-decreasing customer flow shows the relationship between the advertisement ratio, market share, WoM effects, the retention rate for satisfied customers and the required service level.

$$s_{[k-1]} \geq \frac{(1 - a_{[k-1]}/MarShare_{[k-1]} + E_{WOM2})}{(Ret_A + E_{WOM1} + E_{WOM2})} \quad where \ MarShare_{[k-1]} = \frac{flow_{[k-1]}}{X}. \quad (26)$$

In this equation, market share shows what percent of the entire potential customer pool is serviced by the firm. The next flow equation includes all incoming customers:

$$flow_{[k]} = a_{[k-1]} * X + s_{[k-1]} * flow_{[k-1]} * Ret_A + s_{[k-1]} * flow_{[k-1]} * E_{WOM1}$$

$$- (1 - s_{[k-1]}) * flow_{[k-1]} * E_{WOM2} \quad (\mathbf{27})$$

Then flow terms are put on the left side:

$$\frac{flow_{[k]}}{flow_{[k-1]}} = s_{[k-1]} * (Ret_A + E_{WOM1} + E_{WOM2}) + \frac{a_{[k-1]} * X}{flow_{[k-1]}} - E_{WOM2} \quad (28)$$

To have an increasing flow, this ratio needs to be greater than 1. If the equation is rearranged in terms of the service level required to sustain a non-decreasing customer flow, the service level required is as following:

$$s_{[k-1]} \geq \frac{(1 - a_{[k-1]}/MarShare_{[k-1]} + E_{WOM2})}{(Ret_A + E_{WOM1} + E_{WOM2})} \quad if \ \frac{flow_{[k]}}{flow_{[k-1]}} \geq 1. \quad (29)$$

As expected, increasing advertisement spending decreases the required service level needed to sustain the current customer flow. The second observation is that there is a positive relationship between market share and the required service level. In other words, a firm with a larger market share needs to have a higher level of the quality of a service, than a firm with a smaller market share. Also, by putting s_k and a_k values in the equation, one can estimate the positive and negative WoM parameters from the previous time periods. Lastly, if the service level ratio is known, a firm can use the above equation to estimate its needed budget for the

advertisement spending. Next, the scenario where the advertising spending is kept at a constant level is considered.

Proposition 5: If there is constant advertisement spending, then an increasing flow requires an increasing service level to sustain the flow. First, if to define market share as:

$$MarShare_{[k]} = MarShare_{[k-1]} * m \tag{30}$$

where m represents the percentage increase in customer flow. If to distribute the terms and look for the minimum value for $s_{[k]}$ from equation 29, next equation appears:

$$s_{[k]} = \frac{1}{(Ret_A + E_{WOM1} + E_{WOM2})}\left(1 - \frac{a_{[k]}}{MarShare_{[k]}} + E_{WOM2}\right)$$

$$= \frac{1}{(Ret_A + E_{WOM1} + E_{WOM2})}\left(1 - \frac{a_{[k]}}{MarShare_{[k-1]} * m} + E_{WOM2}\right). \tag{31}$$

In this case, the service level required for one period before is:

$$s_{[k-1]} = \frac{1}{(Ret_A + E_{WOM1} + E_{WOM2})}\left(1 - \frac{a_{[k-1]}}{MarShare_{[k-1]}} + E_{WOM2}\right). \tag{32}$$

If to subtract equation 33 from equation 32:

$$s_{[k]} - s_{[k-1]} = \frac{a}{(Ret_A + E_{WOM1} + E_{WOM2}) * MarShare_{[k-1]}}\left(\frac{m-1}{m}\right) \; since \; a_{[k]} = a_{[k-1]} \tag{33}$$

Since m is greater than 0 (a non-decreasing customer flow), $s_{[k]}$ has to be greater than $s_{[k-1]}$. Thus, a firm seeking an increasing customer flow while keeping its advertisement spending constant will need to increase its service level. As the formula suggests, firms with higher retention, positive or negative WoM, or larger market share still have to increase their quality spending, but can do so in smaller increments.

Proposition 6: By replacing $a_{[k-1]} * X / flow_{[k-1]}$ in equation 33 with $NewCustFlowRatio_{[k-1]}$ representing the flow ratio of new customers to all potential customers in the prior time period in equation 33, the equation becomes:

$$s_{[k-1]} \geq \frac{1 - NewCustFlowRatio_{[k-1]} + E_{WOM2}}{(Ret_A + E_{WOM1} + E_{WOM2})}. \tag{34}$$

Those firms with a higher ratio of new customers to existing customers can actually have lower service levels. Firms who are generating high volume of new customers on a regular basis can sustain the same customer flow with lower service levels.

An additional insight can be found when the retention rate and the WoM parameters remain the same. Because a mature firm has a decreasing new customer flow ratio (new customers versus all customers), their needed quality service level is increasing. The effects of quality spending in equation 3 are a concave function with diminishing returns. As a result, there needs to be a higher spending in each time period to increase the service level. So, when a firm is growing, it needs to increase its spending on quality improvements more each time to increase its customer flow. Now, some numerical examples that use the model will be discussed.

3.5   Numerical Examples

In this section, three numerical examples are developed to demonstrate further the results of the propositions and to gain more managerial insights. In the first example, a typical business problem is formulated; then it is solved using the formula given in proposition five and different optimizing software solvers. Results provide further support for proposition five. In the second example, the effect of increased and decreased WoM is investigated on the requirements to the quality level of the service in the planning horizon. In the last example, the effects of a constant increase in advertising spending on the service level required to sustain customer flow are compared. Table 3.1 displays the parameter settings used within these examples.

Table 3.1: Parameter settings for cases used in examples

Parameter	Case	Case B	Case C
a	0.3	0.3	0.3
m	1.05	1.05	1.05
Ret_A	0.95	0.95	0.95
E_{WOM1}	2	4	1
E_{WOM2}	4	11	2
$MarShare_{[k-1]}$	0.3	0.3	0.3
H	1	1	1

Example 1: In this example, the fifth proposition is demonstrated, where the advertisement spending is constant with an increase in customer flow, then the service quality ratio must increase based on the following that:

$$s_{[k]} - s_{[k-1]} = \frac{a}{(Ret_A + E_{WOM1} + E_{WOM2}) * MarShare_{[k-1]}} \left(\frac{m-1}{m}\right). \qquad (35)$$

In this formula, m represents the ratio of the increase in customer flow. For instance, m equals 1.05 in the case of a 5% increase in customer flow. Remember, s is the ratio of satisfied customers to all customers who received a service. In the example, there is a business with a 30% market share at the beginning. Also, the business currently accounts for 30% of all advertising spending in its business industry. It is estimated that 95% of the customers who are satisfied with their encounter will return to the firm. Unfortunately, a dissatisfied customer is likely to spread more negative WoM than a satisfied customer (Anderson, 1998). For example, Xerox believes that a dissatisfied customer will tell two to three times more potential customers about their experience than a satisfied customer (Schlossberg, 1991). Thus, in this example, the settings reflect that a satisfied customer convinces two new customers via positive WoM, while a dissatisfied customer convinces four potential customers to avoid the firm. The required quality level of service to sustain such an increase in customer flow for a ten period horizon using the parameter settings for Case A is investigated.

This problem is formulated as a non-linear problem (NLP) and is solved using several non-linear solvers such as Minos. According NLP, the objective now is to minimize the current budget. Since advertisement spending is set, the objective of minimizing the budget is the same as minimizing the quality service spending. Table 3.2 summarizes the resulting service levels for ten periods after first solving the NLP using various solvers and calculating the ratio using equation 35.

Table 3.2: Resulting service level for the first example

Time Unit	Market Share (%)	Service Level required(%)	Δs (%)	Calculated Difference (%) using equation 35
1	30.00	58.27		
2	31.50	58.95	0.68	0.68
3	33.07	59.61	0.65	0.65
4	34.72	60.23	0.62	0.62
5	36.46	60.82	0.59	0.59
6	38.28	61.38	0.56	0.56
7	40.20	61.92	0.53	0.53
8	42.23	62.43	0.51	0.51
9	44.32	62.92	0.48	0.48
10	46.53	63.38	0.46	0.46

According to Table 3.2, the firm needs to have an initial service level of 57.55%, which needs to increase up to 63.38% to sustain a five percent increase in customer flow for each period when advertisement spending is constant. It is noteworthy that the differences in consecutive service levels are decreasing. Per proposition five, the results show that the service level must increase when advertisement spending is kept constant. In the model, the service level costs are formulated as a fixed cost; so, they do not change as customer flow volume changes. Thus, when the customer flow increases, even larger increases for the spending on the service level are needed. In Figure 3.3, the service level required to achieve the specified market share increase is plotted.
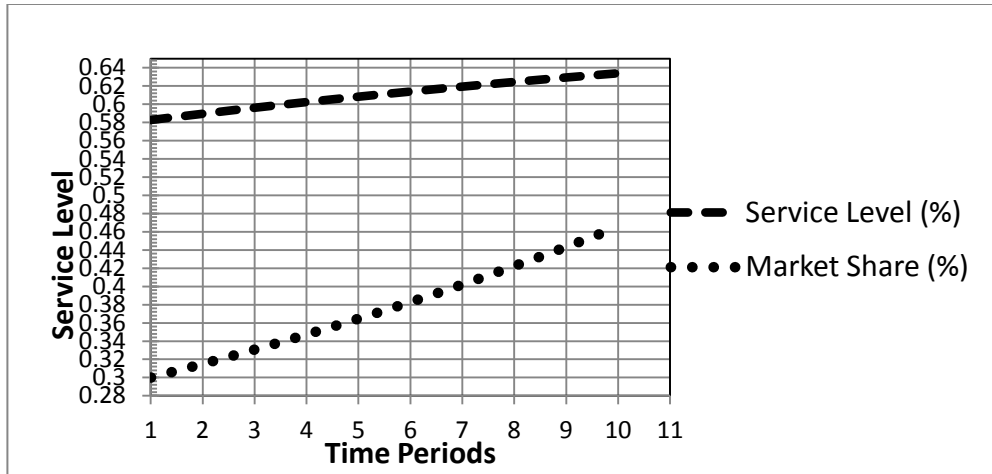
Figure 3.3: Service level requirement vs. market share

From Figure 3.3, it is noteworthy that market share increases at an increasing rate, while the required service level increases at a decreasing rate. Thus, each increment of the service level results in more market share than the previous increment. The effect of WoM is the primary reason for this observation. However, this does not imply that increasing spending on the service level will increase market share at an increasing rate. Spending on the quality increases the service level, but there may be diminishing returns. Remembering that h is the rate of concavity for quality spending, Figure 3.4 shows that the required spending increase in quality with different h rates for the same example.
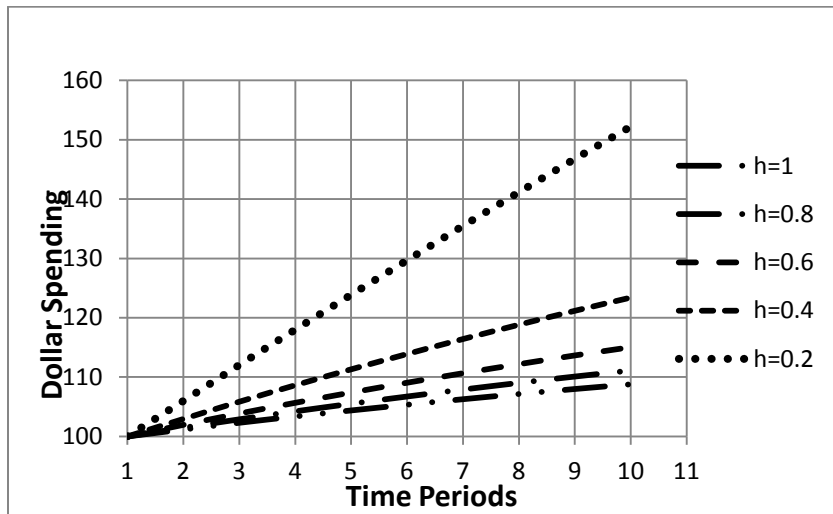

Figure 3.4: Required quality spending

In figure 3.4, the required amount of spending on quality is plotted for different h values between 0 and 1 ($h = 1$ represents the linear relationship and lower values of h represent concavity). Each line starts with a quality improvement budget of $100 in time period 1. With $h=0.2$, $150 are required to improve service quality in time period 10. In the case where $h=1.0$, the required service spending increase is slightly less than 5% to achieve an additional 16.53% of market share. When $h=0.2$, the required increase in the service spending is more than 50%. Thereby, it is imperative for a firm to understand the relation between quality spending and service level increases. In the case of more concave spending curves, additional market share may not be more profitable, if the cost of increasing the service level is prohibitively expensive.

Example 2: In this example, there are two additional cases, B and C (with parameter setting shown in Table 3.1), to assess how the magnitude of WoM effects influences the service level requirements. In case B, there are strong WoM effects when each satisfied customer convinces four new customers, while a dissatisfied customer tells eleven potential customers to avoid the firm. In case C, there are weak WoM effects.

As seen in equation 44, regardless of the type of WoM, positive or negative, an increase in WoM effects causes a decrease in service level increments from one time period to the next one. Also, the increments required in case B will be smaller than those in case A. In case C, they need to be larger. In this example, the ratio of negative WoM against the positive WoM in case A is 1:2, 1:2.75 in case B and 1:2 in case C. Thus, changes in the service level requirements in case B to have the same ratio is expected. While case A and case C have the same ratio, a lower service level requirement is expected due to the constant retention rate for satisfied customers based on conclusions drawn from the equation 36. Thus, the computed the service levels for each for the three cases are in Figure 3.5 below.
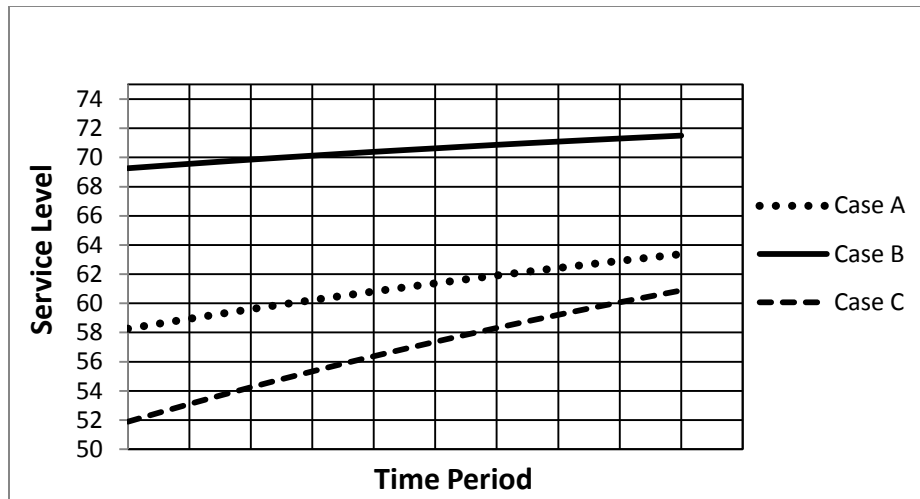
Figure 3.5: Required service level

Results are as expected. Case B requires higher service levels than case A in every time period due to the increase in ratio between negative WoM against positive WoM. Also, the service level required in case B to sustain a five percent increase in customer flow in each time period is lower than in case A as expected from using equation 36. The increments for the service level for case B are lower than those in case A, whereas case C requires larger service level increments. This result can be explained using equation 44.

These results indicate that while a firm having a large WoM ratio will still need to improve its service level to sustain or increase its customer flow, the level of additional investment in quality spending is lower than that for a firm with a small WoM ratio. However, it is also clear that firms having strong negative WoM require higher service levels. For instance, a firm with a small WoM ratio may be able to start with a low service level as long as it increases it over time. However, a business with a strong WoM ratio needs to start with a good service level upfront and then make smaller incremental improvements over time.

Example 3: In this example, the same parameter settings as in case A is used; however, the requirement of sustaining a five percent increase in customer flow is removed (m is set as equal to 1.00) . Also, the requirement that advertising spending increases by five percent in each time period is introduced. With the requirement of sustaining constant customer flow, the required

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service levels for this example as determined using both a NLP solver and equation 36 are shown in Table 3.3 (next page).

First, the match in results between solver and formula 36 support the statement that formula 36 is a useful tool for practitioners to use in what-if analysis concerning spending allocation decisions. Second, the results indicate that the required service level is decreasing as time progresses. Specifically, the required service level is dropping at rates between 1.25 to 2.10% over the planning horizon. A service firm may decide to use the strategy in this example, if the marginal return on advertising is greater than the marginal return on quality spending. While the service level is dropping for consecutive time periods, the rates of change are smaller than those resulting in example one. As a result, a firm needs to increase its advertisement spending if it chooses not to invest sufficiently in the service delivery process.

Table 3.3: Resulting service levels for the third example

Time	Solver	Formula 36	
Period	$s_{[k]}$required (%)	$s_{[k]}$required (%)	Change (%)
1	57.55	57.55	
2	56.83	56.83	-1.25
3	56.07	56.07	-1.33
4	55.28	55.28	-1.41
5	54.45	54.45	-1.51
6	53.57	53.57	-1.61
7	52.66	52.66	-1.71
8	51.69	51.69	-1.83
9	50.68	50.68	-1.96
10	49.26	49.62	-2.10

3.6   Conclusions

In creating a model to allocate funds between advertising and operations for quality improvement, this research provides useful insights into several concepts often considered in service based research. By including WoM, a deeper understanding of how the magnitude of positive and negative WoM influences future customer flow is understood. For example, results from proposition 2 indicate that firms with strong levels of positive WoM can actually flourish with little or no advertising given that their customers experience satisfying service encounters. Once advertising has spread awareness of a service firm, it may be the best for the firm to invest less in advertising and more in the operational aspects of the customer delivery process. For example, service firms should invest in structural, infrastructural and integration aspects of the process as identified by Roth and Menor (2003). In the infrastructural category, investments in the technical skills, social skills and motivation of those employees interacting with the customer has been shown to increase customer satisfaction, and ultimately customer retention (Hennig-Thurau, 2004).

Firms delivering less than satisfying customer experiences have to budget for a combination of advertising and customer recovery strategies. As proposition 3 highlighted, companies with low retention and positive WoM simply cannot sustain the current customer flow without advertising. In proposition 6, it is shown that firms with constant new customer arrivals because of having an ideal location, for example, can spend less on quality improvement efforts. Proposition 4 shows that firms with larger market share need to spend more on quality improvement. On the other hand, proposition 5 shows that firms with larger market share that seek to sustain or grow their customer base will still need to invest in quality improvement but can do so with smaller increments. These firms with larger market share may encounter diminishing returns on their advertising efforts. Thus, they should shift some of their focus towards customer retention. This finding aligns with the view that firms may want to emphasize the "personal touch" within the customer delivery process as opposed to continuing current focus on advertising (Reinartz et al., 2005). In addition to market share, proposition 4, 5, and example 2 show that

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firms with strong positive or negative WoM or higher retention rate need smaller service level increments as well. From this, it is noteworthy that both positive and negative WoM play similar roles in determining the increment sizes. Higher WoM requires smaller increments in quality improvement spending, but higher investment in establishing the initial quality service level. While advertising spending is important, especially in building an initial customer base, results indicate that it is also important to invest in quality efforts in the customer delivery process.

As with other models, this model has some limitations. Interactions between the parameters are not included. For instance, the size of the market share can influence the retention rate for satisfied customers; but both of them treated as static parameters. This is not as large a limitation as it might seem. If the planning horizon is short, the effects from these possible interactions may be negligible. In order to simplify the model, advertising effects are treated as linear. This decision is appropriate given the short tactical time frame of the planning horizon. However, for long-term strategic decisions, the advertising effects should be non-linear.

This paper contributes in two important ways. One, it presents a mathematical model for assessing the relationships of different parameters related to customer service, retention, and referrals. For instance, numerical example 3 shows how to conduct a sensitivity analysis using the model. Analytical analysis of the model and the numerical example provides useful insight, especially with regard to WoM effects. Two, along with providing these insights, provides a mathematical tool for managers in understanding the status of their business with regard to their advertising and operations spending decisions. Using estimates for the different parameters within the model, managers can perform "what-if" analysis to make better decisions. In closing, the results support the conclusion from an earlier study (Rust et al., 2002), in which service firms should focus their quality improvement efforts on projects that improve the service delivery process and thereby increase revenue. Remembering that the quality of the service delivery process plays an important part in customer retention and customer referrals, budget allocation decisions should give due consideration to quality improvement projects within the operations group.

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CHAPTER 4

ALLOCATING MARKETING AND QUALITY SPENDING

IN THE PRESENCE OF WORD-OF-MOUTH EFFECTS:

OPEN MODEL

4.1   Introduction

In today's tight economy, competition among service firms is intense. Not only are firms facing intense competition due to globalization of economies, they are carefully controlling their financial resources, especially after the global financial crisis of 2008 (Acemoglu, 2009). Some firms (i.e., Circuit City, Linens and Things) have perished. Other firms have had to lay off their workers and close stores to survive a bad economy. Now, surviving firms operate with fewer resources and are more closely managing their budget reserves (Acemoglu, 2009). Within service firms, two key functions competing for resources are marketing and operations (Roth & Velde, 1990). Past literature has shown that both marketing and operational efforts have an influence on customer acquisition, customer retention, customer duration, product awareness, market share, and profitability (Bolton, 1998). From these, new customer acquisition and retention are typical customer flows of supply chains. Involvement of operations management techniques in marketing decisions would open new opportunities in the current business environment which is highly competitive, low in profit margins, and highly uncertain.

Customers are sources of both negative and positive word-of-mouth that may influence others in their decision to start, continue, or stop receiving services from a given business (East et al., 2008). Most service-oriented companies are looking for more than a single time transaction, and would prefer to have an ongoing relationship with their customers (Bolton, 1998). As a result, very short tactics such as selling and the disappearing without considering next service encounter are not practical. Traditional word-of-mouth may explain why there are successful and unsuccessful thriving companies that spend no money on marketing. For

instance, existing customers may become a source of self-advertisement, helping to attract new customers and retaining existing customers. Existing customers' perceptions may also damage the company (Ferguson, 2008). This creates intense risk for the entire supply chains (SCs). For instance, the operations side of the business may have to take corrective actions in order to increase customer flow in light of negative word-of-mouth (NWoM). At the same, fluctuating demands would cause problems in upstream SC when sudden NWoM and positive word-of-mouth (PWoM) occurs. Moreover, the development of information and communication technologies (ICT) may ease the transmission of such risks from one SC entity to another one.

The primary objective of this research is to create a mathematical model that seeks to maximize customer flow by optimizing budget allocations for advertising and quality spending for a given planning horizon. One way of calculating the total profit for running an operation is average profit per customer times the number of customers that are served. Many companies try to access customers who are more lucrative by attracting them through better marketing, quality improvements, or new product/service/brand introductions. Such changes are longer-term efforts compared to short-term ones that are based on increasing of the number of customers served. Firms may only tolerate losing customers if the company can attract new customers who bring even more profit than current customers do. Moreover, most firms accept even marginally profitable customers. Even tough, maximizing the customer flow does not necessarily mean maximizing the profit; companies may target increasing the customer flow. Especially if they do not plan to alter their business model or increase or decrease their prices drastically. In the next section, there is a literature review related to the customer flow model containing effects from advertising, retention efforts and WoM. This section is followed by a discussion of the mathematical model and related numerical demonstration. For further understanding, the next-to-last section contains a numerical example of the model using different parameter settings representing real world settings. Lastly, there is a section for managerial insights and possible research extensions.

In this paper, managing word-of-mouth from a perspective operations management and supply chain perspectives will be investigated. Word-of-moth marketing is considered a non-traditional marketing effort. Traditional marketing methods include radio, television and print advertising, direct marketing, trade shows, promotional events, and direct mail (Villanueva et al. 2008; Trusov et al., 2009). Traditional marketing can be considered a benchmark for unorthodox methods, such as word-of-mouth marketing and viral marketing. (Trusov et al., 2009). Word-of-mouth marketing includes deliberate attempts to influence customers to spread a positive message while inhibiting the potential negative word-of-mouth (Godes & Mayzlin, 2009). Although some authors consider WoM and viral marketing as synonyms (Dobele et al., 2005; Kiss & Bichler 2008; Li et al., 2010), there are differences between viral and word-of-mouth marketing (Modzelewski, 2000). Viral diffusion uses channels like the Internet, blogs, or e-mails that are faster and diminish much slower, while word-of-mouth diffuses and diminishes slower using more personal channels such as verbal communication. Viral marketing is electronic by nature; there is no face-to-face communication, and those referrals are usually unsolicited (Bruyn & Lilien, 2008). Viral marketing is used extensively to create product awareness for both startup and mature businesses. There is little disagreement in the statement that a positive word-of-mouth influences sales positively. But if the limited amount of budget to be shared between operational improvement and marketing efforts of word-of-mouth, the question remains how to better share among them.

For a long time, word-of-mouth has been considered as slow in diffusion and customer response compared to many marketing efforts (Villanueva et al., 2008). However, with the introduction of the Internet, this assumption is not necessarily correct anymore (Trusov, et al., 2009). A simple negative experience can spread and influence in minutes a large number of current and potential customers thanks to the Internet, e-mails, and wireless communication (Dellarocas, 2003). A new term "viral marketing" (Leskovec, et al., 2007) is capitalizing on the newest additions of communication in response to the drastic change of speed of word-of-mouth

distribution (Bruyn & Lilien, 2008). The term "viral marketing" was introduced in 1997 by Steve Jurvetson and Tim Draper (Phelps et al., 2004). Using techniques to boost PWoM, companies may increase the number of new customers. A simple mismatch of customers who are attracted by marketing campaigns will result in NWoM, if operations management fails to meet or exceed their expectations. So, operations management responsibility is to ensure the satisfaction of customers attracted with the efforts of marketing.

The terms of customer satisfaction, the quality of service, and the value of service, are often mistakenly and/or unintentionally used interchangeable in literature (Bloemer et al., 1999; Cronin et al., 2000; Kuo et al., 2009; McDougall & Levesque, 2000; Oh, 1999; Sweeney et al., 1997). However, targeting customer satisfaction or increasing quality of service does not necessarily have the same goal (Hua, et al., 2009). A good example is giving discounts for the next visit for customers who are not fully satisfied. These customers after receiving the discounts can turn into satisfied customers, while they may still consider their service quality was low. Alternatively, a customer can be dissatisfied even when he/she considers the service quality was high. In addition, when a customer is offered the same service for a higher price, he/she may still be satisfied, although he/she may not consider the service has the same value (Cronin, et al., 2000). In this article, focus is on customer value. If the increased quality brings even higher increase in prices, customers are not likely to buy the service again, while the value of the service received decreases. Another example is when one of the competitors start offering a better service, while the other side does not improve. Offering more value a competitor is more likely to receive more customers (Eggert & Ulaga, 2002). There is a little disagreement in that; there is a positive correlation between quality improvements and value perception (Cho & Pucik, 2005). For instance, many fast-food chains while offering similar prices bring new restaurants with a better-looking dine-in atmosphere to change for the value perception from their customers.

Profit maximization is a common goal for many corporations (Miller & Matta, 2008; Levinthal & Wu, 2010; Desmet & Parente, 2010). However, spending on marketing activities can be considered risky, especially in the short term (Kumar Kar et al., 2010). Even in a longer period,

calculating benefits directly attached to a certain marketing activity is difficult, if not impossible (Kumar Kar et al., 2010). Good approaches such as using equity value, brand value instead of profit as the merit for marketing activity may help, but for many organizations, it is still a vague goal (Jones, 2008). For many organizations, an average percentage of sales in a certain industry is used more often to decide spending on marketing activities (Srivastava et al., 1999). One thought is that the companies that are not performing well and that are losing sales already should not match marketing US dollars with the industry leader; instead, they should spend even more (Doyle, 2000). A company that is already working at capacity may prefer cuts in marketing efforts, whereas a company who already attracts new and retains existing customers with good word-of-mouth may prefer paying less attention to spending on marketing activities (Brodie et al., 2002). Indeed, total marketing spending is a decision that companies make depending on the market conditions and their goals, making the marketing budget an important issue (Weber, 2002). With their limited sources, companies try to use their budget for improvement and marketing at its most optimum possible (Weber, 2002). Many marketing professionals do not like the idea that marketing efforts actually compete with other spending areas, such as improvement in quality of service (Zeithaml, 2000; Rust & Huang, 2012). When companies spend more on marketing efforts, they have less spending opportunities for such things as quality improvements. Therefore, for many companies, it is an allocation problem between competing incentives in operations and marketing after the budget size is determined. For many firms, investments in maintaining and improving the perceived quality and marketing spending are two competing areas for the limited budget that remains after the usual fixed and variable costs paid off (Yee & Eze, 2012). Considering the importance of these two functions in a service firm, and the presence of fewer resources, budget allocation decisions are even more important.

In researching ways to entice new customers or to retain prior customers, different approaches, such as aspects of advertising (Vakratsas & Ambler, 1999), employee loyalty (Reichheld, 1993), the quality of the customer encounter (Heskett et al., 1994), and methods of customer recovery, (Smith et al., 1999) have been researched. However, the effect of customer

WoM concerning their service encounters has not received that much attention (Wangernheim & Bayon, 2007) although it is considered a key research area (Zeithaml, 2000). In this paper the return on quality framework proposed by Rust et al. (1995) is used to form the theoretical foundation for the optimization model. In their framework, shown in Figure 4.1, they posit that a firm focusing on service quality improvement will ultimately be more profitable through three means: attraction of new customers through WoM, higher retention of customers through quality service encounters, and reductions in cost (Rust et al., 1995). Customers who are pleased with their service encounter are more likely to spread positive WoM, resulting new customers being attracted. The same customers who enjoyed prior service encounters are more likely to have a repurchase intention. Given their familiarity with the firm and its service delivery process, the cost of serving these customers is about 20% of the cost to service a new customer (Rust et al., 1995). This is particularly important because the presence of repurchase intention leads to even higher revenue through both the sale and its associated lower cost.
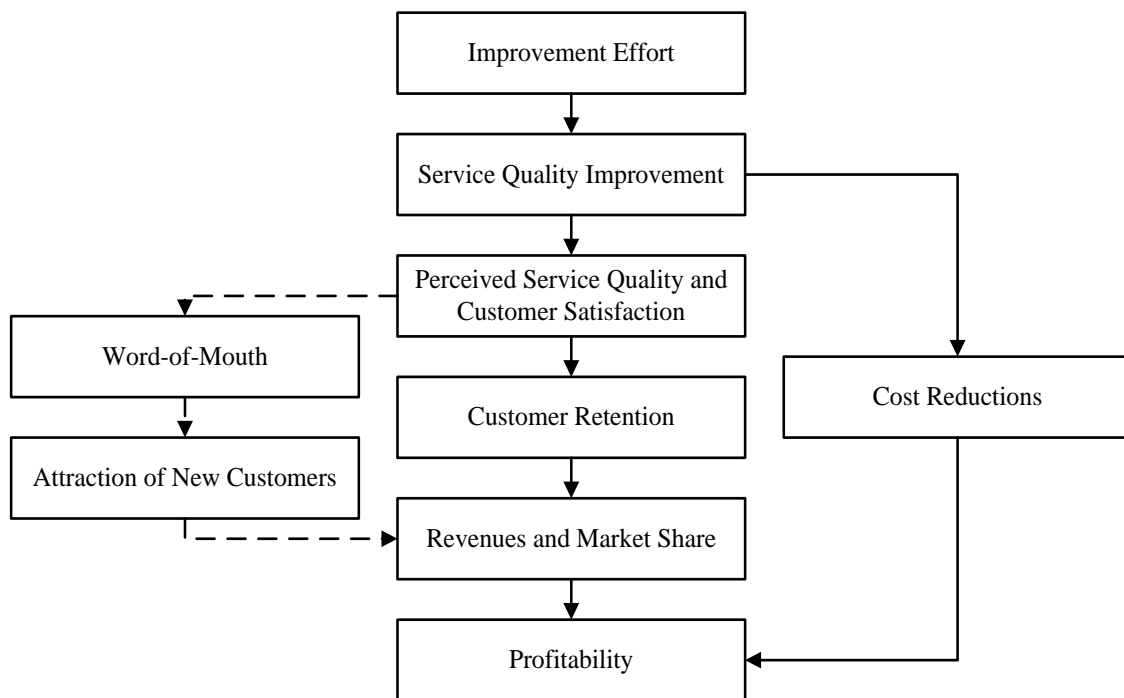

Figure 4.1: Model of service quality improvement and profitability (Rust et al., 1995)

<u>4.3   Model Discussion</u>

Companies with different market positions need to apply different policies in budget allocation decisions. For instance, viral marketing can be very effective for a startup company with very little brand or market penetration. For such companies, viral marketing can bring new customers in at an early stage. On the other hand, mature companies may need to fight with the existing negative word-of-mouth due to low customer satisfaction from earlier periods. As a result, the way the company uses its budget is an optimization problem. The companies of the research interest are divided into certain cases. The dimensions for this research are current growth aspirations, brand/service image, and the diffusion rate of information, the external competition threat, targeting short-term or long-term goals. Growth aspirations show what the current growth agenda of the company is. Some companies prefer not growing but being steady by preserving their market condition, market share, and etc. Such companies may be working already close to full capacity and have little incentive or face prohibitive costs to increase capacity. However, they may still want to replace less profitable customers with more profitable customers. Brand and service images are related to the positive and negative view of existing and potential customers. A company may need to fight against an earlier negative image. Certain industries are more prone to negative and/or positive information diffusion that others. It is a subjective measure, but most business owners can relate to their business. Competition encourages or forces companies to improve their service and spend on marketing efforts. In many industries, competition is the norm. However, here competition does not necessarily mean having another company offering a similar product; instead, it means true competition, where each competitor has to make decisions or review existing ones because of the competitor pressure. Targeting shorter term or longer term is a business decision that a company needs to make by itself. Even though there is much literature suggesting that taking a longer view is better, in the end, a company may prefer short-term goals, even if that means lower returns in the end. However, the short term does not necessarily mean one time sale of service, but a period shorter than a longer period. The length of short term is again subjective, depending on many factors including industry standards.

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Drawing on Rust et al.'s (1995) model, a theoretical open-loop model is presented, shown in Figure 4.2, representing different aspects affecting customer flow. It is an open loop model because the number of individuals in the system can grow or diminish through potential customers and exit customers. Within Figure 4.2, this expands on the Rust et al. (1995) model by considering the effectiveness of the firm's customer flow management. Once customers are attracted to the firm, they will either find enough value in the current service or not. If the customer is satisfied, he or she is more likely to be a repeat customer in the future and spread positive WoM about the business to friends and families.
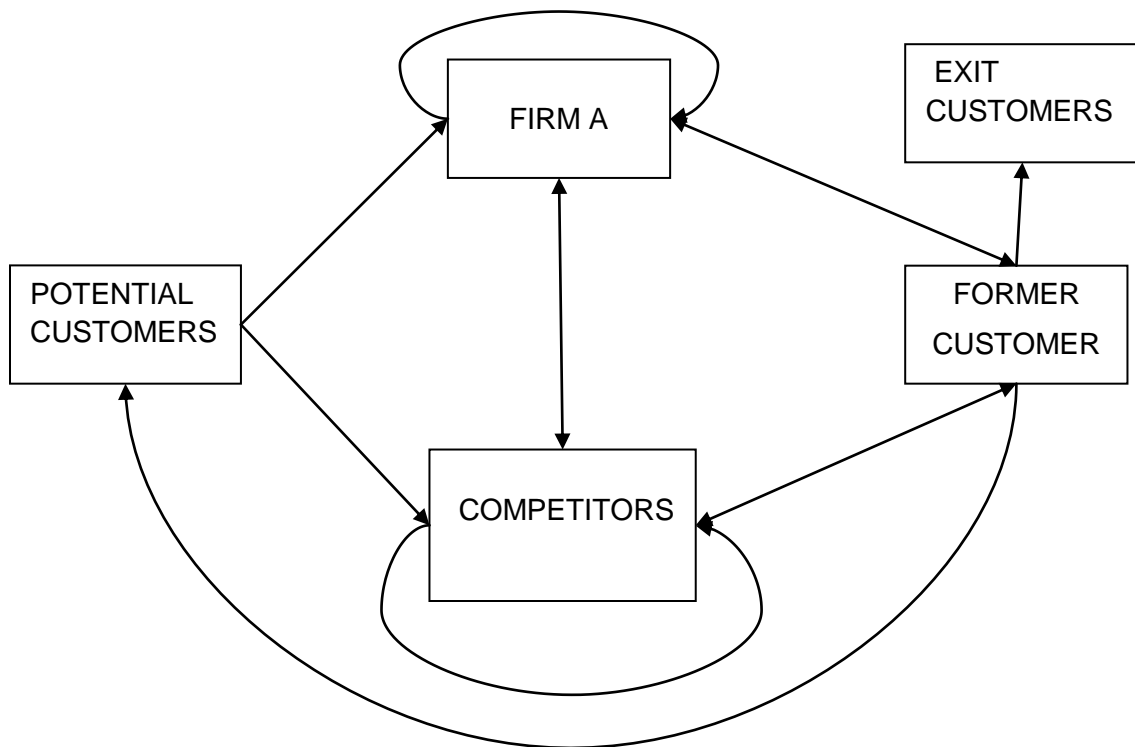

Figure 4.2: Customer flow chart

Although Rust et al., (1995) excluded WoM effects in their evaluation of service quality impact on firm profitability; WoM and analysis is included in the model. As in prior literature, WoM within this paper will refer to communications between prior and potential customers, not

complaints made to the service provider (i.e., Anderson, 1998). A couple of important observations concerning WoM are that customer satisfaction or dissatisfaction with the service encounter is a precursor to WoM, and that the level of satisfaction and dissatisfaction will drive the volume of WoM (Anderson, 1998). Actually, customers who are extremely dissatisfied with their encounter engage in higher WoM than those customers who are extremely satisfied (Anderson, 1998).

This second observation explains the importance of service firms taking both a proactive approach to ensure high quality customer service delivery outcomes and a reactive approach in handling customers who are less than pleased with their service. While many businesses take a proactive approach and invest in quality improvement efforts, firms offering more standardized services will find these investments more cost effective due to economies of scale than firms offering more custom and tailored services (Rust et al., 1995). For this reason, firms offering custom service should consider increasing their customer retention efforts both during and after the sale, given the level of customer involvement in the service transaction.

4.3.1   Model Goal

In many optimization problems, total profit is set as the objective function as firms are profit maximizers. However, in many cases, customer flow maximization gives close enough results as compared to profit maximization unless there is a price change of service. In order to articulate this, here is the general profit function

Total Profit = Average Profit per Customer * Number of Customers at time k

i.e., $TP_k = AP_k * NofC_k$

$TP_{k+1} = AP_{k+1} * (NofCC_{k+1} + NofNC_{k+1})$

always Max $(NofCC_{k+1} + NofNC_{k+1})$ =Max TP_{k+1} if not $AP_{k+1} - AP_k$ (a.k.a. price change)

where AP=Average Profit per Customer, NofNC=Number of New Customers, NofCC=Number of Current Customers, TP=Total Profit

A price change may have a negative and positive impact on the number of customers. In this paper; however, firms who are not willing to or not able to change their prices or firms who

are having planning horizons short enough to keep their prices steady or who are having price elasticities close to 0 are investigated. In terms of conditions that may eliminate using maximization of customer flow instead of maximization of profit, two candidates are noteworthy, namely perceived quality (PQ) and brand/company image (BI). For instance, a low $APNC_{i+1}$ (average price of new customers) may lead to lower PQ and BI, which in turn lower $APCC_{i+1}$ (average price of current customers) and $NofCC_{i+1}$. A huge promotional campaign to attract new customers while lowering profits from them may also frustrate existing customers who are paying more. Existing customers may simply switch/stop receiving service or demand lower prices themselves. In the study, both PQ and BI is included. With the additional effect of WoM, it is unlikely that targeting increased customer flow would lower the PQ and BI. This last part will later be reexamined.

To address the dynamic nature of changes in marketing and operational spending, the system is modeled as a deterministic model with a specified planning horizon that consists of a number of distinct periods (i.e. weeks, months, etc.). Each time period, k, represents the expected time before a customer will need the service again. This time period can be longer and shorter depending on the nature of the business. For example, the period can represent a week for a fast food restaurant, whereas it may represent three months for an automotive business providing oil changes. Next, the mathematical objective and constraints for the model is presented.

4.3.2   Sources of Customer Flows

There are four main types of customer sources: retention of current customers (Type 1), acquisition through potential customers (have little or no experience with the service from any company offering similar service) (Type 2), acquisition of customers from rival company or companies (Type 3), and acquisition of earlier customers of own and rival companies (Type 4). First, there are customers that the company managed to retain as type 1. Usually retention is the cheapest and the easiest way of having customers. Secondly, there are new customers that customer acquire from potential customers, rival companies, and earlier customers. There are

differences in strategy and success in acquiring each type of customers. A former customer with negative experience may be harder (more expensive) to acquire compared to a potential customer with little or no previous experience with the company. If a customer stops receiving service from a company and does not choose a competitor, thus becoming a former customer, it may be that he/she were dissatisfied with all companies or his/her interests have changed. Potential new customers are those who have never experienced the service before or who had experienced it so long ago that they would not consider their last experience as a relevant one in their current decision-making process. Earlier customers, however, are able to remember their last experience but stopped receiving service for various reasons, including dissatisfaction, lack of current need, having limited income, or the possibility of service/product substitution. Depending on the reason they discontinued receiving the service and their satisfaction level from their last experience, earlier customers can be easier or harder sources of customer acquisition There are also customers who will switch from rival companies to our company for various reasons, including dissatisfaction with their last company, positive WoM about our company, or successful marketing. These customers have the opportunity to compare the new provider of service with their existing company; thus, it can be more challenging, especially if they are satisfied with their current service at the hands of other companies.

For all firms, very first customers at the beginning come through acquisition. In order to grow, a company needs to retain these new customers and continue acquiring other new ones. Retaining the current existing customers and retaining new customers acquired from rival companies can be a different challenge. Customers who just left their previous company would compare their service level in our company with the service level of the last company. However, our existing customers mainly compare the current service level with the last service level they received. Though existing customers can also compare our service level with the level of rival companies, this is considered word-of-mouth or brand\company image of the other company since they do not receive service from them and it is utmost their assumption. There are customers who often switch between companies, in our model. When the customer receives

service from a second company, he/she becomes a former customer who the company may or not able to acquire again. Therefore, customer flow is separated into two major types: customer acquisition and customer retention. New customers are coming from potential customers, rival companies, and former customers and try to retain these new customers and former customers.

4.3.3   Role of Marketing

The term "marketing" in this paper is not limited to advertisement or promotion, but any effort in attracting more customers, countering rival marketing efforts and retaining existing and new customers. Without any marketing effort, companies may be able to acquire new customers and retain them through word-of-mouth or quality incentives. However, marketing either enables countering rather a negative situation such as a negative campaign of our rival company or facilitates new customer acquisition and customer retention. Marketing efforts are the only decision factor companies either completely ignore and spend nothing or put some emphasis. In comparison, severity word-of-mouth is not a decision factor, but a result of marketing and quality efforts. As a result, any marketing effort is defined as a separate effort in either acquiring or retaining customers. Next chart summarizes our discussion in customer flows.

Table 4.1: Flow diagram for different flows

		Acquisition / Retention	
		Non-Marketing	Marketing
Type1	Current Customers	RNCR	RCCRM
Type2	New Customers	RNCA	RNCAM
Type3	Rival's Customers	RRCA	RRCAM
Type4	Former Customers	RECA	RECAM

Table 4.2: Name of the customer flow functions

RNCA: the rate of new customers' acquisition	RNCAM: RNCA through marketing
RRCA: the rate of rival's customers' acquisition	RRCAM: RRCA through marketing
RECA: the rate of former customers' acquisition	RECAM: RECA through marketing
RCCR: the rate of current customers' retention	RCCRM: RCCR through marketing

Some of the factors influencing customer flows are the type of industry, company specific attributes, marketing effectiveness of our company, marketing effectiveness of rival company(s), positive and negative word-of-mouth effectiveness of our and rival companies, current customer numbers of our and rival companies, expert opinion about our company and rival companies, brand image and recognition of our company and rival companies. Other than the marketing effectiveness, remaining factors describes the environment the company in which benefits or fights against. So, the main reason of a successful marketing\promotion campaign is either counter negative elements such as an aggressive campaign of the rival, negative word-of-mouth about our company or simply adding on top of positive elements such as a good brand image and word-of-mouth. Having no marketing effort means accepting what is given by the environment and hoping the continuation of the effects of earlier marketing efforts. Additionally, a parameter called "potential customer ceiling" is defined which is rather a company specific number companies choose to define their maximum number of customers with potential access. It can be such as the number of people living in 15-mile radius.

So, Type 2 flow is as following:

$$Type2 = (f_{RNCA}(X_i, BI, C_a, EWoM, EO)$$

$$+ (1 - f_{RNCA}(\ldots))^*f_{RNCAM}(X_i, BI, EWoM, ME, EO))^*NofPC$$

X_i = Type of Industry, might be based on SIC codes; BI_a = relative business Image for the company compared to competitor or competitors in general; EWoME = effective word-of-mouth compared to competitor or competitors in general; ME = marketing effectiveness compared to competitor or

competitors in general ; C_a=number current and former customers of firm; NofPC=Number of Potential Customers; EO is expert opinions

This function gives the amount of new customers through potential customers. It is important to note that function has two main parts: first the part of "natural" flow and the second part is through advertising efforts. Companies can get customers without any effort to acquire them. Any marketing effort is basically to get more customers from the potential ones compared to the natural rate of acquisition. The type of industry the product/service is sold determines the frequency of customer needs in products. Even though, a company has limited power on this rate, over the longer terms this rate may eventually change with our positive or negative actions. Brand images are the placement of certain products and services of a company according to the customer's perspective. Companies with a low or bad brand image may feel the urge to have larger advertisement campaigns compared to the companies with a good brand image. Word-of-mouth is an important source when a customer is making their decision for receiving a new service and even for its continuation. In this paper, effective word-of-mouth shows how effective WoM is compared to competitors. The number of customers that company has including current customers and previous customers are included. Word-of-Mouth is more effective in larger customer pools than smaller ones. Thus, even though, both companies have similar WOM effectiveness, a company with a larger customer population receives larger returns. Expert opinions are rather outside views that can be objective or subjective about the service provided which may be an important factor for certain customers in some industries. For some services in other markets and industries, expert opinions can be a less decisive factor.

In this paper, there is no attempt to give any formula how f_{RNCA} or f_{RAE} is calculated. This calculation is something industry and product specific. The major focus in the paper is how specific changes provide certain results. Our advertisement efforts basically bring customers, who are not aware of us at all, or who are not convinced enough because of inefficient positive word-of-mouth about us, or who are influenced by the positive word-of-mouth of the other company, negative word-of-mouth of our company or negative expert opinions about us.

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Customer acquisition from rival companies can be challenging or easier depending on many factors including the current quality level in the rival organization. Additionally, marketing, word-of-mouth , business image, expert opinion still plays an important role but it may be in different levels than the one in the new customer acquisition (Type1). Some of the customers whom the company is trying to attract can be actually previous customers of ours who left due to dissatisfaction or other reasons. Moreover, such customers can remember the quality level of their last encounter in our company and make comparison with the quality level in the rival organization.

$$Type3= (f_{RRCA}(X_i, BI_a, BI_b, C_a, C_b, EWoM_a, EWoM_b, EO_a, EO_b, Q_{bk})$$

$$+ (1- f_{RRCA}(\ldots))*f_{RRCAM}(X=X_i, BI_a, AE_a))*NofCC_b$$

Customer acquisition from former customers of ours and the rival company might be an important source of customers for certain companies especially in mature industries. Such customers left our service company for various reasons including quality issues. If they are not able to remember their last experience or no longer pay attention to that particular service experience, they are instead considered as potential customers again. Any service improvement from the last experience is expected to have positive impact for a larger pool of customers, even though some might compare their new experience with their expected experience, which can be higher than their last experience. In this case, an improvement can be seen as not enough and can lead dissatisfaction. However, still the magnitude of dissatisfaction would be lower compared to no increase in quality of service. Our formula for customer acquisition through former customers looks similar to the previous formula for type4.

$$Type4= (f_{RECA}(X_i, BI_a, BI_b, C_a, C_b, EWoM_a, EWoM_b, EO_a, EO_b)$$

$$+ (1- f_{RECA}(\ldots))*f_{RECAM}(X=X_i, BI_a, AE_a))*NofFC$$

Lastly, retention is based on similar factors but also the quality level at time k. Quality of the service at the last service counter influences the retention rate. It is also important to notice that marketing is even playing a role in retaining customers.

$$Type1= (f_{RCCR}(X_i, BI, C, EWoM, EO, Q_{ak})$$

$$+ (1- f_{RCCR}(\ldots))*f_{RCCRM}(X_i, BI, EWoM, ME, EO))*NofCCa$$

Exit customers are former customers who have complete distrust/dislike for the current service in general, not necessarily from a single company or who have changed their preferences and no longer need that service. A hairdresser's customer who no longer dyes her hair because she believed coloring her hair was unhealthy should not be considered as a former customer for dying but as an exit customer. Additionally, there are customers who moved to different district/region, eliminating the former service provider because of the distance. Customers may be particularly annoyed by constant advertisement efforts of their former service provider when they no longer need such service anymore. It is crucial for a service company to separate former customers who may be once again be a future customer and others who are no longer a possible future customer. Once again, though, being a former customer or exit customer is a subjective matter. Some marketing experts can claim recruiting any former customer can be possible, but in many cases it is practical to accept that they are exit customers. Having exit customers also help to model demographic changes.

At any period of time, the following equation must be hold:

$$NofPC_k + NofCC_{ak} + NofCC_{bk} + NofFC_k + NofEC_k = (NofPC_{(k-1)} + NofCC_{a(k-1)} + NofCC_{b(k-1)}$$
$$+ NofFC_{(k-1)})*GR_k$$

where $NofEC_k$: the Number of Exit Customers at period k and GR_{k-1}: Market Growth Rate at period k-1

In other words, if market growth rate does not compensate exit customers, in the next period there will be fewer customers in total at the beginning. Markets only grow by having access to new potential customers. This can be through demographic shifts or having access to new customers such as an opening of a new store etc.

4.4   Numerical Demonstration and Results

For many service organizations, the main focus is having a certain market share. The main assumption is any attempt to increase market share by a better service level will be offset

by a further response of the competitors. Since there is no increase in new customer acquisition, there is likely to be a zero net gain of such attempt.

4.4.1   *Myopic focus on Market Share*

Assume there is a company that has 20% of market share. The rest of the market player(s)\competitor(s) have 80% of share. General retention rate for firms is 80%, while there is a small growth in the overall customer base by 0.1% each period. On average, 1% of former customers leave the system indefinitely for various reasons. However, there is a high chance that exit customers in this situation can offset any natural growth since the exit rate is higher. A smaller market share firm considers that attracting other companies' customers might backfire, and the market share will not change, but there is another way to look at this. Currently 20% of the customers of small firms go to bigger companies, while the smaller firm can attract 5% of bigger companies' customers. Therefore, the smaller company decides to attract them with more marketing efforts in order to increase this rate up to 5.5%. In return, other companies respond to this by the increase in marketing spending and attract 22% of smaller companies' customers. In other words, the smaller firm is only able to attract an extra .5% more of other companies' customers, while bigger companies attract an extra 2%.

When the results are compared, however, the smaller firm is able to increase the number of average customers by 1.6% after 50 runs, while bigger firms can increase their average number of customers by only .5%. So, without considering the cost side of such marketing effort, the market as a whole benefited. The market share of the smaller firm increases by .8%, which is half of the number of an average customer increase (1.6%). If the firm only considers market share, this can be a lower incentive, while customer increases can justify the incentive. This excellent example of attracting not satisfied customers from each other can be a good option to some extent for everyone. In fact, each firm should have certain advantages over each other; so directing not-satisfied customers to firms, which can satisfy, can be a win-win strategy as a whole.

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4.4.2   Marketing or Quality Improvements

When firms make decisions between spending on marketing or quality improvement projects, many times there is a misconception that small firms should advertise first then try to retain those new customers. It is very common for firms to invest their limited resources in marketing efforts upfront in order to get a bigger chunk of the market first. In order to test this claim, a small firm with a 20% market share will be investigated. A certain budget is arranged to make improvements in quality to increase the current retention rate of 80%. However, the very same budget can be used to attract more customers in terms of marketing. In the model, this assumption is tested: If the budget only allows company to make an improvement in quality, it will result in an increase of up to 5% in retention rate (old retention rate * 1.05). The second option is spending that money on marketing efforts, resulting in a 5% increase in customer acquisition. In other words, to make the comparison equal, marketing efforts and quality efforts are considered as having similar costs. Also, fractional spending such as 2% in retention rate and 3% in marketing is being tested. The comparison is based on the average number of customers without any marketing or quality improvement. In the second case, there is first an increase in the retention rate for the first half of the time, then there is an investment in marketing efforts for the remaining periods. Lastly, the results are compared when marketing efforts are in the first half, and quality improvements are in the second part (Case III). Results are as following:

Table 4.3: CASE I

Retention Improvement	Marketing Efforts	Improvement over Base Rate
0	0.05	931%
0.01	0.04	954%
0.02	0.03	932%
0.03	0.02	835%
0.04	0.01	625%
0.05	0	252%

Table 4.4: CASE II

Retention Improvement First Half	Marketing Efforts First Half	Retention Improvement Second Half	Marketing Efforts Second Half	Improvement over Base Rate
0	0.05	0	0.05	931%
0.01	0.04	0	0.05	990%
0.02	0.03	0	0.05	1035%
0.03	0.02	0	0.05	1054%
0.04	0.01	0	0.05	1029%
0.05	0	0	0.05	940%

Any marketing or quality improvement brings more customers. A company has the highest improvement in the number of customers when the primary retention effort is followed by strong marketing efforts. Often firms behave as if there is an unlimited number of potential customers, and retention is more important, when the company matures. However, customers who are the company is not able to retain either become customers of a competitor or become former customers who are much harder to acquire again. Moreover, they may be out of the system completely and become exit customers. Spending on retention is most often considered a cheaper option compared to acquiring new customers. It is shown that, even if customer acquisition and customer retention have similar costs, retention should be at the first place, while customer acquisition should be at the second place.

Table 4.5: CASE III

Retention Improvement First Half	Marketing Efforts First Half	Retention Improvement Second Half	Marketing Efforts Second Half	Improvement over Base Rate
0	0.05	0	0.05	931%
0	0.05	0.01	0.04	901%
0	0.05	0.02	0.03	858%
0	0.05	0.03	0.02	798%
0	0.05	0.04	0.01	717%
0	0.05	0.05	0	610%

4.4.3 Understanding the Net Effect of Word-of-Mouth

Word-of-mouth effects are considered harder to measure compared to similar quality improvements. The effects can be negligible or strong, positive or negative. One of the purposes of marketing efforts is to counterbalance the negative effects of the word-of-mouth. Even if there are no marketing efforts, customers may decide to start receiving service or remain a customer. These are natural flows of customers without additional efforts in marketing. A certain company may find such natural flow of customers adequate and may decide not to invest in marketing. Others may feel a further marketing effort is necessary. Understanding the net effect of word-of-mouth is important in making such marketing decisions. All companies in reality are managing four types of customer flows: customer retention (Type 1), customer acquisition from potential customers (Type 2), customer acquisition from customer acquisition from rival companies (Type 3), and earlier customers (Type 4).

A business grows in terms of the number of customers, when $Type1_k >= Type1_{k-1}$. Since $Type1_k = (Type1_{k-1} + Type2_{k-1} + Type3_{k-1} + Type4_{k-1}) *Retention_{k-1}$ and all flows are non-negative;

when Retention is from 0 to 1, this equation holds. However, this condition is not a required one because the acquisition flows at time k, and can compensate for the low retention rate. In the longer term this equation shows a healthy growth that is not accidently for one term. This is because a company will need more and more newly acquired customers to compensate a lower retention rate. This can be similarly interpreted as by stating that if there are fewer retained customers currently than in a previous period, there is likely to have a growth problem.

Ratio of Type 2 (customer acquisition from potential customers) customers over all current customers (NofCC=Type1 + Type2 + Type3 + Type4) is an important measure combined with the retention rate. If Type 2 / NofCC is high and the retention rate is low, a company is in trouble indeed. The company is not able to retain previous customers and depends on primarily only new customers through acquisition, which is not necessarily sustainable. If Type 2/NofCC ratio is low with a high retention rate, a company may be in a mature stage and stagnant. They are able to retain previous customers, but new customer acquisition is much lower compared to retained customers. Having a similar high retention rate with the previous period, but a lower Type1/NofCC ratio, signals a growing company. In this case, customer acquisition becomes stronger, while keeping the retention rate at the same level. If there had been no additional marketing efforts, this may be due to a positive word-of-mouth or change of structure in a certain type of customer acquisition. As mentioned earlier, there are three different types of customer acquisition. If the change is limited only to Type2, it may be caused by a change in the potential number of customers. If the change is limited only to Type3, there might be a problem in the competitor(s) companies, and a company is basically acquiring some of their customers.

The increase in marketing efforts of the competitor(s) will negatively affect our company, if the company does not improve the quality or spend more on marketing efforts. Such competitor(s) marketing efforts would result in a decrease in customer acquisition, and even possibly a decrease in retention. The higher Type1/NofCC ratio is, the better it is to invest in quality improvements; otherwise, marketing efforts bring more customers through acquisition.

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4.5   Conclusions

In this paper, the effects of word-of-mouth and decisions between quality improvements and marketing efforts on budget allocation are investigated. Word-of-mouth adds one more dimension while making this budget decision. An open-loop model is provided to investigate the effects of such decisions. There are new customers appearing in the system, and some of them disappear forever for reasons such as demographic growth/decline, an innovation that would make the existing service less necessary or simply losing interest or trust in any service provider. In general, a quality improvement should be at the first place, and marketing initiatives should follow it. Additionally, marketing efforts to acquire customers from each competitor is indeed beneficial for all firms alike. Also the differences in customer flows and how to interpret for later decisions is investigated. There are four major customer flows, three of them are customer acquisition, and one of them is customer retention. Customer acquisition from potential customers, competitors and earlier customers are these three types. In the paper, it is shown that changes in these flows may signal negative or positive word-of-mouth, growth in the company, or the effects of competitors' decisions on our company.

CHAPTER 5

TRADE CREDIT DURING THE PERIOD OF THE GLOBAL CRISIS OF 2008-2012:

A CASE STUDY OF SIX EASTERN EUROPEAN COUNTRIES

<u>5.1   Introduction</u>

During the period of the global financial crisis (2008-2012), credits lent to firms became expensive or even impossible to obtain. Companies had difficulties in finding credits for working capital needs, procurement, and long-term investments. As a result, it has become vital for companies to use operational measures to reduce their dependency on external financing through banks. One of the ways to manage is by extending trade credits voluntarily through agreements with supplier or involuntarily by simply delaying payments to them. The management of trade credit allows buyers to maintain their financial solvency and keep cash on hand for a longer time. The term "*Trade Credit*" (TC) here refers to the amount of delayed payments or discounts for early payments between two business entities (B2B). Trade Credit (TC) is often a short-term loan, which a supplier offers to its buyers, instead of the immediate exchange between cash and products. The common terminology of TC is Net 30, Net 60, and Net D, which means the buyer has agreed to make payment in 30, 60, or D days.

In trade credit negotiations/agreements, channel power is important. Channel power can be used to delay required payments or to induce/demand earlier payments. Such practices would deteriorate the financial health of the supplier if payments are delayed or the buyer who has been asked to be made earlier payments. For instance, a deferred/later cash flow requires a supplier's operations to be constrained if it is not further financed through costly internal relocation of funds or problematic external sources. Buyers' main motives for delaying payments are to reduce the insolvency risk in case of nonpayment or delayed payments of their own customers, to ensure easier and proper handling of unsold or returned goods by their supplier, or to have an additional buffer against ongoing or potential financial stress. There is insolvency risk when a buyer who is

an intermediate between the final customer and suppliers decides to make a payment before receiving payment from the final customer. During the periods of financial crises, risk associated with nonpayment or delayed payment from both final customer and business partners is alleviated.

There is a lack of empirical studies showing the effects of financial crises on the amount and the duration of trade credit especially in an international setting. Furthermore, current empirical research does not provide tools and/or specify indicators to predict changes in trade credit features. From suppliers' perspective, it is important to know under which conditions a buyer asks for additional trade credit or extension of the payment period. This will allow better management of financial risks associated with the trade credit offer.

Rajan and Zingales (1995) pointed out that trade credit accounts comprise a large percentage of total assets firms hold. During the early 1990s, 17.8% of total assets of all American firms were in the form of trade credits (Bougheas, 2009). Similarly, in certain European countries, trade credit accounts have a much higher rate at 70% of a total short-term debt and up to 55% of total credit received by firms made up trade credit (Gurariglia & Mateut, 2006; Kohler et al., 2000). Trade credit is an additionally important source of funds for firms in emerging economies with weak, insufficient, and/or highly risk-averse banking systems (Ge & Qiu, 2007).

Most of the countries of Eastern Europe are emerging economies and are highly integrated into the larger European markets. This region is one of the most affected areas of the global crisis of the late 2000s, is certainly a good candidate for research in examining trade credit in the face of new global realities. In order to have a large-scale analysis on trade credit changes and structure during the recent recession, a secondary dataset collected by the World Bank from some of these Eastern European countries on firm and industry level about trade credit during the recent recession will be used. In this paper, the focus is to further understand the changes in trade credit during financial crises based on following research questions:

- What determines the level of trade credit?

- Does being in a particular industry, having certain company's size or located in certain country matter?

- Which of these aforementioned factors are more important in using trade credit and why?

- How companies react during the financial crisis in terms of trade credit?

- Which companies are more trustworthy partners in supply chains(SC) in terms trade credit repayment?

- In which situation a company should offer trade credit to his/her SC partner?

The paper continues as follows: first, there is a short discussion on trade credit in SCs followed by a review of theories related to trade credit; second, there is a section for data description and initial analysis; third, empirical results are discussed; and lastly, limitations of the current study and future research potential are discussed.

5.2 Trade Credit in Supply Chains

In managing working capital, firms use funds from credit institutions/banks, internal funds, and trade credit from suppliers. Payments between buyers and supplier can be done before, concurrently, or after the physical delivery of the product/service. During this period, the amount of delayed payment determines the size of the trade credit from supplier to buyer. Supplier carries the risk of potential nonpayment or delayed payment while offering this trade credit. On the other hand, by paying earlier a buyer carries the risk of imperfect, returned, unpaid, underpaid, and unsold products because the seller has less incentive to accept them back. Today's highly competitive business environment compels suppliers to offer trade credits in order to grow or maintain their market share and develop long-term relationships with their customers. Hence, trade credit (TC) decisions can be suboptimal and risky under the pressure of "closing the deal" and not losing the customer, which can jeopardize the very existence of the supplier. Suppliers may have to offer trade credit to firms that are under financial distress or that are very small and thus riskier. Financial intuitions and investors, on the other hand, prefer to lend to larger, mature

firms with better credit ratings (Nilsen, 2002). In understanding why trade credit does exist, the perspectives and reasons of both suppliers who offer and buyers who accept need to be discussed.

On the buyer's side, firms use TC when their alternative sources of financing are limited or less attractive (Alphonse et al., 2004; Danielson & Scott, 2004; Deloof & Jegers, 1999; Niskanen, 2006; Petersen & Rajan, 1994). Trade credit can be cheaper than using bank credit and internal funds if the transaction cost between trade credit partners is lower compared to the one between the firm and bank. In general, TC helps firm in managing working cash by reducing the potential cash inflow and outflow mismatches (Schwartz, 1974). By using trade credit, buyers achieve a more flexible cash outflow in terms of time and amount of payment to suppliers. Additionally, suppliers share certain business risks with their buyers (Chen et al., 2010; Shah & Singh, 2001). Such risks include nonpayment and delayed payment risk of the final customers of buyers. By delaying the payments to suppliers, buyers also have additional leverage in returning unsold or imperfect products. Finally, TC helps in developing long-term relationships between suppliers and buyers. Compared to penalties for nonpayment or delayed payments to financial institutions, penalties in trade-credit agreements can be less severe and destructive since many suppliers prefer long-term relationships with same buyers (Fabbri & Klapper, 2009).

From the supplier's perspective, offering competitive trade credit attracts more potential buyers. Often, in order to secure more orders, suppliers offer buyers trade credit with substantially better conditions than financial institutions do (Chen et al., 2010). In addition, to keep up with competition, a supplier can obtain several advantages by offering trade credit (Petersen & Rajan, 1997). These benefits include:

- reducing informational asymmetries (Biais & Gollier, 1997; Smith, 1987)
- ability to offer price discrimination (Brennan et al., 1988)
- developing long-term relationships
- monitoring advantages (Jain, 2001; Mateut et al., 2006)

- increasing product quality (Lee & Stove, 1993; Long et al., 1993)

- potential leverage for opportunistic behavior (Burkart & Ellingsen, 2004).

Trade-credit agreements allow suppliers to acquire invaluable information about their buyers' financial health. For instance, if a buyer suddenly starts delaying payments, this may indicate potential problems in the financial health of the firm. For future deliveries, a supplier can ask for shorter payment periods, increased initial payment or collateral, or simply request full payment in advance. TC offers an additional way of price discrimination instead of simple discounts. Firms can negotiate on the length of trade credit instead of the product price. By offering TC, suppliers have the chance to develop long-term relationships with their buyers. In turn, this helps suppliers get better feedback about their products which would give them the opportunity to increase quality to a competitive level, to monitor advantages, make necessary adjustments in price, and bring new profitable features to a larger market. Suppliers can use trade credit to acquire invaluable information about the financial health of buyers, their customers, profit margins etc. With the additional leverage of unpaid debt, suppliers can force buyers into bankruptcy for a hostile takeover should the opportunity arise.

5.3 Theoretical Background and Hypothesis Development

According to Burkart and Ellingsen (2004), there are three major areas of TC research. The first research area is to investigate the reasons for trade credit. The second one is to investigate the difference in use of TC depending on countries, firms, industries and time periods. And the third one is to investigate why trade credit is less cyclical than bank credit. Another approach of grouping was offered by Bastos and Pindado (2007), who divided the research interest areas into the ones that focus on the demand side of trade credit, and the ones with the focus on the supply side of trade credit. This paper contributes to the second area of research that is to investigate the difference in TC terms among countries, firms, industries with a focus on a special time period of financial crises. Discussion includes both suppliers and buyers. First, there is a discussion about trade credit through transaction cost theory and agency theories.

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5.3.1   Transaction Cost Theory and Trade Credit

According to transaction cost theory, a firm's aim is to reduce their transaction cost. This is done by growing into larger markets, acquisition of competitor, or developing partnership with their suppliers/buyers and competitors. Transaction cost theory (TCT) provides explanations for why suppliers and buyers are willing to engage in trade-credit (TC) agreements. Bounded rationality and opportunism are two key assumptions of Transactions Cost Economics (TCE) and determine the value of transaction cost while making any decision (Rainfleisch & Heide, 1997). The asymmetric information is one of the key drivers in bounded rationality and opportunism. Longer and in-depth relationships between supplier and buyers reduce information asymmetry, hence bounded rationality and opportunism. This creates a financial incentive to choose TC over a traditional external financing such as from banks. Suppliers have potential transaction cost advantages over financial institutes in following areas (Bastos & Pindado, 2007):

- Collecting of useful information about the buyer and industry

- Forcing buyers to pay by using their dependence on supplier's replenishment

- Revaluing, reselling, and salvaging buyer holdings in case of insolvency.

Suppliers\sellers have better access to crucial information such as the buyer's solvency and creditability, potential profit margins, economic outlook of the industry etc. in a fast and cheap way compared to banks/financial institutes. On the other hand, a financial institute may not necessarily have the means and tools to investigate so many companies in so many industries. A buyer's frequency of purchase orders, changes in purchase amount, and preference on early payments in order to receive discounts can signal the solvency of the buyer. In contrast, such information would not be easily available for a financial institute. For instance, Smith (1987) claims companies that do not take advantage of discounts in return of earlier payments are actually more risky companies in terms of financial strength.

Depending on the channel power of a supplier/seller, a buyer may have to prioritize the supplier's payment over other types of debts and payments. Without regular replenishment of supplies from sellers, buyers can only continue business as long as their inventories last. In case

of limited competition among suppliers or monopoly of a single supplier, a delayed payment may abruptly cut any new delivery of supplies, which would mean a direct interruption of further sales (McMillan & Woodruff, 1999). Thus, certain suppliers can decrease the chance of delayed or unpaid payments compared to financial institutes. This makes their transaction costs lower.

When there is nonpayment, suppliers can simply recall/take over unsold goods from the buyer and sell it to other buyers depending on the condition of product (Mian & Smith, 1992; Petersen & Rajan, 1997). Furthermore, a supplier can more easily determine the appropriate salvage value of its own products. In contrast, a financial institute does not have such flexibility of reusing remaining supplies and often have to rely on the market to assess the real value of salvage at their own cost (Ng et al., 1999). Hence, supplier-buyer relationship may reduce the transaction cost, which makes the TC cheaper compared to outside financing.

5.3.2   Agency Theory and Trade Credit

Classical agency theory focuses on adverse selection and moral hazard. They are both applicable in everyday TC scenarios. There is often asymmetric information between a supplier and a buyer, which feeds the potential adverse selection and moral hazard. For instance, a buyer is not necessarily fully aware of the product quality up to the point of physical delivery, which may occur after his initial payment to a supplier. A buyer may postpone the payments until the final product is received and properly tested (Emery & Nayar, 1998; Lee & Stowe, 1993; Smith, 1987). Issues related to the product quality may arise in many scenarios when the final customer, who is apart from the buyer, starts using the product. For instance, a component of a digital camera can be discovered to be malfunctioning after its final consumer starts using the camera. At that point, the camera producer could have already paid the supplier for the malfunctioning part. Consequently, the best trade-credit offerings can be from the firms that have most issues in the quality; while firms that seek the best trade credit are often the ones with severe solvency problems (Bastos & Pindado, 2007). On the other hand, by accepting later payments after the physical delivery of goods and service, the supplier carries all the associated costs of creditworthiness of the buyer.

Companies with extensive channel power, hit-and-run companies (short term, high profit, too risky business goals), and companies working under weak legal systems carry the biggest potential of moral hazard. Companies with extensive channel power can impose their own rules, which may not directly be in line with what the agreements between supplier and buyers are. For instance, when there is a long delay in payment, a supplier may opt not to enforce penalties agreed to between two parties in order not to lose the buyer, especially if this buyer contributes to a very large portion of their sales. Certain buyers with channel power may simply exercise their power because they can or because of their financial problems. They may do this in order to remain solvent during a financial crisis or to take the advantage of their power. In addition to channel power, there are certain hit-and-run companies or individuals that are simply looking for a victim seller to acquire the goods and then disappear. They later simply refuse to pay, which may mean high legal costs if the seller chooses to go after them. When the legal system is weak, expensive to use or tediously long; certain companies can benefit by delaying payments or refusing to pay the required amount. For instance, if the legal system of a country where the buyer operates does not require additional interest on unpaid total, the buyer may force the seller to go and wait until a legal decision takes place and uses that money as an interest-free loan. During this period, the supplier can go bankrupt from the lack of working capital.

5.4   Data

Part of the data is drawn from a survey conducted by the World Bank in 2010. It consists of responses from individual firms from the following countries: Bulgaria, Hungary, Kazakhstan, Latvia, Romania and Turkey. These countries are middle- to low-income emerging economies located in Eastern Europe. All of these counties have been using their local currencies unlike many developed European countries that use the Euro. Currencies of these countries are Bulgarian Lev, Hungarian Forint, Kazakhstani Tenge, Latvian Lats, Romanian Leu, and Turkish Lira. In addition, these countries follow relatively independent monetary policies but economically are significantly interconnected with the larger European Market. Table 5.1 shows the number of firms responded and accepted as fit to the survey conducted:

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Table 5.1: Countries represented in the study

Country	Number of Firms Responded
Bulgaria	152
Hungary	151
Kazakhstan	233
Latvia	221
Romania	304
Turkey	606
Total	1,667

The total number of firms is well within the acceptable number for a large study. By being a significantly larger economy, Turkey has understandably a great number of companies responding to the survey. Figure 5.1 shows the GDP amount of these countries in 2011.
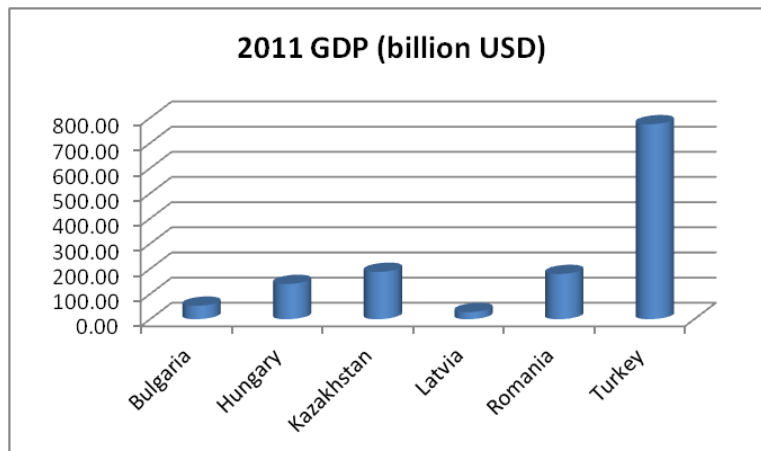

Figure 5.1: 2011 GDP of countries in question

Turkey's GDP is larger than all of these countries' GDP combined and stands at around 750 billion US dollars. Romania and Kazakhstan have similar sized economies, with GDP around 180 billion US dollars, followed by Hungary with 140 billion US dollars. Bulgaria and Latvia are smaller economies with 53 and 28 billion US dollar GDPs, respectively.

The survey data include information for individual firms located in the aforementioned countries. These firms are grouped into small (fewer than 19 employees), medium (20-99 employees) and large (greater than 100 employees). The next table shows the breakdown of companies responded in terms of firm size across all countries in the study.

Table 5.2: The number of firms for each size category

Firm Size	Number of Firms Responding
Small ≤19	559
Medium ≥20 and ≤99	610
Large ≥100	498

The aggregate data (Table 5.2) are equally distributed among small, medium and large sizes in terms of the number of firms in each bracket.

Next, data are divided in terms of industries firms operate. Industries are grouped into 17 industry-specific groups, including retail, manufacturing, food, wholesale, construction, textiles, garments, non-metallic mineral products, chemicals, transportation, metal products, machinery and equipment, plastics and rubber, hotel and restaurants, basic metals, IT, and electronics. The following table shows the number of firms responded to the survey grouped by the industry they are in.

Table 5.3: The number of firms by industry type

Industry	Number of Firms Responding	Industry	Number of Firms Responding
Retail	380	Transport Section	70
Manufacturing	158	Metal Products	64
Food	157	Other Services	54
Wholesale	142	Machinery and Equipment	45
Construction	115	Plastics and Rubber	35
Textiles	105	Hotel And Restaurants	29
Garments	101	Basic Metals	22
Non-Metallic Mineral Products	81	IT	19
Chemicals	73	Electronics	17

5.4.1   Effects of the Late 2000s Crisis

The global financial crisis of the late 2000s originated in the Unites States at the end of 2008. Later problems progressed across the globe in both developed and emerging economies. The exact timing of the start and end for each country in the survey is somewhat different from each other. However, all of the survey data countries had significant financial problems during the common time period of 2009 to 2010.

First, the effects of the financial crisis in the late 2000s in terms of industry, country, and firm's size are discussed in this section. Figure 2 shows the number of firms reported sales lost in 2010 (peak period of the financial crisis) compared to their sales in 2009.
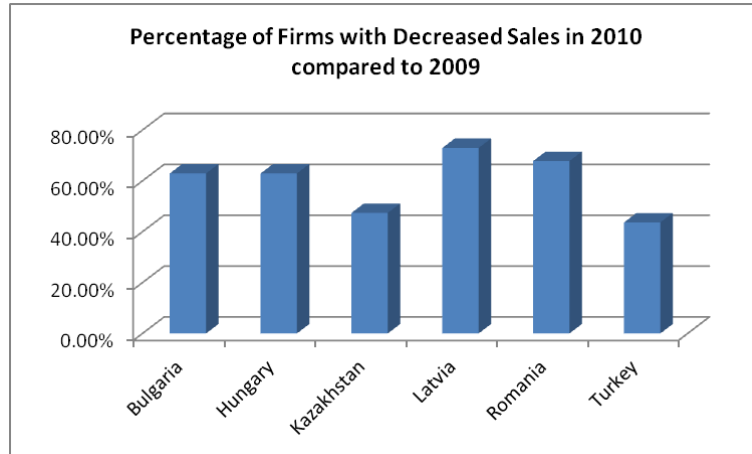

Figure 5.2: Percentage of firms with decreased sales in 2010 compared to 2009 (country-wise)

From Figure 5.2, it can be seen that all countries were affected by the global crisis. However, Turkey and Kazakhstan had better results in terms of firm sales than Bulgaria, Hungary, Latvia and Romania. According to this study, Latvia with 72%, had the biggest number of companies reported a loss in sales compared to 2009. Such high percentage of sale drops is quite significant. Next the figure compares the GDP during the financial crisis and before (the reference year is 2008) for these countries (Figure 5.3).
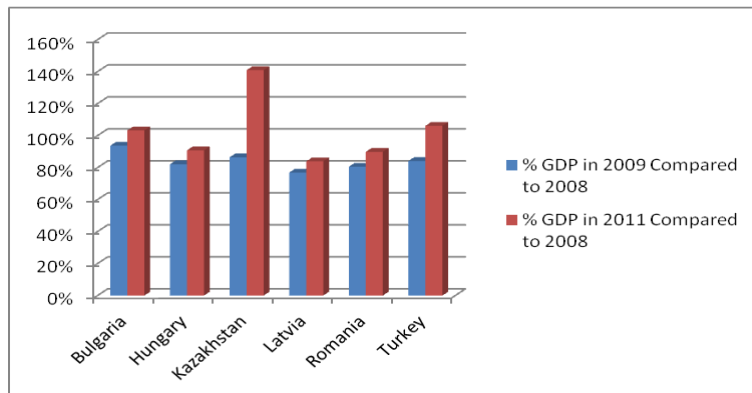

Figure 5.3: Comparison of GDP for selected countries during and before the financial crisis

(2008 GDP is the reference year with 100%)

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GDP numbers are from the World Bank database in terms of US dollars. It is noteworthy that all countries in the study had their GDP drop in 2008, with a range from 6.28% for Bulgaria to 23.15% for Latvia. By 2011, only Turkey, Bulgaria and Kazakhstan had recovered to their pre-crisis year of 2008. Kazakhstan's recovery is definitely more remarkable compared to the other countries. In the following figure (Figure 5.4), the effects of the financial crisis on the average GDP growth in study countries are demonstrated.
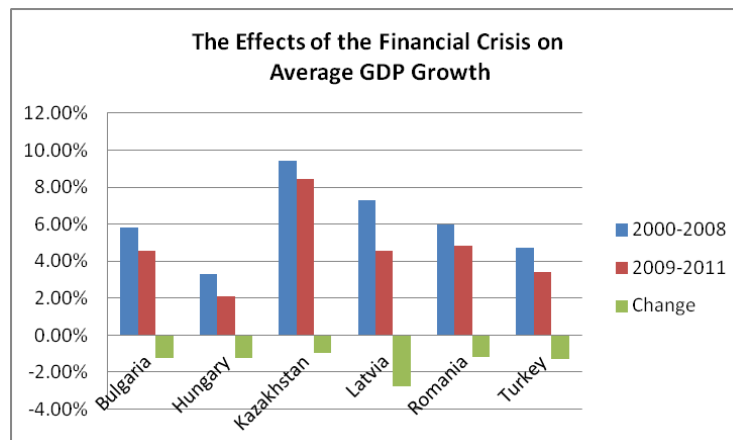

Figure 5.4: The effects of the financial crisis on average GDP growth

When comparing the average GDP growth rates of 2009-2011 with the averages of 2000-2008, a significant change for each country can be observed. Rates range from -2.76% for Latvia to -0.96% for Kazakhstan. Furthermore, there are remarkable differences between countries in terms of growth rates and growth rate changes. The reasons why a certain economy had a better response are not covered in this paper. Next, firm sizes and percentage of firms with decreased sales is shown (Figure 5.5).
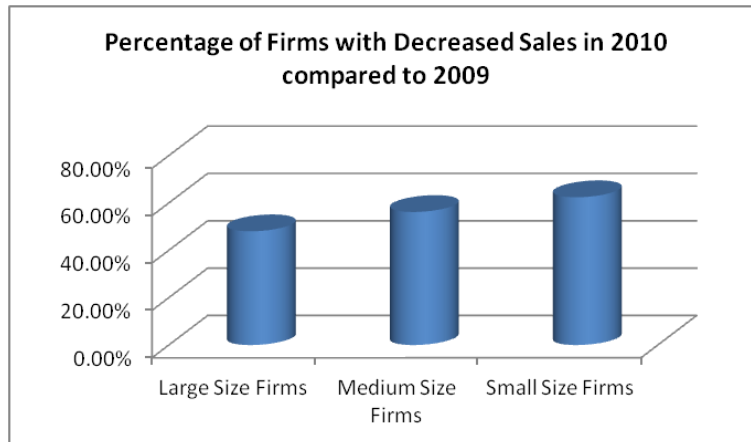
Figure 5.5: Percentage of firms with decreased sales in 2010 compared to 2009 (firm size)

These are aggregate data across the aforementioned countries. It is interesting to notice that large firms have less percentage of decreased sales compared to medium- and small-sized companies. Only 48% of the large firms had decreased sales, while 62% of the small firms had decreased sales. Next, here is the data in terms of industry.

Table 5.4: Percentage of firms with decreased sales in 2010 compared to 2009 (industry-wise)

Industry	Percentage of Firms with Decreasing Sales	Industry	Percentage of Firms with Decreasing Sales
Hotels and Restaurants	78.57%	Wholesale	54.29%
Retail	70.48%	Nonmetallic Mineral Products	50.63%
Electronics	64.71%	Basic Metals	50.00%
Construction	59.29%	Fabricate Metal Products	50.00%
Transportation	58.82%	Garments	48.98%
Other Services	57.41%	Food	47.40%
Machinery And Equipment	55.56%	IT	42.11%
Other Manufacturing	55.41%	Chemicals	38.36%
Plastics and Rubber	54.29%	Textiles	36.54%

It is interesting to see that hotels and restaurants, retail, electronics, construction are the leading sectors in percentage of firms with decreased sales. It can be caused by the fact that customers are more likely to cut first their less immediate needs such as hotels and restaurants.

5.4.2   Variables of Interest

In order to investigate the impact of the global financial crisis on trade credit, firm financial health in the countries surveyed, a set of macro (country-wise) and micro level (individual firms)

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data is used. In terms of macro level, there are two measures in the study to understand the extent of the financial crisis. Both of them are supplied from the World Bank:

- GDP, the gross domestic product for six countries in the years of 1999-2011

- Credit lend through domestic banks in terms of the percentage of GDP in the years 1999-2011

In terms of micro level, the following firm level measures are supplied by the World Bank survey or calculated during this study:

- Demographics of companies in the study

  o Location(country)

  o Size

  o Industry

- Working capital ratio measures:

  o Financed from internal funds

- Pre-crisis ratio

- During the survey ratio

  o Financed from bank credits(only during the survey)

  o Financed from trade credit(only during the survey)

- Change in sales during the survey compared to pre-crisis

- Financial health / insolvency measures

  o Establishment overdue on its obligations to any financial institution in the last three months (Yes or No)

  o Establishment filed for reorganization (readjustment of a firm's debt and capital structure after a bankruptcy or receivership order) in the last three months (Yes or No)

- Financial health / insolvency measures (cont)

  o Establishment was insolvent in the last three months

- o   Establishment filed for bankruptcy during the last three months

- o   Establishment applied for direct state aid in the last three months

- Delays in Payments measures

    - o   Establishment have delays in payments for more than one week in one of the following:

        - ▪ Taxes, excluding payroll taxes

        - ▪ Payroll tax and social security

        - ▪ Suppliers

5.5   Model

In this paper, two layers of models are used. In the first layer, investigation is on whether or not being in certain country, industry and size make a difference in working capital funding methods: trade credit, bank credit, and internal funding. TC ratio is the prime focus on this study. Location includes six countries of the survey, Bulgaria, Hungary, Kazakhstan, Latvia, Romania, and Turkey. Industry includes sixteen categories defined in the study. Size includes small, medium and large. All of these variables are categorical variables.
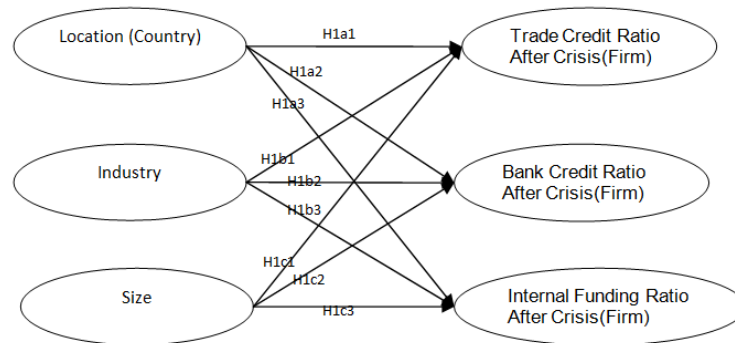

Figure 5.6: Factors in trade credit, bank credit and internal funding ratios

There is a good chance of high correlation between these ratios. The signs of the relationships are interesting to research. For instance, do companies with more trade credit also carry more bank credit?   The next drawing shows the correlation among these three variables.
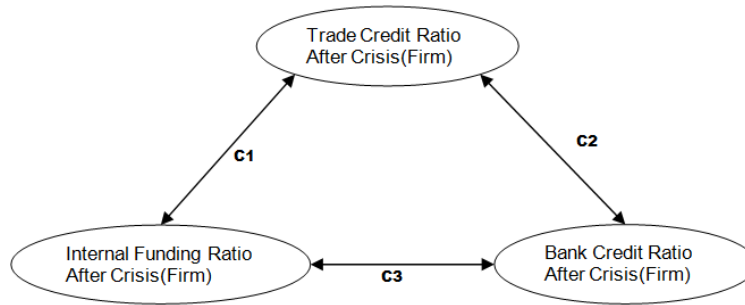
Figure 5.7: Correlation among trade credit, bank credit and internal funding ratios

In the general model, the main focus is again trade-credit ratio. Here it is important to notice: this study is eventually a time series event study based on a secondary data set. First, here is the drawing for the general model. Letter h represents predictor-response relationships while letter c represents directionless correlation.
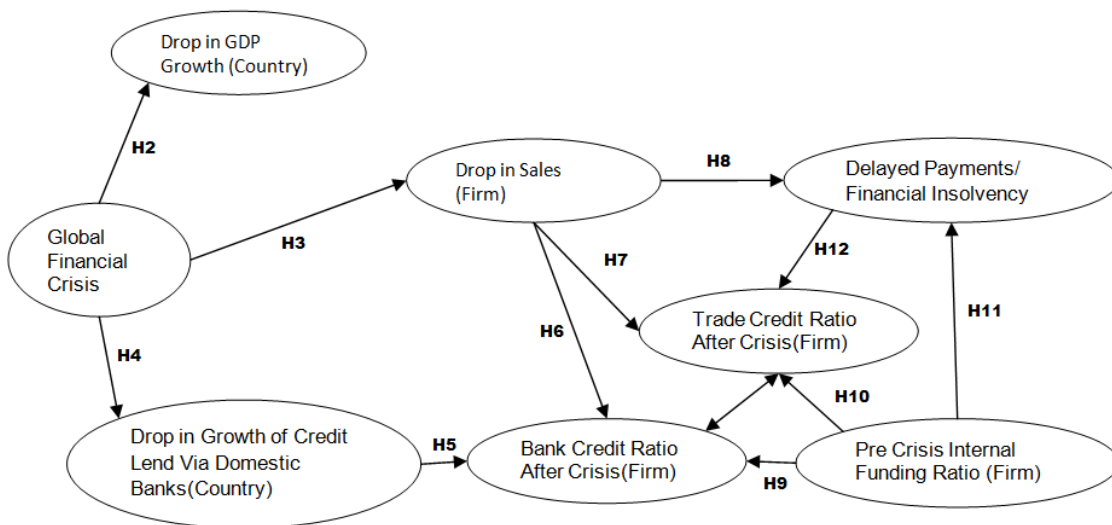

Figure 5.8: The general model

Because there is no control over the type of questions in the survey in this study, only some of the variables can be used to test the difference that a financial crisis brings to trade credit and related firm financial health. For instance, only the trade credit ratio is after the crisis. However, the internal funding ratio has both pre-crisis and post-crisis data. In this study, the global financial crisis has three effects: drop in sales, drop in GDP, and drop in growth of credit lend via domestic banks. In addition to these variables, there three response variables in the

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study: the trade-credit ratio after crisis, bank credit ratio after crisis, and delayed payments/financial insolvency. Delayed payments/financial insolvency is a binary measure where one represents problems in this area and zero represents company without problems when the survey was conducted. All three occur after the crisis started. Predictor variables for them are drop in sales, pre-crisis internal funding ratio, and drop in growth of credit lend via domestic banks. All of these predictor variables precede response variables they are linked to.

5.6   Hypotheses and Methodology:

First, whether or not trade credit, bank credit, and internal funding ratios are influenced/determined by the demographics of firms is investigated. This is important to check before moving to any deeper discussion.

H1:

- H1a1: TC ratio differs significantly by the country a firm is located

- H1a2: Bank credit ratio differs significantly by the country a firm is located

- H1a3: Internal funding ratio differs significantly by the country a firm is located

- H1b1: TC ratio differs significantly by the industry a firm belongs

- H1b2: Bank credit ratio differs significantly by the industry a firm belongs

- H1b3: Internal funding ratio differs significantly by the industry a firm belongs

- H1c1: TC ratio differs significantly by the size of a firm

- H1c2: Bank credit ratio differs significantly by the size of a firm

- H1c3: Internal funding ratio differs significantly by the size of a firm

In order to have confirmatory analysis on the effects of the global financial crisis, two hypotheses on the macro (country) level will be discussed. Because this study focuses on all of these countries, it is imperative to check whether or not the global financial crisis has the same or similar impact on certain macro measures. The first macro measure is that the financial crisis negatively affects the GDP growth of survey countries. Certainly, before the crisis, there are differences in GDP growth among six survey countries. However, it is interesting if the drop in

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GDP growth is the same between these countries. A classical event study will be used to analyze. A binary dummy variable is assigned to distinguish the period before and during the financial crisis.

H2: Financial crisis significantly drops the GDP growth in all of these countries compared to the pre-crisis period.

The second macro measure is the growth of credit lend through domestic banks. Here the term "domestic banks" refers to not only national banks but also to international banks that have branches in these countries. The national saving ratios for all of these six countries are lower since they are all emerging countries and need outside investment. For example, the lending ratio over GDP is no higher than 80% for any of these countries whereas in the Western Europe, the same ratio can be as high as double of the GDP. From a different perspective, there is a big opportunity for each country to grow lending. For instance, this credit lend over the GDP ratio was doubled to tripled for all of these countries from 2000 to 2005 while their GDP also grow dramatically. Hence, it is not expected to see a drop in the amount of credit lent even during the financial crisis. However, the growth rate of this measure is expected to be different. The methodology is the same as the one in hypothesis two with classical event study.

H4: The growth in the amount of bank lend through domestic banks drops significantly from the pre-crisis period

Effects of the financial crisis on firm level can be observed through drop in sales. Large-scale negative events such as wars, terrorist attacks, and global economic recessions cause customers to either postpone or cancel purchases. In other words, decreased customer confidence leads decreased sales. Occasionally, customer confidence is labeled as a potentially irrational or overreacted collective set of behavior. This behavior is closely related to agency theory. Agency theory emphasizes the importance of trust between transaction partners. When this trust is broken or decreased due to external event such as crisis, there is increased transaction cost and increased likelihood of adverse selection. When the size of the effect of the

global crisis is calculated in firm level, the potential country, size, industry effect needs to be cleaned before running the regression.

H3: The global financial crisis significantly drops the firms' sales during the global financial crisis period.

Next, it is investigated whether or not the change in growth ratio in credit lent through domestic banks has a direct effect on the bank credit ratio among firms. Credit lent through banks includes many items, including financing business investment, customer private loans, financing governmental debt, and etc. Here the aim is to assess the pressure of this measure on bank credit. Again, it is important to clean the firm's banking ratio from country, industry effects if necessary. The same is true that the change in the credit lend growth ratio should be cleaned from country effects.

H5: The percentage drop in the credit lend through domestic banks positively affect the firm bank credit ratio in the survey countries.

Other potential factors that are influencing the bank credit ratio of firms include change in firm sales and pre-crisis internal funding ratio. When sales increase, firms need additional financing to support their operations. On the other hand, pre-crisis internal funding ratio shows the financial strength of the firm. Firms use less bank credit when they can sustain their operations with internal funding. Here, a standard regression analysis will be conducted.

H6: An increase in sales positively influence the bank credit ratio.

H9: Companies who have higher internal funding ratio before the crisis also need less bank funding afterwards.

In order to further support hypothesis nine (internal funding ratio indicates financial strength of the firm), a secondary hypothesis between pre-crisis internal funding and delayed payments/financial insolvency will be tested. In the survey, there are various measures for financial hardships: delaying tax and supplier payments, being overdue on obligations to any financial institution in the last three months, filing for readjustment of a firm's debt and capital structure after a bankruptcy or receivership order, filing for bankruptcy, and filing for direct state

aid. Any of these measures show problems in management. In the survey, there is a measure of the proportion working capital financed from internal funds and retained earnings from a year ago before the crisis. It is interesting and insightful to see if this measure is able to predict any of the unwanted results. All of these negative outcomes are combined into a single measure of "yes", if the company had any of these problems, or "no", when the company did not have any of these aforementioned problems. First, any of the country, firm, and industry effects on internal funding are cleaned, then regressed against payment problems using binary logistic regression. In similar fashion, change in sales will be also tested against delayed payments/financial insolvency. Sales drop should be significant reason for any delays in payment and financial insolvency. In return, delayed payments should lead higher trade credit.

H11: A higher level of internal funding ratio percentage leads lower possibility of delayed payments.

H8: A decreased sales growth leads higher possibility of delayed payments.

H12: Having delayed payments leads higher trade-credit ratio

Next, which measures predicts trade-credit ratio will be discussed. It is crucial for firms who offer trade credit to be able to calculate their risks of getting paid full and on time. Sales change and internal funding ratio of the firm are two strong candidates for the job. These two measures preclude the trade-credit ratio during the crisis period. There are definitely other potential measures that determine/predict the later trade credit. However, only these two measures are present in the survey. Hypotheses are:

H7: A negative change on sales increases trade-credit ratio.

H10: Companies who have higher internal funding ratio before the crisis also need less trade credit afterwards.

Lastly, there is a analysis of correlation among trade credit, bank credit and trade-credit ratios. All of these are part of working capital. As so, they are likely to have high correlations. But the signs and magnitudes are important to analyze.

Hypotheses 1:

The survey includes firm size, industry, and country specific information. It is needed to understand which of them are important in determining the percentage of trade credit, internal funds and bank credit. Here are the results to the standard t test.

Table 5.5: Sources of working capital funding in terms of country, industry and size

	Country	Industry	Size
Internal	R-Sq=86.6% R-Sq(adj)=85.3% F-Test= 66.73 P=0.000	R-Sq=15.3% R-Sq(adj)=0.0% F-Test= 0.77 P=0.690	R-Sq=2.8% R-Sq(adj)=0.0% F-Test= 0.63 P=0.60
Bank Credit	R-Sq=30.2% R-Sq(adj)=23.4% F-Test= 4.46 P=0.001	R-Sq=30.0% R-Sq(adj)=13.5% F-Test= 1.82 P=0.060	R-Sq=0.8% R-Sq(adj)=0.0% F-Test= 1.17 P=0.327
Trade Credit	R-Sq=89.7% R-Sq(adj)=88.7% F-Test= 89.6 P=0.000	R-Sq=17.4% R-Sq(adj)=0.0% F-Test= 0.89 P=0.570	R-Sq=0.0% R-Sq(adj)=0.0% F-Test= 0.63 P=0.60
	Country	Industry	Size
Internal	Important	Not Important	Not Important
Bank Credit	Less Important	Less Important	Not Important
Trade Credit	Important	Not Important	Not Important

From the Table 5.5, important conclusions can be drawn. First, country is the most significant factor compared to industry and size in determining the percentage of internal, bank credit and trade credit. Secondly, bank credit is less dependent on country, industry and size compared to internal and trade-credit funding. Bank credit is harder to determine simply using the country, industry, and size factors. Both industry and size has limited ability to determine funding percentages.

H2: Financial crisis significantly drops the GDP growth in all of these countries compared to the pre-crisis period
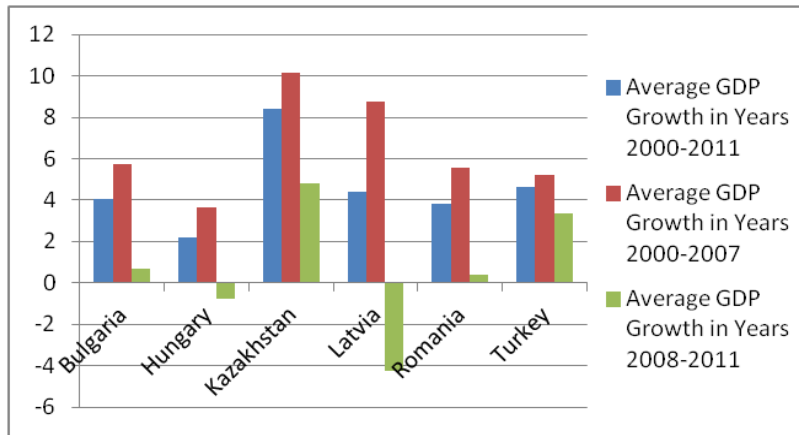
Figure 5.9: Average GDP growth in years before and after the crisis

Based on 11-year growth rates (Figure 5.9), on average there is 5.8% drop across these countries (tstat=5.63) during and after the crisis. The GDP growth rates between pre and during/after crisis periods are significantly different from each other with an estimated average power rate of 75%. This shows that in terms of GDP growth, the crisis, in fact, was felt across all the aforementioned countries.

H3: The global financial crisis significantly drops the firms' sales during the global financial crisis period.

After country-specific effects are cleaned, on average, the global financial crisis caused a 30% drop in sales among all the firms in the survey.

H4: The growth in the amount of bank lend through domestic banks drops significantly from the pre-crisis period

The effects of the late 2000s financial crisis on the banking sector credit are significant. The next figure compares the average growth rate for domestic credit provided by banking sector during the periods of 2000-2011, 2000-2007 and 2008-2011. The drop in banking lending growth across all 6 countries is 24.3% (tstat = 4.35) after country differences are taken into consideration. The population difference between pre and during/after crisis periods are significantly different with 68% test power.
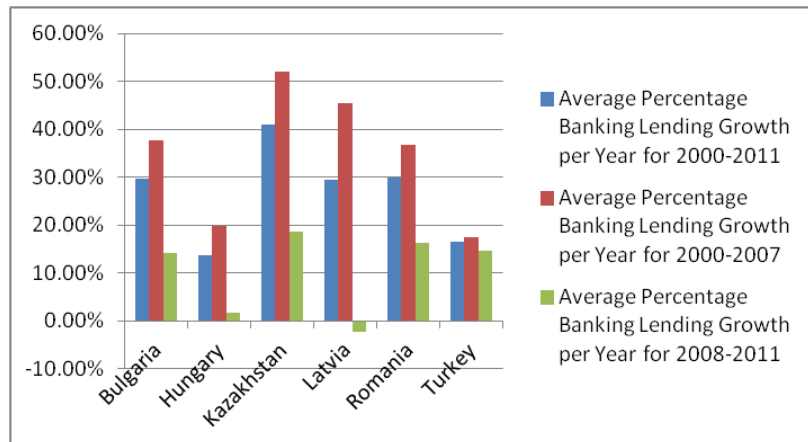
Figure 5.10: Industry, country and size effects in trade credit, internal funds and bank credit ratios

H5: The percentage drop in credit lend through domestic banks positively affect the firm bank credit ratio in the survey countries.

Hypothesis 5 was not supported significantly based on data.

H6: An increase in sales positively influence the bank credit ratio.

Hypothesis 6 was not supported significantly based on data.

H7: A negative change on sales increases trade-credit ratio.

Hypothesis 7 is supported and significant ($F = 87.88$, $p = 0.000$, $R\text{-}sq = 30.3\%$). Every 1% in sales leads to .04% increase in trade credit.

H8: A decreased sales growth leads higher possibility of delayed payments.

Hypothesis 8 is supported significantly ($z = -3.62$, $p = .000$) based on a binary regression.

H9: Companies who have higher internal funding ratio before the crisis also need less bank funding afterwards.

After cleaning country effects on both bank funding ratio and internal funding ratio before the crisis, there is a significant impact of internal funding ratio on bank credit ratio ($t = -14.13$, $p = 0.000$). There is a negative effect on high internal funding ratio before the crisis. Size of the effect is roughly a 0.24% decrease for every 1% increase in internal funding ratio before the crisis. Those companies who managed to have a higher internal funding ratio during the crisis and needs less bank credit afterwards. As an example, if a company uses 10% more internal funding

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than its peers, the same country before the crisis, the same company would have 2.4% more trade-credit needs compared to its peers. This number is half of the earlier trade-credit ratio. In other words, companies are more likely to seek for trade credit than bank credit by 2 to 1 margin.

H10: Companies who have higher internal funding ratio before the crisis also need less trade credit afterwards.

After cleaning country effects on both trade-credit ratio and internal funding ratio before the crisis, there is a significant impact of internal funding ratio on trade-credit ratio (t = -20.07, p = 0.000). There is a negative effect of earlier high internal funding ratio. Size of the effect is roughly 0.48% decrease for every 1% increase in internal funding ratio before the crisis. Those companies who managed to have higher internal funding ratio during the crisis, need less trade credit afterwards. As an example, if a company uses 10% more of internal funding than its peers in the same country before the crisis, the same company will have 4.8% more trade-credit needs compared to its peers.

H11: A higher level of internal funding ratio percentage leads to a lower possibility of delayed payments.

The result is significant (z = -3.63, p = 0.000) and negative. Those companies who have higher internal funding ratio than their country pairs before the crisis are less likely to have problems in payments and working capital later.

H12: Having delayed payments leads to a higher trade-credit ratio

Having delayed payments results in 5.55% higher trade-credit ratio compared to having none (t = 3.21, p = 0.001).

Table 5.6: Correlations among bank credit, trade credit and internal funding ratios

Correlation		
	Internal	Bank Credit
Bank Credit	-0.374	
Trade Credit	-0.838	-0.192

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All correlation numbers are highly significant even at 1% level. From this figure, it is clear that internal and trade-credit ratios move much closer with each other than bank credit. Following table 5.7 and figure 5.11 show the supported hypotheses. Conclusions are the following:

Table 5.7: Summary of hypotheses and results

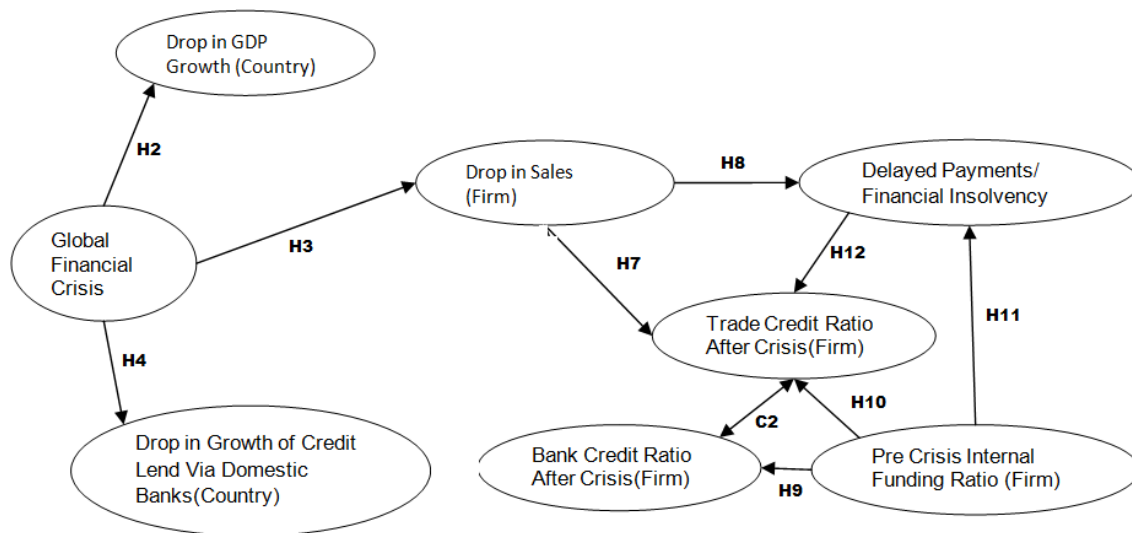| Hypotheses	Supported
H1a1: TC ratio differs significantly by the country firm is located	Yes
H1a2: Bank credit ratio differs significantly by the country firm is located	Yes
H1a3: Internal funding ratio differs significantly by the country firm is located	Yes
H1b1: TC ratio differs significantly by the industry firm belongs	No
H1b2: Bank credit ratio differs significantly by the industry firm belongs	No
H1b3: Internal funding ratio differs significantly by the industry firm belongs	No
H1c1: TC ratio differs significantly by the size of firm	No
H1c2: Bank credit ratio differs significantly by the size of firm	No
H1c3: Internal funding ratio differs significantly by the size of firm	No
H2: Financial crisis significantly drops the GDP growth in all of these countries compared to the pre-crisis period	Yes
H3: The global financial crisis significantly drops the firms' sales during the global financial crisis period	Yes
H4: The growth in the amount of bank lend through domestic banks drops significantly from the pre-crisis period	Yes
H5: The percentage drop in credit lend through domestic banks positively affect the firm bank credit ratio in the survey countries	No
H6: An increase in sales positively influence the bank credit ratio.	No
H7: A negative change on sales increases trade credit ratio	Yes
H8: A decreased sales growth leads higher possibility of delayed payments	Yes
H9: Companies who have higher internal funding ratio before the crisis also need less bank funding afterwards.	Yes
H10: Companies who have higher internal funding ratio before the crisis also need less trade credit afterwards.?	Yes
H11: A higher level of internal funding ratio percentage leads lower possibility of delayed payments.	Yes
H12: Having delayed payments leads higher trade credit ratio	Yes

Figure 5.11: Supported hypotheses in the general model

<u>5.8   Conclusions</u>

The crisis of the late 2000s significantly affected all these countries. However, this effect differs from country to country. For instance, Kazakhstan and Turkey had fewer issues compared to Hungary, Latvia, Romania, and Bulgaria. During this period, bank lending either dropped nominally or grew much slower than before for all these countries. Moreover, for all these countries, bank credit is lower than internal funding, and it is 5%-10% of the working capital requirement. Except for Hungary, the remaining countries, which are from 5% to 20%, do not use TC as a primary source for working with capital, while in Hungary it is up to 70%. However, companies in this region use primarily internal funds. The level of internal funds before the crisis is actually a good sign for later payment delays and business hardships. Companies with a higher level of internal funding are less likely to have delayed payments or insolvency issues. The same ratio also signals TC and bank-funding needs. For each 1% increase in internal funding, there is 0.48% drop in TC and 0.24% drop in bank credit. This 2:1 ratio difference also signals preference or ability of TC compared to bank credit.

Furthermore, companies that increase their sales or have fewer problems in payments, have lower TC needs. Even though the size of the company matters for decreases in sales, size does not play an important role in TC or bank credit decisions. In addition, industry is an important factor in decreased sales. On the contrary, TC and internal funding are not differentiated by an industry or a size of a company, but instead only by the country the firm is located at. Country is the single most important factor for internal, bank credit, and TC funding. Bank credit is more homogeneous across these countries, industries, and size.

<u>5.9   Managerial Insights</u>

Managing working capital and trade credit are important for all businesses, regardless of size. Companies can be on both sides of the game: those who provide trade credit, and those who seek for it. Using primarily trade credit and bank credits is not possible for all firms in every situation. The study clearly shows that except for Hungary, for all of the countries in the study, namely Bulgaria, Kazakhstan, Latvia, Romania, and Turkey, the internal funding is a far more

important source of working capital funding. In the study, lower internal funding ratios are actually signals of increased financial problems and increased needs of trade credit and bank credit. Hence, when a foreign company sells products and services to these countries, they should consider the potential internal funding ratios of buyer firms in order avoid future trouble. Trade credits and internal funding ratios differ significantly from one country to another, whereas bank credit ratios are less significantly different. Therefore, foreign firms should consider the specific condition of a country in which they invest or do business, especially in terms of managing trade credit and bank credits. Because the industry is a less important issue compared to the country factor, multinational countries can channel internal funding to the operations in countries with fewer trade-credit and bank-credit options. Similarly, local firms may consider excessive trade-credit and bank credit requests as being financially unstable. As a result, multinational firms should be careful in using these funding methods. For instance, getting bank credits in countries with rather larger financial markets and using those funds in countries similar to these six countries would make their needs for trade credit and bank credit lower.

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