ESSAYS ON SERVICE INNOVATION

A Dissertation

by

THOMAS DOTZEL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2009

Major Subject: Marketing

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Approved by:

Co-Chairs of Committee,	Venkatesh Shankar
	Leonard L. Berry
Committee Members,	Sanjay Jain
	Li Gan
Head of Department,	Jeffrey S. Conant

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ABSTRACT

Essays on Service Innovation. (August 2009)

Thomas Dotzel, Diplom Betriebswirt (FH), Munich University of Applied Science and Research; Diplôme, Ecole Supérieure de Commerce de Pau; M.B.A., The University of Texas at Arlington

Co-Chairs of Advisory Committee: Dr. Venkatesh Shankar
Dr. Leonard L. Berry

As economies are increasingly driven by services, the introduction of new services to satisfy customers and improve firm value is becoming a critical issue for managers. In my dissertation, I take a step in improving the understanding of service innovations.

In the first essay, I look at the determinants of the number of service innovations introduced by a firm and their interrelationship with customer satisfaction and firm value. Furthermore, I look how these interrelationships vary between Internet-Enabled Service Innovations (IESIs) and Non-Internet-Enabled Service Innovations (NIESIs). I develop a system of equations that link service innovation, customer satisfaction and firm value. I model the determinants of service innovations, using a zero-inflated Poisson model. I estimate the model on a panel data set that I assembled across multiple industries from multiple data sources such as the American Customer Satisfaction Index, Compustat, SDC Platinum, and LexisNexis. My results reveal that IESIs are more strongly influenced by financial resources of the firm and by market growth than are

NIESIs. Surprisingly, neither IESIs nor NIESIs have a significant direct effect on customer satisfaction. However, IESIs have a positive and significant effect on firm value.

Given the differences between consumer markets and business markets, it is important to understand better the determinants and outcomes of business-to-business service innovations (B2B-SIs). In my second essay, I empirically address this issue. I develop a modeling system that relates service innovation to firm value. I estimate my model on unique panel data of service innovations. Results indicate that B2B-SIs have positive effects on firm value. Furthermore, I find that the number of B2B-SIs introduced by a firm is primarily determined by firm-level factors rather than market-level factors

Overall, I find that regardless of firm type or market type, the number of service innovations introduced by a firm has a substantial impact on firm value. In particular, IESIs and B2B-SIs increase firm value. In addition, the two essays also show that liquid financial resources are important determinants of service innovations. This is especially true for IESIs and B2B-SIs.

DEDICATION

To my parents Peter and Elfriede and my wife Fernanda, who are my biggest "fans" and supporters.

My parents have always been there for me and have inspired me with their generosity and their confidence in me. They continue to be my biggest role models.

Without the love and support of my wife Fernanda, this dissertation would not exist. She has been my best friend and I am grateful for her understanding and the innumerable sacrifices she has made for me.

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I am grateful to many people who have helped me complete this dissertation. Most notably, I would like to thank my dissertation co-chairs, Dr. Venkatesh Shankar and Dr. Leonard L. Berry, for their guidance and support not only during my dissertation research but throughout my entire Ph.D. program. The German word for dissertation advisor is *Doktorvater*, which, when translated literally, means "doctor father". I cannot think of a word that better describes how Dr. Berry and Dr. Shankar guided me through the numerous ups and downs of my Ph.D. program. I feel extremely fortunate and grateful to have advisors who are without a doubt demanding, but who are even more caring and concerned about my well being.

From the first day I joined the Ph.D. program, Dr. Shankar has played a central role in guiding me through the program. He has been a great mentor and taught me what it means to be a dedicated, hard working scholar. He has been a constant source of encouragement and support and his methodological expertise has been instrumental for my dissertation research. Dr. Shankar has sacrificed his valuable time and sometimes even his sleep to make sure my dissertation research is of the highest quality and I would get the job I always dreamed of.

Dr. Berry's unmatched expertise and passion for services marketing has been instrumental to both my research and teaching. However, I am particularly grateful for the lesson he has taught me about the importance of balance between professional and personal life. The sentence *"if you say yes to one thing, you automatically say no to*

something else" will be with me throughout my career. Thanks to his mentorship, I am confident that I am not only ready to be a successful scholar, but also a happy and content scholar.

I am deeply indebted to Dr. Berry and Dr. Shankar for their generosity, guidance, time, and encouragement but in particular for how much they care about me.

Along with my dissertation co-chairs, I would also like to thank my committee members, Dr. Jain and Dr. Gan, for sharing with me their time, expertise, and support. Their doors were always open for me in case I had questions, and, in particular, Dr. Jain's feedback during my mock interviews was invaluable.

I wish to extend my gratitude to Dr. Alina Sorescu for her incredible support throughout my time at A&M and in particular during my job search phase. Alina has spent countless hours guiding me through the archival data collection process, reviewing my dissertation essay, having mock interviews, and writing great recommendation letters.

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I would like to thank Atwood and Cricket Jeter, who welcomed me into their family when I first arrived in Texas more than seven years ago. Their unbelievable generosity and support helped me through many of the ups and downs that come with being a Ph.D. student.

Last but not least, I would like to thank my friends and family in Germany and Venezuela. In particular, I would like to thank my brother Volker for always encouraging me and having such great confidence in me.

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CHAPTER I

INTRODUCTION

Services are becoming increasingly important to economic development. In 2007, service industries accounted for approximately 75% of the U.S. gross domestic product (GDP) and are growing faster than the economy as a whole (Lindberg and Monaldo 2008). A similar trend can be seen globally. Since 1970, services' share of GDP in developed countries has risen by approximately 20% to more than 70%. The service sector is the largest sector of the economy in many developed and developing countries (World Bank 2008). Firms in both service and manufacturing industries are seeking to introduce service innovations to create value and stay competitive (Berry et al. 2006; Bitner, Ostrom, and Morgan 2008; Michel, Brown, and Gallan 2008).

Formally, service innovation is *the exploitation of an idea for a performance that is new to the firm and perceived by customers to offer new benefits* (Berry et al. 2006). Because service innovations are so important in today's economy, managers need and want to know more about both determinants and outcomes of service innovations. Indeed, the Marketing Science Institute's (MSI) member companies have identified service innovation as one of the priority research topics (Marketing Science Institute 2008).

Unfortunately, the vast majority of innovation studies focus on goods (see Hauser, Tellis, and Griffin 2006 and Shankar 2008 for detailed reviews). Even within the

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This dissertation follows the style of *Journal of Marketing.*

service management literature, new service management is among the least studied and understood topics (Menor, Tatikonda, and Sampson 2002). We need a deeper understanding of both the determinants and outcomes of service innovations. In this dissertation, I seek to fill this void by examining both the determinants and outcomes of service innovations.

In my first essay, I address the following research questions. (1) What are the determinants of service innovations? (2) What are the effects of service innovations on customer satisfaction and firm value and how are the three constructs related to each other? (3) What are the differences between Internet-enabled service innovations (IESIs) and non-Internet-enabled service innovations (NIESIs) in these relationships, if any?

Drawing on marketing, management, industrial organization, and operations management literature, I formulate a conceptual model of service innovation determinants and interrelationships among service innovations, customer satisfaction, and firm value. I then develop a model composed of a system of equations comprising zero-inflated Poisson and linear regression models in which I control for heterogeneity through fixed effects to account for industry and time differences. I estimate this system using a uniquely assembled panel dataset of 342 service innovations that were introduced from 2000 to 2004 by 32 companies across different industries.

My findings offer important insights on the proposed interrelationships and highlight important asymmetries between IESIs and NIESIs. My research makes important contributions from theoretical, managerial, and methodological viewpoints. From a theoretical point of view, it offers a broad understanding of service innovations

and an explanation of the interrelationships among service innovations, customer satisfaction, and firm value and the differences between IESIs and NIESIs. From a substantive perspective, I offer managers a better understanding of the direct and indirect effects of service innovations and the relative effects of IESIs and NIESIs. From a methodological perspective, I develop a rigorous modeling approach to address the relationships between service innovations, customer satisfaction, and firm value.

In my second essay, I focus on the importance of business markets in today's economy by studying the determinants and outcomes of business-to-business service innovations (B2B-SIs). Specifically, I examine the following two research questions: (1) What are the determinants of B2B-SIs? (2) What is the effect of B2B-SI on firm value? I answer these questions by using a modeling system that relates service innovation to firm value. I estimate my model on unique panel data of 230 B2B-SIs that were introduced by 46 companies across different industries within a five year time period. My results help managers identify and potentially manipulate factors that drive B2B-SIs. Furthermore, they will help them better understand the returns to B2B-SIs.

CHAPTER II

SERVICE INNOVATIONS, CUSTOMER SATISFACTION, AND FIRM VALUE: ASYMMETRIES BETWEEN INTERNET-ENABLED AND NON-INTERNET-ENABLED SERVICE INNOVATIONS

The introduction of new services to satisfy customers and improve firm value is becoming a critical issue for managers in both services- and goods-dominant firms as economies in developed and developing countries are increasingly driven by services,. However, prior research on innovation has primarily focused on goods, leaving open important research questions relating to service innovations. In this essay, I empirically investigate the determinants of the number of service innovations and their interrelationship with customer satisfaction and firm value, while controlling for both firm- and market-specific factors. Furthermore, I examine how these effects differ between Internet-Enabled Service Innovations (IESIs) and Non-Internet-Enabled Service Innovations (NIESIs). I develop a conceptual model and a system of equations that link service innovations, customer satisfaction and firm value. I model the determinants of the number of service innovations, using a zero-inflated Poisson (ZIP) model. I estimate my model on a unique panel data set that I assembled from multiple data sources across multiple industries, using a seemingly unrelated regression (SUR) approach and controlling for unobserved heterogeneity through fixed effects. My results reveal important insights. IESIs are more strongly influenced by financial resources of the firm and by market growth than NIESIs are. Surprisingly, neither IESIs nor NIESIs have a

significant direct effect on customer satisfaction. However, IESIs have a positive and significant effect on firm value.

INTRODUCTION

Services are becoming increasingly important to economic development. In 2007, service industries accounted for approximately 75% of the U.S. gross domestic product (GDP) and are growing faster than the economy as a whole (Lindberg and Monaldo 2008). A similar trend can be seen globally. Since 1970, services' share of GDP in developed countries has risen by approximately 20% to more than 70%. The service sector is the largest sector of the economy in many developed and developing countries (World Bank 2008).

Firms in both service and manufacturing industries are seeking to introduce service innovations to create value and stay competitive (Berry et al. 2006; Bitner, Ostrom, and Morgan 2008; Michel, Brown, and Gallan 2008). While the need for service innovations for service firms is intuitive, the importance of service innovations for goods firms is less obvious. Consider Apple Inc., a goods-dominant company. In 2003, after having introduced the iPod the prior year, Apple launched its iTunes Music Store service that allowed customers to download any of 200,000 tracks for 99 cents each. Although the service innovation was initially available only to Mac users, 475,000 tracks were downloaded in the first two days alone (Black 2003). Since then, the Apple iTunes downloads have skyrocketed, exceeding five billion songs and making Apple the largest U.S. music retailer (Apple Inc. 2008).

Formally, service innovation is *the exploitation of an idea for a service that is new to the firm and intended to provide its customers new benefits* (Berry et al. 2006). Given the growing role of technology in services (Lee and Grewal 2004) and the ubiquitous and rapid growth of the Internet, service innovations can be categorized as Internet-enabled service innovations (IESIs) and traditional or non-Internet-enabled service innovations (NIESIs). IESIs are service innovations that provide the new customer benefit at least partially through the Internet. The Apple iTunes Store example falls in this category as the service is provided through iTunes' online store. In contrast, NIESIs do not require the Internet to provide the new customer benefit. FedEx Kinko's packing services, introduced in 2004, is an example of this type of service. Customers drop off unpacked items at a FedEx Kinko's Office and Print Center and a FedEx Kinko's employee packs and ships them. The customer does not need to use the Internet to enjoy the new benefit.

The distinction between IESIs and NIESIs is important because many of the traditional characteristics that apply to NIESIs do not hold for IESIs. The sources and extent of advantages for innovators differ for Internet-enabled and offline environments (Varadarajan, Yadav, and Shankar 2008). These differences are likely to result in different implications for both managers and customers and need to be considered when studying service innovations. Two traditional characteristics for services include: (1) inseparability due to simultaneous production and consumption of the service (Bendapudi and Leone 2003); and (2) heterogeneity due to higher labor intensity in the production and consumption process. These characteristics make it difficult to achieve

economies of scale for many services. While these characteristics often describe NIESIs, they do not necessarily apply for IESIs. IESIs are often centrally produced (highly separable), involve minimal or no personal interaction, and are homogeneous due to standardized processes (Lovelock and Gummesson 2004). Furthermore, IESIs are highly scalable once they are set up and marginal costs to serve additional customers are minimal (Sawhney, Balasubramanian, and Krishnan 2004). Finally, customers are co-producers of many services. Because the underlying technology in an IESI involves self-service, the customer is responsible for a typically higher portion of production for IESIs than for NIESIs (Meuter et al. 2000).

Because service innovations are important and IESIs differ from NIESIs, managers would like to know the determinants of the number of each type of these innovations. Although the marginal costs for IESIs are small compared to NIESIs, IESIs are likely to require a bigger initial investment. For example, in late 2002, when IBM launched its IESI, on-demand computing initiative, its CEO, Sam Palmisano announced a $10 billion investment in capital, acquisitions, and marketing to successfully implement the IESI (Lundquist 2002). Once the infrastructure for on-demand computing was created, the hourly cost for information processing was expected to be as low as 15 cents, making the IESI a highly scalable innovation (Bigelow 2002). If the IESI is a Web-based delivery service of a consumer good, then it costs about $15-25 million to build a leading Web site and an average of $150 million to develop a fulfillment system (Mandel et al. 2001). Thus, a company's slack resources may be instrumental in creating IESIs. At the same time, because an advantage of IESIs is scalability, they have to be

introduced in large, growing markets for the firm to benefit from this advantage. Therefore, market size, market growth and a firm's slack resources may be significantly more important for IESIs than for NIESIs. By knowing the determinants of the number of service innovations, managers can make more informed decisions.

How do firms measure the success, or more generally, the consequences of their innovations? About 57% of managers use customer satisfaction as a measure of innovation success (Boston Consulting Group 2007), making it the most frequently used metric among senior executives. This finding seems logical because customer focus is key to firm performance (Kumar, Venkatesan, and Reinartz 2008) and customer satisfaction has been shown to increase firm value, whose maximization is a primary goal for managers (e.g., Anderson, Fornell, and Mazvancheryl 2004; Fornell et al. 2006; Gruca and Rego 2005; Kumar, Ramaswami, and Srivastava 2000; Luo and Bhattacharya 2006; Mittal et al. 2005; Morgan and Rego 2006). However, is customer satisfaction a good measure for service innovation success or should managers consider other important measures?

Unfortunately, extant literature does not offer a good answer to this question. We need a deeper understanding of the interrelationships among service innovations, customer satisfaction and firm value. Furthermore, we need to understand if IESIs and NIESIs differ in these relationships. The purpose of this paper is to fill this void by examining these interrelationships and by exploring the effects of IESIs and NIESIs.

I address the following research questions. (1) What are the determinants of service innovations? (2) What are the effects of service innovations on customer

satisfaction and firm value and how are the three constructs related to each other? (3) What are the differences between IESIs and NIESIs in these relationships, if any?

Drawing on marketing, management, industrial organization, and operations management literature, I formulate a conceptual model of service innovation determinants and interrelationships among service innovations, customer satisfaction, and firm value. I then develop a model composed of a system of equations comprising zero-inflated Poisson and linear regression models in which I control for heterogeneity through fixed effects to account for industry and time differences. I estimate this system using a uniquely assembled panel dataset of 342 service innovations that were introduced from 2000 to 2004 by 32 companies across different industries.

My findings offer important insights on the proposed interrelationships and highlight important asymmetries between IESIs and NIESIs. They show that IESIs are more strongly influenced by financial resources than are NIESIs. Furthermore, after controlling for firm- and market-specific factors, IESIs have a positive direct effect on firm value but no significant effect on customer satisfaction. In contrast, NIESIs have no significant effects on customer satisfaction or firm value.

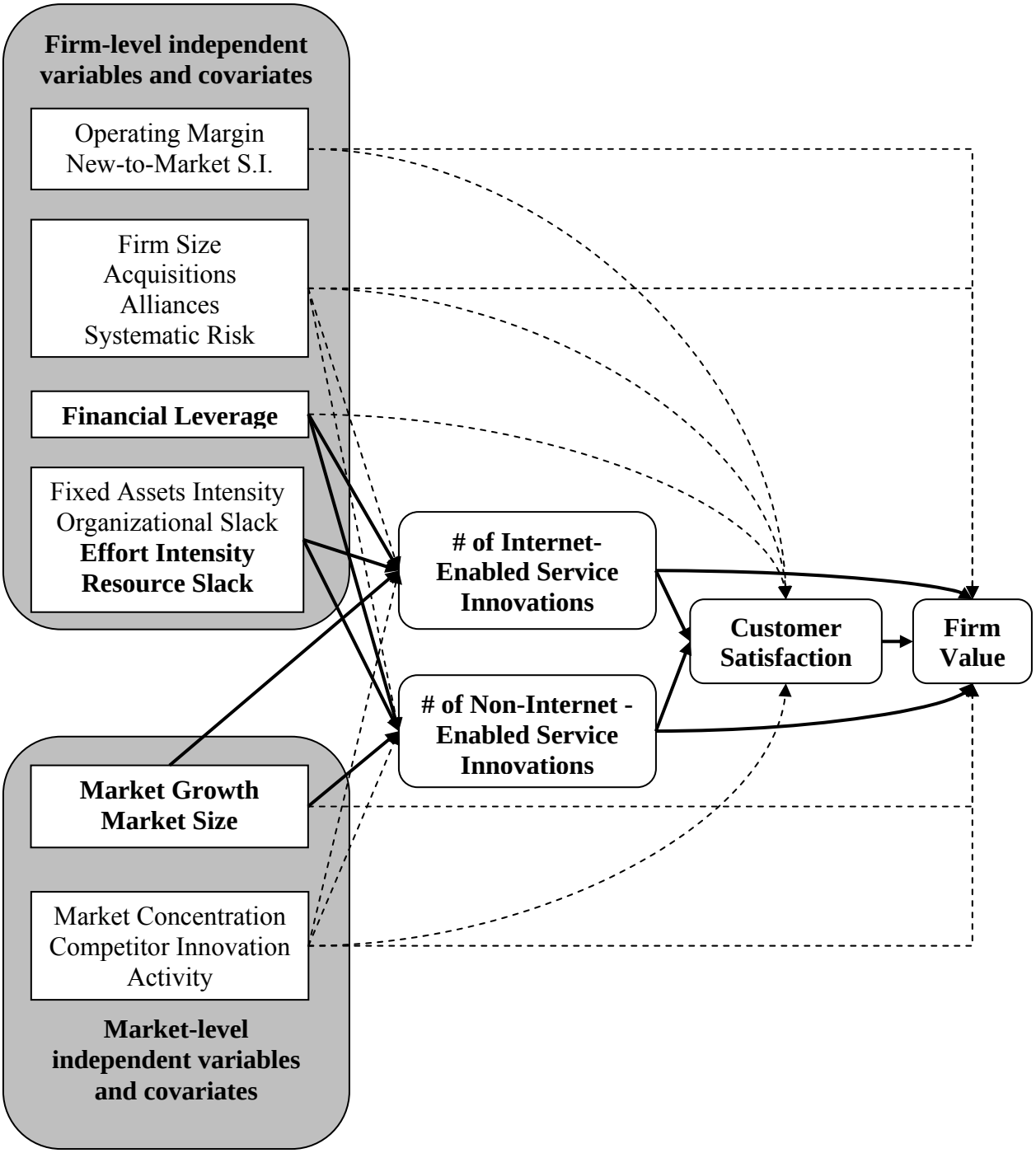
My research makes important contributions from theoretical, managerial, and methodological viewpoints. From a theoretical point of view, it offers a broad understanding of service innovations and an explanation of the interrelationships among service innovations, customer satisfaction, and firm value and the differences between IESIs and NIESIs. From a substantive perspective, I offer managers a better understanding of the direct and indirect effects of service innovations and the relative

effects of IESIs and NIESIs. From a methodological perspective, I develop a rigorous modeling approach to address the relationships between service innovations, customer satisfaction, and firm value.

RELATED RESEARCH AND CONCEPTUAL DEVELOPMENT

I discuss the determinants of service innovations, the effects of service innovations on customer satisfaction and on firm value, and the effect of customer satisfaction on firm value in the context of the conceptual model shown in Figure 1. The conceptual model is based on the resource-based view (RBV) of the firm (Barney 1991; Wernerfelt 1984) and the role of industry or product markets in creating competitive advantage (Rumelt 1991). Firms seek to develop competitive advantage through a bundle of resources such as IESIs, NIESIs and customer assets that are value-creating, rare, inimitable, and non-substitutable (Barney 1991; Rumelt 1984). Thus, I posit IESIs, NIESIs, and customer satisfaction — a measure of customer assets — to influence firm value. I also expect IESIs and NIESIs to affect customer satisfaction to create an effective isolating mechanism, which would make it difficult for competitors to imitate the bundle of the firm's resources (Rumelt 1984). At the same time, industry or market factors also influence innovation activity, customer satisfaction, and firm value, although the effects of industry factors on firm profitability may be weaker than those of firm factors (Rumelt 1991).

FIGURE 1
Conceptual Model Linking Service Innovation (S.I.), Customer Satisfaction, and Firm Value



Notes: Continuous lines indicate focal relationships while dashed lines represent relationships involving non-focal variables. Variables in bold are focal variables while the other variables are control variables.

Consistent with the RBV and the role of industry factors, the numbers of IESIs and NIESIs are determined by both firm and market level factors that vary in importance depending on the type of service innovation. I posit that effort intensity, resource slack, and financial leverage are the focal firm level determinants and market size and market growth are the market level determinants of the number of service innovations. In addition to the focal relationships, I also consider non-focal, or control variables that influence the number of service innovations introduced, customer satisfaction, and firm value. These control variables are: market concentration, competitors' innovation activity, organizational slack, fixed assets intensity, systematic risk, alliances, acquisitions, operating margin, and firm size. Furthermore, I suggest that the effects of IESIs and NIESIs on firm value may be partially mediated by customer satisfaction. In the figure, I distinguish the focal variables from the non-focal or control variables by using a bold font type and continuous arrows for the focal variables and relationships and dashed arrows for the control relationships.

Determinants of Service Innovations

Despite the importance of services to developed and developing economies, little is known about the determinants of the number of service innovations that firms introduce. The vast majority of innovation studies focus on goods (see Hauser, Tellis, and Griffin 2006 and Shankar 2008 for detailed reviews). Even within the service management literature, new service management is among the least studied and understood topics (Menor, Tatikonda, and Sampson 2002).

The literature on goods innovation distinguishes between different types of innovation. Arguably, the most popular approach has been to categorize goods innovations as radical and incremental innovations (e.g., Chandy and Tellis 1998; Sorescu, Chandy, and Prabhu 2003; Sorescu and Spanjol 2008). Similarly, when studying service innovations, it is necessary to distinguish between different types of innovations, such as I have done in this study with IESIs and NIESIs. As previously discussed, the distinction is needed primarily because the traditional characteristics of NIESIs (inseparability and heterogeneity) do not apply to the same degree for IESIs. Therefore, it is important to gain a deeper understanding about the different antecedents and consequences of IESIs and NIESIs.

I reviewed the existing literature on the determinants of goods innovation and examined all the significant factors. Previous research suggests that both firm- and market-specific factors determine the number of innovations introduced by a firm (e.g., David, Hitt, and Gimeno 2001; Katila and Ahuja 2002; Sorescu and Spanjol 2008; Srinivasan, Haunschild, and Grewal 2007). I focus on some of these firm- and market-specific determinants while controlling for others. Furthermore, I account for additional determinants that have not been used in previous research but that are likely to be important in the context of service innovations. I argue that the relative importance of these determinants will be different for IESIs and NIESIs.

Effort intensity

Effort intensity refers to the relative resources or expenditures that a firm uses to achieve sales revenues. It is represented by the ratio of cost of goods sold (COGS)

expenditures to sales revenues. Firms with high COGS relative to sales revenues will likely expend a high level of effort to bring new services to market. The sales revenues for new products increase dramatically only after takeoff in their life cycles (Golder and Tellis 1997). Because sales revenues take off after an introduction period and because COGS increases with the introduction of new services, greater effort intensity should be associated with a higher number of new services. This relationship should be especially true for IESIs because these innovations are often technology based and require a higher up-front investment. The higher initial investment and the delayed sales revenues for IESIs suggest that the positive relationship between effort intensity and number of innovations is expected to be stronger for IESIs than for NIESIs.

Resource slack

Resource slack, the ratio of working capital to total assets, is a measure of unused resources that could influence the number of innovations (Lee and Grewal 2004). The greater the slack resources of a firm, the more efforts it can dedicate to innovation without jeopardizing ongoing operations (e.g., Herold, Jayaraman, and Narayanaswamy 2006). This factor is particularly important for IESIs as the initial investment is likely to be greater than it is for NIESIs. Therefore, greater slack resources should be more important for IESIs than NIESIs.

Financial leverage

Financial leverage, the ratio of long-term debt to total assets, should also be a more important determinant for IESIs than for NIESIs. Financial leverage can be interpreted as the degree to which companies use debt to finance their assets (Srinivasan

2006). Companies with high financial leverage use a large amount of debt and are therefore less able to make additional investments in new technologies to introduce IESIs. NIESIs on the other hand often do not require high investments. Therefore, financial leverage is likely to be less important for NIESIs.

Market size

The size of the market is a determinant of the number of innovations. Introducing new services involves investment in time and money. The innovating firm needs to believe that the market size is large enough to justify these investments (Katila and Shane 2005). Market size is likely to be a more important for IESIs than for NIESIs. IESIs may have high set- up costs but minimal marginal costs, which make the service highly scalable. To take full advantage of scalability and to justify the typically high initial investment, companies in large markets are more likely to introduce IESIs than companies in smaller markets. This is not necessarily the case for NIESIs that do not need to make high initial investments. NIESIs do not primarily realize profits from the scalability of the service innovations, so market size should matter less for them than it does for IESIs. Market size will also likely influence firm value. I control for the size of the market while studying the interrelationships among service innovations, customer satisfaction, and firm value.

Market growth

Markets with high growth tend to have increased investments to keep pace with growth (Szymanski, Bharadwaj, and Varadarajan 1993). I expect market growth to be an important determinant of the number of service innovations. Fast growing markets

require rapid distribution of innovations. NIESIs are often produced and consumed simultaneously and are less separable than IESIs. Companies that introduce NIESIs in a fast growing market need to produce these innovations at many different locations to keep up with the demand. In contrast, IESIs often can be produced centrally, making it easier for the innovating company to satisfy growing market demand. Therefore, I expect market growth to be a significant determinant of IESIs compared to NIESIs. Market growth will also likely affect firm value. Therefore, I control for market growth while studying the interrelationships among service innovations, customer satisfaction, and firm value.

The Effect of Service Innovations on Customer Satisfaction

Services are co-produced by the customer (e.g., Meuter et al. 2005; Vargo and Lusch 2004). A service innovation is a new service, so by definition, it changes the way a service is co-produced. Depending on the type of service innovation, either an entirely new "co-production" process may occur or the responsibilities for co-production may shift between the firm and the customer. For example, with the introduction of self-checkout service in many supermarkets, some co-production responsibilities shifted from the firm (i.e., the employee at the checkout counter) to the customer. If the role of the customer in the co-production process changes, her expectation and/or perception of the service is likely to change as well. Because customer satisfaction is defined as the outcome of the gap between customer expectation and perceived performance of an offering (e.g., Oliver 1980), I anticipate that service innovations should have an effect on customer satisfaction.

I predict that the effect of service innovations on customer satisfaction will be different for IESIs and NIESIs. The co-production change is particularly significant for IESIs because it often results in greater responsibility for the customer (Bendapudi and Leone 2003). For instance, when Papa John's introduced its online pizza ordering service (an IESI), the responsibility of entering the order into the computer system shifted from a front-line employee to the customer. Because a greater shift in the co-production process for an innovation is also likely to result in a greater shift in the gap between customer expectation and perceived performance of the innovation, the effect of IESIs on customer satisfaction is also likely to be greater compared to NIESIs.

The Effect of Customer Satisfaction on Firm Value

Considerable academic research exists on the outcomes of customer satisfaction. Of the various outcomes, increased firm value has been consistently identified as one of the most important goals of a firm. Customer satisfaction is positively related to firm value and financial performance (e.g., Anderson, Fornell, and Mazvancheryl 2004; Fornell, et al. 2006; Gruca and Rego 2005; Kumar, Ramaswami, and Srivastava 2000; Luo and Bhattacharya 2006; Mittal et al. 2005; Morgan and Rego 2006). For example, Gruca and Rego (2005) find that customer satisfaction results in higher firm value because it increases a firm's future cash flow while reducing its variability. Fornell et al. (2006) show that firms with high customer satisfaction not only produce excess financial returns, but they also carry lower systematic risk, which contradicts a previously held belief that high returns are associated with high systematic risk. Mittal et al. (2005) add a caveat to these conclusions. They argue that the positive relationship between customer

satisfaction and the long-term performance of a firm is significantly stronger for firms that are able to emphasize both customer satisfaction and cost efficiency compared to firms that focus only on customer satisfaction. Based on these findings, I predict that customer satisfaction has both a direct effect and a mediating effect for service innovations on firm value.

The Effect of Service Innovations on Firm Value

In addition to customer satisfaction, firm value is an important consequence of interest to firms (Srivastava, Shervani, and Fahey 1998). Lee and Grewal (2004) study the effect of the various forms of Internet adoption on firm value for bricks and mortar retailers. Their findings show that the adoption of the Internet both as an e-alliance and as a communication channel increases overall firm performance. Many studies look at the relationship between innovation and firm value but their findings are inconsistent (Sorescu and Spanjol 2008). While Eddy and Saunders (1980) find no significant relationship between new product announcements and stock prices, other researchers find the effects to be significant and positive (e.g., Pauwels et al. 2004; Sorescu, Chandy, and Prabhu 2003; Sorescu, Shankar, and Kushwaha 2007; Sorescu and Spanjol 2008; Srinivasan et al. 2006). Moreover, all studies on the relationship between innovation and firm value focus on goods innovation, while the effect of service innovations on firm value is largely unknown.

I argue that in addition to a mediated effect of service innovations on firm value through customer satisfaction, there is a direct effect of service innovations on firm value. Firm value reveals the future potential that the market sees in a firm. It is

determined not only by the firm's customers but also by non-customers and other stakeholders. Although these stakeholders are not involved in customer satisfaction scores, they can be influenced by service innovations through word of mouth or by being informed about the new service through advertising or press releases. For instance, when Apple launched its iTunes store, investors might have seen an increase in firm value purely based on word of mouth from iPod users and not because they had actually used the service themselves. As a result, the service innovation had a direct effect on firm value even though the firm value did not derive from the satisfaction of these investors as customers.

I expect differences in the effects of IESIs and NIESIs on firm value as presented in Table 1. These differences stem from differences between IESIs and NIESIs in the characteristics discussed earlier—separability and customer heterogeneity—leading to scalability differences as well. The differences in these characteristics influence the bases of resource-based theory to different degrees for IESIs and NIESIs. These differences, in turn, may lead to differences in the effects of IESIs and NIESIs on firm value. Essentially, the scalability advantage for IESIs over NIESIs provides greater value-creation prospects, making them more non-substitutable than NIESIs. These advantages may be adequate to offset potential relative benefits of NIESIs over IESIs in rarity and inimitability of resources, to produce a stronger effect on firm value for IESIs than for NIESIs.

TABLE 1
Differences between IESIs and NIESIs

Item	IESIs	NIESIs
Characteristics		
Separability	High	Low
Heterogeneity	Low	High
Scalability	High	Low
Bases of Resource Based Advantage		
Value-creating ability	High	Low
Rarity	Low	High
Inimitability	Low	High
Substitutability	Low	High
Firm Value		
Effect	High	Low

Control Variables

When studying the determinants of service innovations and the interrelationships among service innovations, customer satisfaction and firm value, it is important to control for both firm- and market-specific factors. In particular, I control for the following variables:

New-to-the-market service innovations

The relationships among service innovations, customer satisfaction, and firm value may depend on the number of service innovations that are new to the market. Most service innovations are new to the firm introducing the innovation, but only a few are new to the market. *New-to-the-market* innovations may have a greater impact on customer satisfaction and firm value than would new-to-the-firm innovations. For

example, in the case of goods innovations, radical innovations, which are typically new to the market, are positively related to firm value (Sorescu and Spanjol 2008).

Firm size

Previous research shows that larger firms introduce more innovations (e.g., Pauwels et al. 2004; Sorescu, Chandy, and Prabhu 2003). Consistent with previous research, I operationalize firm size as the natural logarithm of the firm's sales revenue (e.g., David, Hitt, and Gimeno 2001; Mithas, Krishnan, and Fornell 2005). Not only do I control for the size of the firm while studying the determinants of service innovations, but I also propose that firm size influences customer satisfaction and firm value (e.g., Mithas, Krishnan, and Fornell 2005; Sorescu and Spanjol 2008). Therefore, I account for it when I examine the relationship among service innovations, customer satisfaction, and firm value.

Acquisitions

Sorescu and Spanjol (2008) argue that acquisitions can increase innovation outputs by expanding the product portfolio or reduce innovation outputs by reducing a firm's available resources necessary to innovate. I control for the number of acquisitions by a firm in examining the determinants of service innovations. Acquisitions also impact customer satisfaction and firm value (Sorescu and Spanjol 2008). Acquisitions can increase or decrease customer satisfaction depending on how the transition process is handled. If the market values the asset increase due to an acquisition as lower (higher) than the firm's book value, the firm value will decrease (increase). Acquisitions of

Internet firms lead to higher value for the acquiring firm (Uhlenbruck, Hitt, and Semadeni 2006).

Alliances

Following previous research (e.g., Srinivasan, Haunschild, and Grewal 2007), I also control for the number of strategic alliances a firm has undertaken. Furthermore, because alliances have an effect on customer satisfaction and firm value (e.g., Kalaignanam, Shankar, and Varadarajan 2007), I also control for this variable in my analysis of the interrelationships among service innovations, customer satisfaction, and firm value.

Systematic risk

Consistent with previous studies, I measure systematic risk as the beta obtained from the capital asset pricing model (CAPM) (e.g., Shankar and Sorescu 2008). Both management and industrial organization studies show that firms with a high degree of systematic risk introduce significantly more innovations (e.g., David, Hitt, and Gimeno 2001) and have a higher degree of R&D intensity (Wedig 1990). I expect a similar relationship for service innovations.

Fixed assets intensity

A high ratio of fixed assets to total assets has been shown to decrease the likelihood to innovate (e.g., Hambrick and McMillan 1985; Sorescu and Spanjol 2008). Firms with high fixed assets intensity suffer from less freedom to finance new innovations because they have less liquid assets available. While previous research has shown this effect for goods innovation, I expect it to hold for service innovations.

Organizational slack

Organizational slack of a company is defined as the ratio of net cash flows from operating activities to total firm assets (Davis and Stout 1992). Firms with greater organizational slack have more resources than needed for ongoing operations. Therefore, they are more likely to introduce service innovations.

Operating margin

Operating margin significantly affects firm value (Rao, Agarwal, and Dahlhoff 2004). Furthermore, I expect operating margin to have an effect on customer satisfaction as it can be interpreted as a firm's ability to charge a premium for delivering greater value to its customers. I control for these effects in my analysis of customer satisfaction and firm value.

Market concentration

In addition to market size and market growth, I also control for market concentration. Market concentration represents the market's competitive structure, which influences the need to introduce service innovations. In highly concentrated markets, companies are less likely to focus on customer satisfaction due to the lack of alternatives for the customers. Similarly, market concentration can also influence the value of a firm as the market may perceive the business prospects of companies that operate in highly concentrated markets to be different from those that face strong competition in their markets. Consistent with previous research, I operationalize market concentration as the Herfindahl-Hirschmann Index at the four-digit North American

Industry Classification System (NAICS) code (e.g., Luo and Homburg 2007; Rao, Agarwal, and Dahlhoff 2004).

Competitor innovation activity

A firm's innovation activity or new product spending is influenced by its competitors' innovation activities (Shankar 1999). If its competitors actively boost their sales through innovations, the firm may be likely to compete by introducing new services. I also propose that the competitor innovation activity influences customer satisfaction and firm value as well.

DATA

To empirically test my predictions, I require panel data on customer satisfaction, firm value, firm- and market-specific determinants of service innovations, and the number and type of service innovations introduced by a firm. Because these data are not readily available from a single data source, I manually assembled a unique panel data set using different sources. The advantage of this approach is that I avoid common method bias by using separate sources for key independent and dependent variables (Mithas, Krishnan, and Fornell 2005).

Because my research involves customer satisfaction, I use as my sampling frame the American Customer Satisfaction Index (ACSI) database, which has been widely used by prior research and which is reasonably representative of the universe of U.S. firms. The ACSI data are collected annually by the National Quality Research Center at the University of Michigan for more than 200 business units, companies, and federal

government agencies across 40 industries. For a detailed description of the ACSI estimation process, see Fornell et al. (1996).

I first identified all companies that have ACSI scores for the years 2001 to 2005. I then eliminated 38 companies for which the necessary financial data were not available (private firms). Of the remaining 90 companies, I randomly selected 32 firms across different industries. Table 2 provides a detailed list of variables, operationalization, and data sources. The focal variables are collected from LexisNexis, the ACSI website, CRSP, and COMPUSTAT. The determinants of service innovations and control variables are sourced from CRSP, COMPUSTAT, and SDC Platinum databases.

TABLE 2
Variables, Measures, and Data Sources

Variable	Notation	Operational Measure	Data Source
Focal Variables			
Internet-enabled Service Innovations	IESI	Annual firm-level count of IESIs	LexisNexis
Non-internet-enabled Service Innovations	NIESI	Annual firm-level count of NIESIs	LexisNexis
Customer Satisfaction	ACSI	American Customer Satisfaction Index as reported by the National Quality Research Center	www.theacsi.org
Firm Value	TOBINQ	Tobin's Q	CRSP, COMPUSTAT
Determinants of Service Innovations			
Effort Intensity	EFFINT	Ratio of Cost of Goods Sold to Sales revenues	COMPUSTAT

TABLE 2 Continued

Variable	Notation	Operational Measure	Data Source
Resource Slack	RESLACK	Ratio of working capital to total assets	COMPUSTAT
Financial Leverage	FINLEV	Ratio of long-term debt to total assets	COMPUSTAT
Market Growth	MGROWTH	12 months percentage growth in industry sales	COMPUSTAT
Market Size	LMSIZE	Natural logarithm of industry sales	COMPUSTAT
Control Variables			
New to Market Service Innovations	NTMSI	Annual firm-level count of service innovations that were new to the market.	Lexis Nexis
Firm Size	LFSIZE	Natural logarithm of a firm's sales	COMPUSTAT
Acquisition	ACQUIS	Annual firm-level count of acquisitions	SDC Platinum
Alliance	ALLIANCE	Annual firm-level count of strategic alliances	SDC Platinum
Organizational Slack	ORGSLACK	Ratio of net cash flow from operating activities to total assets	COMPUSTAT
Fixed Asset Intensity	FAINT	Ratio of fixed assets to total assets	COMPUSTAT
Systematic Risk	RISK	Beta obtained from Capital Asset Pricing Model (CAPM)	CRSP
Operating Margin	OPMARGIN	Ratio of net income before depreciation to sales revenues	COMPUSTAT
Competitor Innovation Activity	COMPINA	Ratio of 12 months cumulative competitors' sales increase (in US$) to market size	COMPUSTAT
Market Concentration	HHI	Herfindahl-Hirschman Index	COMPUSTAT

Service Innovations

I collected information on service innovations using all news sources available in LexisNexis (including news wires). I collected the number of service innovations introduced between 2000 and 2004 for each of the 32 firms that were randomly selected from the ACSI database.[1] Because I am studying the effect of service innovations on customer satisfaction, it is important to ensure that the innovation was introduced prior to the collection of the data for the ACSI scores. I eliminate this reverse causality concern by lagging the number of service innovations by one year so that the effect of an innovation introduced in a year will be captured by the next year's ACSI score.

I conducted a broad search on LexisNexis to ensure that I capture all service innovations that were introduced by a company in a given year. Overall, I searched more than 55,000 different news releases and obtained a usable sample of 342 service innovations. Consistent with my definition, I looked for three characteristics of a service innovation to include it in the sample: a performance of a function, an intangible offering that the firm did not provide before, and a new benefit to the firm's customers. For each firm I used the broad search terms *service*, *new, and innovat!.* Using the exclamation mark after *innovat* allowed me to capture all terms that start with *innovat*, such as innovation, innovative, and innovator. Furthermore, by using the singular word forms I was able to catch singular, plural, and possessive forms of the terms. I then conducted a content analysis and categorized the service innovations into IESIs and NIESIs. I

[1] Some firms did not introduce any innovation in some of the years, making the sample more attractive in representativeness of the universe of all firms.

assessed the reliability of my content analysis by having two judges (not involved with the research) independently analyze the content of the news releases. The average correlation between the judges' coding and my initial coding was high (.90, $p < .01$). I resolved discrepancies in the coding by reevaluating the news source. My final sample includes 81 NIESIs and 261 IESIs. Some examples for each type of service innovation appear in Table 3. These examples are drawn from different industries, including computer and electronics, consumer packaged goods, traditional retail, online retail, and other services.

Figures 2 and 3 present the frequency distributions of IESIs and NIESIs, respectively in my sample. The distributions are skewed with a high proportion of zeros. Accordingly, I will use zero-inflated count data models in my subsequent empirical analysis.

TABLE 3
Examples of Service Innovations

Company	Year Introduced	Type	Service Innovation
Home Depot	2000	NIESI	"Home Depot Home Improvement Loan Account […] Whether remodeling a kitchen or bath, or building an addition to a home, customers who are approved for a loan can begin shopping immediately. Customers complete a brief application and receive a decision within minutes." (6/5/2000)
Gateway	2001	NIESI	"Gateway, Inc. (NYSE: GTW) today begins offering technology installation services into homes across the U.S. with the Gateway House Call program.[…] With 296 stores acting as service hubs in virtually all major U.S. metropolitan areas, Gateway dispatches highly skilled technicians into customers' homes to set up their PCs…" (11/15/2001)
FedEx	2004	NIESI	"FedEx Custom Critical, a provider of time-critical delivery services, is offering a validating option, TEMP-ASSURE Validated, for temperature-sensitive shipments. The company said the new service was developed to address increasing concerns about the proper handling of temperature-sensitive materials." (2/4/2004)
Nike	2000	IESI	"Nike is among the first to use the Web to deliver this service. […] Nike's new site provides consumers the opportunity to build their own Nike product (primarily shoes, but also a few other items in the baseball/softball and team categories)" (1/1/2001)
Papa John's	2002	IESI	"Online pizza from Papa John's Papa John's International Inc. said it will let customers order pizza from more than 2,500 domestic restaurants through its Web site. Papa John's is the first U.S. pizza chain to offer online ordering nationwide, the company said." (1/10/2002)
Apple	2003	IESI	"Apple Computer will on Monday start its bid to become the leading online music retailer with a fee-based service allowing songs to be downloaded for 99 cents apiece." (4/27/2003)

FIGURE 2
Distribution of Internet-Enabled Service Innovations (IESIs)

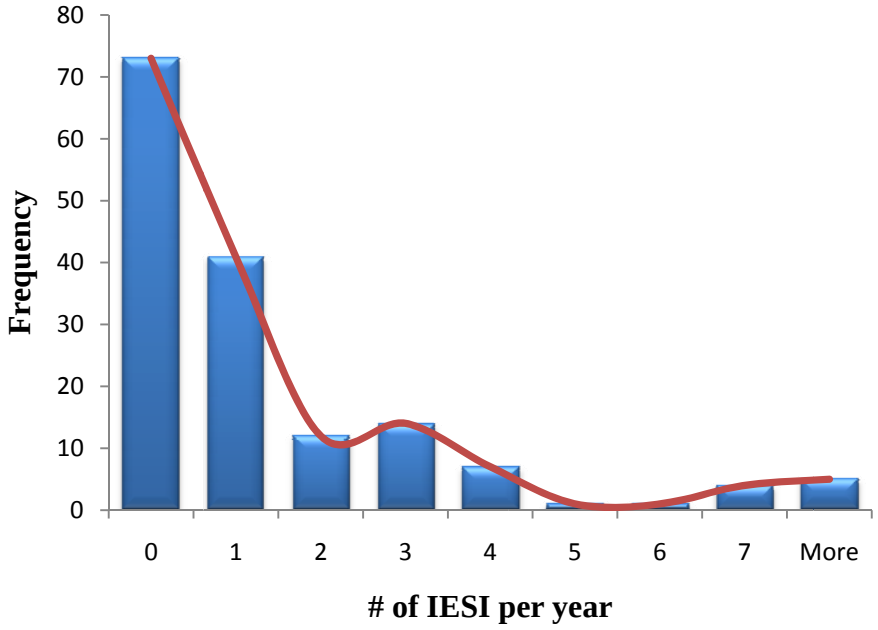
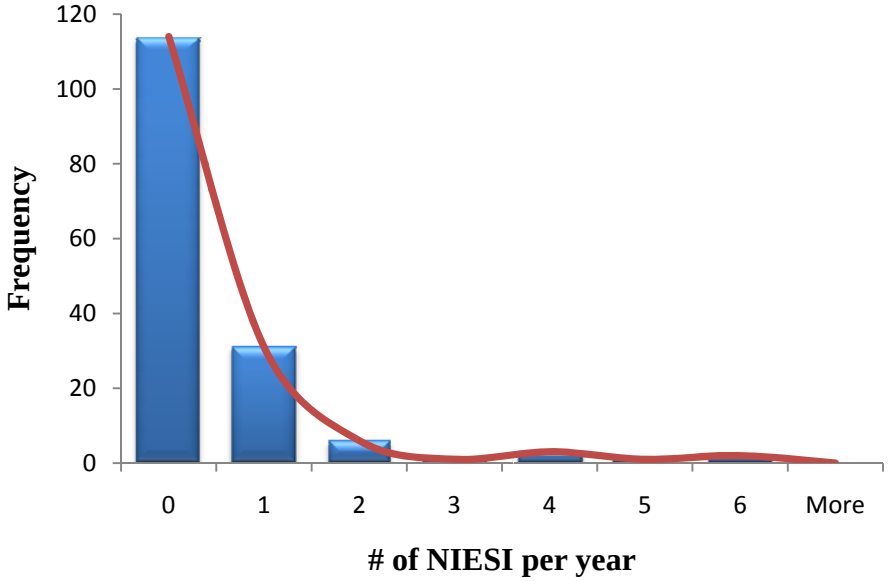


FIGURE 3
Distribution of Non-Internet-Enabled Service Innovations (NIESIs)

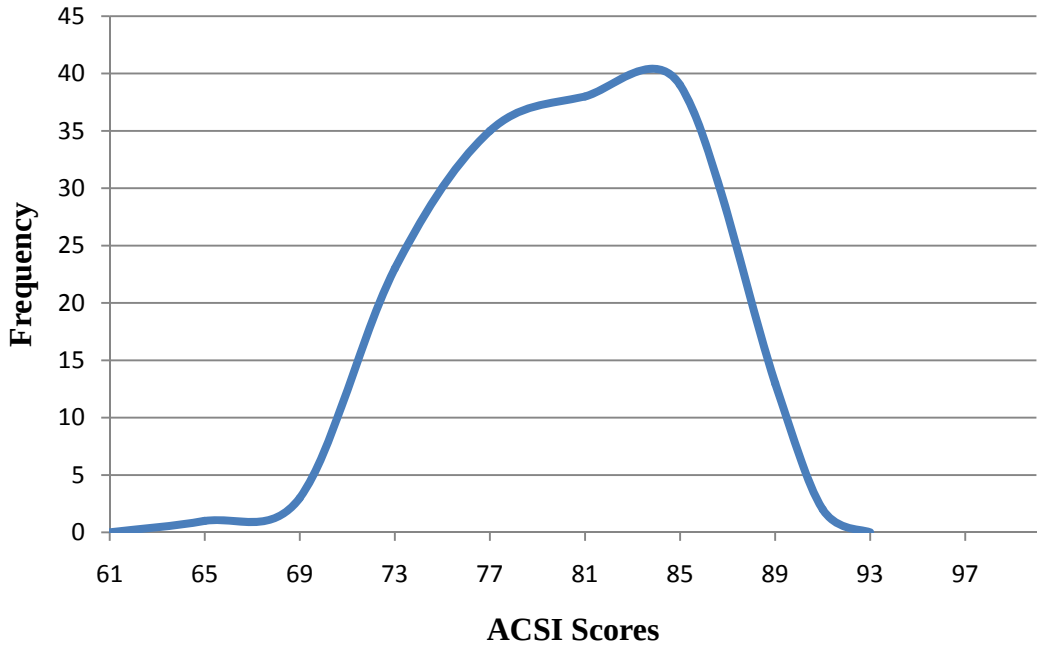


Customer Satisfaction

I use the ACSI scores as my measure of customer satisfaction. The scores are based on telephone interviews with 250 customers of each company and are reported on a 0-100 scale (Fornell et al. 1996). Using the ACSI scores as the measure of customer satisfaction has three significant advantages. First, multiple studies have used this measure (e.g., Aksoy et al. 2008; Anderson, Fornell, and Mazvancheryl 2004; Gruca and Rego 2005; Luo and Homburg 2008; Morgan and Rego 2006), permitting me to compare results across studies. Second, as Morgan and Rego (2006) point out, it provides a longitudinal cross-industry measure of customer satisfaction that is based on the same type of data since 1994. Third, the majority of companies in the database are publicly traded companies, allowing me to collect the necessary financial data from secondary sources. Furthermore, the ACSI scores measure customers' overall satisfaction with a firm and are not limited to satisfaction with specific service innovations. This is a desirable characteristic because overall satisfaction is positively related to firm value (e.g., Anderson, Fornell, and Mazvancheryl 2004; Fornell et al. 2006; Gruca and Rego 2005; Luo and Bhattacharya 2006; Mittal et al. 2005; Morgan and Rego 2006).

Figure 4 presents the smoothed distribution of ACSI scores in my sample. The distribution resembles a normal distribution, allowing me to use linear regression to model its determinants.

FIGURE 4
Distribution of Customer Satisfaction Scores



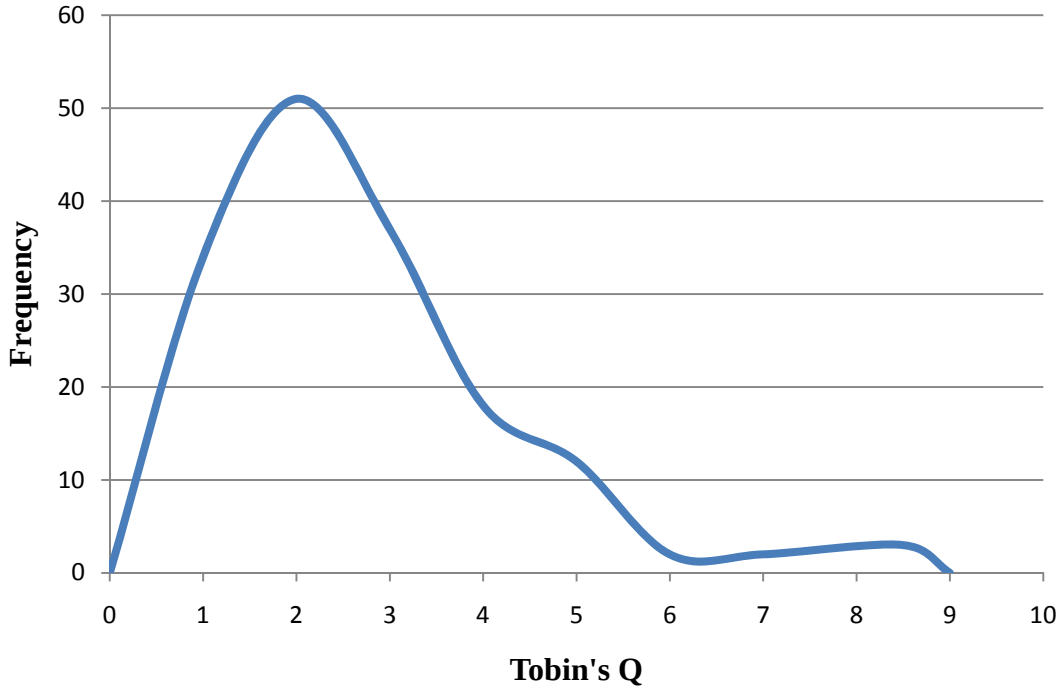
Firm Value

Consistent with prior research (e.g., Bharadwaj, Bharadwaj, and Konsynski 1999; Rao, Agarwal, and Dahlhoff 2004; Sorescu and Spanjol 2008; Srinivasan 2006), I use Tobin's Q as a measure of firm value. Tobin's Q has three significant advantages (Lee and Grewal 2004). First, it is a forward looking measure as it is derived from stock market prices. Second, it captures the long-term performance of a firm because it compares its replacement value to the market value. Third, it can be used across industries as it is not influenced by accounting conventions (Chakravarthy 1986).[2]

[2] Using the COMPUSTAT/Center for Research on Security Prices (CRSP) database, I compute Tobin's Q as *(market value of the firm's common stock shares + book value of the firm's preferred stocks + book value of the firm's long-term debt + book value of the firm's inventories + book value of the firm's current liabilities – book value of the firm's current assets)/(book value of the firm's total assets)*, consistent with prior research (e.g., Chung and Pruitt 1994).

Rather than use year-end stock price and common shares outstanding, I use the average stock price and common shares outstanding at the end of the four quarters to calculate Tobin's Q as suggested by Lee and Grewal (2004) and Luo and Bhattacharya (2006).[3] Figure 5 presents the smoothed distribution of Tobin's Q in my sample. The distribution is unimodal and although it is not shaped like a typical normal distribution, it does exhibit some symmetry around the mode to allow me to use a normal approximation for modeling purposes.

FIGURE 5
Distribution of Tobin's Q



[3] This approach is more conservative as it overcomes a volatility problem that might be present when the year-end measure of stock price and common shares outstanding approach is used. Nevertheless, the correlation between the averaged and year-end measures of Tobin's Q is high (.94) in my data.

Determinants of Service Innovations

I compute the values of the firm- and market-level determinants of service innovations, using the COMPUSTAT database. I operationalize *Effort Intensity* as the ratio of COGS to sales revenues. I compute *Resource Slack* as the ratio of working capital to total assets, and *Financial Leverage* as the ratio of long-term debt to total assets. I calculate *Market Growth* as the average 12 months growth in industry sales at the four-digit North American Industry Classification System (NAICS) code (e.g., Morgan and Rego 2006) and *Market Size* as the natural logarithm of the sum of net sales revenues.

Control Variables

I obtain data to compute *Organizational Slack*, *Fixed Asset Intensity*, *Operating Margin, Firm Size* and *Competitors' Innovation Activity* directly from COMPUSTAT. I collect data on the *New-to-the-market Service Innovations* from LexisNexis. I calculate *Market Concentration* or the Herfindahl-Hirschmann Index at the four-digit NAICS code (e.g., Luo and Homburg 2007). I operationalize competitor innovation activity through the ratio of the dollar sales increase of all the competitors due to new offerings (in the same four digit NAICS code) over market size. I collect data on *Alliances and Acquisitions* from SDC Platinum. Finally, my measure of *Systematic Risk*, CAPM beta, is from the CRSP database.

The summary statistics and correlation matrix appear in Table 4 and Table 5, respectively. The Tobin's Q and customer satisfaction scores are within reasonable range, consistent with prior studies (e.g., Anderson, Fornell, and Mazvancheryl 2004;

Lee and Grewal 2004). The number of service innovations introduced by a firm in a year varies from zero to 21, with IESIs displaying a wider range than NIESIs. The correlation matrix shows that the correlations among the independent variables are not too high, indicating that multicollinearity is not a problem in the data. I also checked the variance inflation factors (VIFs) during the estimation process and all VIFs are smaller than 10, providing further support that there is no multicollinearity issue in the data.

TABLE 4
Descriptive Statistics

	Obs.[a]	Mean	Median	Std. Dev.	Min	Max
Focal Variables						
Tobin's Q	159	2.21	1.92	1.50	.33	8.44
Customer Satisfaction	154	78.83	79.00	5.12	65.00	91.00
IESI	158	1.65	1.00	3.32	.00	21.00
NIESI	158	.51	.00	1.15	.00	6.00
Determinants of Service Innovations						
Effort Intensity	159	.62	.66	.17	.08	.88
Resource Slack	159	.13	.12	.17	-.32	.60
Financial Leverage	159	.23	.19	.21	.00	1.32
Market Size	159	11.09	11.27	1.45	6.21	13.50
Market Growth (%)	159	7.44	5.91	17.89	-33.13	115.13
Control Variables						
New to Market Service Innovations	158	.15	.00	.35	.00	1.00
Firm Size	159	9.07	9.14	1.30	5.96	12.56
Acquisitions	160	1.21	.00	1.92	.00	10.00
Alliances	160	.47	.00	1.02	.00	7.00
Systematic Risk	159	.88	.85	.52	-.19	2.22
Fixed Asset Intensity	159	.34	.29	.19	.05	.74
Organizational Slack	159	.12	.12	.08	-.25	.31
Operating Margin (%)	159	.13	.13	.09	-.15	.40
Competitor Innovation Activity	159	.13	.04	.31	-.46	.97
Market Concentration	159	.27	.21	.22	.03	1.00

[a] Observation refers to the combination of firm and year for which data are available.

TABLE 5

Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Tobin's Q	1.00																		
2. Customer Sat.	.13*	1.00																	
3. IESI	.32**	-.12	1.00																
4. NIESI	-.16**	-.23**	.01	1.00															
5. Effort Intensity	-.44**	-.31**	-.36**	.35**	1.00														
6. Resource Slack	.32**	-.22**	.26**	-.19**	-.16**	1.00													
7. Fin. Leverage	-.09	.31**	-.12	-.19**	.11	-.27**	1.00												
8. Mkt. Size	-.23**	-.38**	-.15*	.26**	.40**	-.19**	-.08	1.00											
9. Mkt. Growth	.60**	-.01	.08	.01	-.34**	.15**	-.15**	-.28**	1.00										
10. New to Mkt S.I.	.07	-.17**	.41**	.13	-.09	.03	-.13*	-.03	.14*	1.00									
11. Firm Size	-.35**	-.26**	-.25**	.33**	.47**	-.35**	.05	.64**	-.30*	.06	1.00								
12. Acquisitions	.16**	.06	.48**	-.01	-.27**	.06	.05	-.08	.03	.23**	-.10	1.00							
13. Alliances	.63**	.01	.59**	-.01	-.33**	.28**	-.01	-.22**	.42**	.23**	-.29**	.37**	1.00						
14. Systematic Risk	.28**	-.28**	.28**	.11	.10	.43**	-.21**	.06	.14**	.15*	.09	.00	.34**	1.00					
15. Fixed Asset Int.	-.27**	-.21**	-.31**	.27**	.34**	-.49**	.15**	.24**	-.08	.04	.34**	-.13*	-.31**	-.18**	1.00				
16. Org. Slack	.14**	.08	-.11	.04	-.03	-.14**	-.22**	.08	.12*	.00	.17**	-.13*	-.09	-.10	.12*	1.00			
17. Oper. Margin	.19**	.40**	.00	-.13*	-.62**	-.25**	.00	-.09	.22**	-.08	-.12*	.15**	-.02	-.37**	.06	.35**	1.00		
18. Comp. Inn. Act.	.06	-.13*	.01	.01	-.17**	-.22**	.08	.18**	.17**	.04	.06	.00	-.01	-.19**	.05	.04	.06	1.00	
19. Mkt. Conc.	-.13*	.12	-.21**	-.01	.10	-.06	.03	-.59**	.12*	-.03	-.02	-.13*	-.22**	-.10	.15**	.00	-.07	-.21**	1.00

* p<.10
**p <.05

MODEL DEVELOPMENT AND ESTIMATION

Model Development

The model is composed of a system of four equations with IESI, NIESI, customer satisfaction, and firm value as the dependent variables. In each equation, subscript *i* represents the firm and subscript *t* represents the calendar year. These equations are as follows:

$$
\begin{aligned}
IESI_{it} = {} & \alpha_0 + \alpha_1 EFFINT_{i(t-1)} + \alpha_2 RESLACK_{i(t-1)} + \alpha_3 FINLEV_{i(t-1)} + \alpha_4 LMSIZE_{i(t-1)} \\
& + \alpha_5 MGROWTH_{i(t-1)} + \alpha_6 LFSIZE_{i(t-1)} + \alpha_7 ACQUIS_{i(t-1)} + \alpha_8 ALLIANCE_{i(t-1)} \\
& + \alpha_9 RISK_{i(t-1)} + \alpha_{10} FAINT_{i(t-1)} + \alpha_{11} ORGSLACK_{i(t-1)} + \alpha_{12} COMPINA_{i(t-1)} \\
& + \alpha_{13} HHI_{i(t-1)} + \alpha_{14} CPG_i + \alpha_{15} TRETAIL_i + \alpha_{16} MISCSERVICE_i \\
& + \alpha_{17} ONLRETAIL_i + \alpha_{18} YAHOO_i + \sum_{k=1}^{4} \omega_k YEAR_k + \eta_{it}
\end{aligned} \tag{1}
$$

where IESI is the number of Internet enabled service innovations, EFFINT is the effort intensity, RESLACK is a firm's resource slack, FINLEV is the financial leverage, LMSIZE is the natural log of the market size, MGROWTH is the market growth, LFSIZE is the size of a firm, ACQUIS is the number of acquisitions, ALLIANCE is the number of alliances, RISK is the systematic risk, FAINT is the fixed asset intensity, ORGSLACK is the organizational slack, COMPINA is the competitor innovation activity, HHI is the market concentration, CPG is a dummy variable capturing whether firm i is a consumer packaged goods company, TRETAIL is a dummy variable denoting whether firm *i* is a traditional retailing company, MISCSERVICE is a dummy variable capturing other types of service firms, and ONLRETAIL is a dummy variable denoting

whether a firm is a pure online retailer. I use a separate dummy variable YAHOO for Yahoo!, Inc. because a significantly high number of service innovations were introduced by Yahoo!, Inc. between 2000 and 2004. Computer and electronics firms represent the base industry. YEARs are dummy variables that denote calendar years in the sample, with 2001 as the base year. "η" is an error term. The industry and year dummy variables allow me to control for heterogeneity, using the fixed effects approach, consistent with prior research (e.g., Shane, Shankar, and Aravindakshan 2006).

$$
\begin{aligned}
NIESI_{it} = {} & \beta_0 + \beta_1 EFFINT_{i(t-1)} + \beta_2 RESLACK_{i(t-1)} + \beta_3 FINLEV_{i(t-1)} + \beta_4 LMSIZE_{i(t-1)} \\
& + \beta_5 MGROWTH_{i(t-1)} + \beta_6 LFSIZE_{i(t-1)} + \beta_7 ACQUIS_{i(t-1)} + \beta_8 ALLIANCE_{i(t-1)} \\
& + \beta_9 RISK_{i(t-1)} + \beta_{10} FAINT_{i(t-1)} + \beta_{11} ORGSLACK_{i(t-1)} + \beta_{12} COMPINA_{i(t-1)} \\
& + \beta_{13} HHI_{i(t-1)} + \beta_{14} CPG_i + \beta_{15} TRETAIL_i + \beta_{16} MISCSERVICE_i \\
& + \beta_{17} ONLRETAIL_i + \beta_{18} YAHOO_i + \sum_{k=1}^{4} \vartheta_k YEAR_k + \varepsilon_{it}
\end{aligned} \tag{2}
$$

where NIESI is the number of Non-Internet enabled service innovations, ε is an error term, and the other terms are as defined earlier.

$$
\begin{aligned}
ACSI_{it} = {} & \gamma_0 + \gamma_1 IESI_{i(t-1)} + \gamma_2 NIESI_{i(t-1)} + \gamma_3 NTMSI_{i(t-1)} + \gamma_4 LFSIZE_{i(t-1)} \\
& + \gamma_5 ACQUIS_{i(t-1)} + \gamma_6 ALLIANCE_{i(t-1)} + \gamma_7 OPMARGIN_{i(t-1)} + \gamma_8 RISK_{i(t-1)} \\
& + \gamma_9 FINLEV_{i(t-1)} + \gamma_{10} COMPINA_{i(t-1)} + \gamma_{11} HHI_{i(t-1)} + \gamma_{12} CPG_i \\
& + \gamma_{13} TRETAIL_i + \gamma_{14} MISCSERVICE_i + \gamma_{15} ONLRETAIL_i + \gamma_{16} YAHOO_i \\
& + \sum_{k=1}^{4} \theta_k YEAR_k + \mu_{it}
\end{aligned} \tag{3}
$$

where ACSI is customer satisfaction, NTMSI is the number of service innovations that were new to the market, OPMARGIN is operating margin, μ is an error term, and the remaining terms are as defined earlier.

$$
\begin{aligned}
TOBINQ_{it} = {} & \delta_0 + \delta_1 ACSI_{it} + \delta_2 IESI_{i(t-1)} + \delta_3 NIESI_{i(t-1)} + \delta_4 NTMSI_{i(t-1)} \\
& + \delta_5 LFSIZE_{it} + \delta_6 ACQUIS_{it} + \delta_7 ALLIANCE_{it} + \delta_8 OPMARGIN_{it} \\
& + \delta_9 RISK_{i(t-1)} + \delta_{10} MGROWTH_{i(t-1)} + \delta_{11} COMPINA_{i(t-1)} + \delta_{12} HHI_{i(t-1)} \\
& + \delta_{13} LMSIZE_{i(t-1)} + \delta_{14} CPG_i + \delta_{15} TRETAIL_i + \delta_{16} MISCSERVICE_i \\
& + \delta_{17} ONLRETAIL_i + \delta_{18} YAHOO_i + \sum_{k=1}^{4} \lambda_k YEAR_k + \nu_{it}
\end{aligned} \tag{4}
$$

where TOBINQ is the firm value and v is an error term. All other terms are as defined earlier.

Following prior research (e.g., Anderson, Fornell, and Mazvancheryl 2004; Luo and Bhattacharya 2006; Morgan and Rego 2006; Rao, Agarwal, and Dahlhoff 2004; Sorescu and Spanjol 2008), I lag many independent variables in all four equations by one time period to control for endogeneity. Using lagged variables not only helps eliminate the potential of reverse causality but also overcomes any potential correlation of the independent variables with the error term. Furthermore, I use lagged IESIs and NIESIs in Equations 3 and 4 to ensure that I include only service innovations introduced before customer satisfaction and firm value measures are realized.

Model Estimation

The four equations form a recursive system. Furthermore, an analysis of the cross-correlations of error terms indicates that the errors across the service innovation,

customer satisfaction, and firm value equations are not significantly correlated with one another ($p > .10$). A recursive system of equations with uncorrelated error terms allows me to estimate each equation independently (Greene 2003). Even so, I use a more conservative estimation approach and estimate all four equations by using a seemingly unrelated regression (SUR) estimation approach (Zellner 1962).

Determinants of service innovations (Equations 1 and 2)

The outcome variables in Equations 1 and 2 are count variables. Furthermore, a large number of firms in the data did not introduce a service innovation during a given year, leading to a high proportion of zeros in the dependent variable. I account for these excess zeros by using a zero-inflated Poisson (ZIP) regression (Lambert 1992). I subsequently test my ZIP regression model against a standard Poisson regression using a Vuong test (Vuong 1989). I also test the ZIP regression against a zero inflated negative binomial (ZINB) regression (Long and Freese 2003), which would be a more appropriate model if the data are still over-dispersed after accounting for the excess zeros. I find that there is no over-dispersion after accounting for excess zeros, confirming that the ZIP regression is appropriate. Furthermore, I include year dummies and industry dummies to control for unobserved heterogeneity through fixed effects.

Interrelationship between service innovations, customer satisfaction, and firm value (Equations 3 and 4)

Because the dependent variables in Equations 3 and 4 are not count variables, I am able to estimate Equations 3 and 4 using linear regression. Similar to Equations 1 and 2, I account for unobserved heterogeneity through fixed time and industry effects. I use a Hausman (1978) test to compare a random effects model with the fixed effects model for both the equations. Because the test rejected a random effects model ($p > .10$), I use the fixed effects approach for these equations (e.g., Wooldridge 2002).

RESULTS AND DISCUSSION

Determinants of Service Innovations

The results of Equations 1 and 2 are presented in Table 6. Effort intensity ($p < .01$), resource slack ($p < .05$), and financial leverage ($p < .01$) are significant determinants of the number of IESIs introduced in the expected directions. These findings show that liquid financial resources are important firm-level determinants of IESIs.

TABLE 6
SUR Estimation Results of IESI and NIESI Equations

Parameter/Independent Variables	$IESI_{it}$ Coefficient (SE[a])	$NIESI_{it}$ Coefficient (SE)
Focal Variables		
Intercept	-5.05 (2.13)**	-2.32 (3.32)
Effort Intensity $_{i(t-1)}$	3.86 (.78)***	3.19 (3.33)
Resource Slack $_{i(t-1)}$	1.38 (.62)**	-3.94 (1.25)***
Financial Leverage $_{i(t-1)}$	-1.88 (.50)***	-5.65 (1.33)***
Market Size $_{i(t-1)}$	.02 (.15)	.36 (.31)
Market Growth $_{i(t-1)}$	.01 (.00)**	.01 (.01)
Control Variables		
Firm Size $_{i(t-1)}$	.25 (.11)**	-.43 (.23)*
Acquisitions $_{i(t-1)}$	-.01 (.02)	.06 (.06)
Alliances $_{i(t-1)}$	-.14 (.04)***	-.13 (.18)
Systematic Risk $_{i(t-1)}$	.04 (.20)	-.14 (.39)
Fixed Asset Intensity $_{i(t-1)}$	2.73 (1.12)**	-2.97 (2.14)
Organizational Slack $_{i(t-1)}$	-.04 (1.05)	-.02 (2.47)
Competitor Innovation Activity $_{i(t-1)}$	-.79 (.53)	1.07 (.62)*
Market Concentration $_{i(t-1)}$	-3.27 (1.06)***	3.40 (2.32)
Fixed Effects/Dummy Variables[b]		
Consumer Package Goods	-.56 (.37)	-.67 (1.12)
Traditional Retailing	-.30 (.55)	1.55 (.60)***
Miscellaneous Services	-.83 (.49)*	2.70 (.89)***
Online Retailing	3.39 (.68)***	-35.19 (1.65)***
Yahoo	5.48 (.72)***	-38.90 (2.72)***
Year Dummies	1 out of 4 significant*	1 out of 4 significant*
Model Fit Statistics[c]	Log-likelihood = -164.40 $X^2 = 300.43$; $p < .01$.	Log-likelihood = - 87.36 $X^2 = 78.82$; $p < .01$.

*$p < .10$.
** $p < .05$.
*** $p < .01$.
Notes:
[a] SE = Standard Error
[b] Base level for industry dummies is computer and electronics firms; for year dummies, it is 2001.
[c] Model fit statistics are based on independent estimation.

My expectation that financial resources of a firm are significant determinants for IESIs relative to NIESIs is only partially true. While effort intensity has a significant effect on IESIs ($p < .01$) and an insignificant effect on NIESIs ($p > .10$), the difference between its coefficients for IESIs and NIESIs is statistically not significant ($p > .10$). Financial leverage is a significant determinant ($p < .01$) for both IESIs and NIESIs in the same direction, although its effect is greater for NIESIs than it is for IESIs ($p < .01$). One possible explanation for this unexpected observation is that firms with a high level of long-term debt relative to total assets may not be able to introduce NIESIs because they are typically less scalable than IESIs are. Firms might interpret this lack of scalability as too big a challenge to pay back the increased debt in a reasonable period of time. Interestingly, while resource slack has a positive effect on IESIs ($p < .05$), it has a negative effect on NIESI ($p < .01$) and the difference between the coefficients is significant ($p < .01$). While the positive relationship between resource slack and IESIs is consistent with my expectation, the negative effect of resource slack on NIESIs is surprising and needs further exploration by future research.

While market size is not a significant determinant of the number of IESIs and NIESIs ($p > .10$), market growth is a significant positive determinant of IESIs ($p < .01$). This finding supports my expectation that IESIs are particularly attractive for growth markets because they allow a firm to leverage the scalability benefits of IESIs. The effects of the control variables are generally in the expected directions.

The Effect of Service Innovations on Customer Satisfaction

I present the estimation results for Equation 3 in Table 7. Surprisingly, the number of service innovations introduced by a firm does not have a significant effect on customer satisfaction ($p > .10$). This unexpected result has several plausible explanations. First, firms might introduce service innovations that do not offer adequately new benefits to exceed customer expectations. Second, many service innovations do not replace existing services but simply extend existing services or goods. In such situations, customers can continue to benefit without having to use the new service or change their behavior. In such cases, the new service will not change customer satisfaction. Third, as discussed earlier, the ACSI scores measure the overall satisfaction with a firm. It is possible that customers are satisfied with a specific service innovation, but this satisfaction does not significantly influence the overall satisfaction with a firm. Finally, it may take more than a year for some service innovations to have an effect on customer satisfaction.[4]

[4]I tested this possible explanation and estimated Equation 3 with both two- and three-year lagged effects of service innovations. However, the results from this analysis are consistent with the proposed model results (that is, service innovation's effect on customer satisfaction is still non-significant), so I rule out this possible explanation.

TABLE 7
SUR Estimation Results of Customer Satisfaction Equation

Parameter/ Independent Variables	Coefficient (SE[a])
Focal Variables	
Intercept	78.71 (3.61)***
IESI $_{i(t-1)}$	-.25 (.20)
NIESI $_{i(t-1)}$	.56 (.41)
Control Variables	
New to Market Service Innovations $_{i(t-1)}$	.57 (1.06)
Firm Size $_{i(t-1)}$	-.34 (.39)
Acquisitions $_{i(t-1)}$	-.20 (.20)
Alliances $_{i(t-1)}$	.12 (.33)
Operating Margin $_{i(t-1)}$	16.77 (4.24)***
Systematic Risk $_{i(t-1)}$	.09 (.76)
Financial Leverage $_{i(t-1)}$	8.64 (1.49)***
Competitor Innovation Activity $_{i(t-1)}$	-1.43 (.79)*
Market Concentration $_{i(t-1)}$	2.71 (1.49)*
Fixed Effects/Dummy Variables[b]	
Consumer Package Goods	-.73 (1.33)
Traditional Retailing	-4.35 (1.02)***
Miscellaneous Services	-5.17 (2.36)**
Online Retailing	1.04 (1.82)
Yahoo	1.05 (3.76)
Year Dummies	0 out of 4 significant*
Adjusted R-Square[c]	.49

*$p < .10$.
** $p < .05$.
*** $p < .01$.
Notes:
[a] SE = Standard Error
[b] Base level for industry dummies is computer and electronics firms; for year dummies, it is 2001.
[c] Adjusted R-Square is based on independent estimation.

The Effects of Service Innovations and Customer Satisfaction on Firm Value

Table 8 presents the estimation results of Equation 4. Customer satisfaction has a strong positive effect on firm value ($p < .05$), consistent with previous studies (e.g.,

Anderson, Fornell, and Mazvancheryl 2004; Fornell et al. 2006; Luo and Bhattacharya 2006). My expectations about the relationship between service innovations and firm value are partially confirmed. While IESIs have a positive effect on firm value ($p < .05$), NIESIs do not have a significant influence on firm value ($p > .10$). This asymmetric effect may be due to differences in the characteristics of IESIs and NIESIs and in how they are perceived by the market. IESIs tend to be more scalable, more separable, and less heterogeneous than NIESIs. The scalability and separability advantages allow IESIs to diffuse faster than NIESIs, which are often produced and consumed simultaneously in decentralized locations. In addition, IESIs are technology based, typically involving high set-up costs. The high set-up costs combined with potentially patent-protected technology can create efficient barriers for competitors to imitate the service innovation. As a result, the market might view an IESI as increasing the firm's competitive advantage significantly more than an NIESI. Because Tobin's Q is a forward looking measure that incorporates the future potential of a firm and creation of competitive advantage increases the firm's future potential, IESIs have a significantly stronger effect on Tobin's Q than NIESIs.

TABLE 8
SUR Estimation Results of Firm Value Equation

Parameter/ Independent Variables	Coefficient (SE[a])
Focal Variables	
Intercept	-5.84 (2.53)**
ACSI $_{it}$	.05 (.02)**
IESI $_{i(t-1)}$	.11 (.05)**
NIESI $_{i(t-1)}$	-.04 (.08)
Control Variables	
New to Market Service Innovations $_{i(t-1)}$	.22 (.25)
Firm Size $_{it}$	.30 (.11)***
Acquisitions $_{it}$	-.08 (.03)**
Alliances $_{it}$	-.18 (.10)*
Operating Margin $_{it}$	7.30 (1.96)***
Systematic Risk $_{i(t-1)}$	-.04 (.20)
Market Growth $_{i(t-1)}$	.01 (.01)**
Competitor Innovation Activity $_{i(t-1)}$	-.95 (.24)***
Market Concentration $_{i(t-1)}$	-.26 (.60)
Market Size $_{i(t-1)}$	.09 (.13)
Fixed Effects/Dummy Variables[b]	
Consumer Package Goods	-.34 (.47)
Traditional Retailing	-.03 (.34)
Miscellaneous Services	-.96 (.55)*
Online Retailing	2.87 (.76)***
Yahoo	.53 (1.06)
Year Dummies	3 out of 4 significant*
Adjusted R-Square[c]	.55

*p < .10.
** p < .05.
*** p < .01.
Notes:
[a] SE = Standard Error
[b] Base level for industry dummies is computer and electronics firms; for year dummies, it is 2001.
[c] Adjusted R-Square is based on independent estimation.

Robustness Checks

I performed several additional analyses to ensure that my results are robust. First, I estimated my models with firm-level dummy variables in lieu of industry dummy

variables to check if the industry variables more parsimoniously captured firm-specific effects. The results for the focal and control variables were consistent with those from my proposed model. Second, to test for potential endogeneity of customer satisfaction, I estimated Equation 4 by replacing the actual customer satisfaction score by the residual from Equation 3 (Gourieroux, Monfort, and Trognon 1987). The results were directionally consistent with those of the proposed model. Third, to test the robustness of my model for over-dispersion, I estimated both Equations (1) and (2) by zero-inflated negative binomial (ZINB) regression and found the results to be consistent with those from the ZIP model. Fourth, I estimated my system of equations using a random effects panel model in addition to including industry dummies in the model. The results were not substantively different, suggesting that there is no unobserved heterogeneity that my proposed fixed effects model fails to capture. Fifth, I included lagged customer satisfaction as a proxy for pricing and management quality in Equation 3. The findings were substantively similar, suggesting that the proposed model captures unobserved heterogeneity well.[5] Finally, to control for macroeconomic trends that might drive innovation activities and firm performance, I explored the inclusion of change in GDP as an additional covariate. However, because the value of this variable is fixed across industries for each year, it is linearly dependent with yearly dummies, precluding its inclusion in the final model.

[5] I did not include the lagged customer satisfaction in Equation 4 due to its high correlation (.88) with customer satisfaction.

Table 9 provides a summary of my key findings. Among the focal variables, effort intensity, resource slack, and market growth have a positive effect on IESIs. Neither IESIs nor NIESIs have a significant effect on customer satisfaction, suggesting customer satisfaction may not partially mediate the effects of service innovations on firm value. Both customer satisfaction and IESIs have significant direct effects on firm value. The remaining effects of focal variables are not significant.

TABLE 9
Summary of Key Findings

Variables	IESIs	NIESIs	Customer Satisfaction	Firm Value
Customer Satisfaction				+
IESI			N.S.	+
NIESI			N.S.	N.S.
Effort Intensity	+	N.S.		
Resource Slack	+	–		
Financial Leverage	–	–		
Market Growth	+	N.S.		
Market Size	N.S.	N.S.		

MANAGERIAL IMPLICATIONS

My research sheds light on the highly relevant, yet understudied area of service innovation and my findings provide useful managerial guidelines. First, IESIs and NIESIs have different determinants. In particular, IESIs are significantly related to liquid financial resources and market growth. Managers need to ask themselves if they have the financial muscle to successfully introduce IESIs and if the market is growing fast enough to leverage potential economies of scale associated with IESIs.

Second, the finding that service innovations have an insignificant effect on customer satisfaction suggests that managers need to reconsider the idea that customer satisfaction is the main measure of innovation success. Firms commonly use customer satisfaction as the predominant measure of the performance of innovations (Boston Consulting Group 2007). Furthermore, firms that reward their executives based on customer satisfaction measures following the introduction of service innovations should consider incentives tied to firm value rather than to customer satisfaction.

Third, although service innovations do not have a significant effect on customer satisfaction, managers should continue to focus on increasing customer satisfaction as it has a positive and significant effect on firm value, even after controlling for the direct effect of innovation on firm value. Improvements in customer satisfaction can be achieved by improving the quality of the existing product (good and service), employee training, internal marketing, customer support, and customer relationship management, among other initiatives.

Fourth, although neither type of innovation has a significant direct effect on customer satisfaction, if financial resources permit, managers may want to focus more on IESIs than NIESIs because IESIs have a significant and positive direct effect on firm value.

LIMITATIONS, FUTURE RESEARCH, AND CONCLUSIONS

Several limitations of this study provide opportunities for future research. First, although my method of combining multiple secondary data sources avoids common

method bias and my models control for heterogeneity, they also limit me to the variables for which I can obtain data across all companies. I did not have data on whether a service innovation was discontinued or unsuccessful and on the quality of service innovations. If such data are available, future research could examine the trade-off between many average quality service innovations and fewer high quality innovations. Second, while Internet-enablement (IESI vs. NIESI) is a useful and important dimension of service innovations, there are other dimensions of service innovations worth exploring. These dimensions include market-creating versus nonmarket-creating service innovations (Berry et al. 2006) and revenue creating versus customer supporting. Third, with suitable data, it would be worthwhile to explore the success drivers of IESIs and NIESIs. Fourth, it would be useful to extend this investigation to customer solutions, which is fast becoming an important subject of managerial importance and research (Tuli, Kohli, and Bharadwaj 2007).

To my knowledge, my study is the first to examine the determinants of service innovations and the interrelationships among service innovations, customer satisfaction, and firm value in the same framework. I addressed the following research questions. (1) What are the determinants of service innovations? (2) What are the effects of service innovations on customer satisfaction and firm value and how are the three constructs related to each other? (3) What are the differences between IESIs and NIESIs in these relationships, if any?

My results show that financial resources and market growth are particularly important determinants of IESIs, while market size is not. Surprisingly, neither IESIs nor

NIESIs have a significant direct effect on customer satisfaction, and only IESIs have a positive effect on firm value. However, both customer satisfaction and IESIs are positively associated with firm value. Given adequate financial resources and growing markets, managers should consider the potential of IESIs for their firms.

CHAPTER III

DETERMINANTS AND OUTCOMES OF B2B SERVICE INNOVATIONS

Given the differences between consumer markets and business markets, it is important to better understand the determinants and outcomes of business-to-business service innovations (B2B-SIs). In this essay, I empirically address this issue by studying both the determinants and outcomes of B2B-SIs. I develop a modeling system that relates service innovation to firm value. I estimate my model on unique panel data of service innovations assembled from multiple data sources across multiple industries. Results indicate that B2B-SIs have positive effects on firm value. My findings offer executives important insights about the value and the determinants of B2B-SIs for their companies.[6]

INTRODUCTION

Business markets account for the majority of commerce in the United States (Perreault and McCarthy 2004). While many firms in business markets are traditionally manufacturing firms, there has been a trend over the past decades for these firms to provide total customer solutions by adding services to their existing offerings of goods

[6] Explanatory note: This essay is primarily driven by its contribution to both marketing theory and practice. Service innovation in business markets is an important area that is underresearched. Even though I am using a similar research approach as well as the majority of the variables introduced in the previous essay, I decided to write up this essay as a "stand alone" research study without referring to definitions or operationalizations from the previous essay. While this may cause some repetitiveness for readers who are interested in the entire dissertation, it will give readers with a special interest in business markets the opportunity to focus solely on this chapter of my dissertation.

(e.g., Lusch, Vargo, and O'Brien 2007; Sawhney, Balasubramanian, and Krishnan 2004). In its latest trend study, *The Institute for the Study of Business Markets* (ISBM) at Penn State University identified the development of "products, services and business models that counter commoditization" (ISBM 2008) as one of the major trends in business markets. This development is not surprising considering the importance of services in today's global economies. The World Bank (2008) reports that the service sector is the largest sector in most developed and developing countries. As a result, managers of both goods- and service-dominant firms are trying to compete by introducing service innovations (e.g., Bitner, Ostrom, and Morgan 2008). Take for example Xerox, a company primarily known for manufacturing office equipment such as printers and copy machines. In 2002, the company added a new service called *eSupport Centre* to its product line. The service allowed Xerox customers to manage their accounts, access contracts, and submit equipment meter-reads online. By providing this new service, Xerox provided additional value to customers and created more separation from competitors.

Service innovation is the *exploitation of an idea for a service that is new to the firm and intended to provide its customers new benefits* (adapted from Berry et al. 2006). Previous research has found that companies in business markets are often facing a saturation of their core goods markets (Sawhney, Balasubramanian, and Krishnan 2004). This makes it difficult for them to grow. Adding services to their goods portfolio will give them the opportunity to enter new, untouched markets and trigger organic growth of the company. Service innovations in business markets are crucial for a company to

create organic growth and a sustainable competitive advantage. Given the importance of service innovations in business markets and given the importance of business markets in today's economy, we need a deeper understanding of the determinants and outcomes of B2B-SIs.

In this essay, I seek to address this important issue and examine both firm- and market-level factors that determine the number of B2B-SIs introduced by a firm. I also study the effect these innovations have on firm value. Although service innovations are important for both business markets and consumer markets, I focus solely on B2B-SIs due to fundamental differences between business markets and consumer markets. Based on these differences, the challenges that come with the typical characteristics of people intensive service are likely to apply for business-to-business (B2B) services to a different degree than for business-to-consumer (B2C) services. As a result, the conclusions I draw in this essay may not apply to the same degree for B2C-SIs. For example, characteristics for labor intensive services include: (1) inseparability due to simultaneous production and consumption of the service (Bendapudi and Leone 2003); (2) heterogeneity due to higher labor intensity in the production and consumption process (Zeithaml, Bitner, and Gremler 2009); and as a result (3) low scalability due to often decentralized production. While these characteristics can pose significant challenges for both business and consumer markets, they are likely to affect business markets to a different degree. For instance, relative to consumer markets, business markets are frequently characterized by a lower number of customers that are often geographically concentrated (e.g., Morris, Pitt, and Honeycutt 2001). Furthermore,

Lilien and Rangaswamy (2006) point out that scale based cost reduction is not as important in business markets as in consumer markets. Therefore, one can argue that challenges such as inseparability (decentralized production) or low scalability are significantly smaller for B2B services than B2C services.

Given the importance of innovation to business success, managers need to learn more about the determinants and outcomes of B2B-SIs. Indeed, ISBM (2008) points out that "as firms continue to seriously 'mix' service offerings […] with hard product offerings, the issue of computing the value, demonstrating value, and documenting value is becoming ever more important." Extant literature has not addressed this issue and we need a better understanding of both determinants and outcomes of the number of B2B-SIs introduced by a firm.

In this essay, I seek to address the following two research questions. First, what are the determinants of B2B-SIs? Second, what is the effect of B2B-SI on firm value? I do this by using a modeling system that relates service innovation to firm value. I estimate my model on unique panel data of 230 B2B-SIs that were introduced by 46 companies across different industries during a five year time period. The research helps managers identify and potentially manipulate the factors that drive B2B-SIs. Furthermore, it offers managers a better understanding of the returns of B2B-SIs. From a theoretical viewpoint, the research answers the question of what factors drive B2B-SIs and why and the question of how B2B-SIs affect firm value and why.

The remainder of the chapter is organized as follows. In the next section, I develop a conceptual framework based on literature from marketing, management, and

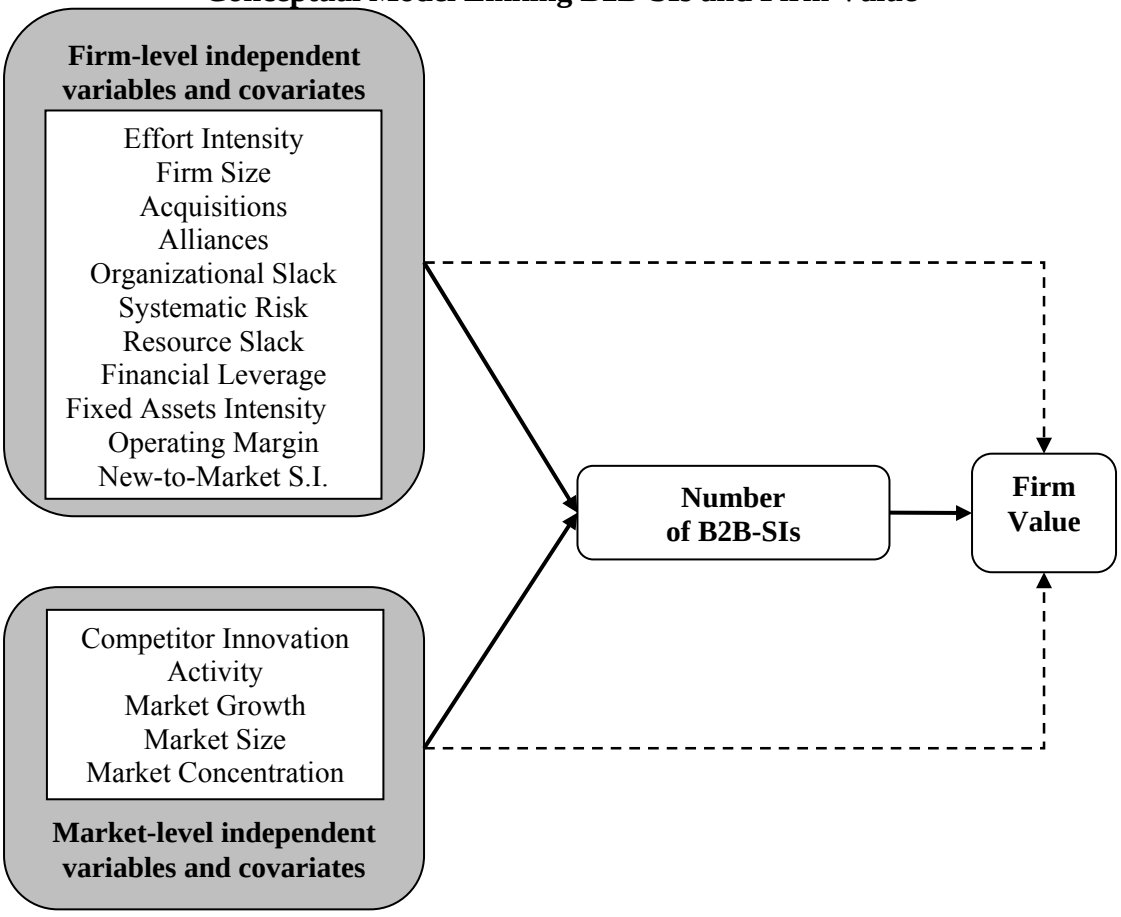
industrial organization. In the third section, I discuss the data and the operationalization of variables. The fourth section discusses the model formulation and estimation. The fifth section presents and discusses the results, followed by a presentation of the managerial implications. I conclude by summarizing the results and discussing both limitations and ideas for future research.

CONCEPTUAL DEVELOPMENT

The conceptual model is presented in Figure 6. It is based on the resource-based view (RBV) of the firm (Barney 1991; Wernerfelt 1984) and the role of industry or product markets in creating competitive advantage (Rumelt 1991).

I argue that firms seek to develop and effectively utilize firm-specific, difficult to imitate resources such as B2B-SIs. These B2B-SIs will then have a positive effect on overall firm value. The degree to which they are able to develop B2B-SIs depends on both firm-level factors (Wernerfelt 1984) and market-level factors (Rumelt 1991). Furthermore, the firm-level and market-level factors are by themselves valuable resources that will have a direct effect on firm value. In the figure, I use continuous lines for relationships involving focal variables and dashed lines for relationships involving control variables.

FIGURE 6
Conceptual Model Linking B2B-SIs and Firm Value



Notes: Continuous lines indicate focal relationships while dashed lines represent relationships involving control variables. Each firm-level variable will affect the number of B2B-SIs, the firm value or both.

Determinants of B2B-SIs

Existing literature on innovation focuses heavily on the innovation of goods (e.g., Hauser, Tellis, and Griffin 2006; Shankar 2008). Despite the importance of new services in today's economy, little is known about the determinants of service innovation. This is particularly true for the determinants of B2B-SIs that have not been studied in previous research. Therefore, I used the goods innovation literature to identify both firm- and market-level factors that determine the number of B2B-SIs introduced by a firm. I argue

that the determinants for both goods and service innovations are similar even though the importance of each determinant varies significantly between the two types of innovation. The following section focuses on the firm-level factors that determine the number of B2B-SIs introduced by a firm. Although there is an extensive list of firm-level factors in my models, my discussion in the next section will focus on the most relevant determinants (focal variables) for this study. I will then proceed to the market-level determinants. In previous research, the majority of these factors have been shown to affect the number of innovations a firm introduces. The section concludes by introducing the various non-focal and control variables.

Most relevant firm-level factors

Effort intensity

Effort intensity is defined as the ratio of cost of goods sold (COGS) to sales revenues. COGS represents the direct costs associated with the production of a product. For labor-intensive services, the direct costs are often primarily labor costs. Therefore, effort intensity represents a firm's willingness to spend money on the production of products relative to its sales revenue. Since the introduction of B2B-SIs is likely to be associated with high expenditures, I argue that a higher degree of effort intensity will result in a larger number of B2B-SIs a firm introduces.

Firm size

Pauwels and colleagues (2004) show that larger firms introduce more innovations. I posit that this is also true for B2B-SIs. Following previous research, firm size is operationalized as the natural logarithm of the firm's sales revenue (e.g., David,

Hitt, and Gimeno 2001; Mithas, Krishnan, and Fornell 2005). Furthermore, previous research also shows that firm size has a direct effect on firm value (e.g., Mithas, Krishnan, and Fornell 2005; Sorescu and Spanjol 2008). Therefore, when examining the effect of B2B-SIs on firm value, I control for the size of the firm.

Acquisition

Sorescu and Spanjol (2008) point out that acquisitions can either increase or decrease the innovative output of a firm. They state that while firms often gain new product lines through acquisitions (which would result in an increase of innovative output), acquisitions can also reduce the amount of resources available for innovation (which would result in a decrease of innovative output). Therefore, I do not make any a priori propositions about the effect of acquisitions on B2B-SIs and approach this question empirically. Furthermore, I will also control for the number of acquisitions when studying the effect of B2B-SIs on firm value.

Alliance

Previous research has shown that alliances can have a significant effect on innovation output (e.g., Srinivasan, Haunschild, and Grewal 2007), which is likely to hold for B2B-SIs as well. Similar to acquisitions, however, the effect of alliances can be in both directions and this question will be approached empirically. Furthermore, because alliances have an effect on firm value (e.g., Kalaignanam, Shankar, and Varadarajan 2007), I also control for this variable in my analysis of the outcome of B2B-SIs.

Organizational slack

Following previous research, organizational slack is defined as the ratio of net cash flow from operating activities to total firm assets (Davis and Stout 1992). The greater organizational slack, the more resources firms have available to introduce B2B-SIs. Consequently, organizational slack is expected to have a positive effect on the number of B2B-SIs a firm introduces.

Market-level factors

Competitor innovation activity

Competitor innovation activity is defined as the ratio of 12 months cumulative competitors' sales increase (in US$) to market size, which captures the competitors' active increase in sales through the introduction of innovations. Shankar (1999) finds that a firm's innovation activity is influenced by its competitors' innovation activities. This relationship is expected to hold for B2B-SIs. Furthermore, I control for these effects in my analysis of firm value.

Market growth

Market growth is defined as the 12 months percentage growth in industry sales. Previous research has shown that markets with high growth also tend to have higher investments to keep pace with growth (Szymanski, Bharadwaj, and Varadarajan 1993). While market growth is expected to be an important determinant of the number of B2B-SIs a firm introduces, I posit that the effect of market growth on B2B-SIs is significantly smaller than the effect of the firm-level determinants previously introduced. As stated before, business markets are characterized by a low number of customers (Morris, Pitt,

and Honeycutt 2001). Therefore, a growing market is likely to be less important when a company decides to introduce B2B-SIs. I also control for the effect of market growth while studying the effect of B2B-SIs on firm value.

Market size

Market size is defined as the natural logarithm of industry sales. Katila and Shane (2005) posit that firms need to believe that a market is large enough to justify the investment that comes with introducing new services. Similar to the market growth variable, I expect market size to be a significant determinant of the number of B2B-SIs a firm introduces, but significantly less important than the firm level factors. Having a large market is especially important for innovations that rely on economies of scales. However, scale based causes of cost reduction are not as important for business markets compared to consumer markets due to the lower number of customers (Lilien and Rangaswamy 2006). Consequently, the size of the market will not be as relevant when managers make decisions to introduce B2B-SIs. I also control for market size while studying the effects of B2B-SIs on firm value.

Market concentration

Following previous research, market concentration is measured as the Herfindahl-Hirschmann Index at the four-digit North American Industry Classification System (NAICS) code (e.g., Luo and Homburg 2007; Rao, Agarwal, and Dahlhoff 2004). I expect the competitive structure of a market to be a significant determinant of the number of B2B-SIs a firm decides to introduce. In highly concentrated markets, firms are expected to introduce fewer B2B-SIs because they do not necessarily have to

take the risk that comes with the additional investment in service innovation. I also control for market concentration when studying the effect of B2B-SIs on firm value.

In summary, both firm-level and market-level factors are expected to be significant determinants of the number of B2B-SIs introduced by a firm. However, I posit that firm-level factors as well as the market-level factors that focus on competition (i.e., market concentration and competitor innovation activity) are significantly more important determinants than market size and market growth. This argument is based on the characteristics of business markets discussed before. Firms that compete in business markets often have fewer customers. Furthermore, the relationship these firms have with their customers is often formal and certified by a contract (Morris, Pitt, and Honeycutt 2001). Consequently, it is crucial for a firm to acquire a customer first because once the relationship has been established, business customers are less likely to switch than customers in consumer markets. However, in order to acquire a customer, firms will not only have to provide greater value than the competitors, but they will also need the resources to communicate the value offering through personal selling. As a result, the competitive situation as well as the financial resources of a firm are likely to be important determinants of the number of B2B-SIs a firm decides to introduce. On the other hand, since research has shown that economies of scale are less prevalent in business markets (e.g., Lilien and Rangaswamy 2006), the size and the growth of a market are likely to be less important determinants of the number of B2B-SIs introduced by a firm.

Effects of B2B-SIs on Firm Value

Previous research that studied the financial return of innovation provides contradicting results. While early studies did not find any relationship between stock price and new product announcement (e.g.,Eddy and Saunders 1980), more recent work provides strong support that there is a significant positive effect (e.g., Pauwels et al. 2004; Sorescu, Chandy, and Prabhu 2003; Sorescu, Shankar, and Kushwaha 2007; Sorescu and Spanjol 2008; Srinivasan et al. 2006). Although these studies are all based on goods innovations, it can be argued that there is also a positive effect of B2B-SIs on firm value. Firms that compete in business markets are using B2B-SIs to provide greater value for their customers. Instead of simply providing a good, they are aiming for an entire customer solution (Sawhney, Balasubramanian, and Krishnan 2004). This in turn should help firms to differentiate themselves from their competitors and create a competitive advantage. Investors are likely to pick up on this and since firm value reveals the future potential a market sees in a firm, the number of B2B-SIs introduced by a firm is likely to have a positive effect on its firm value.

Control variables

Based on previous research, additional factors that are not central to this essay may influence the number of B2B-SIs introduced by a firm and firm value. Accordingly, I control for the following variables.

Resource slack

Resource slack is defined as the ratio of working capital to total assets. The more slack resources a firm has, the more it is able to invest in service innovation without

jeopardizing ongoing operations (e.g., Lee and Grewal 2004; Herold, Jayaraman, and Narayanaswamy 2006). Therefore, I argue that a firm's resource slack is a positive determinant of the number of B2B-SIs introduced by a firm.

Financial leverage

Financial leverage is defined as the ratio of long-term debt to total assets. It can be understood as the degree to which companies use debt to finance their assets (Srinivasan 2006). The more a company uses debt to finance its assets, the less likely it is able to invest in the introduction of B2B-SIs. Consequently, the financial leverage of a firm should have a negative effect on the number of B2B-SIs a firm introduces.

Fixed asset intensity

Fixed asset intensity is defined as the ratio of fixed assets to total assets. Previous research has shown that a high degree of fixed asset intensity will decrease the likelihood to innovate due to a lack of liquid financial resources. I expect this relationship to hold for B2B-SIs.

Systematic risk

Systematic risk is measured as the beta obtained from the capital asset pricing model (CAPM) (e.g., Shankar and Sorescu 2008). Existing literature in management and industrial organization finds that firms with a high degree of systematic risk introduce more innovations and have a higher degree of R&D intensity (e.g., Wedig 1990; David, Hitt, and Gimeno 2001). I expect a similar relationship for B2B-SIs. Furthermore, I also control for the effect of systematic risk on firm value.

New-to-the-market B2B-SIs

Previous research on goods innovation (Sorescu and Spanjol 2008) finds that radical innovations have a greater effect on firm value than incremental innovations. Based on this finding, it is reasonable to assume that B2B-SIs that are entirely new to the market are perceived differently by investors than B2B-SIs that are "only" new to a firm. Therefore, while studying the effect of B2B-SIs on firm value, I will control for B2B-SIs that are new to the market.

Operating margin

Since it has been shown in previous research that operating margin has a significant effect on firm value (Rao, Agarwal, and Dahlhoff 2004), I will control for operating margin in my analysis of firm value.

DATA

In order to empirically test the conceptual model, panel data for all firm- and market-level factors as well as for the number of B2B-SIs introduced by a firm and firm value is necessary. Unfortunately, there is no single data source readily available that provides these types of data. For that reason, I manually assembled a unique panel data set from multiple data sources across industries. The advantage of this approach is that common method bias is avoided by using separate sources for key independent and dependent variables (Mithas, Krishnan, and Fornell 2005).

Since the focus of the study is on the determinants and outcomes of B2B-SIs, I used the member companies of ISBM at Penn State University as my sampling frame.

Since the necessary firm and market level data was only available for 20 of the 69 ISBM member companies, I increased my sample by randomly sampling 26 firms from the American Customer Satisfaction Index (ACSI) database that operate in both business and consumer markets. My final sample consists of 46 firms across different industries. The variables are collected from CRSP, COMPUSTAT, LexisNexis, and SDC Platinum. Table 10 provides a detailed list of variables, operationalization, and data sources.

TABLE 10
Operationalization of Variables and Data Sources

Variable	Notation	Operational Measure	Data Source
Focal Variables			
Firm Value	TOBINQ	Tobin's Q	CRSP, COMPUSTAT
B2B Service Innovations	B2BSI	Annual firm-level count of B2B service innovations	LexisNexis
Firm Level Independent Variables			
Effort Intensity	EFFINT	Ratio of Cost of Goods Sold to Sales revenues	COMPUSTAT
Resource Slack	RESLACK	Ratio of working capital to total assets	COMPUSTAT
Financial Leverage	FINLEV	Ratio of long-term debt to total assets	COMPUSTAT
Firm Size	LFSIZE	Natural logarithm of a firm's sales	COMPUSTAT
Acquisition	ACQUIS	Annual firm-level count of acquisitions	SDC Platinum
Alliance	ALLIANCE	Annual firm-level count of strategic alliances	SDC Platinum

TABLE 10 Continued

Variable	Notation	Operational Measure	Data Source
Organizational Slack	ORGSLACK	Ratio of net cash flow from operating activities to total assets	COMPUSTAT
Fixed Asset Intensity	FAINT	Ratio of fixed assets to total assets	COMPUSTAT
Systematic Risk	RISK	Beta obtained from Capital Asset Pricing Model (CAPM)	CRSP
New to Market Service Innovations	NTMSI	Annual firm-level count of service innovations that were new to the market.	Lexis Nexis
Operating Margin	OPMARGIN	Ratio of net income before depreciation to sales revenues	COMPUSTAT
Market Level Independent Variables			
Competitor Innovation Activity	COMPINA	Ratio of 12 months cumulative competitors' sales increase (in US$) to market size	COMPUSTAT
Market Growth	MGROWTH	12 months percentage growth in industry sales	COMPUSTAT
Market Size	LMSIZE	Natural logarithm of industry sales	COMPUSTAT
Market Concentration	HHI	Herfindahl-Hirschman Index	COMPUSTAT

Service Innovations

Since there is no database readily available that provides data on B2B-SIs, I used an archival data collection method. Information on service innovations was collected using all news sources available in LexisNexis (including news wires). I collected the number of service innovations introduced between 2000 and 2004 for each of the 46 firms in my sample.

To make sure all service innovations that were introduced by a company between 2000 and 2004 were captured, I conducted a broad search on LexisNexis. Consistent with the definition, I looked for three characteristics of a service innovation to include it in the sample: a performance of a function, an intangible offering that the firm did not provide before, and a new benefit to the firm's customers. For each firm the broad search terms *service, new, and innovat!* were used. Using the exclamation mark after *innovat* allowed me to capture all terms that start with *innovat*, such as innovation, innovative, and innovator. Furthermore, by using the singular word forms, singular, plural, and possessive forms of the terms were caught. Based on these search terms, I was able to identify 230 B2B-SIs, which are drawn from 15 different industries. Some examples of B2B-SIs appear in Table 11.

TABLE 11
Examples of B2B-SIs

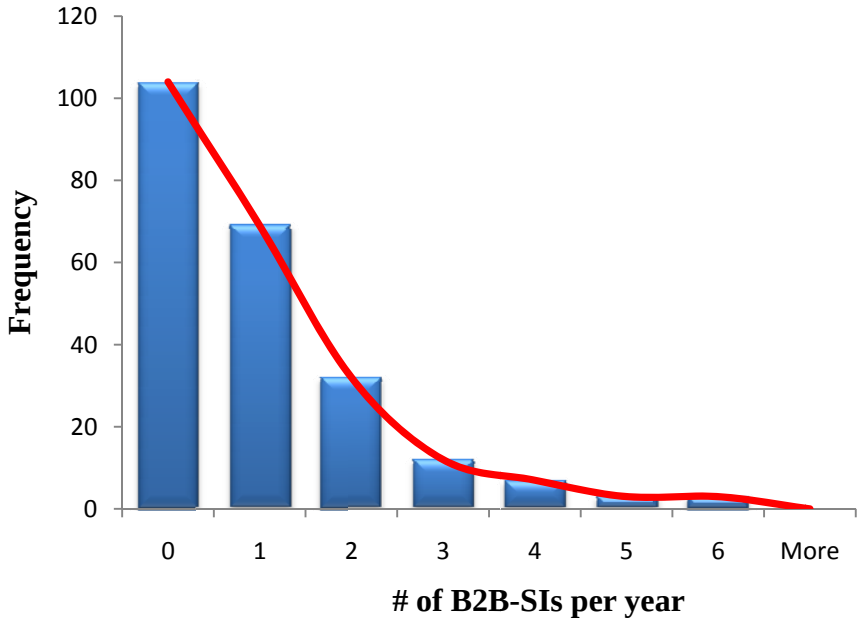
Company	Year Introduced	Service Innovation
FedEx	2002	"International shippers now have an easier and more affordable way to estimate the multitude of governmental charges, duties and other fees associated with many of their inbound and outbound overseas shipments. FedEx Corp. (NYSE:FDX) today unveiled the first carrier-provided, online duty and tax estimator on its Internet-based FedEx(R) Global Trade Manager application." (6/11/2002)
Dell	2002	"Dell announced a new line of services for small and medium-sized businesses that typically do not have large technical staffs or budgets. […] Services include network design, network installation and staff training. Prices vary, but begin at $199 for design and $99 a year for training." (12/8/02)

TABLE 11 Continued

Company	Year Introduced	Service Innovation
Dow Chemical Company	2003	"The Dow Chemical Company announced the launch of ChelaMed radiopharmaceutical services to its portfolio of products and services for the pharmaceutical industry. The new service offers technology and capabilities to enable biopharmaceutical companies to transform their breakthrough targeting molecules into biotargeted radiopharmaceuticals." (7/23/2003)
ConocoPhillips	2004	"ConocoPhillips Co. is offering the new AnalysisPlus[TM] Oil Analysis Program. The new line of oil analysis testing offers […] customers multiple options designed to suit different oil analysis needs."(9/1/2004)

Figure 7 presents a frequency distribution of the B2B-SIs in my sample. Since some firms did not introduce any B2B-SI in some of the years, there is a significant amount of zeros in my sample. I will account for this high proportion of zeros by using a zero-inflated count data model in my estimation.

FIGURE 7
Distribution of B2B-SIs



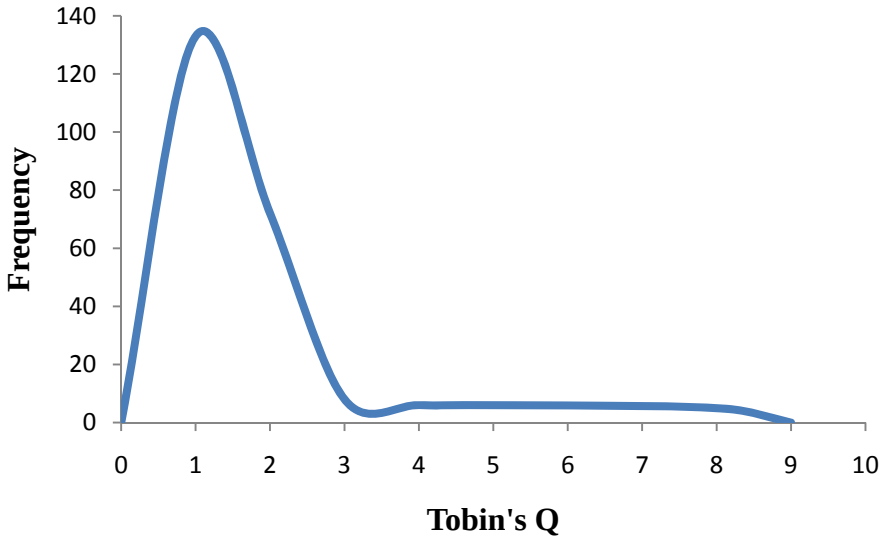
Firm Value

I use Tobin's Q as a measure of firm value, following prior research (e.g., Bharadwaj, Bharadwaj, and Konsynski 1999; Rao, Agarwal, and Dahlhoff 2004; Sorescu and Spanjol 2008; Srinivasan 2006). Using the COMPUSTAT/Center for Research on Security Prices (CRSP) database, I compute Tobin's Q as *(market value of the firm's common stock shares + book value of the firm's preferred stocks + book value of the firm's long-term debt + book value of the firm's inventories + book value of the firm's current liabilities – book value of the firm's current assets)/(book value of the firm's total assets)*, consistent with prior research (e.g., Chung and Pruitt 1994). Tobin's Q has various advantages over alternative outcome measures. As Lee and Grewal (2004) point out, Tobin's Q is a forward looking measure as it is derived from stock market prices. Secondly, it captures the long-term performance of a firm because it compares its

replacement value to the market value. An additional advantage of Tobin's Q is that it is not sensitive to different accounting standards, which makes it very suitable for application across multiple industries (Chakravarthy 1986).

Following Lee and Grewal (2004) and Luo and Bhattacharya (2006), a more conservative approach to calculate Tobin's Q was adopted. Rather than use year-end stock price and common shares outstanding, I use the average stock price and common shares outstanding at the end of the four quarters to calculate Tobin's Q. This approach is more conservative as it overcomes a volatility problem that might be present when the year-end measure of stock price and common shares outstanding approach is used. Figure 8 shows the smoothed distribution of Tobin's Q in my sample. The distribution is unimodal and exhibits some symmetry around the mode to allow me to use a normal approximation for modeling purposes.

FIGURE 8
Distribution of Tobin's Q of Firms with B2B-SIs



Determinants of Innovation

As illustrated in Table 10, the COMPUSTAT database is used to calculate the majority of the firm- and market-level determinants of B2B-SIs. Based on previous research (e.g., Morgan and Rego 2006, Luo and Homburg 2007), I use the four digit NAICS code as the basis to calculate the four market-level determinants *Market Growth*, *Market Size*, *Market Concentration* and *Competitor Innovation Activity*. Data on *Alliances* and *Acquisitions* is collected from SDC Platinum.

Control Variables

CAPM beta from the CRSP database is used as a measure of *Systematic Risk*. I collect data on the *New-to-the-market B2B-SIs* from LexisNexis and obtain data to compute *Operating Margin* from the COMPUSTAT database.

Table 12 and Table 13 provide summary statistics and the correlation matrix, respectively. The Tobin's Q scores are very similar to prior studies (e.g., Anderson, Fornell, and Mazvancheryl 2004; Lee and Grewal 2004), indicating that the sample is representative. The number of B2B-SIs introduced by a firm varies between zero and six per year. Furthermore, the correlation matrix does not indicate that multicollinearity is a problem in the data, which was confirmed after the model was estimated. None of the variance inflation factors are greater than ten.

TABLE 12
Summary Statistics

	Obs.[a]	Mean	Median	Std. Dev.	Min	Max
Outcome Variables						
Tobin's Q	230	1.30	.95	1.14	.22	8.44
B2B-SI	230	1.00	1.00	1.27	.00	6.00
Independent Variables						
Effort Intensity	230	.69	.73	1.74	.08	1.06
Firm Size	230	8.80	8.76	.99	5.41	11.41
Acquisitions	230	1.76	1.00	2.41	.00	17.00
Alliances	230	.70	.00	2.07	.00	16.00
Organizational Slack	230	.09	.08	.06	-.28	.34
Systematic Risk	230	.86	.86	.55	-.10	2.90
Resource Slack	230	.06	.02	.15	-.43	.67
Financial Leverage	230	.25	.26	1.53	.00	.67
Fixed Asset Intensity	230	.40	.38	.20	.03	.81
Operating Margin	230	.17	.15	.11	-.27	.56
New to Market Service Innovations	230	.13	.00	.43	.00	3.00
Competitor Innovation Activity	230	.04	.06	.18	-.59	.52
Market Growth (%)	230	9.57	6.94	23.97	-35.97	116.95
Market Size	230	11.78	11.53	1.48	7.72	14.35
Market Concentration	230	.13	.08	.12	.02	.66

[a] Observation refers to the combination of firm and year for which data are available.

TABLE 13

Correlation Matrix of Model Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	Tobin's Q	1.00																
2.	B2B-SI	.32**	1.00															
3.	Effort Intensity	-.51**	-.26**	1.00														
4.	Resource Slack	.33**	.17**	-.50**	1.00													
5.	Fin. Leverage	-.38**	-.18**	.21**	-.39**	1.00												
6.	Firm Size	-.17**	.14**	.38**	-.47**	.00	1.00											
7.	Acquisitions	.19**	.23**	-.25**	.06	-.15**	.11*	1.00										
8.	Alliances	.54**	.29**	-.48**	.36**	-.33**	-.09	.39**	1.00									
9.	Org. Slack	.35**	.19**	-.18**	.00	-.30**	.23**	.06	.12**	1.00								
10.	Fixed Asset Int.	-.37**	-.25**	.40**	-.50**	.54**	.12**	-.26**	-.35**	-.15**	1.00							
11.	Systematic Risk	.25**	.10	-.23**	.37**	-.16**	-.08	-.01	.22**	.02	-.39**	1.00						
12.	New to Mkt. S.I.	.08	.30**	-.21**	.07	-.05	.00	.02	.14**	-.01	-.01	.11*	1.00					
13.	Operating Margin	.12**	.00	-.43**	-.28**	.38**	.01	.10*	.00	.17**	.29**	-.26**	.09	1.00				
14.	Comp. Inn. Act.	.20**	.02	-.13**	.03	-.09	-.13**	-.02	.03	.01	.02	-.02	-.01	.10*	1.00			
15.	Market Growth	.40**	.15**	-.20**	.11*	-.08	-.09	.15**	.17**	.04	-.01	-.09	.06	.12**	.01	1.00		
16.	Market Size	-.19**	-.01	.21**	-.39**	.26**	.52**	-.06	-.02	-.18**	.32**	-.24**	-.05	.20**	-.04	.03	1.00	
17.	Market Concentr.	-.07	-.02	.11*	.18**	-.26**	.00	-.07	-.04	.20**	-.16**	.19**	-.05	-.39**	-.09	-.18**	-.63**	1.00

* p<.10

**p <.05

MODEL FORMULATON AND ESTIMATION

Model Formulation

The model is composed of a system of two equations with B2B-SI and firm value as the dependent variables. In each equation, subscript *i* represents the firm and subscript *t* represents the calendar year. The two equations are as follows:

$$
\begin{aligned}
B2BSI_{it} = {} & \alpha_0 + \alpha_1 EFFINT_{i(t-1)} + \alpha_2 RESLACK_{i(t-1)} + \alpha_3 FINLEV_{i(t-1)} + \alpha_4 LFSIZE_{i(t-1)} \\
& + \alpha_5 ACQUIS_{i(t-1)} + \alpha_6 ALLIANCE_{i(t-1)} + \alpha_7 ORGSLACK_{i(t-1)} + \alpha_8 FAINT_{i(t-1)} \\
& + \alpha_9 RISK_{i(t-1)} + \alpha_{10} COMPINA_{it} + \alpha_{11} MGROWTH_{i(t-1)} + \alpha_{12} LMSIZE_{i(t-1)} \\
& + \alpha_{13} HHI_{i(t-1)} + \alpha_{14} APPLIANCES_i + \alpha_{15} TRETAIL_i + \alpha_{16} ONLRETAIL_i \\
& + \alpha_{17} INTERNET_i + \alpha_{18} HOTELS_i + \alpha_{19} COURIER_i + \alpha_{20} HEALTH_i \\
& + \alpha_{21} TELECOM_i + \alpha_{22} PAPERMAN_i + \alpha_{23} CHEMAN_i + \alpha_{24} METMAN_i \\
& + \alpha_{25} ELECTMAN_i + \alpha_{26} WHOLESALE_i + \alpha_{27} SECURITY_i + \sum_{k=1}^{4} \omega_k YEAR_k + \eta_{it}
\end{aligned} \tag{5}
$$

where B2BSI is the number of business-to-business service innovations, EFFINT is the effort intensity, RESLACK is a firm's resource slack, FINLEV is the financial leverage, LFSIZE is the size of a firm, ACQUIS is the number of acquisitions, ALLIANCE is the number of alliances, ORGSLACK in a firm's organizational slack, FAINT is the fixed asset intensity, RISK is the systematic risk, COMPINA is the competitor innovation activity, MGROWTH is the market growth, LMSIZE is the natural log of the market size, HHI is the market concentration, APPLIANCES is a dummy variable capturing whether firm *i* is a appliances company, TRETAIL is a dummy variable capturing whether firm *i* is a traditional retailing company, ONLRETAIL is a dummy variable identifying whether a firm is a pure online retailer, INTERNET is a dummy variable

denoting whether a firm is a Internet portal, HOTELS is a dummy variable capturing whether a firm is in the hospitality industry, COURIER is a dummy variable identifying whether a firm is a courier service, HEALTH is a dummy variable denoting whether a firm is a health insurance company, TELECOM is a dummy variable capturing whether a firm is in the telecommunication industry, PAPERMAN is a dummy variable denoting whether a firm is a paper manufacturer, CHEMAN is a dummy variable identifying whether a firm is a chemical manufacturer, METMAN is a dummy variable capturing whether a firm is a metal manufacturer, ELECTMAN is a dummy variable denoting whether a firm is an electronic component manufacturer, WHOLESALE is a dummy variable denoting whether a firm is a wholesaler, and SECURITY is a dummy variable capturing whether a firm is a security service firm. Computer firms represent the base industry. YEARs are dummy variables that denote calendar years in the sample, with 2001 as the base year. "η" is an error term. The industry and year dummy variables allow me to control for heterogeneity, using the fixed effects approach, consistent with prior research (e.g., Shane, Shankar, and Aravindakshan 2006).

$$
\begin{aligned}
TOBINQ_{it} = {} & \delta_0 + \delta_1 B2BSI_{i(t-1)} + \delta_2 NTMSI_{i(t-1)} + \delta_3 LFSIZE_{i(t-1)} + \delta_4 ACQUIS_{i(t-1)} \\
& + \delta_5 ALLIANCE_{i(t-1)} + \delta_6 OPMARGIN_{i(t-1)} + \delta_7 RISK_{i(t-1)} + \delta_8 COMPINA_{it} \\
& + \delta_9 MGROWTH_{i(t-1)} + \delta_{10} LMSIZE_{i(t-1)} + \delta_{11} HHI_{i(t-1)} + \delta_{12} APPLIANCES_i \\
& + \delta_{13} TRETAIL_i + \delta_{14} ONLRETAIL_i + \delta_{15} INTERNET_i + \delta_{16} HOTELS_i \\
& + \delta_{17} COURIER_i + \delta_{18} HEALTH_i + \delta_{19} TELECOM_i + \delta_{20} PAPERMAN_i \\
& + \delta_{21} CHEMAN_i + \delta_{22} METMAN_i + \delta_{23} ELECTMAN_i + \delta_{24} WHOLESALE_i \\
& + \delta_{25} SECURITY_i + \sum_{k=1}^{4} \lambda_k YEAR_k + \nu_{it}
\end{aligned}
\tag{6}
$$

where TOBINQ is the firm value, NTMSI is the number of service innovations that were new to the market, OPMARGIN is operating margin and ν is an error term. All other terms are as defined earlier.

In order to avoid reverse causality and potential correlations of independent variables with the error terms, I follow previous research and lag the independent variables by one time period in both equations[7] (e.g., Anderson, Fornell, and Mazvancheryl 2004; Luo and Bhattacharya 2006; Morgan and Rego 2006; Rao, Agarwal, and Dahlhoff 2004; Sorescu and Spanjol 2008).

Model Estimation

The two equations form a recursive system. I estimate this system using a seemingly unrelated regression (SUR) estimation approach (Zellner 1962), which accounts for potential correlation of the error terms.

Determinants of B2B-SIs (equation 5)

As discussed earlier, a significant number of firms in my sample did not introduce a B2B-SI in a given year, resulting in a significant amount of zeros in my sample. I account for the over dispersion that is caused by these excess number of zeros by using a zero inflated Poisson (ZIP) regression (Lambert 1992). The appropriateness of the ZIP model is checked by using a Vuong test (Vuong 1989) and also by running a zero inflated negative binomial (ZINB) model (Long and Freese 2003). The Vuong test checks the ZIP regression model against a traditional Poisson model while the ZINB

[7] I did not lag competitor innovation activity but included the variable contemporaneously due to a high correlation with the market growth variable.

regression model would be more appropriate if the data is still over dispersed after accounting for the excess zeros. There is no over dispersion after accounting for the excess zeros and a significant Vuong test ($p < .05$*)* indicates that the ZIP model is the appropriate model. I control for unobserved heterogeneity through year and industry fixed effects.

Effects of B2B-SIs on firm value (equation 6)

I am able to estimate this equation using linear regression as firm value is not a count variable. Fixed time and industry effects are used to account for unobserved heterogeneity. I use a Hausman (1978) test to compare a random effects model with the fixed effects model for both the equations. Because the test rejected a random effects model ($p > .10$), the fixed effects approach for these equations is used (e.g., Wooldridge 2002).

RESULTS AND DISCUSSION

Determinants of B2B-SIs

The results of Equation 5 are presented in table 14. Firm size ($p < .05$), acquisitions ($p < .05$), alliances ($p < .05$), organizational slack ($p < .10$), systematic risk ($p < .01$), and effort intensity ($p < .05$) are significant determinants of the number of B2B-SIs introduced.

TABLE 14
SUR Estimation Results of B2B-SI Equation

Parameter/Independent Variables	Coefficient (SE[a])
Intercept	-3.09 (.06)*
Effort Intensity $_{i(t-1)}$	-1.37 (.66)**
Firm Size $_{i(t-1)}$	.25 (.13)**
Acquisitions $_{i(t-1)}$	.07 (.03)**
Alliances $_{i(t-1)}$	-.07 (.03)**
Organizational Slack $_{i(t-1)}$	2.13 (1.16)*
Systematic Risk $_{i(t-1)}$	.65 (.14)***
Resource Slack $_{i(t-1)}$	-.39 (.70)
Financial Leverage $_{i(t-1)}$	-.23 (.64)
Fixed Asset Intensity $_{i(t-1)}$	-.62 (.68)
Competitor Innovation Activity $_{it}$	.82 (.58)
Market Growth $_{i(t-1)}$	-.00 (.00)
Market Size $_{i(t-1)}$	.10 (.15)
Market Concentration $_{i(t-1)}$	.28 (2.20)
Fixed Effects/ Dummy Variables	
Appliance	-.99 (.63)
Retailing	1.16 (.97)
Online Retailing	.20 (.61)
Internet Portal	.71 (.66)
Hospitality	.26 (.40)
Courier Service	1.03 (.58)*
Health Insurance	-.44 (.39)
Telecommunication	-.46 (.38)
Paper Manufacturing	.31 (.40)
Chemical Manufacturing	.61 (.28)**
Metal Manufacturing	.43 (.49)
Electronic Component Manufacturing	-.16 (.49)
Wholesale	1.25 (.56)**
Security Services	-.00 (.74)
Year Dummies	3 out of 4 significant*
Model Fit Statistics[c]	Log-likelihood = - 260.72 $X^2 = 101.08$; $p < .01$.

*$p < .10$; ** $p < .05$; *** $p < .01$.
Notes:
[a] SE = Standard Error
[b] Base level for industry dummies is computer firms; for year dummies, it is 2001.
[c] Model fit statistics are based on independent estimation.

For the most part, the results confirm my initial expectations based on previous research findings. As suggested, the positive effect of firm size and organizational slack indicates that large firms with liquid financial resources are more likely to introduce B2B-SIs. Interestingly, while the number of acquisitions has a positive effect on the number of B2B-SIs, the number of alliances has a negative effect ($p < .05$). One possible explanation for this result is that large firms want to use their trusted brand name to sell services because of the previously discussed high degree of uncertainty that comes with people-intensive services. Consequently, firms are more likely to acquire rather than partner to introduce B2B-SIs. The ownership will not only make it easier for the acquirer to provide the B2B-SIs under its own brand name, it will also make it easier to control service quality. While the positive effect of organizational slack on B2B-SIs is consistent with my expectations, the negative effect of effort intensity ($p < .05$) is surprising and requires further exploration in future research. The effects of non-focal variables are generally as expected. The highly significant effect of systematic risk on the number of B2B-SIs introduced by a firm confirms my initial expectation. It also extends David, Hitt, and Gimeno's (2001) findings to the context of B2B-SIs.There is no evidence that resource slack, financial leverage and fixed asset intensity are significant determinants of the of B2B-SIs introduced by a firm.

My expectations that market size and market growth are less important determinants than market concentration, competitor innovation activity, and firm-level determinants are only partially supported. None of the four market-level determinant have a significant effect on the number of B2B-SIs ($p > .10$). While this indicates that

they are indeed less important drivers of B2B-SIs than firm-level determinants, I cannot confirm that there are asymmetries among the four market-level determinants.

Effects of B2B-SIs on Firm Value

Table 15 represents the results of Equation 6. My expectation that the number of B2B-SIs has a positive effect on firm value is confirmed ($p < .10$). The market perceives new services that are added by B2B firms as a source for an increase in future potential and competitive advantage. Since Tobin's Q is a forward looking measure that incorporates the future potential of a firm, it will be affected positively by B2B-SIs.

Surprisingly, B2B-SIs that are not just new to the firm but new to the market have a negative effect on Tobin's Q ($p < .05$). One possible explanation for this finding is the greater degree of uncertainty that is associated with services that are entirely new to the market. Due to the intangibility characteristic of services, investors may find it difficult to evaluate the potential of a B2B-SI that is new to the market. Usually, there is no prototype or reference point investors can refer to. As a result, while investors can evaluate the resources that were invested in a B2B-SI, they may not be able to evaluate the future potential of it, resulting in a negative effect on firm value. The effects of the control variables are generally in the expected directions.

TABLE 15
SUR Estimation Results of Tobin's Q Equation

Parameter/ Independent Variables	**Coefficient (SE[a])**
Focal Variables	
Intercept	.12 (.92)
B2B-SI $_{i(t-1)}$	.11 (.06)*
Control Variables	
New to Market Service Innovations $_{i(t-1)}$	-.17 (.08)**
Firm Size $_{i(t-1)}$	.43 (.12)***
Acquisitions $_{i(t-1)}$	-.05 (.03)
Alliances $_{i(t-1)}$	.21 (.07)***
Systematic Risk $_{i(t-1)}$	.10 (.13)
Operating Margin $_{i(t-1)}$	.66 (.72)
Competitor Innovation Activity $_{it}$	-.07 (.31)
Market Growth $_{i(t-1)}$	.00 (.00)
Market Size $_{i(t-1)}$	-.25 (.09)
Market Concentration $_{i(t-1)}$	-.32 (.56)
Fixed Effects/ Dummy Variables[b]	
Appliance	-.61 (.27)**
Retailing	.14 (.42)
Online Retailing	4.70 (.73)***
Internet Portal	2.21 (.64)***
Hospitality	-.00 (.23)
Courier Service	-.77 (.33)**
Health Insurance	.78 (.19)***
Telecommunication	-.56 (.29)*
Paper Manufacturing	.31 (.18)*
Chemical Manufacturing	-.37 (.19)*
Metal Manufacturing	-.38 (.24)
Electronic Component Manufacturing	-.29 (.14)*
Wholesale	.47 (.23)**
Security Services	-.91 (.34)***
Year Dummies	0 out of 4 significant*
Adjusted R-Square	.65

*$p < .10$; ** $p < .05$; *** $p < .01$.

Notes:

[a] SE = Standard Error

[b] Base level for industry dummies is computer firms; for year dummies, it is 2001.

[c] Adjusted R-Square statistic is based on independent estimation.

Robustness Checks

Several robustness checks were performed to ensure the robustness of the results. First, as discussed earlier, I estimated Equation 5 by zero-inflated negative binomial (ZINB) regression to test the robustness for over dispersion. The result of the ZINB regression model were consistent with the ZIP regression model. Second, I included firm-level dummy variables instead of industry-level dummy variables to check if the industry dummies capture the firm-specific effects. The results of the variables of interests were consistent with those from the proposed model. Third, the model was estimated by using a random effects panel model while including the industry fixed effects. The results were substantively consistent, indicating that the dummy variables in the model are appropriate to capture unobserved heterogeneity.

Table 16 provides an overview of my key findings. The number of B2B-SIs introduced by a firm has a positive effect on firm value. Furthermore, B2B-SIs are primarily determined by firm-level factors, in particular firm size, acquisitions, alliances, and organizational slack. There is no evidence that market level factors determine the number of B2B-SIs introduced by a firm.

TABLE 16
Overview of Key Findings

Variables	B2B-SIs	Firm Value
B2B-SIs		+
Firm-Level Determinants	Firm Size (+) Acquisitions (+) Alliances (-) Organizational Slack (+)	
Market Level Determinants	N.S.	

MANAGERIAL IMPLICATIONS

The findings of this essay provide useful implications for managers of firms that compete in business markets. First, B2B-SIs have a positive effect on firm value. Introducing B2B-SIs merits managerial attention regardless of whether the firm is goods- or service-dominant. In particular, goods-dominant firms that are facing a saturation of their core market should consider B2B-SIs as a way to enter new markets and accelerate organic growth.

Second, managers in the current economic crisis are frequently forced to compete in markets with very low or no growth. This study shows that given sufficient financial resources, managers should consider introducing B2B-SIs as they increase firm value but are not determined by market-level factors. B2B-SIs are an effective way for B2B firms to separate themselves from their competitors by providing total customer solutions.

Third, large firms with slack resources that acquire other firms are likely to introduce more B2B-SIs. When competing in business markets, managers should

identify and carefully observe these types of firms. As previously pointed out, acquiring new customers is particularly important in business markets. There are often a lower number of customers, which are frequently less likely to switch vendors once they make a choice. Consequently, it is not only important to offer the best customer value, it is also important to offer it at least at the same time as the competition does. As a result, being able to identify firms that introduce B2B-SIs as early as possible is crucial for firms to stay competitive.

Fourth, there is no evidence that market-level determinants affect the number of B2B-SIs introduced by a firm. Managers should not overestimate market-level factors in their decision to introduce B2B-SIs. Simply because a market is not growing or is not very large does not mean that managers of B2B firms should decide against introducing B2B-SIs. This finding is particularly important for managers who compete in markets that are hit heavily by the current economic crisis.

LIMITATIONS, FUTURE RESEARCH, AND CONCLUSIONS

Several limitations of this study provide opportunities for future research. First, my study is limited to the variables for which data was readily available. While I control in the models for these data limitations by introducing fixed effects, I am not able to answer otherwise important research questions with this study. For instance, it would be interesting to not only look at determinants of B2B-SIs but also find out what are the success drivers of B2B-SIs and what are the reasons for failure. Furthermore, with suitable data, it would be worthwhile to further differentiate B2B-SIs in different

categories and examine potential asymmetries among these types of B2B-SIs. For example, are there differences between revenue generating B2B-SIs and non-revenue generating B2B-SIs? What are the differences between B2B-SIs that only extend existing services and those that introduce an entirely new service line? Future research could also look at firms that operate in both business and consumer markets and study how B2B-SIs compare to B2C-SIs.

In this essay, I took an important first step in studying the determinants and outcomes of the number of B2B-SIs. My results show that B2B-SIs have a positive effect on firm value and they are primarily determined by firm-level factors rather than market-level factors. Managers of both goods- and service-dominant firms in B2B markets should consider introducing B2B-SIs. Furthermore, in order to compete in business markets, they should identify large firms with a propensity of acquisitions as these are the firms that are most likely to introduce B2B-SIs.

CHAPTER IV

SUMMARY

Service innovation is an underresearched area that has become a strategic priority for many firms. In this dissertation, I provide insights of this important area by studying both determinants and outcomes of service innovation. My findings will provide both managers and academicians with a better and deeper understanding of service innovations.

In my first essay, I find that there are significant asymmetries between Internet enabled service innovations (IESIs) and non-Internet enabled service innovations (NIESIs) in terms of what determines their introduction as well as their interrelationship with customer satisfaction and firm value. I find that financial resources and market growth are particularly important determinants for IESIs. Furthermore, while there is no evidence that either type of service innovation has an effect on firm level customer satisfaction, I find that IESIs have a positive effect on firm value. I expect that these findings will help managers of both goods- and service-dominant firms to make better informed decisions when it comes to introducing and evaluating service innovations.

In my second essay, I study service innovations in the context of business markets, which differ from consumer markets in important ways. I address the question of what determines B2B service innovations (B2B-SIs) and what are their outcomes. I find that the number of B2B-SIs introduced by a firm is primarily determined by firm-level factors rather than market-level factors. Furthermore, I provide evidence that B2B-

SIs increase firm value. These findings are particularly important for managers who compete in the current time of economic crisis. I suggest that B2B-SIs can be an effective and efficient way for B2B companies (both goods- and service-dominant) to differentiate themselves from their competitors by providing complete customer solutions.

One can take away three major lessons from these essays on service innovation. First, regardless of firm type or market type, the number of service innovations introduced by a firm has a substantial impact on firm value. In particular, IESIs and B2B-SIs increase firm value. Second, the two essays also show that liquid financial resources are important determinants of service innovations. This is especially true for IESIs and B2B-SIs. Hence, while managers should introduce service innovations, they must ask themselves if they have the financial muscle to successfully introduce them. Finally, both essays show no evidence of market size as a significant determinant of the number of service innovations introduced. Thus, service innovations can still increase firm value in the absence of a large market.

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VITA

THOMAS DOTZEL
Desautels Faculty of Management - McGill University
Bronfman Building
1001 Sherbrooke Street West
Montreal, QC H3A 1G5 Canada
Thomas.dotzel@mcgill.ca

EDUCATION

Mays Business School, Texas A&M University, College Station, TX
Ph.D., Marketing, 2009

University of Texas at Arlington, Arlington, TX
M.B.A., Marketing, 2003

Ecole Supérieure de Commerce de Pau, Pau, France
Diplôme de l'Ecole Supérieure de Commerce de PAU, 2002

Munich University of Applied Science and Research, Munich, Germany
Diplombetriebswirt (FH), 2002