

Competing in Crowded Markets: Multimarket Contact and the Nature of Competition in the Enterprise Systems Software Industry

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As more and more firms seek to digitize their business processes and develop new digital capabilities, the enterprise systems software (ESS) has emerged as a significant industry. ESS firms offer software components (e.g., ERP, CRM, Marketing analytics) to shape their clients' digitization strategies. With rapid rates of technological and market innovation, the ESS industry consists of several horizontal markets that form around these components. As numerous vendors compete with each other within and across these markets, many of these horizontal markets appear to be crowded with rivals. In fact, multimarket contact and presence in crowded markets appear to be the pathways through which a majority of the ESS firms compete. Though the strategy literature has demonstrated the virtues of multimarket contact, paradoxically, the same literature argues that operating in crowded markets is not wise. In particular, crowded markets increase a firm's exposure to the whirlwinds of intense competition and have deleterious consequences for financial performance. Thus, the behavior of ESS firms raises an interesting anomaly and research question: Why do ESS firms continue to compete in crowded markets if they are deemed to be bad for financial performance? We argue that the effects of rivalry in crowded markets are counteracted by a different force, in the form of the economics of demand externalities. Demand externalities occur because the customers of ESS firms expect that software components from one market will be easily integrated with those that they buy from other markets. However, with rapid rates of technological innovation and market formation and dissolution, customers experience significant ambiguity in deciding which markets and components suit their needs. Therefore, they look at crowded markets as an important signal about the legitimacy and viability of specific components for their needs. Through their presence in crowded markets, ESS firms can signal their commitment to many of the components that customers might need for their digital platforms. Customers might find that such firms are attractive because their commitments to crowded markets can mitigate concerns about compatibilities between the components purchased across several markets. This unique potential for demand externality across markets suggests that ESS vendors might, in fact, benefit from competing in many crowded markets. We test our explanations through data across three time periods from a set of ESS firms that account for more than 95% of the revenue in this market. We find that ESS firms do reap performance benefits by competing in crowded markets. More importantly, we find that they can enhance their benefits from crowded markets if they face the same competitors in multiple markets, thereby increasing their multimarket contact with rivals. These results have interesting implications not just for understanding competitive conduct in the ESS industry but also in many of the emerging digital goods industries where the markets have similar competitive characteristics to the ESS industry. Our ideas complement emerging ideas about platform models of competition in the digital goods industry and provide important directions for future research.

Key words: enterprise software; standards; multimarket contact; crowded markets

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1. Introduction

As firms architect digital systems through the integration of business processes and enterprise systems, the enterprise systems software (ESS) industry has grown in size and salience in the global economy. Enterprise systems software is a breed of software components, such as enterprise resources planning (ERP), customer relationship/response management (CRM), and supply chain management (SCM). Client organizations¹ buy these components in their efforts to digitize their business processes and build the business capabilities needed to compete in today's economy (Davenport 1998, Sambamurthy et al. 2003). This industry boasts of giants such as SAP and Oracle, and it had sales in excess of \$222.6 billion in 2009.² With the continued and growing demand for ESS applications, established software providers as well as startups have been attracted to the industry and enhanced rivalry in the industry.

The ESS industry consists of several horizontal markets around specific software components of interest to customers in their digitization efforts (Moschella 1997, Yoffie 1997). Table 1 shows examples of some of these markets and the number of ESS firms competing within them. Although individual ESS firms do not develop *all* the software components, each firm typically offers several of these components (Markus 2000). For example, i2 offers components such as advanced planning and scheduling and SCM, whereas large vendors like SAP offer most of i2's components as well as others such as CRM and product data management components. As a result, each ESS firm chooses to compete in a different number of markets. Conversely, individual ESS markets vary in the number of rivals. As descriptive evidence, Table 1 illustrates that the individual markets in the ESS industry vary in the number of rivals.

Two significant characteristics define the nature of competition among the firms in the ESS industry. First, individual firms operate in multiple markets, and they are likely to encounter several of the

Table 1 Software Component Markets in the ESS Industry

Advanced Planning and Scheduling (19)
Customer Response Management (7)
E-Business (16)
Enterprise Resource Planning (23)
Product Data Management (10)
Component Management (10)
Groupware (10)
Supply Chain Planning (23)
Forecasting and Demand Management (9)
Supply Chain Execution (17)
Transportation and Logistics (9)
Warehouse Management (16)

Note. Average number of participating firms (during years 1999–2003) in each market given in parenthesis.

same rivals across many markets. Theories of the economies of scale and scope suggest that ESS firms should benefit from competing in as many product markets and serving as many vertical industry segments as possible (Teece 1980). In addition, theories of multimarket contact suggest that ESS firms can engage in tacit collusion and mutual forbearance to reap performance benefits (Jayachandran et al. 1999). Second, many of the markets where ESS firms operate are crowded with rivals. Table 1 shows crowded markets for advanced planning and scheduling, enterprise resource planning, or warehouse management. Crowded markets subject firms to high market domain overlaps with their industry rivals and adversely impact their performance (Baum and Korn 1996). Yet, ESS firms appear to compete in crowded markets. This anomaly deserves investigation because little research has examined the nature of competition in this industry and existing strategy research does not suitably explain the competitive behavior of ESS firms.

Our research empirically investigates the structure of competition in the ESS industry. Three questions motivate our study. First, should ESS firms compete in as many markets as possible? Second, are they better off by avoiding crowded markets? Third, do they benefit by repeatedly facing rival firms in multiple markets? Although the extant literature on multimarket competition sheds some light on outcomes in such competitive markets, the anomalies noted above raise a need for fresh enquiry: does the competitive structure of the ESS industry require a different set of guidelines for strategic conduct?

¹ We use the terms "enterprise" or "client organizations" to refer to users of ESS and the terms "ESS firms" or "vendors" to refer to producers of business software components.

² AMR Research—<http://www.amrresearch.com>; Gartner research—<http://gartner.com/>.

We answer these questions through a review of existing research on multimarket competition. We then estimate a random effects model of firm performance using data collected from multiple independent secondary sources over three time periods. The rest of this paper is structured as follows. In §2 we present the theory discussion and formulation of hypotheses in the ESS industry context. Section 3 discusses the method and measures employed in our empirical study. The model, analysis and results are presented in §4. Finally, §5 discusses our findings, managerial implications, and directions for future research.

2. The Nature of Competition in the ESS Industry

Because the competitive nature of the ESS industry is characterized by multimarket contact and crowded market rivalry, we examine the theories and conceptual underpinnings of each dimension in the following sections.

Multimarket Contact and the Performance of ESS Firms. Multimarket competition occurs when firms compete with other firms in more than one product and/or geographical markets (Karnani and Wernerfelt 1985). The multimarket contact of a firm increases when it has a large number of overlapping markets with its rivals. Intuitively, higher multimarket contact could enhance rivalry and competitive activity. However, research in strategy has argued that multimarket contact could foster mutual forbearance as firms face the rivals repeatedly across several markets. It can actually lower competitive intensity, which in turn leads to better overall performance (Jayachandran et al. 1999). Firms will not engage in price or promotional wars because the focal firm realizes that if it undercuts its multimarket competitor in one market, the rival firm might engage in similar tactics in another market (Baum and Korn 1996, Clark and Montgomery 1998). Competitive actions, such as a price war, could lead to decreasing profit margins to both rivals and deter any one rival from initiating a threatening action. As a result, a form of tacit collusion might arise and prices can remain high across all markets, resulting in higher overall performance of the firm and its rivals. Evidence of such

behavior is well documented both in industries where there is product diversification, e.g., telephone and cable (Parker and Roller 1997), and geographic market diversification, e.g., airlines and supermarket chains (Evans and Kessides 1994).

The competitive elements that are known to foster such mutual forbearance are familiarity and deterrence. When a firm maintains multimarket contact with its rivals, its strategic actions are often guided by those of its close rivals, because these define the competitive horizons and influence managerial cognition (Greve 1998).³ There is an abundant opportunity for ESS firms to learn about their rivals and provide familiarity through an understanding of past actions and gauging of future strategic behaviors. Not only is there a plethora of product and vendor information in the media (Swanson 1997), but the ESS industry is also characterized by a small group of technology consulting firms where personnel turnover and cross-firm movement is the norm (Gosain et al. 2005, Keil and Tiwana 2006). Thus, when the same two ESS firms compete in multiple software markets, the opportunity to learn about each other's application programming interfaces (APIs), integration issues, and other technical elements only increases.

The second element leading to mutual forbearance is deterrence, or the extent to which a firm can prevent its rivals from initiating aggressive tactics that eventually are strategically harmful (Bernheim and Whinston 1990, Jayachandran et al. 1999). Certain characteristics of ESS products make it possible for the vendors to present a credible threat to their competitors. For instance, most often ESS components do not incorporate strongly patented technology, thus making it easier for competitors to retaliate by mimicking rivals' products. Furthermore, the highly capital intensive nature of software implementation for client organizations also makes it feasible for ESS vendors

³ Note that multimarket contact refers to the repeated contact between rivals over many markets. The actual measure is computed at different levels (from dyadic to market, to firm-in-market to firm-level), primarily based on the nature of the research question. See §3.1 and Gimeno and Jeong (2001) for further discussion on measure computation. In this research, our interest is in firm performance and hence multimarket contact is computed at the firm-level over different time periods.

to engage in flexible pricing. This creates the opportunity to engage in competitive pricing if the need to retaliate ever arises (Cusumano 2004). For example, because the marginal cost of software components is negligible, ESS vendors are able to offer highly discriminatory pricing to buyers by manipulating licensing fees, service, maintenance, and training and installation contracts. In addition, ESS vendors also have the ability to engage in bundle pricing by providing complementary components at relatively nominal prices. All these price dimensions allow ESS vendors to easily reprice their products as retaliatory tactics. Furthermore, whereas in some industries (e.g., semiconductor design and manufacturing), investments in long-term basic research and development go a long way, the most central characteristics of ESS products are prices and continued support. Thus, one can observe frequent promotions and repricing decisions, thereby creating an environment where mutual forbearance is most likely to be fostered.

Gimeno (1999) argues that the potential for mutual forbearance in multimarket contacts is amplified when firms have asymmetric interests in the focal markets and other markets where they face their rivals. When a firm is a leader in certain markets, but its challengers in those markets are leaders in other markets where the firm is present, there is a stronger motivation for mutual forbearance. Indeed, game theoretic literature (Bernheim and Whinston 1990) suggests that it is the existence of such variance, particularly reciprocal differences, that poses credible threats to undercutting and hence leads to tacit collusion. In the ESS industry, firms are differentially enabled across markets. Consider the example of Siebel (now Oracle), which entered the market as a best of breed in the CRM market, whereas SAP entered this market after having established its strengths in the ERP market. So, SAP is cognizant of Siebel's (now Oracle) differently endowed ability in the CRM market when it considers exercising its power in the ERP component market. In other words, firms in many of the ESS markets experience asymmetric interests across the markets where they face each other.

In sum, for ESS firms that maintain multimarket contact with rivals, familiarity with market rivals goes hand-in-hand with an ability to present a credible

retaliatory threat should any type of rivalrous behavior ensue (Jayachandran et al. 1999). Therefore, those firms with high multimarket contact are in a better position to enjoy the benefits of mutual forbearance and strengthen their performance through tacit collusion.

HYPOTHESIS 1. The performance of an ESS firm is positively related to its degree of multimarket contact with the other ESS firms.

Crowded Market Structure and the Performance of ESS Firms. Markets become crowded as more firms offer a given software component. As noted earlier in Table 1, the ESS industry appears to be characterized by markets with varying levels of crowdedness. When a firm participates in crowded markets, it increases its market domain overlap with its industry rivals (Baum and Korn 1996). While multimarket contact refers to the instances where a focal firm faces the same competitor, market overlap is a reflection of the instances of a focal firm competing in crowded markets. Multimarket contact captures the across-market relationships between the focal firm and its rivals, whereas market domain overlap captures the crowdedness in each of the markets of the focal firm.

The strategy literature cautions that with high domain overlap, firms compete for the same customers with near similar resources, and they have limited opportunities to extract premiums or sustain profitability and performance (Baum and Korn 1996, Hannan and Freeman 1977, McPherson 1983). It is indeed for this reason that some of the extant literature in strategy uses the domain overlap measure to represent intensity of competition. Therefore, this literature would suggest that competing in crowded markets might not be desirable and questions the wisdom of firm behavior in the ESS industry.

However, we note that such arguments are primarily based on supply-side pressures, viz., that market overlap increases the competition for common resources and customers. Interestingly, some conceptualizations of markets advance an alternative perspective about the presence of rivals. Canina et al. (2005) propose that some firms, particularly in the lodging industry, might benefit from being colocated in a geographically proximate market because of the potential for both supply and demand externalities.

Supply-side benefits include access to labor pool and spillover benefits, whereas the key demand-side benefit is an exposure to greater consumer base, ostensibly due to lower search costs (McCann and Folta 2008). However, the economics of spatial and location competition warns that the attractiveness of such rivalrous markets is limited to certain types of markets.⁴ Only some firms derive the benefits of agglomeration, a form of demand side externality. Even if not quite similar to the ESS industry, this literature does give pause to the argument that crowded markets are to be avoided in all situations, particularly when there are demand-side benefits to be derived.

Our thesis is that the ESS firms experience a demand externality unique to software systems, because their customers need software components from one market to be integrated with those they buy from other markets. Extant research has identified such externalities, suggesting that “consumption side economies are closely linked to the consumer’s willingness-to-pay for interoperability” (Cottrell and Nault 2004, p. 1009). However, such integration is not easy or inexpensive. For example, most customers find that it is not easy to buy a supply chain module from i2 and a human resources module from Oracle and expect them to work seamlessly without significant integration costs. The clients of ESS firms expect that their individual acquisitions of software components should all operate as a system independent of where they were acquired. Thus, a client enterprise’s choice of software components in a specific market is not entirely independent of its choice of products from other ESS markets.

Because multiple components from the same firm work better with each other, one of the strategies for an ESS firm to consider could be to simply offer all or as many components as possible. Research suggests that when such integration benefits exist, the entire

product suite becomes far more attractive for organizational buyers (Chen and Forman 2006). Cottrell and Nault (2004) found that software firms perform better when they have a broader array of product offerings. However, the decision to offer a full suite of product markets might be a costly proposition for most ESS firms, particularly if clients follow a best-of-breed approach to buying components (Markus et al. 2000). As innovations in ESS products result in the emergence of newer markets, the ESS firm will find it prohibitively expensive to continually expand its portfolio of markets. Sorenson (2000) found that although a firm might find it beneficial to offer a broader variety of products when it is unsure about the customers’ needs, the value of the multiple products declines rapidly as specific product markets get crowded. Thus, there are economic and strategic limits to competing in all or most ESS markets.

Alternatively, ESS firms can strategically participate in selected markets, especially if they can identify the ones that are likely to be valued by their customers. They could choose those markets that have the largest, or have potential for the largest, customer base. However, in an industry where new components and markets are consistently being created through advances in technology, customer choices are evolutionary (Sorenson 2000). It is difficult to a priori ascertain which product markets are likely to be attractive to customers. For example, prior to the advent of Web-based strategies and the establishment of data acquisition and mining techniques, CRM modules were not considered to be critical by most client organizations. Because ESS products are technically complex and embedded with multiple standards and interfaces, customers often lack enough knowledge about them. Studies of technology adoption reveal that many customers lack the sophisticated knowledge. They experience knowledge barriers in their attempts to make sense of the different products in each market and the complementary products across different markets (Attewell 1992, Fichman and Kemerer 1999). The multiple and often conflicting standards that define how the components could be integrated into their digital platforms add to their experienced ambiguity. Therefore, ESS vendors cannot reliably base their commitment to selected markets through an analysis of uncertain customer

⁴ Early work on economics of spatial competition (see Hotelling 1929) has derived conditions under which colocation is optimal and many extensions follow. Recent research has also suggested that pricing strategies such as everyday low pricing (see Chellappa et al. 2010) influence colocation and agglomeration decisions, e.g., EDLP firms like Wal-Mart and Southwest Airlines will avoid malls and online travel agencies respectively, primarily for fear of being price-compared.

choices. In fact, it is more likely that the customers rely on the vendors' range of offerings and commitments to certain markets as signals in their own purchase decisions.

As a third option, ESS firms could focus on the actions of their industry rivals for choosing the markets where they should compete. In ESS industries, where new markets continually emerge, firms could adopt a mimetic or herding behavior to market selection rather than strategic, game-theoretic assessments (Haveman 1993, Haveman and Nonnemaker 2000). Instead of a priori calculations about the costs and benefits of markets, ESS firms could consider those markets that are also attractive to and being selected by other ESS firms. As individual ESS firms follow their rivals into crowded markets, they increase their market domain overlap. However, they derive two potential benefits. First, potential customers might find the presence of numerous ESS vendors in a market as a signal about the legitimacy and desirability of that component for their digital platform architectures. They might interpret the presence of numerous vendors as a collective judgment by the ESS industry that the specific component is important and worthy of committing resources to the offering. Further, the presence of numerous rivals might reinforce their confidence in the viability of that market over time, especially in terms of product support.

Customers utilize numerous prepurchase criteria, such as sales support, service, maintenance, cross-product integration and product upgrades (Tingling and Parent 2004) as well as an analysis of the post-purchase life-cycle of the products (Hirt and Swanson 1999). When they lack adequate product-market knowledge, they rely upon technical and market expertise from third-party sources, such as systems integrators and consultants. Therefore, the third-party sources play a valuable advisory role as knowledge brokers in assisting the customers choose appropriate software components and vendors (Ko et al. 2005). Third-party sources devote significant resources toward training and educating their own personnel to acquire knowledge and expertise about software components and vendors in different markets. We propose that they are likely to devote more of their knowledge brokering investments (e.g., hiring and training) toward crowded markets because

they would interpret the crowdedness as a signal of the legitimacy, viability, and attractiveness of the markets and components. Investing in expertise in the crowded markets would allow their consultants to apply their knowledge over a larger base of vendors. Thus, crowded markets also assure the third-party systems integrators and consultants about the long-term viability of the market and trigger a reinforcing cycle of resource deployments. In turn, their investments in knowledge brokering could further serve to strengthen the attractiveness of the crowded markets to customers.

In addition, we argue that there are potential benefits to an ESS firm when it participates in more of the crowded markets. The presence in more of the crowded markets likely provides an amplified signal of its commitment to many of the components that customers might legitimately need for their digital platforms. Customers might find such firms attractive because their market commitments can mitigate concerns about compatibilities between the components purchased across several markets. This unique potential for demand externality across markets suggests that ESS vendors might, in fact, benefit from competing in many crowded markets.

In summary, our arguments provide a novel perspective whereby participation in crowded markets could actually benefit ESS firms. Therefore, we propose the following hypothesis.

HYPOTHESIS 2. *The performance of an ESS firm is positively related to its degree of participation in crowded markets, or the extent of market domain overlap.*

Our thesis has been that the participation in crowded markets enables firms to leverage the economics of demand externalities and improve their performance. However, in other industries, Sorenson (2000) and Cottrell and Nault (2004) demonstrate that heightened rivalry from participating in multiple markets could potentially dilute the externality benefits of the crowded markets. Crowded markets could force firms to provide similar software components to address specific business needs of their clients. As a result, ESS firms might be less able to differentiate themselves. As more ESS firms operate in crowded markets, their ability to leverage the virtues of the

crowded markets could be diluted by the dissipating effects of rivalry.

We propose that ESS firms can counter the threats of rivalry in crowded markets if they have high levels of multimarket contact. Recall that multimarket contact refers to the focal ESS firm facing the same rivals in multiple markets. Because multimarket contact allows the potential for mutual forbearance, ESS firms can reduce the adverse effects of rivalry in crowded markets. Clearly, an ESS firm that is present in crowded markets with high multimarket contact has a greater opportunity to learn about its rivals. Similarly, presence in these markets is also a show of strength and such a firm can credibly deter a rival in any attempt to undercut prices or engage in other multimarket competitive action. Therefore, we propose that even as crowded markets increase rivalry and threaten to undermine the attractiveness of those markets, ESS firms can enhance their performance when they exercise high levels of multimarket contact in conjunction with their participation in crowded markets. Therefore, we offer the following hypothesis.

HYPOTHESIS 3. *The positive effects of ESS firms' participation in crowded markets are increased by the level of multimarket contact with other ESS firms.*

2.1. Control Variables

We control for the effects of two theoretically salient variables in explaining firm performance: the number of software components and net market size of firms. From a resource-based point of view, high technology industries are known to exhibit economies of scale and scope (Teece 1980). In particular, multi-product firms possess opportunities for transferring technologies across product lines and even melding them to create new ones. Even if the functional areas are distinct and require specialists, the programming itself can be leveraged across disciplines; hence, offering a greater number of software components can be profitable. Many software suites exhibit economies of scope. For example, Microsoft leverages economies of scope in the desktop publishing arena and offers software for functionally diverse areas such as word processing, spreadsheet management, and presentation management. The source of economies of scope is not only restricted to programming and functional capabilities, but it also includes access to consultants

and implementation specialists. While the end-user of an ESS software component is the organizational user, e.g., accountants, and shop-floor managers, the components themselves are installed by third-party consultants because there is always a degree of customization required to support organization specific business processes. These management consultants, such as CGEY, KPMG, Accenture, and others, implement software components that cut across various functional disciplines and develop close relationships with the ESS vendors themselves. Therefore, if such advantages from economies of scope exist, an ESS vendor producing a larger number of software components should see positive impacts on performance.

Furthermore, unlike end-user-oriented software such as desktop publishing suites, ESS components are developed for specific industries such as the automobile, defense, or aerospace industry segments (Sandoe et al. 2001). The components are built with templates that are specific to a particular industry and the business processes conducted within, and such templates are then customized to suit the needs of the specific organization. For example, one industry might follow a first-in–first-out accounting practice while another might follow a last-in–first-out method for its inventory management practices (Davenport 1998). Generally, customizing a software component for a given industry implies providing an instance of a business process specific to that industry; it does not imply a full customization because that is managed by the implementers hired by the client organization. Prior research has suggested that when such a large degree of code reuse is possible, there are indeed production economies of scale in software development (Banker and Kemerer 1989). These arguments would suggest that an ESS firm is better off by customizing software components for a number of different industry segments. Thus, we control for the total market size of an ESS firm before we investigate any specific impact of multimarket contact and participation in crowded markets. Gimeno and Woo (1999) argue that the economies of scope and multimarket competition are likely to occur concurrently. In their study of the airlines industry, they demonstrate that the forbearance effects of multimarket competition are stronger when firms compete in markets where they can share

common resources. Therefore, it is important to incorporate measures of the economies of scope. Their study of the airlines industry allowed them to construct more precise measures of the economies of scope (i.e., sharing of airport facilities across markets). In the ESS industry, though the leverage of resources is not as clearly visible for the purposes of proxies, we believe that the market size of the ESS firm is a satisfactory proxy for the economies of scope.

We also control for the several mergers and acquisitions of large and small firms, typical of any technology industry. It has been suggested that any temporal analyses of such industries (Hagedoorn and Duysters 1999) must account for firm-level changes. Finally, firms differ largely in their base resources and prior research suggests that controlling for firm-size is important to any analysis of firm-performance (Haveman 1993). Recent research on alliance formation in the ESS industry has also suggested that both these factors, firm-level changes (M&A) and firm size, influence firm performance (Chellappa and Saraf 2010).

3. Data and Method

We collected data from two independent sources. Our first source is an unbiased (not related to any ESS firm or end-user organization) industry group (Reed Elsevier Inc.) that employed a consulting organization to collect revenue and other information for nearly a complete set of ESS firms to be included in its publication (MSI index and newsletter). Because most of the firms in the ESS industry are privately held, the only way to acquire information about revenue, component markets, and other information is to solicit it directly from the firms. The consulting organization sends out a survey every other year and nearly all ESS firms (big and small) participate in this survey. Although the term “survey” is used, it is actually a reporting of factual numbers from the top 100 firms, i.e., the “survey” does not include subjective or perceptual questions. The list of surveyed firms is compiled by a group of highly experienced professionals in the industry. Over the three time periods considered in our research, the actual sample consisted of only 97, 98, and 95 firms (even if it is a Top 100 list) because there were incomplete data from a few firms.

While this data source provides much of the revenue and product-portfolio information of ESS firms, additional elements such as firm size and alliances had to be acquired from other independent sources. These include the Mergent Online company database, Security and Exchange Commission filings, Gale Group database, and OneSource Business Browser. We compared information from the primary data source with publicly available ones and found no discrepancy. Furthermore, each firm in the list was contacted by telephone by a revolving group of research assistants over the data collection period and was compared with a manager and senior manager at Ernst and Young (now CGEY), who had extensive knowledge on the partnerships between ESS firms because they implement most of these modules. To the best of our knowledge this is a comprehensive list, as there are no secondary data sources that maintain this information.

ESS firms compete in a number of different software component markets, e.g., enterprise resource planning, customer relationship management, advanced planning and scheduling, supply chain planning, transportation and logistics, and business intelligence modules. In addition, these firms customize their generic products for specific vertical industry segments, e.g., aerospace and defense, automotive, consumer packaged goods, electronics and computer industry, food and beverages, pharmaceuticals, service parts, etc. Overall, we have data for three time cross-sections between 1999 and 2003 for an initial panel of 69 ESS firms with a total of 180 usable observations.

3.1. Measures

To avoid any causal ambiguity along the lines of earlier work (Li and Greenwood 2004), we incorporated a temporal lag between our dependent variable and other variables. Thus, the control and independent variables are measured in year t , and the dependent variable is measured in year $t + 1$.

ESS Firm Performance (LSREV): The dependent variable, firm performance, was measured as the natural logarithm of revenue from software licensing. Revenue commonly has been used as a measure of firm performance in studies investigating the impact of multimarket contact (Jayachandran et al. 1999).

Extent of multimarket contact (MMC): Gimeno and Jeong (2001) reviewed existing research on multimarket competition and observed that the construct has been operationalized at several levels of analysis, including the markets, firms-in-markets, or between dyadic pairs of firms. They provide guidance about the choice of the appropriate unit of measurement by stating: "...the need to align analyses with the level of dependent variables may change the level of analysis and require the aggregation of multimarket contacts at different levels. Data availability may therefore drive the choice of the level of analysis. For instance, if the only available dependent variables were at the market level (e.g., average market prices), statistical analysis would also have to be carried at the market level, even if firm-in-market measures were more appropriate" (p. 363).

In our research, because the dependent variable is firm performance, we compute the measure of multimarket contact at the level of firm. Our approach is similar to that of other researchers who have explored the implications of multimarket contact for firm performance (e.g., Coccoresse and Pellicchia 2009, Feinberg 1985, Pilloff 1999). For example, Feinberg (1985) argued that decision-making about market entry is coordinated across various business units and it is important to see how much performance is affected by pursuing an overall multi-point strategy. He states: "Since the mutual forbearance theory requires that there be a company-level decision-making process coordinated across LBs (line of business), a more aggregated company-level analysis is appropriate here" (p. 28). Generally, in industries such as banking where revenue and other performance measures are reported at the firm level while rivals meet each other at branch levels, multimarket contact is abstracted at the firm-level.

We compute the extent of multimarket contact through a two-step process. First, for any firm, we compute the extent of its multimarket contact in a specific market m , as the sum of its dyadic connections with each ESS rival. Next, after computing a firm i 's multimarket contact in each market m , separately, we compute the *sum* of all of its multimarket contacts. As

per Baum and Korn (1996), the multimarket contact for a firm i in a market m is given by

$$MMC_{im} = \frac{\sum_{j \neq i} D_{im} \cdot D_{jm}}{\sum_m D_{im} \cdot N_{MMC}}, \quad \forall j \sum_m (D_{im} \times D_{jm}) > 1. \quad (1)$$

$D_{im} = 1$ if firm i competes in market m (as in Table 1), and $D_{jm} = 1$ if firm j competes market m . N_{MMC} is the number of firms that contact the firm i in at least one market other than market m . To calculate MMC for a firm i , we aggregated the multimarket contact of firm i (Equation (1)) across all its software component markets. Thus,

$$MMC_i = \begin{cases} \sum_{m=1}^{SFT_i} MMC_{im} & \text{when } SFT_i > 1 \\ 0 & \text{when } SFT_i = 1 \end{cases}, \quad (2)$$

i.e., multimarket contact in software component markets can occur for a firm i only if it participates in more than one market.

Participation in Crowded Markets (MOVP): We base our measure of this construct on the market overlap measure with which it is analogous (Baum and Korn 1996). However, the measure simultaneously considers not only the number of markets a firm participates in, but also how many other firms participate in each of those markets. Formally, it is given by

$$MOVP_i = \sum_{i \neq j} \frac{\sum_m (D_{im} \cdot D_{jm})}{\sum_m D_{im}}, \quad (3)$$

where m denotes the given market in the full set of component markets. The market domain overlap of firm i with the rest of the vendors in the sample varies from zero to $n - 1$, where n is the number of ESS vendors in each time period in our sample. When a focal firm i competes with other ESS firms by offering the entire range of software components produced by the competing firms, then the market domain overlap is said to be at its maximum. This measure is a finer-grained assessment of rivalry than can be obtained by using common measures such as the Herfindahl-Hirschman index (HHI) (Hannan 1997). In fact, while the HHI has been widely used, it has also been widely critiqued regarding its robustness with respect to the definition of the market (Lijesen 2004). In contrast,

MOV_P as defined here directly measures the extent of crowdedness faced by a firm.

Although both multimarket contact and market overlap are common measures, the differences between the two merit a clear elucidation. In Equation (1), which is the basis for computing multimarket contact, the numerator expression is calculated only for those firms j that are multimarket contacts of the firm i . The additional condition that follows the equation “ $\forall j \sum_m (D_{im} \times D_{jm}) > 1$ ” is important. For the focal firm, the numerator includes only the subset of the markets where the focal firm is in contact with a rival more than once. Therefore, it measures the raw instances of multiple meetings between two firms. In contrast, Equation (3), which computes market overlap, utilizes a numerator that reflects a raw count of the number of rival firms in each of the markets of the focal firm, regardless of the frequency of contacts between the focal firm and the rival firms.

The difference between the two can also be illustrated as follows: Consider a focal firm A that competes in some n markets, where MMC_A and MOV_P_A represent the multimarket contact and market overlap of firm A. Now suppose m new firms enter market such that each new firm produces one component only (i.e., competes in only one market), then we can see that MMC_A of A does not change since A does not meet any of these new firms in more than one market (contact is only in a single market, not multiple ones). On the other hand, the rivalry in each market has increased since there is one more new competitor in each one of them, thus increasing MOV_P_A .

Firm size (EMP): The literature provides many ways to control for the effect of organizational size when investigating the effect of other independent variables on firm performance (see Haveman 1993). In our study, we use employee strength (in thousands) to represent firm size and this is appropriate as the ESS industry is primarily dependent on human capital (programmers).

Merger/acquisition (MAQ): Any merger/acquisition activity has to be controlled and we use a binary variable (MAQ) for this purpose. MAQ is 1 when a firm has undergone a merger or acquired another firm in a given year t , and 0 otherwise.

ESS firms' software components markets (SFT): Data was acquired on the number of software components

produced by the firm for each time period. This was normalized with respect to the total number of components for an entire enterprise system.

ESS firms' total market size (MSIZE): Data were collected for each time period on the number of industry segments for which each software component was produced. The total market size is computed as a product of the number of software components offered and number of the industry segments competed in. This product was then normalized with respect to the maximum possible market size in the industry.

3.2. Model and Analysis

We formally test our model through a time fixed effects, random-coefficients regression model (see Equation (4)). Although we could have used the ordinary multiple regression techniques on panel data, they might not be optimal because the estimates could be subject to omitted variable bias. With our current data and analyses, it is possible to control for some types of omitted variables even without observing them, by observing changes in the dependent variable over time.

$$\begin{aligned} LSREV_{i,t+1} = & \beta_0 + \beta_1 MAQ_{i,t} + \beta_2 EMP_{i,t} + \beta_3 SFT_{i,t} \\ & + \beta_4 MSIZE_{i,t} + \beta_5 MMC_{i,t} + \beta_6 MOV_P_{i,t} \\ & + \beta_7 (MMC_{i,t} \times MOV_P_{i,t}) + \beta_8 t_1 + \beta_9 t_2 \\ & + \beta_{10} t_3 + v_i + \varepsilon_{i,t}. \end{aligned} \quad (4)$$

The dependent and independent variables were described earlier. The random effects models for longitudinal data are regression models where the regression coefficients are allowed to vary across subjects. There are essentially two components to this model; a within-firm component where a firm's change over time is given by a regression with population-level intercept and slope. The second element is the between-firm component where variations in intercepts and slopes are captured across firms. In our model, v_i is the firm-specific residual, and $\varepsilon_{i,t}$ is the standard residual with mean zero and uncorrelated with the other terms in the model. While there are a number of ways of analyzing longitudinal data, the random effects analyses do not require that subjects be measured on the same number of time points and

Table 2 Descriptive and Bivariate Statistics

Variables		Mean	S.D.	1	2	3	4	5	6
Software revenue (natural log)	<i>LSREV</i>	3.89	1.36	1.00					
Firm size (no. of employees in thousands)	<i>EMP</i>	0.56	7.26	0.57	1.00				
Software components	<i>SFT</i>	0.17	0.16	0.29	0.24	1.00			
Net market size	<i>MSIZE</i>	0.05	0.16	0.39	0.33	0.88	1.00		
Multimarket contact	<i>MMC</i>	0.35	0.30	0.25	0.20	0.66	0.47	1.00	
Market overlap	<i>MOVP</i>	0.56	0.19	−0.06	−0.09	−0.26	−0.22	−0.24	1.00

the time points do not need to be equally spaced. We have an unbalanced panel because many mergers and acquisitions take place in the ESS industry over time, and information on some firms was not available for all time cross-sections.

While the fixed-effects model makes a strong assumption that $\sigma_v = 0$ (firms are unchanged over time), we can think of each firm as having its own systematic baseline where the intercept is the result of a random deviation from some mean intercept. In the random-effects model, the intercept is drawn from some distribution for each firm. Instead of trying to estimate n (i.e., the number of firms) parameters as in the fixed effects case, we only need to estimate parameters describing the distribution; hence, a σ_v is reported. More importantly, the results can be generalized from the random-effects model. Note that while β_0 is intercept of the regression, coefficients β_8 , β_9 , and β_{10} are additional intercepts for each year. We take t_3 to be the base year and hence $\beta_{10} = 0$.

Table 2 provides descriptive statistics of our dependent and independent variables. The pairwise correlations do not show multicollinearity problems except in the case of software components and net market size (high correlations, but *not* significant). To further examine for any potential problems, we examined the collinearity diagnostics and observed that the variance inflation factor (VIF) is less than 3.9—this suggests that no obvious multicollinearity problems exist.

Table 3 displays the results of the analysis. Model 1 corresponds to the base model with the control variables. Model 2 includes our variables of interest to capture competitive dynamics in this industry. We use the Schwarz' Bayesian information criterion (BIC) to compare the two models. Given any two estimated models, the model with the lower value of BIC is the one to be preferred. The BIC is a decreasing function of residual sum of squares, goodness of fit, and

an increasing function of the number of free parameters to be estimated. The BIC penalizes free parameters more strongly than does the Akaike information criterion (AIC) and is generally considered to be a better metric than AIC or $-2\log$ likelihood measures. The table also reports the variance of firm-specific residuals (σ_v) and uncorrelated error terms (σ_e) with zero mean.

At the outset we should note that the control variables firm-size and the occurrence of mergers/acquisitions are both significant at 99% confidence level

Table 3 Results

Independent variables	Model 1	Model 2
Intercept	3.45*** (0.20)	3.42*** (0.19)
Firm merged or acquired <i>MAQ</i>	0.41*** (0.15)	0.41*** (0.15)
Firm size <i>EMP</i>	0.09*** (0.02)	0.09*** (0.02)
Software components produced <i>SFT</i>	−1.36** (0.87)	−1.97** (1.10)
Net market size <i>MSIZE</i>	1.85*** (0.93)	2.59*** (0.98)
Multi market contact <i>MMC</i>		0.55** (0.28)
Market overlap <i>MOVP</i>		0.88* (0.55)
Multimarket contact * market overlap <i>MMC * MOVP</i>		3.86*** (1.49)
YR1	0.84*** (0.17)	0.96*** (0.17)
YR2	0.28** (0.16)	0.34** (0.16)
YR3	0.00 (BASE)	0.00 (BASE)
σ_v	0.807***	0.7761***
σ_e	0.348***	0.3263***
BIC	530.0	526.9
No. of observations	180	180

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

and positive. The next two control variables account for the number of software component markets a firm participates in and the total vertical industry segments it serves. The correlation matrix and collinearity diagnostics show no relationship between firm size and these variables, indicating that it is not necessary that larger firms participate in more markets. Interestingly, we observe that the coefficient for *SFT* (β_3) is negative and significant at the 95% confidence interval. This implies that simple participation in a larger number of markets actually makes the firm worse off.

On the other hand, the coefficient for *MSIZE* (β_4) is positive and significant at the 99% confidence interval, implying that once a firm sells a component it benefits by creating templates for different vertical industry segments. There appear to be beneficial economies of scale in serving multiple vertical industry segments. This is consistent with Gimeno and Woo (1999) and demonstrates the performance gains due to sharing common expertise across markets.

In Model 2, we introduce the hypothesized variables of multimarket contact, market overlap, and their joint effects. The coefficient for *MMC* (β_5) is positive and significant and lends support to Hypothesis 1, viz., higher multimarket contact leads to better firm performance. Thus, when an ESS firm engages rivals in multiple markets, it enjoys the benefits of mutual forbearance. The coefficient for *MOVP* (β_6) is positive and weakly significant at the 90% confidence level suggesting there is some evidence of the suggested externality benefit in Hypothesis 2. Yet, the weak significance suggests that the externality benefits might indeed be diluted by heightened rivalry.

Finally, the coefficient for *MMC*MOVP* (β_7) is relatively large in magnitude, positive, and highly significant at the 99% confidence level, thus lending strong support for Hypothesis 3. Our results reveal that firms operating in crowded markets and experiencing high market overlap can enhance their performance through multimarket contact. This supports our assertion that the mechanisms of mutual forbearance and tacit collusion allow firms to dilute the effects of rivalry in crowded markets and preserve higher levels of performance. In effect, such firms are able to leverage the beneficial effects of demand externality in crowded markets, while diluting the adverse effects of rivalry through multimarket contact.

Note that the coefficients for both t_1 and t_2 are significant and positive, while the third time period t_3 was the base. Because the base year was 2003, which is well after Y2K, we can see that the revenues were higher before 2003. This is consistent with changes in investments in systems software, which peaked around 1999.

Although random effects do not allow us to identify the firm-specific time-invariant effects, these models do reveal the distribution of *all* these effects. Table 3 presents this information on the firm-specific residual and the uncorrelated error term. For the final model (Model 2) with all the hypothesized independent variables included, the results show that the former has a variance of 0.776, whereas the latter with zero mean has a variance of 0.326. Note that both these measures are highly significant ($p < 0.001$), suggesting that the firm-specific effects on firm performance can be drawn from a distribution (Normal with $\mu_v = 0$ and $\sigma_v = 0.7761$). The interpretation is that a firm like Ariba (with market cap of, say, \$20B) might have a fixed effect of zero (becomes the baseline fixed effect), whereas it might be at the lower end of the tail (negative fixed effect, maybe 2 standard deviations *below* zero = -2×0.7761). On the other hand, Oracle might be at the higher end of the tail (a fixed effect that is two standard deviations *above* zero given by 2×0.7761). So while the random effect model does include a v_i (firm-specific intercepts), the actual estimate is unspecified.

Furthermore, our analysis categorically shows that Model 2 with the competitive effects included is a superior fit because it has a lower BIC. Furthermore, while the SAS procedure used for this method does not automatically provide the Chi-squared (χ^2) value, it can be computed by subtracting the $-2 \log$ likelihood value of the models and comparing it a Chi-squared table for the relevant degrees of freedom. The Chi-squared test values are also highly significant, indicating that the models proposed have sufficient goodness of fit.

Questions about endogeneity are always likely when dealing with such panel data. Although we lag our independent variables so that the dependent variable is future revenue, there is still a possibility of unobservable heterogeneity bias. A single unobservable factor could be affecting both sides of the

equation; e.g., managerial competence might cause a firm to have a greater number of components as well as revenue. Given that this endogeneity problem is severe in an ordinary least-squares model where all the data is pooled, we use the panel data analysis. Note that we could theoretically have used a *fixed or random* effects model to manage the time-invarying heterogeneity. While both models can account for firm-specific intercepts, these intercepts are identifiable in fixed effects, whereas the overall distribution of these effects is modeled in random effects.

The Hausman specification test or *m*-statistic (Hausman 1978) is used to draw conclusions on *both* the issue of endogeneity and whether a fixed or random effect model is appropriate for these data. This well-known statistic is essentially a test for the correct specification, i.e., the correct way to deal with the error term. Our analysis ($p = 0.38$) clearly shows that we cannot reject the null hypothesis of the test that the effects are indeed random. Essentially, we test if the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. An insignificant *p*-value tells us that it is safe to use random effects. Furthermore, we have a large *N* small *T* (more panel structure) rather than a large *T* data set, i.e., we have more firms over small number of periods rather than a time-series cross-section data set. For the former, a random effects model is more appropriate. In addition, we have an imbalanced panel, i.e., the cross-sections of firms over the different time periods are not identical. Therefore, a fixed-effect model is not appropriate because it will simply eliminate these data points, whereas a random effects model will account for them.

4. Discussion

Most firms are investing in enterprise systems in order to digitize their business processes and build capabilities for successful performance in a digital economy (Sambamurthy 2003). As a result, the growing demand for enterprise systems software has fueled growth of the ESS industry and proliferation of software components and horizontal markets. Descriptive examinations of the industry suggest that many of the ESS firms not only face each other in multiple markets, but they also compete

in crowded markets. Existing research on multimarket competition, primarily in airlines, lodging, and financial services, suggests that the participation in crowded markets should have adverse effects on firm performance. Given this anomaly and the paucity of research on the structure of competition in the ESS industry, our goal is to examine the performance consequences of competition among enterprise systems software providers.

We seek to answer three questions. First, should ESS firms compete in as many markets as possible? Our research provides clear evidence that firms do not benefit by offering a large number of software components. Because the customers of ESS products prefer that their acquisition of components from different markets be compatible with each other, it would have been logical to expect an ESS firm would benefit from presence in most, if not all, markets. Yet our results do not provide support for such a choice by ESS firms. Does this then imply that client enterprises do not care about integration anymore?

The answer to the above question lies in understanding the common ways in which ESS products are purchased and implemented. First, all ESS components are not purchased at the same time. Client organizations typically roll out a sequential acquisition and implementation schedule. Second, new components markets continue to emerge over time due to technological innovation and entrepreneurship. Finally, systems integrators and consultants can make components from different vendors work together, albeit at a cost. These peculiarities of the ESS marketplace suggest that simply having a portfolio of all components does not by itself contribute to an ESS vendor's performance. Instead, our results suggest that an ESS firm stands to benefit if it strategically chooses specific markets.

In second, the question, we examined how ESS firms should select their markets. We had argued that the customers of ESS firms experience ambiguity and lack the necessary insight to decide which software components might be important for them. Therefore, ESS vendors cannot base their market selection on a priori analyses of customer choice. Instead, the customers' choice of components is influenced by the ESS industry's signals about which markets and components are more desirable in their digital platforms. Thus, as an

alternative, ESS vendors could use mimetic or herding behaviors and choose crowded markets. When a large number of vendors commit to a specific market, their collective presence provides a credible signal to the customers. ESS vendors benefit from being present in crowded markets because they are likely to be viewed as offering important components. Consistent with our hypothesis, we do find evidence of the positive effects of participation in crowded markets. Thus, in quite a contrast with the existing strategy literature, we find that ESS vendors should benefit from the positive signaling aspects of crowded markets. Evidently, participation in markets where most other vendors compete is a credible show of strength to the client organizations. This could perhaps be because when buying components, client organizations prefer firms that offer components in important markets, and any externality benefit driven by the user need to integrate components can be internalized largely by such strategic choices of markets. Therefore, our results suggest that the common supply-side fears of competing for resources (and hence avoiding markets with high overlap) as observed in other industries (Baum and Korn 1996) is not a valid concern for competition in ESS and even perhaps other digital goods industries. Rather, the user-driven need to integrate components and the resulting indirect externalities that can accrue to vendors trump any disadvantages from high market overlap.

However, our results demonstrate that the positive effects of participation in crowded markets are only weakly significant. Based on the existing literature, we had argued that even though crowded markets are attractive, they are still buffeted by the adverse effects of increased rivalry. The weak significance suggests that the positive effects of signaling are countered by the growing pressures of rivalry. Thus, the benefits of participation in crowded markets do appear to be diluted by increased market overlap and competitive rivalry.

In that context, our third contribution is to demonstrate how ESS vendors can leverage multimarket contact to enhance the virtuous effects of crowded markets. Not only did we find that multimarket contact enhances firm performance, but also that the interaction of multimarket contact and market overlap has a significant positive effect on firm performance. Our research suggests that ESS vendors can

significantly benefit from participation in crowded markets when they have higher multimarket contact with their rivals. Few studies have examined the joint effects of multimarket contact and market overlap and our research provides insights into how ESS vendors can profit from competing in the crowded markets of the ESS industry.

Our results do flow against the grain of analytical models in the economics of standards that have suggested that firms should offer a large number of software components to extract externality benefits (Economides 1988, Matutes and Regibeau 1988). Our results suggest that these benefits exist only when the components are offered selectively, i.e., vendors should strategically extend their functionality footprint across the ESS portfolio. The resource-based view research provides another plausible explanation for why simply participating in a large number of component markets might not be beneficial. Gimeno and Woo (1999, p. 329) argue that a firm's success in leveraging the economies of scope is intricately related to the possibility of competitors also pursuing the same strategies, "...even if economies of scope make firms more efficient, those economies may not result in superior performance if rivals are able to draw on similar economies and are motivated to compete intensely." This is supported by the fact that multimarket contact is a common occurrence in this market.

Interestingly, while competing in multiple component markets might not be beneficial, it is evident that ESS firms benefit from customizing whatever components they produce to different industry sectors in that market. We find supporting arguments for such scale economies in other high technology industries as well where it has been observed that: "Product proliferation involves serving as many niches in the market as feasible by customizing the product offering to appeal to different users. To the extent that such a strategy is successful, it maximizes the potential size of the market and, therefore the rate of growth of the installed base" (Hill 1997, p. 17).

Theories of multimarket competition argue in favor of firms engaging in mutual forbearance and imply that when firms compete with each other in many markets they might engage in a form of tacit collusion leading to higher prices and revenue

(Bernheim and Whinston 1990). While there is adequate evidence of this phenomenon in many different industries, prior research underlines the need to investigate multimarket contact together with other market characteristics (Gimeno and Woo 1999). Our empirical findings not only support the mutual forbearance hypothesis (Jayachandran et al. 1999) but do so in the face of other variables. An important assumption in the mutual forbearance theses for Bernheim and Whinston (1990) and others is that multimarket contact is result of conscious decisions by firms. While multimarket contact is implicitly assumed to be a strategic intention on the part of a firm to trigger mutual forbearance, such a contact could also simply be an incidental outcome of market dynamics (Jayachandran et al. 1999). However, we can see that while multimarket contact and domain overlap are not correlated (i.e., firms with high multimarket contact do not necessarily have high domain overlap), ESS firms are able to leverage the multimarket benefits when they simultaneously make strategic choices about their market participation. This is an important finding particularly relevant to digital competition where newer markets constantly emerge.

4.1. Managerial Insights

Several managerial insights can be drawn from our results. First, ESS firms are better off by focusing on a limited number of software components while ensuring that they can instantiate a version or template for multiple industry segments. For example, while there might not be benefits to SAP to leveraging its resources devoted to developing HR modules in developing accounting modules, there are indeed advantages of positioning its HR module for not only the automobile industry but for food, services, telecommunications, and other industries. Second, the market selection should be a strategic one, i.e., even if a firm has expertise only in one or two component markets, it benefits by participating in crowded product markets. Crowded markets are an important signal of where the ESS vendors are likely to converge and create an attractive offering to the customers. It is judicious for the focal firm to participate in that market with a reduced fear of rivalry. This also implies that managers of ESS firms need to reassess their presence in a market on an ongoing

basis—certain markets might have become important since their inception, and crowdedness is one measure of such importance. Third, firms should simultaneously identify multimarket rivals so to maintain contact with them as they branch into newer markets. Finally, if an ESS firm is already present in a market that is becoming crowded (either by foresight or by chance), it should not only continue to stay in the market but can also attempt to extract any externality benefits by entering other markets. Our results tell us that if such a new market being considered also has a high degree of multimarket contact, then the firm benefits very strongly.

Note that these results are not only applicable to ESS firms but also to the wide array of information services firms like Google, Yahoo!, and others. A key takeaway of our research is that a new firm with a specialized portfolio cannot survive if it doesn't also offer services in the already crowded email, portal, and other services arenas. Our research provides some insights about why firms such as YouTube are quickly absorbed into larger portals, and very few independent niche providers survive for long.

4.2. Directions for Future Research

Before identifying directions for future research, it is important to acknowledge the important limitations of our research. One limitation of our data set is that we do not have individual performance metrics for each component market. This might have allowed us to identify market-level phenomena in addition to our current firm- and industry-level analyses. Both research and practice can benefit from a more granular analysis, i.e., through examining performance metrics in each market and by examining the evolution of market choices—although relatively little data are forthcoming at this level for this industry. Furthermore, the nature of enterprise software is such that new functional requirements continually emerge as business practices change, and it would be interesting to study how incumbents choose to enter into new markets and study their survival. As new functional requirements continually emerge with changing business practices (and thus result in new markets), investigation at a granular level will be warranted in the future to evaluate incumbents' choices of entry into new markets. Furthermore, we also know

that ESS firms engage in alliances to overcome product incompatibility. While such alliance choices are known to influence firm performance (Chellappa and Saraf 2010), more research is needed to understand alliance choices in crowded markets with the potential for mutual forbearance. Future studies might also try to test the recent argument that mutual forbearance could be limited or cease to exist with constant innovation (Roy and Prescott 2002).

The movement of ESS firms (and clients) toward Web services and cloud computing rather than installed components provides future researchers a rich base to study multimarket competition and related vendor strategies. As a result of this evolution, we observe the emergence of platform models of competition (Parker and Van Alstyne 2005) as many larger ESS firms will attempt to set up a platform and develop allied services around their platforms. It is not fully clear how the dynamics of mutual forbearance will hold as competition moves from multiple markets to platforms—a winner-take-all approach of platforms could even negate traditional multimarket considerations.

Our current results and extensions suggested above have significant implications for the study of competitive conduct in other digital goods and services industries as well. Firms such as Google, Apple, Yahoo!, and Microsoft jockey for competitive advantage in an industry exhibiting elements of both multimarket contact and crowdedness. Our study provides some guidance for researchers who wish to investigate these industries while taking into account that the business models in some of these industries do not extract direct rent from users but through third-party advertising networks. While empirical research in information systems has largely studied the usage of digital goods and services, less evidence is forthcoming on the market-level dynamics of firms that produce and offer these services. We hope that our ideas will stimulate further research that incorporates the principles of crowded markets and multimarket contact.

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