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Firm boundaries and buyer-supplier match in market transaction: IT system procurement of U.S. credit unions

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Abstract

By examining IT system procurement between U.S. Credit Unions (CUs) and IT vendors, we present descriptive analyses showing that firms' outsourcing decisions might be interrelated to each other through suppliers' market entry decisions. The buyer-supplier match in the market might also play an important role in determining firms' boundaries. We also argue that market thickness along the product space might determine the characteristics of input that is procured through the market.

Key words

Firm boundaries, IT system, match, relationship-specific investment

JEL codes: L22, L86

Section 1 Introduction

What makes firms outsource a part of their production process? This fundamental question in the theory of the firm has been attracting significant attention from researchers in both theoretical and empirical perspectives. While the development of this literature has deepened our understanding of firms' outsourcing decisions, the vast majority of these studies have considered a firm's outsourcing decision as an independent bilateral relation between an upstream and a downstream firm (Holmström and Roberts, 1998).

In this paper, we conduct descriptive analyses to examine whether firms' outsourcing decisions might in fact be interrelated to each other, through suppliers' market entry decisions. As more firms demand a particular feature of an input, it is possible that a supplier enters the market producing the input with the feature (market thickness effect). The firms whose preference is different from others may not be able to find a good "match" with any supplier and might decide to produce the input in-house.

We examine IT system procurement between U.S. Credit Unions (CUs) and IT vendors. The IT system for CUs is used for data-processing (DP) of routine data management and Customer Relationship Management (CRM). IT system often refers to software, hardware, and IT staffs who perform the DP. CUs' IT system is procured in two main forms, Vendor-Online (VOL) and Vendor In-House (VIH), which is distinguished by what (software or DP) is procured through the market. In the VIH case, CUs procure software from a software vendor and perform DP with their own IT staffs. In the VOL case, CUs procure DP from a DP vendor, which manages their entire IT system. The adoption of VOL means a higher degree of outsourcing for CUs.

We examine the patterns of (i) procurement forms (VIH or VOL) of IT system adopted by different CUs, (ii) CU-vendor (buyer-supplier) matches, and (iii) CUs' vendor switching. Note that, VIH facilitates less outsourcing compared to VOL, as CUs adopting VIH perform DP themselves. However, VIH still involves the market transaction of software. This allows us to examine the patterns of market transactions where firms adopt different degrees of outsourcing. We report the patterns of the above (ii) and (iii) for CUs adopting VIH and VOL separately, and provide possible explanations that are consistent with the observed outsourcing patterns (i.e. (i)).

We complement our data with a field study on CUs' IT system procurement, based on trade magazines and our interviews with large IT vendors for CUs and industry specialists. This helps us to understand how diverse CU preferences are over DP characteristics and how differentiated the software or DP can be across vendors. Several variables seem associated with such heterogeneity in DP preference. Among them, we use the size of a CU as a proxy for a CU's preference. The field study also helps us to identify the sources of relationship-specific investment that may be necessary when a CU uses a particular vendor's software or DP.

Main findings are as follows; 1) The likelihood that CUs use VOL is high for medium-size CUs and low for both small and large CUs, and 2) for both software and DP transactions, vendors seem to

differentiate their products. In particular, while CUs adopting VIH are more diverse than those adopting VOL in terms of their size, each software vendor seems to focus on servicing CUs in the same size category; within-vendor variation of CUs is similar between VIH and VOL. We also found that 3) a CU is more likely to switch vendors when its characteristics are more different from the vendor's typical CU. Given that the CU switches vendors, the CU also tends to choose a vendor whose typical clients are similar to the CU.

Based on such observations and our field study, we argue that CUs are heterogeneous in preference over the product space of DP. It might be more costly for a vendor to service a CU who is more different from the vendor's typical CU, because the vendor has to adjust its product to satisfy the CU's preference. The adjustment might incur relationship-specific investments, which may be bore by the vendor or CU. Thus, the vendor services only a section of the market instead of servicing CUs with diverse preferences. Such investment may be essential for the transaction of both software and DP, as we observe that, both software and DP vendors seem to differentiate their products, each servicing a section of the market. However, a relationship-specific investment may be more essential for VOL, because DP is a more complete input as compared to software. Thus, in the VOL case, vendors are concentrated in a segment of DP product space with many CUs with similar preferences, i.e. a thick market along the product space. In a thin market over the CU's DP preference, CUs choose to perform DP in-house, because the "investment" or the adjustment to any DP being provided in the market would be too large as compared to the costs of internal provision.

Our study is unique in several points as compared to the existent work in the literature on firm boundaries. First, our data provide us with a unique opportunity to observe the pattern of the combination of all firms matched to a particular supplier, allowing us to study on how suppliers' decisions on the characteristics of their products may be important in understanding firm boundaries. The strategy of suppliers in the market has been abstracted in the literature of the theory of the firm, as the market transaction is assumed always superior without the existence of asset specificities.

Second, the panel feature of our data provides us a rare opportunity to observe both supplier switching and procurement forms. It is a well-known notion that a market transaction of a specific input imposes potential supplier switching costs, and firms might decide to procure such an input in-house instead of through the market to avoid the risk of hold-up problems. By observing both, we can examine whether the supplier switching behavior of those who outsource can also be explained by the degree of specificity of the input transacted between firms and suppliers. No existing empirical study on firm boundaries has examined the behavior of supplier switching.[1] In addition, most empirical studies on

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[1] Based on the Transaction Cost (TC) theory, those which select market procurement require relatively less specific input. For example, Monteverde and Teece (1982) find that automobile assembler firms tend to vertically integrate the production of more firm-specific auto components and interpret it as a result of firms' avoiding potential

supplier or brand switching (ex. Chintagunta, 1998) focus on the transaction of consumer goods or the market when procurement style alternatives to the market is not realistic. We also observe the patterns of market transaction for software when firms produce DP in-house. This allows us to consider how the suppliers' strategy in entering the market for both complete and semi-complete products may interact with firms' degree of outsourcing.

Finally, as compared to the existing studies on the effect of market thickness (Hubbard, 2001; Pirrong, 1993; Ono, 2008), which looked at the role of market thickness that vary across geographical areas, we address the role of market thickness that vary across product space. The relative similarity and difference between their preferences may be associated with the level of relationship-specific investment necessary in the market transaction.

In Section2, we outline CUs' business operation and their use of IT systems. Section 3 describes organization forms of IT procurement. Section 4 describes our data set. Section 5 focuses on presenting the different characteristics between CUs adopting VIH and VOL. Section 6 presents the patterns of within-vendor distribution of firms. Section 7 presents the patterns of vendor switching. Section 8 concludes providing possible stories behind the observed patterns.

Section 2 Background: CUs and IT systems

CUs are financial institutions that provide services to their members (customers). CUs offer not only checking and saving accounts but also a wider array of financial services including more sophisticated saving and investment options as well as personal loans and mortgages; the specific product offerings vary across CUs. CUs are non-profit organizations and are entitled to preferential tax treatment, but they can draw customers only from the limited group defined by their field of membership; thus, managing the operation costs is essential for CUs.

Like many cooperatives, the members of CUs elect the board, who appoint a manager or a management team, who make various operational decisions. In small CUs, managers perform various roles including IT management. Any surplus is returned to the members as a form of high interest rates, etc. In that sense, members are residual claimants and board members who represent members' interest have incentive to choose a manager who operates the CU efficiently.[2]

Like other financial service providers, CUs need to perform DP, which include not only routine data management but also Customer Relationship Management (CRM). Routine data management includes recording, summarizing, and archiving transaction records as well as to secure such data and perform daily trouble shooting. CRM includes analyzing strategies on pricing, promotions, and other

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switching costs. The paper does not present, however, any observations or anecdotal evidence that assemblers do switch suppliers for the products that they outsource.

[2] See Emmons and Schmid (2000) for a discussion.

sales to improve their financial services, increase assets and sales, and retain members. CRM is considered a critical input for financial institutions (Knittel and Stango, 2008).[3] While CUs are non-profit organizations, CRM is still considered essential for CU survival.

Software functions define the kinds of financial products that CUs can offer, which determine the kinds of routine data management. Software functions also decide the kinds of analyses that can be performed for CRM. However, there are various ways DP could be heterogeneous among users of the same software. CUs may have different preferences in how trouble shootings are performed as well as for securing data. Given software functions, CUs perform CRM, focusing on different issues and creating different strategies dependent on their particular environments and needs. While CUs are typically smaller than banks, their preferences seem diverse as they differ in size, the base of potential members, and characteristics of members (income, ethnic group, occupation, community, etc.). The diversity of CUs' preferences on DP characteristics may influence their choice of how to procure IT systems as well as which vendors to choose.

Section 3 IT system procurement forms and the transaction cost theory

IT procurement forms

There are mainly two forms of IT system procurement, VIH and VOL. In the VIH case, a CU procures licensed software from a software vendor and performs DP in-house through its own IT staffs. The software is installed typically on a CU's hardware or comes with hardware in case of a so-called turn-key system.[4] In contrast, in the VOL case, an entire IT system resides at a vendor site (often called a service bureau), and a CU purchases DP from a vendor. A vendor performs DP using its own IT staffs and its software installed on its own hardware.[5] The clients communicate with the service bureau through terminals connecting to the vendor's servers.

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[3] For example, calculating the return on investment (ROI) for a specific investment requires software and examination on whether it is tightly aligned with the CU's particular product. The CU may also examine a specific product penetration and which specific members are responding. By doing so, many CUs decide who to target, which members to wave fees and which members to let go. (Source: Credit Union Magazine (March 1, 2005) "CRM success depends more on strategy than software")

[4] The turn-key system is pre-packaged with both software and hardware.

[5] The CU data resides on the vendor's system and is transmitted to the service bureau through terminals (often PCs) connecting to the vendor's servers by a network, such as the internet.

Note that a small fraction of CUs produce software itself.[6] We exclude these CUs to focus on the difference between the above two forms. In the VIH case, our field study suggests that the extent of the customization of licensed software is limited, and that open source license is rare, while CUs can purchase add-one, which are typically purchased from the same vendor for its core software.

Relationship-specific investment for DP

Because of CUs' diverse preference over DP characteristics, in the VOL case, a vendor has to learn each of its client's preferences and adjust its DP; in fact, many VOL vendors claim that they customize their DP for each CU. The more different is a CU's preference from the vendor's typical CU, the larger the necessary relationship-specific investment may be. Whether such costs are bore by the vendor or the CU, the particular investment is only valuable for that particular combination of vendor and CU.

As TC theory argues, when such relationship-specific investment is necessary, under the environment when complexity and uncertainty induce contractual incompleteness, one or both parties face the risk of opportunistic behavior (ex-post bargaining after the relationship-specific investment is made), the ex-ante investment would be inefficient.

In the VIH case, because DP is performed in-house, the risk of hold-up from the relationship-specific investment is considered mitigated.[7] Moreover, if the specificity arises only because of the relative difference between the CU and other clients of a vendor, in the VIH case, "specificity" may not actually exist, because the CU's IT staffs perform DP for only one CU.

Note, however, that the use of a VIH system does not remove all the issues due to market transactions, because CUs using a VIH system still have to purchase software (semi-complete input), which is used to produce DP (complete input). Because the necessary trainings (for CUs' IT staffs) are specific to a particular vendor's software, there would also be a risk of hold-up. However, by performing DP in-house, CUs would have more control over the characteristics of their DP.

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[6] In our study periods, 7% of all CUs developed software, while 64% used VIH and 26% used VOL. Apart from these CUs, 2.4% reported that they used manual systems, and 1.3% reported that they used other arrangements. These CUs are also excluded from our study.

[7] As Lafontaine and Slade (2007) point out, TC theory does not discuss much about how the opportunistic behaviors by employees is mitigated.

Section 4 Data

We use the NCUA Call Report data, [8] which record the characteristics of essentially all CUs including the information on their IT systems. The survey starts collecting the name of the vendor in December 1996. We use the semi-annual (June and December) data between December 1996 and December 2006.

Among all CUs in the original data, most CUs adopt VIH or VOL defined in Section 3 when procuring IT systems. As we mentioned above, we exclude a small fraction of CUs that use manual or entirely in-house developed systems. To increase the accuracy of identifying vendor information, we also drop some fraction of CUs whose vendor names are not verified by other sources.[9] This leaves roughly 6,700 CUs per period; during our sample period, the number of CUs declines from about 7,000 to 6,000 due to M&As as well as exits. On average, in our sample, 70% CUs use VIH, and 30% use VOL.

Section 5 CU characteristics and their choices on IT system procurement form

As Table 1 shows, CUs are quite heterogeneous. Small CUs service only a couple of hundred members, while the size of large CUs is compatible with some banks. The number of members is highly correlated with CUs' asset size; the correlation coefficient is .96 in terms of logarithm. Our field study seems to suggest that the difference in CU size is one of the important factors that differentiate CUs' preferences over DP characteristics. In this paper, we use the log number of members at a CU as a variable corresponding to a particular DP preference over the DP product space.

Note that while we cannot observe details of DP characteristics (especially the one related to CRM) that each CU performs, we at least observe characteristics of their software managing IT system based on the information on the kinds of financial services. The variation of financial products that CUs offer differentiates not only the routine data management but also the kinds of CRM that have to be performed (CUs providing small and large number of financial products may have to adopt different strategies). Our data provide information on CUs' offering of some selected advanced products, including fixed-rate mortgages, variable-rate mortgages, credit card loans, auto loans, home equity loans, business

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[8] The NCUA data serve as the analogue to the Federal Deposit Insurance Corporation (FDIC)'s Call Reports for commercial banks and are the source of records for balance sheets, income, and other information about CUs.

[9] The vendor names are reported by each CU in the data, and the name of the vendor is sometimes reported differently across reporting CUs and periods. To identify supplier switching accurately it is important to verify (clean) the vendor name with other sources. For such small vendors, however, it is difficult to verify the vendor's name information. We exclude a small fraction of CUs using relatively small vendors. In particular, we exclude CUs that ever use vendors that did not reach a certain size (20 CU clients) during our sample period. In order to exclude CUs miss-reporting their procurement form, we also exclude a vendor's particular procurement form if the number of its CU clients is fewer than ten during the sample periods. (30% of CUs using VIH and VOL are excluded from this procedure)

loans, money market, IRA/KEOGH, and share certificates. Typically, CUs increment their product offerings starting from a basic product such as auto loan to a more sophisticated product such as variable rate mortgage.[10] Thus, the count of these advanced financial products summarizes the variation of product offerings. Figure 1 shows how the number of advanced financial products is correlated with CU size. The CUs offering more advanced products are larger, which is consistent with our view based on our field study.

Figure 2 shows the distribution of CU size (log number of member) by IT system procurement form based on the data in June, 2003. We can see distinct differences between procurement forms. The size distribution of CUs adopting VIH is more diverse than those adopting VOL; the inter-quartile distance (IQD) of the log number of a CU's membership is 2.34 for CUs adopting VIH and 1.21 for CUs adopting VOL.

In Figure 3, we plot the predicted probability that a CU adopts VOL based on a Probit analysis where the regressors are CU size and the squared CU size. The CUs in both tails of the size distribution seem more likely to adopt VIH than medium-sized CUs. We found the same tendency using log assets of a CU as a measure of CU size.

As we mentioned in Section 1, such a pattern of adoption of procurement forms may be reflecting the CUs' heterogeneous preferences over DP as well as the entry of vendors providing software and those providing DP in the market. In the next section, we report vendor characteristics as well as the match between CUs and vendors to learn more about vendors' behaviors.

Section 6 Vendor characteristics and within-vendor distribution of CU characteristics

Vendor characteristics

Our sample consists of 46 vendors per period, on average. While some vendors cater to both VIH and VOL forms of IT procurement and selling software and DP to different CUs, in this paper, we treat each division of a vendor, separately, but we intend to take this into account in our future work. In June 2003, we identify 34 VOL vendors and 24 VIH vendors; 18 vendors offer both VIH and VOL.

Vendor sizes are diverse. In June 2003, the number of CUs per vendor is 24 at the 25th percentile and 143 at the 75th percentile, while there are also some very large vendors such as Fiserv with over 1,800 CU clients. While it is beyond the scope of this paper to explain the degree of market concentration for IT services for CUs, it is instructive to note that the market seems concentrated. For example, in June 2003, the top 3 vendors represent 50% of the market, while the other 50% is shared by 37 vendors. The market

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[10] Most basic services after saving and checking accounts seems to be auto loans (99% of CUs in our data offer auto loan), then share certificates, and then IRAs. The variable rate mortgage seems to be the most sophisticated among the products we observe (only 9% of CUs in our data offer this product).

share of the top 3 is high in each market for software and DP. Looking at vendor size by procurement form in Table 2, we notice that DP vendors have fewer numbers of CUs than software vendors, reflecting the nature of DP production.

<u>Within-vendor distribution of CU characteristics</u>

In Table 3, we summarize characteristics of CUs per vendor for each procurement form. First, let us look at the variation of CU characteristics that vendors might be targeting when they decide the basic characteristics of their products. The variation of such targets may give us an idea of how differentiated the vendors' products are. We use the median CU size of a given vendor as a proxy for such a variable. The within-vendor median CU sizes are less diverse for DP vendors than software vendors. The variation of vendor's targets seems to reflect that of the CU population distribution by IT procurement form.

More interestingly, the within-vendor variation of CU sizes is similar between VIH and VOL, based on the IQD of CU sizes within a vendor. For VIH, the within-vendor IQD of CU size is 1.15 on average, which is much smaller than the IQD of sizes of all CUs adopting VIH (2.34). For VOL, the contrast is small, but the within-vendor IQD of CU sizes is on average still smaller (1.06) than that of the overall IQD (1.21). It is possible, responding to CUs' heterogeneous DP preferences, vendors differentiate their products over product space, servicing only a section of the market. Such a tendency seems especially strong for software vendors, where it is much less clear for DP vendors.

We also note that the within-vendor median CU size is more similar among DP vendors than among software vendors. The standard deviation of the within-vendor median CU size is 1.2 for software vendors, but 0.67 for DP vendors. This may be reflecting various things. A DP vendor may have more incentive to service CUs with similar DP preferences than software vendors, because DP transaction may incur larger relationship-specific investments. At the same time, CUs may also have an incentive to adopt VOL only if there is a vendor providing DP that matches closely to their preferences so that necessary adjustments would be small. Following such stories, it is possible that DP vendors can enter only in the dense market around the medium- sized CUs in the CU population.

Of course, the observed patterns may also be reflecting many other factors that determine the combination of CUs serviced by a vendor. Such factors may include CUs' product offerings, location, field of membership, tenure with a particular vendor, etc. These other factors may also explain why the within-vendor CU size distribution overlaps between vendors. Figures 3-1 and 3-2 show the within-vendor CU size distribution for vendors with 20 or more CU clients. The within-vendor CU size seems to overlap especially among DP vendors. However, as we discuss in Section 7, even in the VOL case, CUs seem to distinguish DP vendors by the difference in the vendors' targets (or location in DP product space).

Section 7 Vendor switching patterns

In this section, we examine the patterns of vendor switching by CUs. When CUs' preferences over DP characteristics are heterogeneous, it is possible that the level of "match" between a CU's preference and a particular vendor's base product varies across the CUs transacting with the same vendor. It is possible that the more different a CU is from a vendor's typical CU, it is more costly for the vendor or the CU because of the necessary level of relationship-specific investment. While we observe the match between a vendor and the CUs in equilibrium, because both software and DP transactions involves long-term contract of typically 5 years, it is possible that some changes in vendor and/or CU characteristics motivate a CU to switch or a vendor to let go of some CUs instead of adjusting their product to a CU's preference change.

Definition of vendor switching

We identify vendor switching based on the vendor names reported by CUs in the data. In our sample, the total number of vendors falls from around 50 to less than 40, reflecting M&A activity, among IT vendors. When we observe that the change in vendor name reported by a CU corresponds to a M&A, we do not consider them to be a vendor-switching; we supplement our data by external sources to check which vendors are acquired and merged. In the sense that we do not capture CUs that intended to switch to an acquiring vendor regardless of M&A, we under-identify vendor switchings. Of all CUs in our sample, about 2.9% of CUs switch vendors between 6 month periods.

We also note that 1.7% of CUs switch IT procurement forms between 6 month periods. In particular, during our sample period, VIH seems to have become slightly more popular, increasing the number of CUs adopting this form from 68% to 70%; 3% of CUs adopting VOL switch to VIH between 6 month periods. In this paper, we focus on examining the patterns of vendor switchings focusing on CUs that did not switch procurement forms, while we intend to incorporate the CUs' switchings of procurement forms in future work.

Patterns of vendor switching: vendor's market segment

Is a vendor switching motivated to increase the degree of "match"? Here, we illustrate how the degree of "match" between a CU and a vendor is different before and after the vendor switch. To do that, we first create a measure of the "match" by calculating the distance between a CU and a vendor's typical (median) CU in terms of CU size, and standardize the distance by dividing it by the standard deviation of CU sizes of the vendor. We denote such a standardized distance by $dij(t)$ for CU i using vendor j in period t. The positive (negative) number indicates that a CU is larger (smaller) than the vendor's median CU.

In Figure 4, we plot $dij(t)$ against $dij(t-1)$ for the CUs that switch vendors as well as for the CUs that stay with the same vendors between two consecutive periods. Figure 4-1 is for CUs adopting VIH in both periods, and Figure 4-2 is for those adopting VOL in both periods. In both cases, for stayers, dij

changes only by a small amount, because CU size and the combination of CUs within the same vendor do not change much in a 6 month interval; thus, stayers are plotted along a 45 degree line. For CUs that switch vendors, we can see that, the distance shrinks after the switch. CUs seem to switch to a vendor targeting a CU more similar to themselves; the slope of the fitted line for switchers is less steep than that for stayers (45 degree line).

Such findings are complemented by Figure 5, where, for CUs that switch vendors, we examine the difference in the characteristics of base product between an incumbent and a new vendor. The Y-axis shows the difference in the median CU size between the new and the incumbent vendors; the positive number indicates that the new vendor is targeting a larger CU, and the negative number indicates that the new vendor is targeting a smaller CU. The X-axis is the switchers' distance (not an absolute distance) in the within-vendor distribution of the incumbent vendor. The positive (negative) number indicates that a new vendor targets a larger (smaller) CU than an incumbent vendor.

We can see that, among switchers, the CUs in the right tail of the incumbent vendors tend to switch to vendors focusing on larger CUs than their incumbent vendor, and the CUs in the left tail of the incumbent vendors tend to switch to vendors focusing on smaller CUs. In both cases, the "match" tends to be improved.

Such patterns of vendor switchings may be reflecting the incentive by both the CU and vendor to improve "match." The improved match may reduce the costs of future opportunistic behaviors as we discussed above. Recall that we observed that DP vendors' typical CUs are similar across vendors. However, switchers still seem to distinguish DP vendors by the combination of their clients and tend to switch to the vendor whose target is more similar to them.

Who switch out of incumbent vendors?

So far, we have looked at the match between a vendor and a CU in terms of CU size. However, as we noted above, various other factors may influence the match. We test whether we still observe the above tendencies even after controlling for other factors. In particular, we examine whether the likelihood that a CU switches out of its incumbent vendor increases with its relative size to the vendor's other CUs, after controlling for other variables. As a key variable, we include the absolute distance between a CU and the incumbent vendor's median CU in terms of size. Instead of including the standardized distance, we include the standard deviation of CU sizes for each incumbent vendor, separately from the distance measure, in order to see whether the variation of CU sizes at a vendor has a different effect. Below, we summarize the motivation to include other variables.

Other variables

Geography may matter for vendor switchings for various reasons. First, the CUs in the same locality may communicate with each other to exchange ideas in order to improve the efficiency of their operations.

Second, it is possible that CUs prefer to transact with the vendor that has an office in their locality so that they can maintain better communication; this may be more important especially when CUs adopt VOL, because the CUs rely on vendors more for the final characteristics of DP. In addition, if CUs are similar within the same locality, what we observed above may be reflecting CUs switching to a vendor that has an office in their locality.

To control for these effects, we include the measure of how intensely a CU's incumbent vendor services the CU's locality. As such a measure, we use the locality's share in the number of the vendor's clients. As we show in Appendix 1, different vendors seem to have different geographical nodes. In the area with a high share of the vendor's clients, the clients may communicate more to support each other in using the particular vendor's system. The high share may also be correlated with the likelihood that the vendor has its own office to assist clients in their locality. Even if the vendor does not have a physical office, it is possible that the vendor can save costs of travel if face-to-face communications are necessary.

We also include a variable to indicate whether a CU offers more financial products than other clients of its incumbent vendor. Our field study indicates that it is costly for a vendor to expand the functionality of software for a few clients. We include a dummy variable indicating the CUs offering the maximum number of financial products among a vendor's clients. It is possible that such CUs are facing a restriction in expanding their product offerings, and may be more likely to switch vendors. At the same time, the vendor may not be willing to expand their product offerings for only a few CUs. It is, however, possible that the vendor has already made specific investments to service such CUs.[11] In such a case, the vendor may be more motivated to keep such CUs.

We also control for CU size. Including a large CU would increase a vendor's scale more than including a small CU. It is possible that the vendor may try to keep a large CU by, for example, offering a lower price. We also control for the size of the incumbent vendor. Large vendors having more scale economy may satisfy their clients more, in general.

Finally, we include a dummy indicating the CUs using the incumbent vendor for the last 5 years or more. While the length of contracts varies, our field study suggests that a typical contract period is 5 years. A CU may more likely to switch after the initial five year has passed. While we cannot identify when exactly a contract started for most CUs, we can at least identify whether the CU used a particular vendor for the last 5 years or more; we exclude CUs for which we do not have observations of the previous 5 years. Note that the tenure with a vendor may also represent "revealed preference." The CUs that did not switch for the last 5 years might have stayed with the vendor because of some unobserved preference.

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[11] Of course, it is possible that because a vendor knows that the CU is not switching, it invested to service this CU.

Results

Tables 4-1 and 4-2 summarize the results of the logit analyses. We also perform fixed-effect logit analyses, in which we control for CU-specific effects. The qualitative results are similar between VIH and VOL. We found that, even after controlling for other variables, the absolute distance is positively correlated with the probability that a CU switches out of its incumbent vendor, consistent to our explanation. Note that when we replace the absolute distance with the CU size and squared CU size to allow the effect of CU size to be estimated flexibly, only the squared CU size obtained a significant sign.

The CUs at either tail of the within-vendor distribution seem to have more incentive to switch. If there are any costs of switching, it is possible that such CUs might have stayed with the incumbent vendor until the disadvantage from staying exceeded switching costs. The incumbent vendor may not adjust the characteristics of its product for such CUs that deviate "too much" from the vendor's target; adjusting the product for such CUs would impose so much risk of opportunistic behavior that the vendor may decide to let go of such CUs.

Geography seems to matter. The high concentration of the incumbent vendor's clients in the CU's locality is negatively associated with the CU's likelihood to switch out. This possibly reflects the effect of distance to the vendor's office as well as the effect of communications among CUs using the same vendor's product.

Vendor size is negatively correlated with the CU's likelihood to switch out. While this is consistent with the story of greater scale economies with larger vendor, it may also reflect many unobserved vendor-specific factors. Note that CU size does not obtain significant coefficients nor does the dummy indicating the CUs offering the maximum number of financial products.

Interestingly, the standard deviation of CU sizes for an incumbent vendor is positively associated with the CU's likelihood to switch for VIH, but the effect is insignificant for VOL. There may be various ways to interpret such a difference. It is possible that providing the product that can be used to diverse characteristics of CUs reduces the overall quality of the product. For example, software vendors may allocate less resource to customer service for existing clients while allocating more resource to enhance software functionalities for more diverse clients. In the VOL case, it is possible that CUs monitor vendors more closely because they entirely depend on vendors for the performance of DP.

Finally, the dummy indicating the CUs using its incumbent vendor for 5 or more years obtains negative and significant coefficients in the logit analyses, but obtains positive coefficients in the fixed effect logit analyses. In the fixed effect logit, where we control for CUs' unobserved preferences, it seems that the variable captures the fact that after 5 years the contract may be less binding and there would be less penalty for switching.

<u>Given CU switches, which vendor is chosen?</u>

Next we examine whether a switcher's choice of a new vendor is consistent with the static patterns of vendor-CU match. Among alternative vendors, is the vendor whose typical CU is closest to the CU (in terms of size) more likely to be chosen?

We perform a multinomial logit where a switcher chooses a new vendor among alternative vendors. In the VIH (VOL) case, the choice set consists of all the vendors that supply software (DP). Note that, here, we evaluate the vendor's characteristics in period *t-1* and that of CUs in period *t*, and we examine the CU's choice of a new vendor between *t-1* and *t*.

We include a dummy indicating the vendors whose product (software or DP) did not supports (in *t-1*) the offerings of financial products that the CU offers in *t*. It may be difficult for a vendor to expand its product characteristics for one or a few number of new CUs. The results indicate that it may be extremely unlikely that the vendor expands the functionalities of its product for new CUs. This is an extreme example indicating a vendor may decide to supply its product only if the necessary relationship-specific investment does not exceed a certain level.

Again, geography seems to matter. Given that a CU switches vendors, the CU is more likely to choose a vendor that has a geographical "node" in the CU's local region. Such geographical node may change over time for each vendor, because of the change in geographical distribution of their clients; the most dramatic case would be due to M&As between vendors. It is possible that as a vendor's geographical node moves across regions, the cost of communication between a vendor and a particular client may also change.

Finally, vendor size is positively associated with the likelihood that the vendor is chosen, again possibly reflecting scale economy effects. The standard deviation of CU sizes within a vendor is negatively associated with the probability of the vendor being chosen in the VIH case, but such effect is not statistically significant in the VOL case. This is consistent with what we found for the CUs switching out of an incumbent vendor.

Section 8 Conclusion

In this paper, we document stylized facts that seem to suggest that firms' outsourcing decisions are in fact interrelated to each other. Examining the match between IT vendor and CU, we found that (1) CUs are more likely to adopt VOL when their sizes are close to the average, (2) CUs of similar characteristics are sorted into the same vendor, and (3) CUs are more likely to leave the incumbent vendor when they are more different from other CUs using the same vendor.

Our finding is consistent with our hypothesis that vendors' products are horizontally differentiated and it is less costly for vendors to serve CUs of similar types since they can avoid relationship-specific investment. To the extent that a CU's preference is different from the vendor's target, providing the product to the CU may require relationship-specific investment, involving adjustment of the products.

Dependent on which vendor to transact with, a CU's preference may become less specific or more specific as compared to the vendor's typical CU. The need for the relationship-specific investment may be high for the case of DP transaction than software transaction, because DP is a more complete input for the CU. In the VIH case, because IT staffs perform DP for only their own CU, "relative" specificity of CU preference does not exist. This may explain why DP vendors enter only the thickest section of the market, where they could capture many CUs even by just focusing on a small section along the product space.

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Tables and Figures

Table 1 CU characteristics

	5th	10th	25th	Median	75th	90th	95th
N. of members	371	585	1,325	3,272	9,010	24,433	43,034
Log N. of members	5.9	6.4	7.2	8.1	9.1	10.1	10.7
Assets (mil $)	0.52	0.91	2.6	8.3	28	91	190
N. of advanced financial services	1	1	2	4	6	7	8

Table 2 The number of CUs per vendor for a given mode

June, 2003

	Any services	VIH	VOL
		Allvendors	All vendors
N. of vendors	40	34	24
	N. of CU clients per vendor for a given mode		
25th percentile	23.5	12	13.5
Median vendor	60.5	46	23.5
75th percentile	142.5	158	56

Table 3 Within-vendor CU characteristics for a given mode

June, 2003

	All modes	VIH	VOL
		All vendors	All vendors
N. of vendors	40	34	24
	Median CU size per vendor		
25th percentile	7.21	6.94	7.73
Median	8.08	7.78	8.24
75th percentile	8.57	9.01	8.43
	Inter-quartile distance of CU sizes		
25th percentile	.975	.908	.918
Median	1.20	1.15	1.06
75th percentile	1.50	1.48	1.25
	Standard deviation of CU size per vendor		
25th percentile	.75	.74	.72
Median	.89	.88	.83
75th percentile	1.00	1.00	.94

Table 4 When does a CU switch out of an incumbent vendor?

Dependent variable: Switch_out=1 if a CU switches vendor between t and t+1

Table 4-1. VIH

	Logit		Fixed effect logit (within CU variation across time)	
	Coef.	Robust s.e.	Coef.	Robust s.e.
Abs. relative dist. to a vendor's typical CU	0.388***	0.0471	1.10***	0.145
D=1 if a CU offers the max N. of financial product among CUs within a vendor	-0.00383	0.131	0.289	0.234
CU size	-0.0986***	0.0354	-0.115	0.560
The vendor's share in a CU's region	-1.27***	0.209	-3.69***	0.618
D=1 if a CU uses the same vendors for last 5 years	-0.829***	0.147	2.72***	0.173
Vendor size: log sum of members of a vendor's CU clients	-0.221***	0.0531	-0.254***	0.0781
SD of CU sizes at a vendor	0.378**	0.183	0.907**	0.402
Field of membership dummy	Yes		Yes	
Period dummy	Yes		Yes	
N. of observations	42309		7576	

* significant at 10% level; ** significant at 5% level; *** significant at 1% level
Robust s.e. with clustering over vendor-period for logit and robust s.e. for for fixed effect logit are used.

Table 4-2. VOL

	Logit		Fixed effect logit (within CU variation across time)	
	Coef.	Robust s.e.	Coef.	Robust s.e.
Abs. relative dist. to a vendor's typical CU	0.289***	0.088	0.840*	0.428
D=1 if a CU offers the max N. of financial product among CUs within a vendor	-0.04	0.173	0.26	0.295
CU size	-0.08	0.051	-1.46	1.09
The vendor's share in a CU's region	-1.66***	0.227	-4.48***	0.886
D=1 if a CU uses the same vendors for last 5 years	-0.416***	0.152	4.63***	0.427
Vendor size: log sum of members of a vendor's CU clients	-0.349***	0.034	-0.658***	0.142
SD of CU sizes at a vendor	-0.41	0.403	0.059	1.07
Field of membership dummy	Yes		Yes	
Period dummy	Yes		Yes	
N. of observations	18508		3243	

* significant at 10% level; ** significant at 5% level; *** significant at 1% level
Robust s.e. with clustering over vendor-period for logit and robust s.e. for for fixed effect logit are used.

Table 5. Given that a CU switches vendors, which vendor does the CU chooses?

Characteristics of vendors are evaluated at (t-1) and that of CU is evaluated at (t).

	VIH	VOL
Abs. dist. to a vendor's typical CU	-1.12***	-0.883***
D=1 if a CU's N. of financial products (t) is greater than the vendor's Max N. of financial products (t-1)	-14.9***	-13.2***
The vendor's share in a CU's region	2.56***	2.89***
SD of CU sizes at a vendor	-1.67***	-0.155
Vendor size: Log sum of members of the CU clients of a vendor	0.718***	0.778***

* significant at 10% level; ** significant at 5% level; *** significant at 1% level;
Robust s.e. with clustering over CUs is used.

Figure 1 CU size distribution by the number of financial products that CUs provide

(June, 2003)
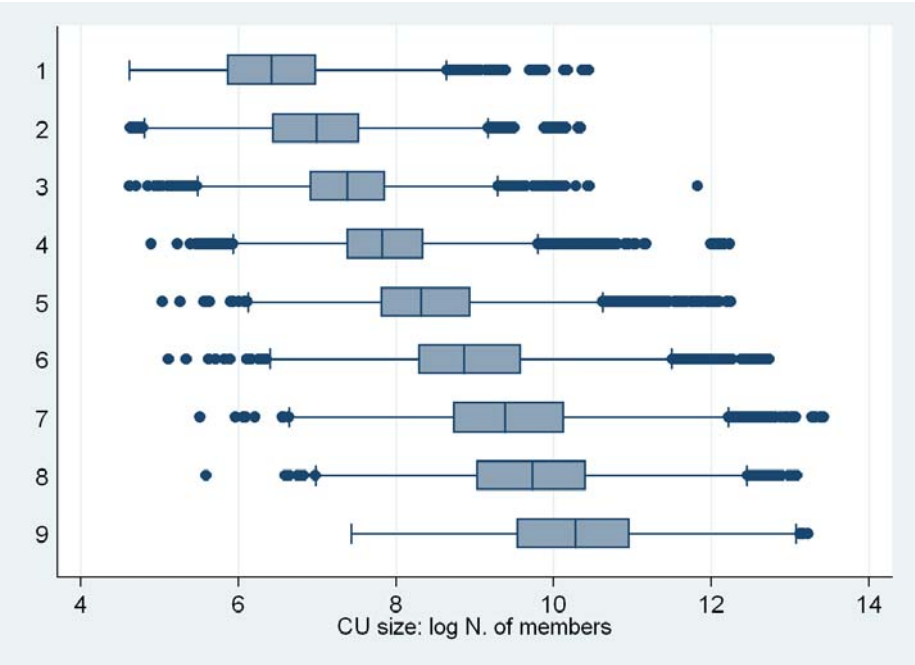
Figure 2 CU size distribution and choice between VIH and VOL

Figure 2-1 CU size distribution by IT procurement form (June, 2003)

Graphs by mode of procuring DP system
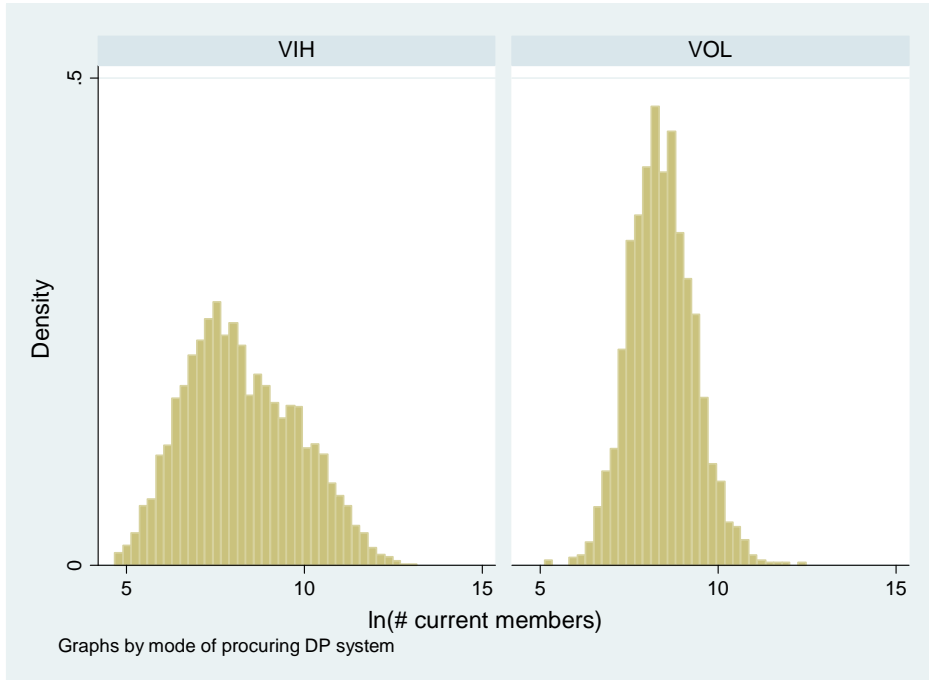
Figure 2-2 Predicted probability for a CU to use VOL (June, 2003)

Model: Probit model with CU size and the squared CU size
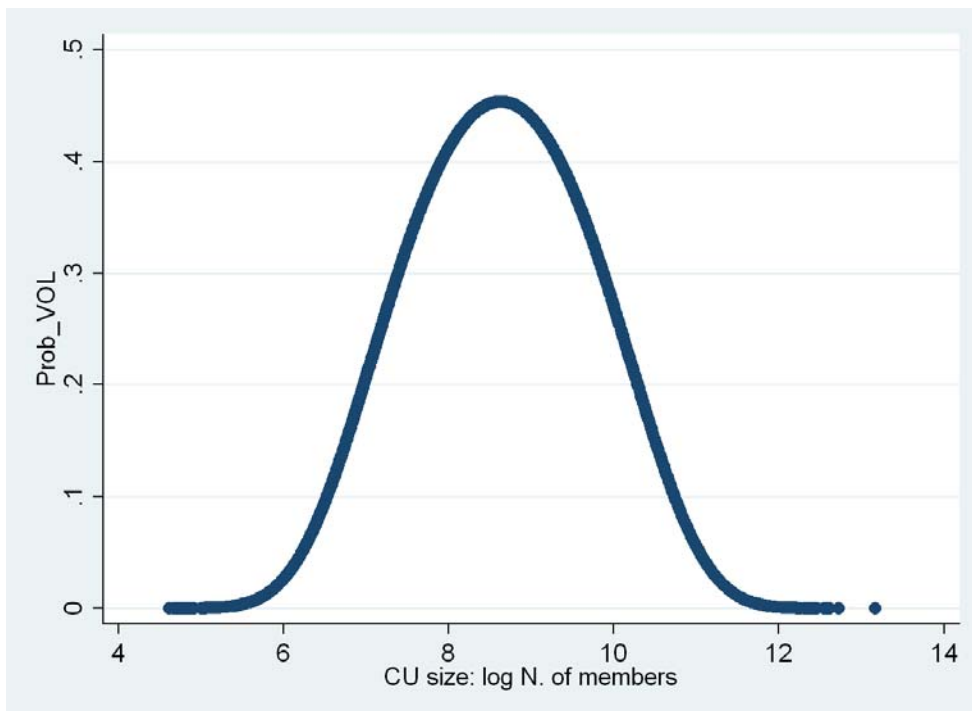
Figure 3 Within-vendor CU size distributions for each mode

Center line in the shaded box indicates the median. Right line of the box is 75th percentile, and left line is 25th percentile. Right adjacent line indicates the value that is approximately 1.5 times of the gap between 25th and 75th percentile above from the 75th percentile. Left adjacent line indicates the value that is approximately 1.5 times of the gap between 25th and 75th percentile below from the 25th percentile.

Figure 3-1 VIH
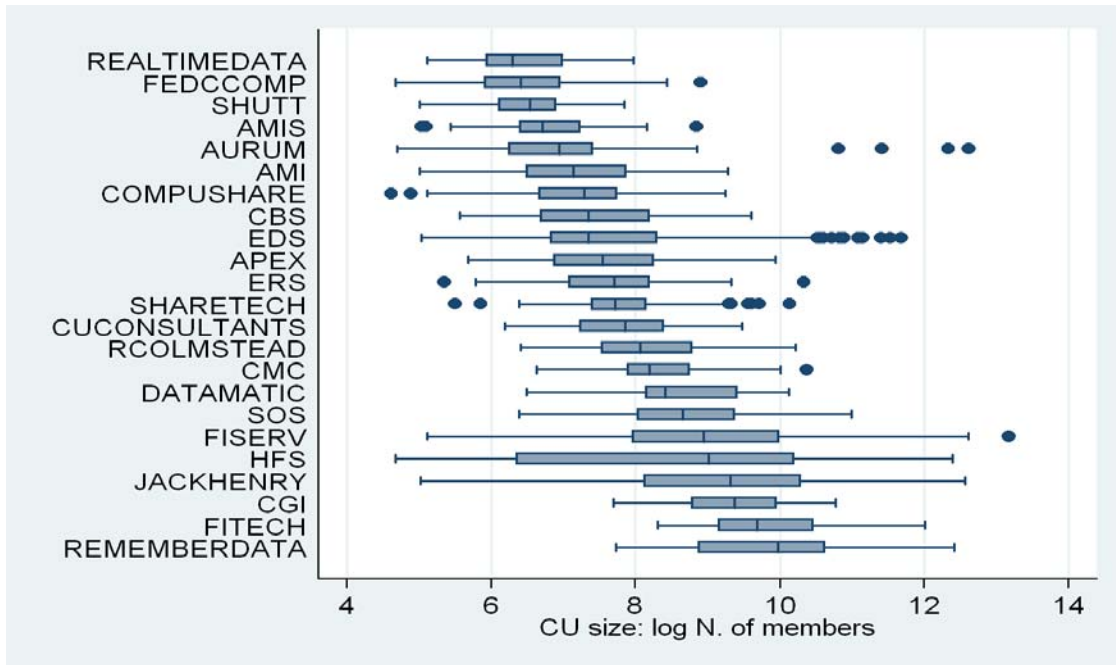
Figure 3-2 VOL
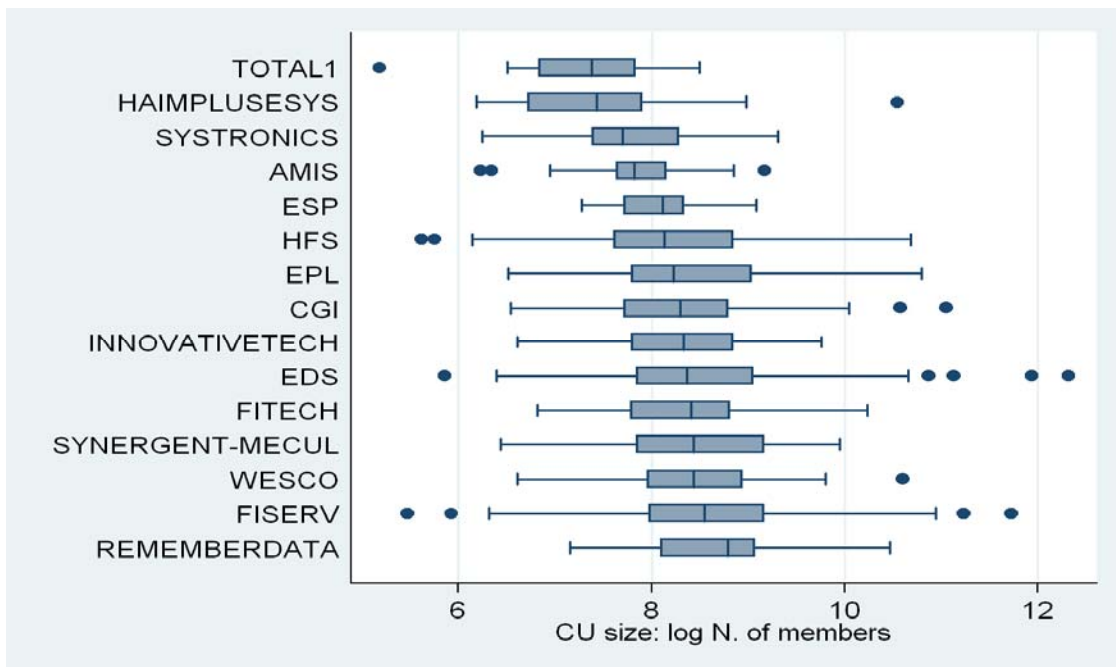
Figure 4 The standardized distance between a CU and the vendor's typical CU in terms of CU size: the change between two consecutive periods

Figure 4-1 VIH
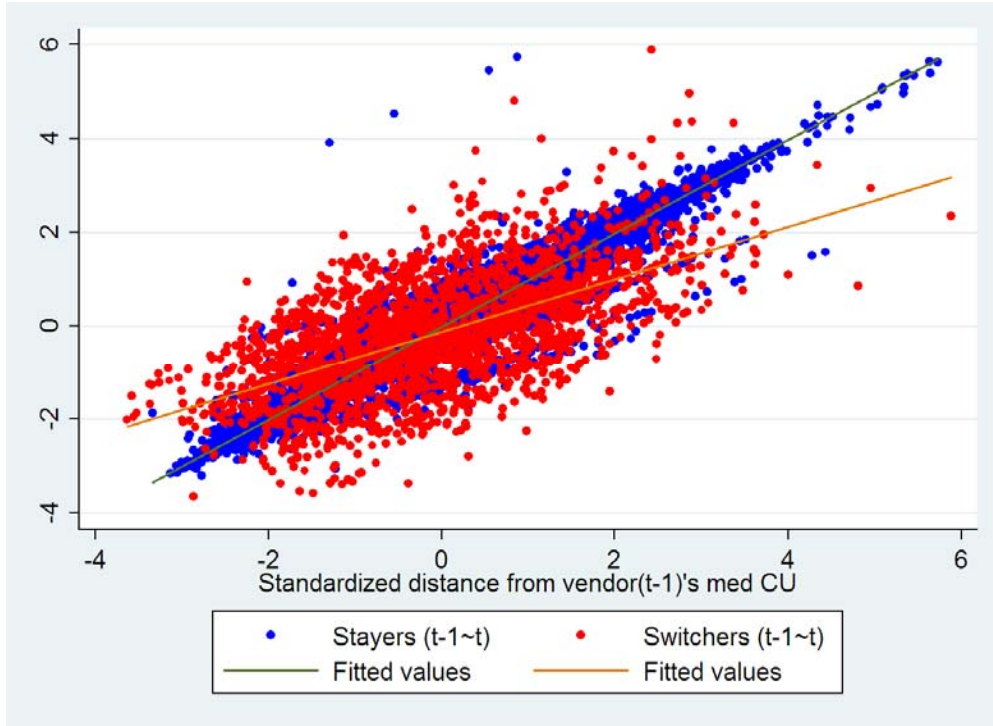
Figure 4-2 VOL
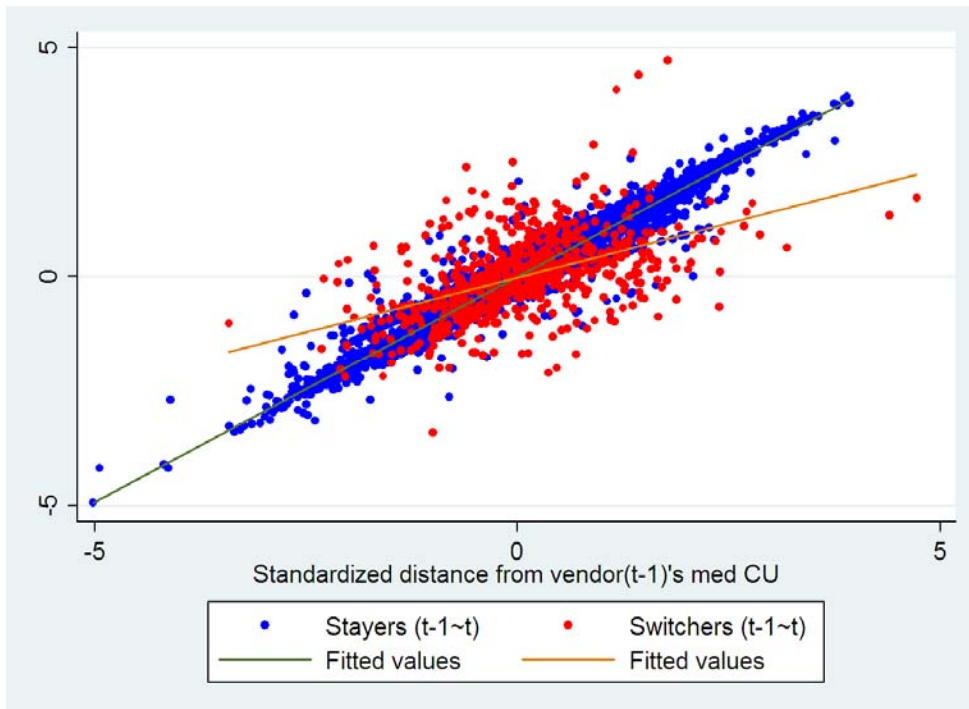
Figure 5 Do CUs switch to vendors in different market segments?

Figure 5-1 VIH: vendor switchers
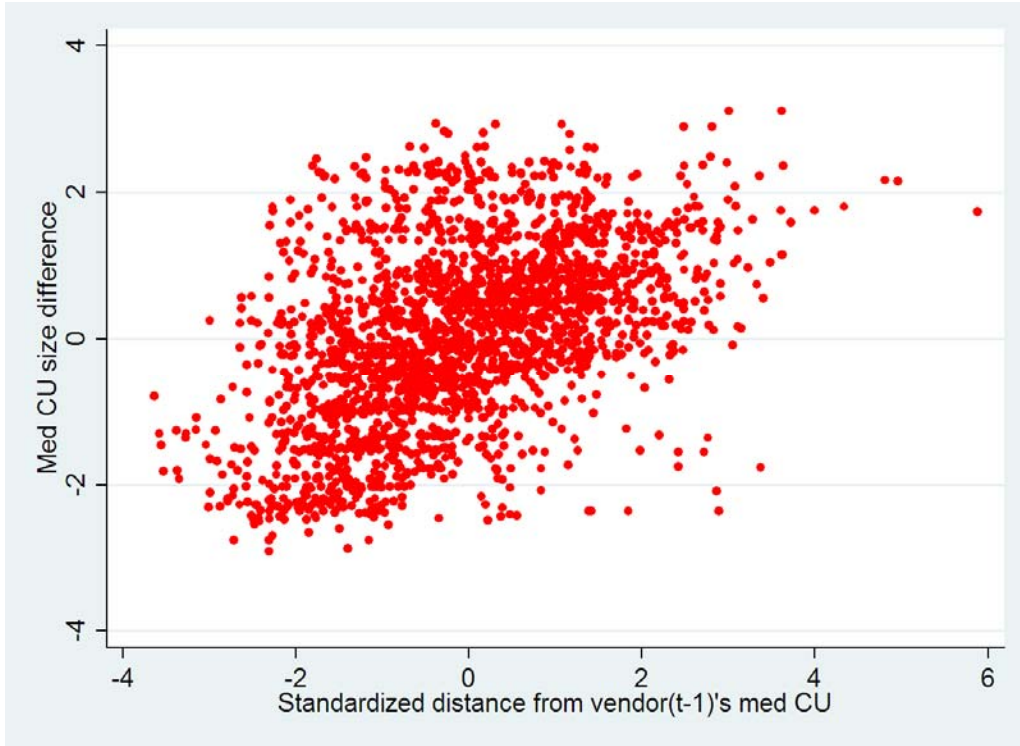
Figure 5-2 VOL
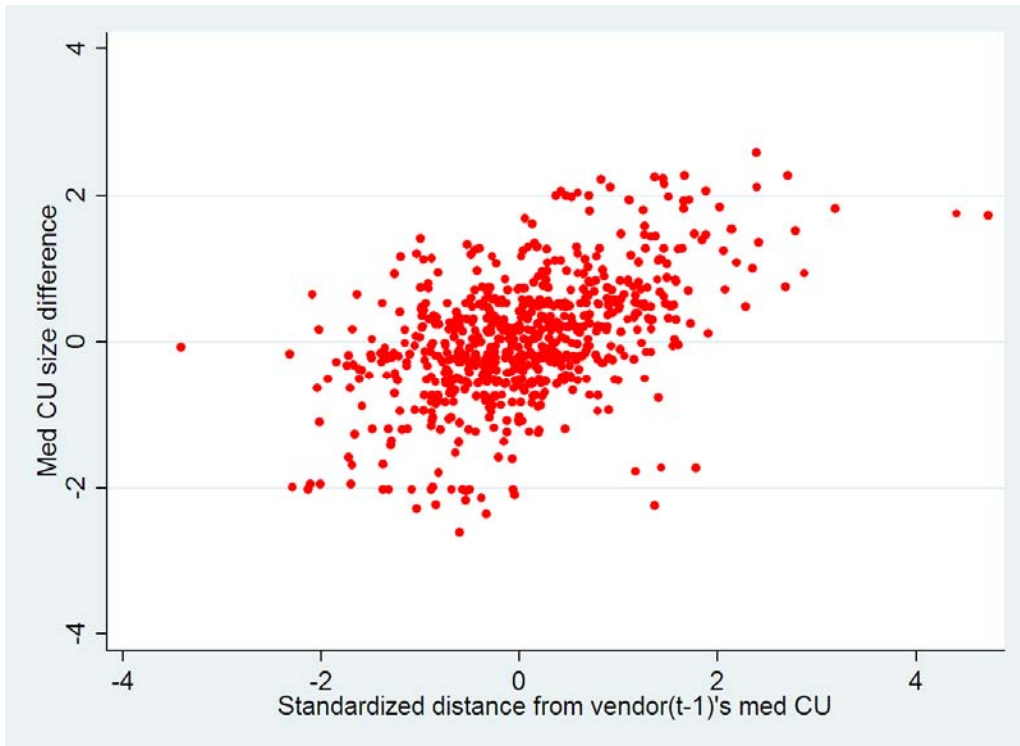
Appendix

A 1 Within-vendor distribution of CU locations

Here we show whether a vendor services a particular geographical area more intensely than others. For each procurement form, we compare the geographical distribution of CUs and that of a particular vendor's CU clients. It is often considered that the geography or the distance between suppliers and firms do not matter for IT service distributions, which may suggest even distribution of clients for a particular vendors. The data, however, seem to indicate the clients are unevenly distributed.

Table A.1 shows the comparison between the distribution of all CUs using VIH and that of three largest vendors. We also calculate the location quotients (LQ) that show how a given vendor's clients are concentrated in a particular area disproportionately to the overall CU distribution. There seem significant differences in geographical concentration of VIH services across vendors. The VIH users of FISERV are concentrated in the New England region 1.8 times more than the CUs using VIH, while those of JACKHENRY are concentrated in the East South Central region 2.5 times more than all CUs using VOL. Table 2 shows that such tendencies also exist among VOL vendors. While only 2.6% of CUs using VOL are in the Mountain area, 29% of Hearland Financial Service's CU clients are concentrated in that area.

Table A1 Geographical concentration (location quotient) of a vendor's CU clients

(June, 2003)

Table A1-1 VIH

Geographical division	All CUs	FISERV		FEDCCOMP		JACKHENRY	
	Distribution	Distribution	LQ	Distribution	LQ	Distribution	LQ
	(1)	(2)	(2)/(1)	(3)	(3)/(1)	(4)	(4)/(1)
New England	6.40%	11.6%	1.81	5.14%	.803	1.80%	.282
Middle Atlantic	16.8%	12.8%	.760	20.0%	1.19	6.96%	.414
East North Central	20.7%	15.6%	.753	15.8%	.763	10.8%	.523
West North Central	6.45%	9.03%	1.40	4.77%	.740	2.58%	.400
South Atlantic	13.5%	12.4%	.917	18.3%	1.36	19.6%	1.45
East South Central	5.57%	3.89%	.699	10.5%	1.88	13.9%	2.50
West South Central	11.8%	10.7%	.906	16.5%	1.40	10.8%	.920
Mountain	6.96%	7.48%	1.07	5.69%	.817	6.70%	.963
Pacific	11.9%	16.6%	1.40	3.30%	.278	26.8%	2.26
	100%	100%		100%		100%	

Table A1-2 VOL

Geographical division	All vendors	FISERV		Harland Financial Solutions		EDS	
	Distribution	Distribution	LQ	Distribution	LQ	Distribution	LQ
	(1)	(2)	(2)/(1)	(3)	(3)/(1)	(4)	(4)/(1)
New England	8.49%	8.56%	1.01			1.88%	.221
Middle Atlantic	13.7%	13.5%	.985			22.5%	1.64
East North Central	21.2%	20.0%	.944	28.6%	1.35	10.6%	.501
West North Central	6.63%	4.37%	.659	9.52%	1.44	3.96%	.597
South Atlantic	17.1%	27.0%	1.58			17.1%	.999
East South Central	8.97%	2.91%	.325			14.2%	1.58
West South Central	9.74%	7.1%	.729	9.52%	.978	15.6%	1.60
Mountain	2.63%	2.0%	.762	28.6%	10.9	3.96%	1.51
Pacific	11.5%	14.6%	1.26	23.8%	2.06	10.2%	.885
	100%	100%		100%		100%	

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