Information technology and organizational slack

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Abstract

A characteristic of the information age is the dramatic increase in expenditures by organizations on information technology (IT). As a result of these investments, managers generally anticipate productivity gains, which are commensurate with the costs of IT. However, several empirical studies in the 1980s and early 1990s found no statistical association between IT spending and financial performance (the productivity paradox, PP). One possible source of this paradox was proposed by Brynjolfsson [\textit{Commun. ACM} (1993)]. He proposed that during the pre-1991 period, IT might have increased slack, but neither organizational output nor profits. We test whether the relation between investment and IT in the productivity paradox era was due to increased slack. We find that overall, IT investment led to an increase in slack in the period prior to 1991, but not after. Our results are primarily driven by manufacturing companies.

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1. Introduction

The impact of investments on information technology (IT) is still debated among researchers and practitioners (Martinsons and Martinsons, 2002). Contrary to theoretical arguments and professional beliefs that suggest a positive association between investment in IT and improved financial performance, empirical evidence in the 1980s and early 1990s suggested that there was no statistical association between IT spending and financial performance, hence, the productivity paradox (PP). However, by the mid-1990s, a positive
relation had been established (Brynjolfsson and Hitt, 1996; Bharadwaj et al., 1999; Bharadwaj, 2000; Stratopoulos and Dehning, 2000). As an explanation for the findings in the PP era, Brynjolfsson (1993) proposed that IT investment might have increased slack, but not either output or profits. A similar argument is presented in Brynjolfsson and Hitt (1996).

The proposition of Brynjolfsson (1993) is supported, indirectly, by the findings of Im et al. (2001). They find no market reaction to IT implementation announcements during the PP era (1981–1990), but they do find a significant positive market reaction after the PP era (1991–1996). To test this proposition directly, we test whether there was increased slack during the PP era (pre-1991), but not after the PP era. Specifically, we empirically test the assertion of Brynjolfsson (1993) of mismanagement as a possible explanation for the PP. This test of the relation between organizational slack and IT investments, allowing for moderating effects, indicates that companies that invested in IT during the PP era experienced a significant increase in organizational slack, whereas companies that invested in IT following the PP era, did not experience a similar increase.

2. Theory and hypotheses development

2.1. Organizational slack

Based upon a review of the literature regarding varying definitions of organizational slack, Bourgeois (1981, p. 30) proposed the following definition:

Organizational slack is that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to external environment.

In their seminal work, Cyert and March (1959, 1992) define organizational slack as the difference between the resources available to an organization and the necessary payments required to maintain the organization. The authors argue that slack may take several forms, it is not distributed evenly within the organization, and members who are in a position to accumulate more slack will do so.

Wages in excess of those required to maintain labor are paid; executives are provided with services and personal luxuries in excess of those required to keep them; subunits are permitted to grow without real concern for the relation between additional payments and additional revenue (Cyert and March, 1992, p. 42).

In addition, they argue that slack tends to increase—it absorbs excess resources—during relatively good periods, and tends to decline—works as a pool of emergency resources—during relatively bad times. In spite of the stabilizing role that slack can play within an organization, the authors point out that “this is not to argue that slack is deliberately created for such a stabilizing purpose; in fact it is not” (Cyert and March, 1992, p. 44).
Numerous empirical studies have used slack as an explanatory variable. Prominent among them are studies linking it to organizational innovation (Bourgeois, 1981; Cyert and March, 1992; Damanpour, 1987; Singh, 1986), entry timing/product market entry (Wally and Fong, 2002), as surrogate measure for the creation of an organizational environment that enhances a company’s IT investments and increases its chances of sustaining an IT enabled-competitive advantage (Kettinger et al., 1994), and to separate excellent firms from nonexcellent firms within the computer industry (Chakravarthy, 1986).

2.2. Productivity paradox

Several empirical studies in the 1980s and early 1990s found no statistical association between IT spending and financial performance, hence, the productivity paradox. Brynjolfsson (1993) has proposed the following four nonexclusive explanations for the PP: (1) mismeasurement of inputs and outputs; (2) lags due to learning and adjustment; (3) redistribution and dissipation of profits; and (4) mismanagement of information and technology.

Brynjolfsson (1993) attributes the potential mismeasurement of IT-related inputs and outputs to the difficulty of developing accurate, quality-adjusted price deflators. Lags due to learning and adjustment are a possible explanation for the PP because benefits associated with investments in IT may take several years before they materialize. These lags are due to a period of learning associated with adjustment and, possibly, with the restructuring of the organization caused by new IT. Redistribution is another possible explanation of the PP since “IT rearranges the shares of the pie” in favor of some companies “without making it any bigger”.

With respect to mismanagement, there are currently two possible interpretations, one introduced by Brynjolfsson (1993) and one introduced by Stratopoulos and Dehning (2000). Brynjolfsson (1993) argues that managers may have a hard time bringing the benefits to the bottom line, especially if investment in IT is not accompanied by changes in business processes. “Successful IT implementation processes must not simply overlay new technology on old processes” (Brynjolfsson, 1993, p. 75). The result is that investments in IT lead to increases in organizational slack rather than productivity and improved financial performance. Stratopoulos and Dehning (2000) present an alternative form of mismanagement, the inherent difficulty of managing IT projects. They attribute the lack of a significant association between investment in IT and performance to the high percentage of IT projects that are challenged or fail during their implementation stage.

Bakos (1998) offers a similar list of possible explanations for the PP: mismeasurement, mismanagement, diffusion delay, and capital stock theory. Although diffusion delay is similar to the lags of Brynjolfsson (1993), he replaces redistribution with the capital stock theory of Oliner and Sichel (1994). According to Bakos (1998), despite the recent spending on IT, its share of capital stock is still small. This is because firms have only recently started investing heavily in IT, and by nature, IT tends to rapidly become obsolete. This makes it difficult for researchers to directly observe the impact of investment in IT on financial performance.

Stratopoulos and Dehning (2000) argue that in all likelihood, the PP is due to a combination of factors and that, to truly understand it, each explanation should be tested.
independently, and then together. Brynjolfsson and Hitt (1996) considered and empirically tested the possibility of the PP as "an artifact of mismeasurement". Using neoclassical production theory, they calculated the contribution of inputs such as computer capital and IS staff labor to output. Output was measured in inflation adjusted dollars because, according to the authors, this partially accounts for changes in product quality and the introduction of new products. Their results indicate that IS made a substantial and statistically significant contribution to firm output and that the PP disappeared by 1991.

Stratopoulos and Dehning (2000) examined to what extent companies that have been recognized by industry experts and their peers as successful users of IT successfully will experience a statistically significant performance advantage relative to their competitors. Their empirical results provided support for the argument that successful investment in IT leads to superior financial performance. However, their tests were primarily after 1991 (the post-PP era), and they examined only successful users of IT.

As mentioned, there are two possible interpretations of mismanagement as an explanation for the PP: One suggestion was made by Brynjolfsson (1993) and another interpretation was provided Stratopoulos and Dehning (2000). While the latter was empirically tested and validated as another viable explanation for the PP, the proposition of Brynjolfsson (1993) was never empirically tested. In this paper, we empirically test the proposition of Brynjolfsson (1993) of increased slack as a possible explanation for the PP. We argue that there are two different IT investment paradigms, and the year 1991 is the approximate demarcation of the PP era and the post-PP era.

2.3. Hypotheses development

Over the past 20 years, the business environment has become more competitive due to a move toward globalization, rapid technological changes, and an increased sophistication in customer’s behavior. These changes, when coupled with the dramatic increase in computer processing power and data storage capability, led to an incremental approach of investing in IT. Prior to 1991, IT was generally seen as a panacea that could cure all corporate maladies and, as such, was added as an extra layer in the organization. In many cases, IT was simply added to existing business processes (Brynjolfsson, 1993). Companies tended to invest in IT to speed up existing processes, often without questioning the rationality of these processes in an IT-rich environment. Superimposing IT on existing processes led companies to some marginal improvement in these processes, but the overall impact on financial performance was anemic when the cost of investing and supporting IT and the organizational burden of adding an IT department were added to the picture. As a result, investments in IT during the PP era led to an increase in organizational slack rather than an improvement in productivity and financial performance (Brynjolfsson, 1993). This leads to our first hypothesis:

**Hypothesis 1.** Firms will realize an increase in organizational slack after implementing IT.

According to Hammer (1990), significant productivity improvements cannot be completely planned in advance, nor can they be implemented incrementally. Instead, they result from discontinuous thinking: a paradigm shift in which the business processes are reengineered from a cross-functional perspective. In the early 1990s, a paradigm shift
came about that was driven by the movement on business process reengineering or redesign (BPR). BPR was introduced as a way to deal with the changes in the business environment (Davenport and Short, 1990; Hammer, 1990). In what is considered the classical view, Davenport (1995) defined BPR as “the radical redesign of broad, cross functional business processes with the objective of order-of-magnitude performance gains, often with the aid of information technology”. Hammer (1990), Davenport and Short (1990), and Davenport (1993) have argued for the role of IT as an enabler of BPR. For example, Ford, Siemens, CIGNA, Eastman Chemical, Caterpillar, and American Express are among the well-documented cases where the IT-enabled reengineering of one or more business processes led to significant reductions in operating costs and inventory levels as well as in improvement in cycle time (Bartolomew, 1993; Davenport, 1995; Hammer, 1990). As a result of this, IT-enabled reengineering effort companies emerged leaner and more efficient in the 1990s. Surprisingly, even during the most recent economic downturn, companies and the economy, in general, continue to report productivity gains from investments in IT (US Department of Commerce, 2002).

Building on the proposition of Brynjolfsson (1993) of the mismanagement of IT investment as an explanation for the PP, we argue that the creation of organizational slack might have been masking the effect of IT investment on firm performance. Two broad facets of mismanagement relate to the creation of slack: overlay of technology and difficulty in managing the product. On the one hand, the overlay of technology would increase slack if the firm simply added on IT, without removing the technology that it was to replace. The result might be higher levels of slack [possibly from the selling, general, and administrative expenses (SG&A)/sales measure, for example]. On the other hand, difficulty in managing the project would result in a similar increase in slack, as the company would see increased SG&A. Additionally, mismanagement of IT will cause increased slack in the inventory/sales and AR/sales measures if the company does a poor job of implementing an IT that is related to either of those components of slack (i.e., an accounting information system). For example, in 1997, Oxford Health failed to catch millions of dollars in medical care costs as a result of poor planning and mismanagement of the IT system (Hoffman, 1998; Champy, 1998).

We test whether an increase in slack actually occurred in firms implementing IT during the PP era and if the process was reversed in the 1990s. The reversing of the process will coincide with the paradigm shift that BPR brought in the management of IT investments. This argument is consistent with the claim that “the PP disappeared by 1991, at least in our sample of firms”, (Brynjolfsson and Hitt, 1996 p. 541) and leads to our second hypothesis:

**Hypothesis 2.** Firms implementing IT in the PP era will have increased organizational slack, while firms implementing IT in the post-PP era will not have increased organizational slack.

While everybody is familiar with news reports comparing the efficiency of Ford versus Mazda and GM versus Toyota, we hardly ever hear similar comparisons from companies in the service industries. While a significant percentage of Americans drive foreign cars and watch their favorite shows on imported television sets, the majority of Americans travel on domestic airlines and bank with local banks. Given the very nature of service industries, they have been sheltered from international competition. In general, enterprises
which are not exposed to competition tend to develop slack (Baily, 1993). In a similar fashion, Roach (1991) suggests that manufacturing firms have had more of an incentive to reduce organizational slack than service firms have. He claims that service companies did not change their methods to be more efficient due to less competition in the service sector. He states that investment in IT by service companies did not improve productivity and made service companies less profitable. Ceteris paribus, manufacturing companies had a stronger incentive to reduce the IT-induced slack than service companies had. Hence, our third and fourth hypotheses:

**Hypothesis 3.** For manufacturing firms implementing IT, slack increased less in the post-PP era than it did during the PP era.

**Hypothesis 4.** For service firms implementing IT, slack increased the same in the post-PP era as it did during the PP era.

### 3. Dataset

The data set used in this study consists of organizations that announced significant investments in IT from the period 1981 to 1996 (Im et al., 2001). We began with the 238 IT announcements found in Im et al. (2001) and eliminated firms that did not have complete data in the Compustat Research Insight database during a 10-year period surrounding each IT investment announcement (5 years before the announcement and 5 years after the announcement). This process resulted in 109 suitable IT investment announcements.

Changes in the relative level of organizational slack, rather than absolute amounts, are significant in explaining firm behavior (Bourgeois, 1981). Measuring organizational slack as a change in the relative level of slack is important because many organizations make decisions based on the infusion or loss of slack, rather than based on its presence. Thus, our empirical tests use changes in organizational slack after an IT investment, relative to the level of organizational slack prior to the IT investment.

Organizational slack ratios may not generalize across industries or even organizations. As such, we measure organizational slack relative to each organization’s specific median industry slack. Following Miller and Leiblein (1996), organizational slack is measured using three financial ratios: accounts receivable as a percentage of sales, inventory as a percentage of sales, and SG&A as a percentage of sales. The ratios of accounts receivable/sales and inventory/sales measure the two largest noncash components of working capital as a percentage of sales. SG&A/sales captures slack in more discretionary costs such as advertising, salaries of nonproduction staff, and managers, etc., and captures the recurring components of slack. The aggregate recoverable slack measures for a given year consisted of the unweighted sum of the three standardized slack indicators (accounts receivable/sales, inventory/sales, and SG&A/sales).

For comparison purposes across industries, all ratios were normalized by industry average and industry standard deviation, and then averaged over 5 years (either 5 years preceding the IT implementation announcement or 5 years following the IT implementation announcement). The dependent variable is the change in the relative level of
organizational slack: average organizational slack 5 years after IT implementation minus average organizational slack 5 years before IT implementation. Descriptive statistics and correlations are presented in Panel A of Table 1 for all firms in both time periods. Panel B of Table 1 reports the descriptive statistics for each of the two time periods examined. A cursory examination of Table 1 seems to offer support for Hypotheses 1 and 2. The change in slack after implementing IT was positive overall and in the PP era, but near zero in the post-PP era. In addition, the change in slack after implementing IT is correlated with firm size, time period, and the manufacturing versus service firm distinction.

4. Empirical tests

First, we performed univariate $t$ tests of the change in organizational slack after implementing IT (results shown in Table 2). As predicted by Brynjolfsson (1993) and in our first hypothesis, the level of organizational slack increased significantly after implementing IT. This was true for the overall sample (mean=0.572, $P=.003$) and manufacturing firms (mean=1.297, $P=.013$). Our second hypothesis predicts that in the PP era (before 1991), slack increased significantly after implementing IT, but that the increases in slack stopped after 1990. In the PP era, slack increased significantly for the overall sample (mean=1.521, $P=.004$), service firms (mean=0.429, $P=.044$), and manufacturing firms (mean=2.953, $P=.010$). In the post-PP era, there were no significant

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**Table 1**

(A) Descriptive statistics and correlations, all firms and time periods

<table>
<thead>
<tr>
<th>Variable</th>
<th>$n$</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>S.D.</th>
<th>$Size$</th>
<th>$ABROE$</th>
<th>$Early$</th>
<th>$Service$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Diffslick$</td>
<td>109</td>
<td>-3.93</td>
<td>11.38</td>
<td>0.57</td>
<td>1.97</td>
<td>0.254$^a$ (.008)$^b$</td>
<td>-0.029 (.764)</td>
<td>0.348 (.000)</td>
<td>-0.287 (.002)</td>
</tr>
<tr>
<td>$Size$</td>
<td>109</td>
<td>4.28</td>
<td>11.86</td>
<td>9.00</td>
<td>1.52</td>
<td>0.006 (.947)</td>
<td>-0.009 (.925)</td>
<td>-0.232 (.015)</td>
<td></td>
</tr>
<tr>
<td>$ABROE$</td>
<td>109</td>
<td>-130.85</td>
<td>94.70</td>
<td>7.21</td>
<td>22.29</td>
<td>-0.010 (.918)</td>
<td>-0.215 (.025)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Early$</td>
<td>109</td>
<td>0.00</td>
<td>1.00</td>
<td>0.34</td>
<td>0.48</td>
<td>-0.171 (.076)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$Service$</td>
<td>109</td>
<td>0.00</td>
<td>1.00</td>
<td>0.68</td>
<td>0.47</td>
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(B) Descriptive statistics by time period

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<tbody>
<tr>
<td>$Diffslick$</td>
<td>$n$</td>
<td>Min.</td>
</tr>
<tr>
<td>$Size$</td>
<td>37</td>
<td>-0.77</td>
</tr>
<tr>
<td>$ABROE$</td>
<td>37</td>
<td>-20.40</td>
</tr>
<tr>
<td>$Service$</td>
<td>37</td>
<td>0.00</td>
</tr>
</tbody>
</table>

$Size$=firm size, measured as the natural log of sales. $ABROE$=abnormal return on equity, measured as ROE minus the industry median ROE. $Early$=a time period dummy variable, one in 1981–1990, and zero in 1991–1996. $Service$=a dummy variable representing service or manufacturing companies. $Diffslick$=change in the relative level of organizational slack due to IT investments, measured as slack after IT implementation minus slack before IT implementation.
increases in slack after implementing IT in the overall sample (mean=0.084, \(P=.394\)), service firms (mean=0.104, \(P=.416\)), or manufacturing firms (mean=0.034, \(P=.803\)). These results provide strong evidence in support of both Hypotheses 1 and 2. Thus, an increase in slack appears to provide an explanation for both the PP and the end of the PP.

We use the analysis of covariance (ANCOVA) to compare the change in organizational slack after implementing IT (diffslck variable) in two time periods, the PP era, 1981–1990, and the post-PP era, 1991–1996 (early variable). To test the third and fourth hypotheses, we examine the difference in the change in slack in the PP era compared with the post-PP era for service and manufacturing companies, controlling for firm size (size variable) and performance (ABROE variable).

The time period (early) is measured using a dummy variable coded “1” to represent 1981–1990, the PP time period, and “0” to represent 1991–1996, the post-PP time period. We introduce the service dummy variable to separate our sample into two industry groups, service and manufacturing firms. Using a firm’s primary SIC code to determine industry membership, the service variable is coded “1” to represent service firms and “0” to represent manufacturing firms. Firm size (size) was measured using the natural log of annual sales averaged over the same 5-year period for which organizational slack was computed. Abnormal return on equity (ABROE) is company-specific return on equity (ROE) minus the industry average ROE. ROE is a common accounting-based measure of firm performance. As such, this study uses the difference in firm ROE and its corresponding industry average.

There were two fixed effects in the model (early and service) and two covariates (size and ABROE) to control for the differences in firm size and operating performance as alternative explanations for the differences found in changes in organizational slack after implementing IT. Industry- and economy-wide factors are controlled for through use of slack measures standardized by the industry median and standard deviation each year.

The results of the ANCOVA analysis (shown in Table 3) show that there is a significant difference in the change in slack after implementing IT before and after 1991 (early variable, \(P=.000\)) and a significant difference in the change in slack after implementing IT between the service and manufacturing firms (service variable, \(P=.007\)). The interaction between early and service tests whether the difference in the change in slack before and after 1991 is different between manufacturing and service firms. The interaction term is significant at \(P=.002\). However, the slack measure used (sum of three ratios: inventory as a percent of sales, A/R as a percent of sales, and SG&A expenses as a percent of sales) is very different for service (e.g., banks) and manufacturing firms. It might not be appropriate to compare them, even after standardizing by industry.
The mean levels of changes in slack (Table 4, and shown in Fig. 1) can be used to test our third and fourth hypotheses. Fig. 1 demonstrates that although slack increased slightly for service firms in the PP era, it increased dramatically for manufacturing companies. Then, in the post-PP era there was no longer an increase in slack associated with IT investments.

The results in Table 4 are different from the univariate tests because they test if the mean levels of the change in slack after implementing IT are significantly different from zero, controlling for size and financial performance. First, there is a significant increase in slack after firms implement IT, and there is a significant decrease in the change in slack after implementing IT after 1990 ($P = .000$). One finding of these tests (when size and financial performance are controlled for in the model) that is different from the univariate tests is that service companies did not see a significant increase in slack after implementing IT in either period. Manufacturing companies did see an increase in slack after implementing IT, both overall and in the PP period. The increase in slack after implementing IT for manufacturing companies was significantly higher than the increase observed for service companies ($P = .007$). If fact, it appears as if the results are being driven primarily by manufacturing companies in the PP period. When controlling for firm size and financial performance, only manufacturing companies saw a significant increase in slack after implementing IT, and only in the PP period. There were no significant increases in slack after implementing IT in the post-PP period for the overall sample, service companies, or the manufacturing companies.

Table 4
Change in the mean level of organizational slack, controlling for size and performance*

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<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Manufacturing companies</td>
<td>0.875**</td>
<td>1.674**</td>
<td>0.075</td>
<td>1.600**</td>
<td>.000</td>
</tr>
<tr>
<td>Service companies</td>
<td>1.427**</td>
<td>2.799**</td>
<td>0.055</td>
<td>2.744**</td>
<td>.000</td>
</tr>
<tr>
<td>Difference</td>
<td>0.322</td>
<td>0.550</td>
<td>0.094</td>
<td>0.456</td>
<td>.420</td>
</tr>
<tr>
<td>Significance</td>
<td>1.105**</td>
<td></td>
<td></td>
<td></td>
<td>.007</td>
</tr>
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<td></td>
<td>.007</td>
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*Evaluated at covariates appeared in the model: size=9.0046, ABROE=7.2073. **Different from zero at $P<.01$, significant results in bold.
To test our third and fourth hypotheses, we have to compare the increase in slack after implementing IT in the PP era to the increase in slack after implementing IT in the post-PP era. For manufacturing companies, slack increased 2.799 after implementing IT in the PP era, and 0.075 after implementing IT in the post-PP era, a significant difference of 2.724. Thus, Hypothesis 3 is supported. For service companies, slack increased 0.550 after implementing IT in the PP era, and 0.094 after implementing IT in the post-PP era, an insignificant difference of 0.456. Thus providing support for Hypothesis 4.

5. Discussion and limitations

Our second hypothesis states that slack should increase for firms implementing IT in the PP era, but not after the PP era. The results support this hypothesis. Firms implementing IT during the PP era did significantly increase slack, while firms implementing IT after the PP era did not increase slack. This is consistent with the notion that in the PP era, organizations might have been simply superimposing IT onto existing business processes or increasing slack to remove some of the risk inherent in IT projects, resulting in a significant increase in slack following the IT investment. Whereas in the post-PP era, organizations had significantly less increases in slack following their IT investments.

Many of the difficulties that researchers have in quantifying the benefits of IT would also affect managers. If output targets, work organization, and incentives are not appropriately adjusted, managers may have difficulty in bringing the benefits of IT to the bottom line. The result is that IT might increase organizational slack instead of output or profits. Roach (1991) claims that service companies historically have had less of an incentive to reduce slack relative to manufacturing companies. Roach (1991) says that financial service companies (such as banks) did not have a need, during the time of our study, to improve efficiency the way that manufacturing companies did. First, there was a

Fig. 1. Graphical depiction of the change in the mean level of organizational slack, controlling for size and performance.
lack of competition in the financial services industries due to regulation and few foreign competitors. This made the need to change their methods to be more efficient less important than in the manufacturing sector, where intense competition led to dramatic changes and increases in efficiency. When manufacturing companies made investments in IT, they were forced to use them as levers to increase efficiency. When service companies invested in IT, this incentive was missing. Roach (1991) does point out that this is changing, but we do not observe this change in IT investments made through 1996. Our measures of slack captures this effect because Roach (1991) observed that when services invest in IT, there is an increase in fixed costs, but not a corresponding decrease in labor costs, as in the manufacturing sector. Unless service companies can somehow spread the fixed costs of IT over a larger base, investments in IT decrease efficiency. Previously, banks had difficulty doing this due to prohibitions on interstate banking and the combining of banks and securities firms that would allow banks to benefit from economies of scale. This was not true in manufacturing companies that managed to use IT more efficiently than service companies did.

An alternative explanation exists for the seemingly irrational consequence that in the service sector, investments in IT lead to an increase in fixed costs, but not a corresponding decrease in labor costs. This is attributable to the negative association between changes in customer satisfaction and changes in productivity, which have been observed in the service sector (Anderson et al., 1997). Contrarily, the authors observe a positive association in the goods industries. Anderson et al. (1997, p. 130) argue that “if a firm downsizes, productivity (e.g., sales per employee) may increase in the short term, but future profitability will be threatened if customer satisfaction is dependent on customized services by personnel”.

This study has several limitations. The first is the use of 1991 as the end of the PP era. This date was introduced by Brynjolfsson and Hitt (1996) and further tested by Im et al., 2001. We did not test to see if a different date provides a more clear demarcation of the eras. In addition, our use of 1991 is imprecise because we do not know the actual implementation date of the IT investments, only the date of the announcement of the IT investments. Most of the announcements are of planned investments, but many are of completed or in-process investments. We use 5 years before and 5 years after the announcements to measure slack. This assures that we are capturing the change in slack, albeit with a noisy measure. Thus, we cannot definitively answer as to when the productivity era ended, other than to say it was around 1991.

There are also possible problems with our measure of organizational slack. Although the measure we used has been used in previous studies (e.g., Miller and Leiblein, 1996), it might not be the best measure of slack, particularly for service companies that do not have inventory. This is partly mitigated by the fact that slack is measured relative to the industry level of slack.

A third limitation is the fact that we test for increases in slack as an explanation for the PP, independently of the other explanations offered by Brynjolfsson (1993) and Bakos (1998). To the effect that these explanations are confounded, there is a possible problem with correlated omitted variables. Further research should test the explanations for the PP simultaneously to see if each explanation holds, controlling for alternative explanations.
A fourth limitation is that our fourth hypothesis predicts the null. There was a slight change in the increase in slack after implementing IT for service companies in the post PP era versus the PP era, but the difference was insignificant in our model. It is possible that with more powerful tests (larger sample size, less noisy measures, better control variables), this difference might be significant, refuting our fourth hypothesis.

6. Conclusion

This study builds on prior research on the productivity of IT investments in the spirit of continuing a cumulative tradition of IS research. This work serves to complement the rich case study and other quantitative work, which are beginning to show that IT spending is of value to the firm. In doing so, this study provides further insight into the notion of firm-level IS effectiveness and provides some additional optimism in its observation of positive impacts of IT investments in recent years.

Both practitioners and academic researchers of IT management have attempted to determine the value of investment in new technology. As such, the PP has intrigued and even frustrated researchers. Now, the picture is becoming clear that the PP was due to a combination of factors such as IT not contributing significantly on average to profitability and researchers having difficulty measuring the benefits of IT when they did occur. IS researchers are now able to pinpoint the reasons for IT not making a significant contribution (the failure of a large number of IT projects, mismanagement of IT assets, etc.) due to theoretical models explaining when IT will and will not pay off and the more precise measurements of the benefits of IT (or lack thereof). It now appears as if there was little real contribution from IT to the average firm’s productivity or efficiency before 1991, but after 1991, IT started to pay off even for the average firm. One reason is that IT was starting to be used to replace and streamline business processes rather than being added as an additional layer with corresponding increases in expenses.

We predicted that as IT became a lever in BPR, these increases in slack would go away. Our results confirm this hypothesis. We find that after implementing IT in the PP era, firms had an increase in slack. However, manufacturing firms, the firms using IT as a key component of BPR in the post-PP era, did not have increases in slack after implementing it.

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References

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