



Do Information Technology Resources Affect Motor Carrier Firm Performance?

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Importance of Information Technology for Motor Carriers

- Firms are investing in IT:
 - On board satellite tracking systems
 - Integrated web sites allowing multiple user functions
 - Programming their own transportation management software applications
 - Other physical hardware such as office computers, networks
- Thin industry margins and strong competition mean that technology decisions need to contribute to bottom line

Framing of Research Question

- General IT Impact

- Past 20 years has seen many studies study impact of IT on firm performance (productivity paradox), with varying results due to:

- Industry differences
 - Dependent variable measure (productivity measures more likely to show sig. results vs. financial measures)
 - Data (firm level more likely to show sig. results vs. industry level)

- (Barua et al., 1991; Loveman, 1994; Brynjolfsson and Hitt, 1996 & 2000; Kohli and Devaraj, 2003)*

- Research draws on the resource based view (RBV) to define how IT acts as a resource for the firm *(Barney, 1991; Bharadwaj 2000, Zhu and Kraemer 2002, Melville and Kraemer 2004)*

Does information technology affect firm performance?



Model and Variables

- Data:
 - Firm performance characteristics come from government U.S. DOT Census database for 2003
 - IT-related variables come from 2002-2003 HarteHanks surveys of motor carriers (firm level data)
- Variable Measures:
 - Dependent Variables (two models):
 - Financial measures: Firm profit
 - Productivity measures: Total ton-miles



Model and Variables

Independent Variables:

- Commonly separated into physical and human resources (Grant 1995; Bharadwaj 2000)
 - **Physical-IT** (PIT-Intensity): measure of intensity calculated as the number of PC's in the firm divided by the number of employees in a firm (Harris 1991; Mayberry-Stewart 1996; Zhu and Kraemer 2002)
 - **Human-IT** (HIT-Intensity): measure of intensity calculated as the number of programmers hired by the firm divided by the number of employees in a firm
 - **PIT-x-FirmSize**: the physical IT variable above interacted with annual sales information
 - **HIT-x-FirmSize**: the human IT variable above interacted with the annual sales information
 - » *Winter and Taylor 1996; Orlikowski 2002*
 - » *Sambamurthy et al. 2003: IT increases operational agility; counters bureaucracy*
 - » *Bailey et al. 2005: IT investment is possible antidote to bureaucracy*

Control Variables:

- **Firm Size**: measured as the firm sales for 2003
- **LTL-Dummy**: coded 1 if an LTL carrier, 0 otherwise
- **HHG-Dummy**: coded 1 if a HHG (household goods) carrier, 0 otherwise

OLS Regression Results

<u>Variable Name</u>	<u>Net Profit A</u>	<u>Net Profit B</u>	<u>Total Ton-Miles C</u>	<u>Total Ton Miles D</u>
Physical IT (PIT Intensity)	.026 (.483)	-.063 (-1.094)	.184** (2.958)	-.160** (-3.193)
Human IT (HIT Intensity)	-.017 (-.325)	.144* (2.095)	.006 (.095)	.214** (3.565)
PIT*FirmSize		.265** (4.080)		.878** (15.703)
HIT*FirmSize		-.280** (-3.722)		-.380** (-5.831)
FirmSize	.101* (2.020)	.047 (.817)	.393** (6.767)	.051 (1.012)
LTL-Dummy	.137** (2.789)	.144** (2.957)	-.023 (-.402)	-.065 (-1.560)
HHG-Dummy	-.156** (-3.165)	-.168** (-3.489)	-.034 (-.593)	-.061 (-1.479)
<i>N</i>	401	401	266	266
<i>R</i> ²	.055	.105	.163	.572

Beta coefficients above; t-scores underneath in parentheses

Dependent and Independent Variable data are for the year 2003

* $p < .05$ ** $p < .01$

Discussion

- Results are varying – depending on the measure of the dependent performance variable
- Human IT resources are positive and significant only in the models where the interaction effects are included
- Physical IT resources are positive and significant in the second model
- The HIT interaction variable is negative and significant for both models. This could suggest a negative effect of programmers as a firm grows larger
- The PIT interaction variable is positive and significant for both models



Conclusions and Implications

- This research has shown that both financial and output productivity measures can show significant results in the motor carrier industry
- As a firm grows larger, there appears to be a lessening impact of adding human technology resources

Thank You



Model

$$\begin{aligned} \text{PERFORMANCE} = & \beta_0 + \beta_1 \text{PIT} + \beta_2 \text{HIT} + \beta_3 \text{PITxSALE} + \beta_4 \text{PRGxSALE} + \\ & \beta_5 \text{DRIVERS} + \beta_6 \text{DRIVERS}^2 + \beta_7 \text{LTLDUMMY} + \beta_8 \text{HHGDUMMY} + \varepsilon \end{aligned}$$

Pearson Correlations

Dependent Variables

Independent Variables

Control Variables

	Net Profit	Ttl Ton Miles	PIT03	HIT03	PITxFirm Size	HITxFirm Size	Firm Size	HHGDummy	LTLDummy
Net Profit	1								
Ttl Ton Miles	.591**	1							
PIT03	-.008	-.008	1						
HIT03	-.006	.066	.338**	1					
PITxFirmSize	.269**	.274**	.275**	.199**	1				
HITxFirmSize	-.040	.141*	.222**	.660**	.491**	1			
Firm Size	.332**	.700**	-.044	-.004	.326**	.268**	1		
HHGDummy	-.098*	-.034	.048	-.015	-.010	-.023	-.022	1	
LTLDummy	.112*	-.031	-.016	.003	.116*	.102*	.082	-.088	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Sensitivity Analysis

- Variants of the six models were run to address the following questions:
 - What if the variables are lagged?
 - A: the independent variables were lagged by one year, with all six of the models and the corresponding variables staying either significant or not significant
 - What if the interaction terms are taken out?
 - A: the interaction terms were taken out of the six models and the results showed that the R^2 decreased or stayed the same for each model. Variables either became non-significant or were weakened slightly

