

# Process Innovation, Transaction Costs and Make or Buy Decisions

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# Background

- Tests of transaction cost theory on vertical integration
  - Wide range of studies
  - Reviews indicate support effect of asset specificity, or something like that, on in-house production
    - Variety of measures
    - Usually assume incomplete contracting or add uncertainty variables as predictors

# Literature on competence effects in conjunction with transaction costs

- Walker and Weber (1984)
  - Control for relative production costs between buyer and supplier (*call it comparative production costs – CPC*)
  - Showed effect of supplier market competition net of the production cost difference between buyer and supplier
  - Used by current researchers to argue that
    - Relative competences don't render transactions costs irrelevant
    - or
    - Relative competences affect make or buy decisions much more than measures of transaction costs
- Emerging empirical literature on capabilities
  - Poppo and Zenger, 1998; Schilling and Steensma, 2002; Leiblein and Miller, 2003; Jacobides and Hitt, 2005; Hoetker, 2005; Rawley and Simcoe, 2010
- Also, conceptual literature (Winter, 1988; Argyres and Zenger, 2010)

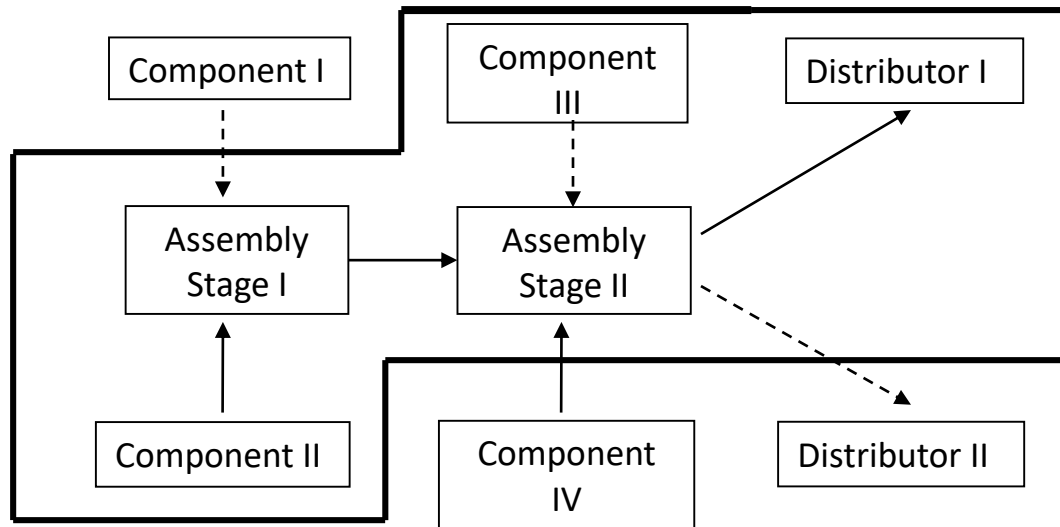
# Current study

- Examines role of buyer process innovation in make or buy decisions
- But adds the potential for buyer process innovation when the activity is internalized or when the activity is kept in-house
- Why process innovation?
  - If relative production costs are a powerful predictor of vertical integration, they must reflect a change in the buyer's production process
  - Process innovation (if it is negatively related to firm experience) indicates the initialization of a new capability

# Empirical Context

(Adapted from Williamson, 1981)

- Activities within the heavy line are owned and operated by the firm
- Activities outside the heavy line are owned and operated by market suppliers
- A dashed line with an arrow means that there is new information regarding the relative transaction and production costs inside and outside and so the firm undertakes a make or buy analysis
- A solid line with an arrow means the firm has no new information and so no make or buy analysis is performed



# Implications

- Innovations occur in activities – mostly
- Three types of activity
  - Current decision (Components I and III)
    - Only current decisions (I and III) are amenable for the analysis of the relationship between vertical integration, relative transaction costs and relative competence
  - Status quo (Components II and IV)
  - Tapered integration – Distribution I and II
- Make-to-make and buy-to-make activities are likely to have different frequencies of process innovation
  - Buy-to-make activities have no legacy process
    - *The process therefore must be new*

## Make to Make Decisions

Tapered Integration	Spillovers	Legacy Processes	Process Innovations
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## Buy to Make Decisions

Tapered Integration	Spillovers	Process Innovations
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# Assumptions

- 1) Buyer and supplier capabilities are substitutes
  - Alternative task designs, inputs, policies (including incentives)
    - Langlois (1992, Langlois and Robertson, 1989); Poppo and Zenger (1998), Jacobides and Hitt (2005), Rawley and Simcoe (2010)
    - Hoetker (2005)? Hard to tell
  - Substitutability increases with asset specialization
  - Can control problems be tied to supplier stickiness (Langlois)?



# Assumptions

- 2) Both buyer and supplier competence need to be measured (Hoetker, 2005) (Again, they are substitutes)
  
- 3) It is important to measure both buyer and supplier competences separately from their relative costs
  - Walker and Weber's (1984) measurement of relative costs is uninformative about the development of capabilities
  - Need measures of both production and transaction costs
  - *Relative competences and costs are related reciprocally*

# Assumptions

4) Make or buy decisions may be influenced by the availability of process innovation, but the reverse relationship is problematic

- Process innovation and make or buy decisions are coterminous and involve common variables
- Question to be resolved empirically
- Compare with Winter (1988) and Argyres and Zenger (2010) arguments regarding status quo activities

# Supplier asset specialization and buyer process innovation

## The Inducement Mechanism Argument:

- If the supplier's assets are specialized, the buyer is likely to experience higher transaction costs (standard transaction cost approach)
- To lower these costs through vertically integrating the activity, a favorable CPC is necessary, requiring modification of current process or investment in a new process

## The New Process Opportunity Argument:

- The buyer wants to invest in a new process to lower costs but is willing to allow the supplier to make the investment instead (Langlois, 1992; Langlois and Robertson, 1989)
- But the supplier's specialization lowers its incentives to invest

Either way:

**H1: Supplier asset specificity predicts buyer process innovation, controlling for relative production costs**

# Predicting Make or Buy Decisions

Based on the empirical context as described, compare the effect of process innovation on make to make decisions and buy to make decisions:

H2a: Process innovations are more likely to occur when the activity was previously sourced from a market supplier.

H2b: Process innovations are more likely to predict buy to make decisions than make to make decisions.

# Buyer Experience

For the new process to be a true innovation, and not a recombination of existing expertise, the buyer should have little experience regarding the technology required for activity. Buyer experience is also a necessary condition for buyer asset specialization (see Walker and Poppo, 1991; Poppo and Zenger, 1998).

So:

**H3: Lower buyer experience is positively related to process innovation.**

# Specification

$$1) \text{ ProcIn} = a_1 + b_{11} \text{ CPC} + b_{12} \text{ AssSpec} + b_{13} \text{ PriorMB} + b_{14} \text{ BuyExp} + b_{15} \text{ Proscope} + e_1$$

$$2) \text{ CPC} = a_2 + b_{21} \text{ ProcIn} + b_{22} \text{ AssSpec} + b_{23} \text{ PriorMB} + b_{24} \text{ BuyExp} + b_{25} \text{ ScFavSup} + e_2$$

$$3) \text{ MBdec} = a_3 + b_{31} \text{ ProcIn} + b_{32} \text{ AssSpec} + b_{33} \text{ BuyExp} + b_{34} \text{ CPC} + b_{35} \text{ VolUnc} + b_{36} \text{ TechUnc} + e_3$$

# Hypothesized Signs

Equation 1		Equation 2		Equation 3	
DepVar: Process Innovation (Procin)		Dep Var: CPC (positive values favor buyer)		Dep Var: Make (1) or Buy (0) Decision (Separate MM from BM decision)	
Coefficient/ Variable	Expected Sign	Coefficient/ Variable	Expected Sign	Coefficient/ Variable	Expected Sign
$\beta_{11}$ CPC	+	$\beta_{21}$ Procin	+	$\beta_{31}$ Procin	BM over MM
$\beta_{12}$ AssSpec	+	$\beta_{22}$ AssSpec	-	$\beta_{32}$ AssSpec	+/-
$\beta_{13}$ PriorMB	-	$\beta_{23}$ PriorMB	+	$\beta_{34}$ BuyExp	+
$\beta_{14}$ BuyExp	-	$\beta_{24}$ BuyExp	+	$\beta_{14}$ CPC	+
$\beta_{15}$ Proscope	+	$\beta_{25}$ ScFavSup	-	$\beta_{35}$ VolUnc	+
				$\beta_{36}$ TechUnc	+

# Data

- Forty make or buy decisions made over five years in a division of a large U.S. consumer durables company
- The author had access to the archive kept by the process engineers for each decision
- The CPC and narrative data for the decision were recorded for all but two decisions
- A questionnaire was developed to measure the variables in the hypotheses



But:

- Five decisions involved outsourcing to another division in the corporation
- The participating engineers in nine cases could not be located
- In two cases, the archival data were markedly different from the responses to the questionnaire
- Three cases had significant missing data on the questionnaire
- So the 59 total cases, only 40 were useful for analysis.

# Method

- Measurement model:
  - Multiple indicators (following Walker and Weber, 1984)
  - Factor analysis to assess convergent and discriminant validity
- Hypothesis tests:
  - Equations 1 and 2: Simultaneous equation model
    - Compare coefficients from 2SLS and LIML to assess weak instruments problem
  - Equation 3: Multinomial logit to compare Make-to-Make and Buy-to-Make decisions using Make-to-Buy as the comparison state

# Variables

Latent or Observed Variable	Acronym	Item Description	Questions (1 to 7) Likert scale, from Low to High)
Process Innovation	buynewpro	New Process	To what extent did your division invest in a new process or improve its old process so that it gained a production cost advantage over the supplier?
	newknow	New Knowledge	If your division invested in or improved its production process to increase its competitiveness, to what extent
Supplier Asset Specificity	suppropt	Supplier Proprietary Technology	To what extent does the leading outside supplier for this activity possess proprietary technology (e.g., patents) that gives it an advantage over other producers?
	suplabsk	Supplier Unique Labor	To what extent does the activity require labor skills that are relatively unique to outside suppliers?
	suptlseq	Supplier Unique Equipment	To what extent does this activity require tools and equipment that are relatively unique to outside suppliers?
Buyer Experience	buytlseq	Buyer Similar Equipment	How similar are the tools and equipment required for this activity to those already employed by your division?
	buyexperi	Buyer Similar Technology	To what extent does your division possess strong experience or expertise in the technology that comprises this activity?
Technological Uncertainty	techimp	Expected Technological Improvements	At the time of the decision, what was the probability of future technological improvements for parts produced by this process?
	specch	Expected Specification Changes	At the time of decision, how frequently were changes expected in the specifications of the parts produced by this activity?
Volume Uncertainty	volunc	Uncertain Volume Estimates	At the time of the decision, to what extent did you consider the volume estimates for the part or parts produced by the activity to be uncertain?
	volfluct	Expected Volume Fluctuations	At the time of the decision, to what extent did you expect significant fluctuations in the volume requirements for this activity?
Scope Economies	Proscope	Scope Economies in Buyer Process Innovation	If the division invested in or improved its production process to increase competitiveness, to what extent were the components of the new process useful for the production of other parts or part families
Scale Favors Supplier	scfavsup	Scale Favors Supplier	To what extent do substantial differences in the scale of operations for this activity between your division and outside suppliers favor the outside suppliers?

# Measurement Model

	Volume Uncertainty (VolUnc)	Supplier Asset Specificity (AssSpec)	Buyer Process Innovation (ProcIn)	Technological Uncertainty (TechUnc)	Buyer Expertise (BuyExp)
buynewpro	0.4064	-0.0577	<b><u>0.6915</u></b>	0.1949	-0.1534
newknow	0.1762	0.1902	<b><u>0.7272</u></b>	0.2273	-0.1867
suppropt	-0.1598	<b><u>0.6124</u></b>	-0.1918	0.2528	-0.0946
suplabsk	0.1561	<b><u>0.8243</u></b>	0.2046	0.0237	-0.1406
suptlseq	0.0371	<b><u>0.7348</u></b>	-0.0819	-0.0523	0.1298
buytlseq	-0.0667	-0.5274	-0.2774	0.1491	<b><u>0.5721</u></b>
buyexperi	-0.014	0.0159	-0.1901	0.0037	<b><u>0.6506</u></b>
techimp	0.314	-0.0097	0.3044	<b><u>0.7149</u></b>	0.1042
specch	0.6355	0.1093	0.2851	<b><u>0.4782</u></b>	-0.0725
volunc	<b><u>0.8326</u></b>	-0.0353	0.091	0.1292	-0.1001
volfluct	<b><u>0.8112</u></b>	0.1463	0.2116	0.0684	0.0873

	Number of Decisions
Make to Make	11
Make to Buy	20
Buy to Make	8
Buy to Buy	1

## Dependent Variable: Buyer Process Innovation

Independent Variables:	LIML	2SLS	LIML	2SLS
	Est. (s.e.)	Est. (s.e.)	Est. (s.e.)	Est. (s.e.)
CPC (endogenous) <span style="margin-left: 100px;">H2a</span>	0.185*** (0.0438)	0.166*** (0.0350)	-0.511 (0.436)	-0.248** (0.109)
Prior make or buy (PriorMB) (0=Supplier, 1=Buyer)	-1.538** (0.647)	-1.573** (0.616)	5.024 (5.177)	2.157 (1.563)
Supplier asset specialization (AssSpec) <span style="margin-left: 100px;">H1</span>	0.473** (0.233)	0.430** (0.209)	0.876** (0.387)	0.627*** (0.145)
Buyer Expertise (BuyExp) <span style="margin-left: 100px;">H3</span>	-0.511** (0.222)	-0.476** (0.202)	0.313 (0.480)	0.0228 (0.190)
Process Scope (Proscope)	-0.132 (0.187)	-0.0807 (0.162)	0.173 (0.160)	0.135 (0.102)
Make/Buy Decision (endogenous)			-21.17 (15.08)	-12.12*** (3.819)
Constant	4.171** (1.722)	3.991** (1.589)	11.32* (6.056)	7.944*** (1.726)
R-squared	0.392	0.487	0.484	0.724
Wald $\chi^2$	55.14***	64.84***	109.32***	198.01***

## Dependent Variable: CPC

Independent Variables:	LIML	2SLS
	Est. (s.e.)	Est. (s.e.)
Buyer process innovation (ProcIn)	9.68*** ( 2.696)	9.476*** (2.616)
Supplier asset specialization (AssSpec)	-4.401* (1.835)	-4.305* (1.795)
Prior make or buy (0=Supplier, 1=Buyer) (PriorMb)	16.329* ( 6.800)	15.943* (6.643)
Buyer Expertise (BuyExp)	3.927** (1.442)	3.858** (1.412)
Scale Favors Supplier (ScFavSup)	2.209 (1.571)	2.104 (1.531)
Constant	-40.755 * ( 16.098)	-39.718* (15.689)
R-squared	.422	.428
F- Value - df – 5,39	5.41***	5.54***

*Substitutes*



	I		II		III		IV	
	Make to Make Decision	Buy to Make Decision	Make to Make Decision	Buy to Make Decision	Make to Make Decision	Buy to Make Decision	Make to Make Decision	Buy to Make Decision
	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)	Coeff (s.e.)
(Signed) logCPC	.162** (.055)	.137** (.057)	.0960 (.067)	.0861 (.071)	-.019 (.077)	-.265 (.2)	-0.0056 (0.0643)	-0.101 (0.0916)
Supplier Asset Specialization (AssSpec)			-.836* (.493)	-1.04* (.536)	-1.44* (.783)	-2.71** (1.19)	-1.43** (0.707)	-2.37*** (0.895)
Buyer Expertise (BuyExp)			-.29 (.381)	-.514 (.411)	-.027 (.497)	1.68 (1.13)		
Technological Uncertainty (TechUnc)			.548 (.463)	.258 (.512)	.282 (.571)	-.533 (.813)		
Volume Uncertainty (VolUnc)			-.049 (.437)	.102 (.473)	-.179 (.532)	.073 (.677)		
Process Innovation (ProcIn)					1.437* (.770)	5.607** (2.53)	1.475** (0.711)	2.971*** (1.016)
Constant	-.753	-1.08**	1.78	3.51	-1.086	-23.18*	-0.976	-5.602*
Chi-Squared	17.07**		24.93		47.76		42.57	
Pseudo-R <sup>2</sup>	.216		.315		.604		.539	
AIC	65.96		66.12		45.26		44.46	



## Comparison of MM and BM

	I	II	III	IV
(log)CPC (signed)	$\chi^2(1) = .33$	$\chi^2(1) = .04$	$\chi^2(1) = 1.71$	$\chi^2(1) = 1.73$
Supplier Specialization		$\chi^2(1) = .22$	$\chi^2(1) = 1.96$	$\chi^2(1) = 2.57$
Process Innovation			$\chi^2(1) = 2.98^*$	$\chi^2(1) = 4.25^{**}$



H2b

# Some Thoughts

- Micro analytic studies are necessary to expose nuances in the capabilities/transaction cost research program
  - For example: make to make, buy to make
- Including process innovation is necessary to understand capabilities and transaction cost approaches to vertical integration
  - Generalizability of the empirical context
- Frictions between buyer and supplier regarding process investments increase with supplier asset specialization and indirectly lead to a make decision – preserving transaction cost approach
  - Williamson (1988) semi-strong model
- So large scale customization may not be necessary for transaction costs
  - Again, Langlois and co-authors (Robertson, Foss)

# Some Thoughts

- The transaction cost research program goes forward assuming only 1) problems in adaptation and 2) the availability of alternative institutional solutions to these problems
  - Problems in adaptation may have to do with technology commitments
  - Need to examine elements of buyer-supplier substitution
    - Platforms and policies
- Replication shows different results from Walker and Weber, 1984
  - Units vary in the weights they assign to transaction cost variables
  - Need to explore determining factors – probably technological