

Product, Process & Service

A New Industry Lifecycle Model

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Michael Cusumano (MIT)

Fernando Suarez (BU)

Steve Kahl (MIT/Chicago)

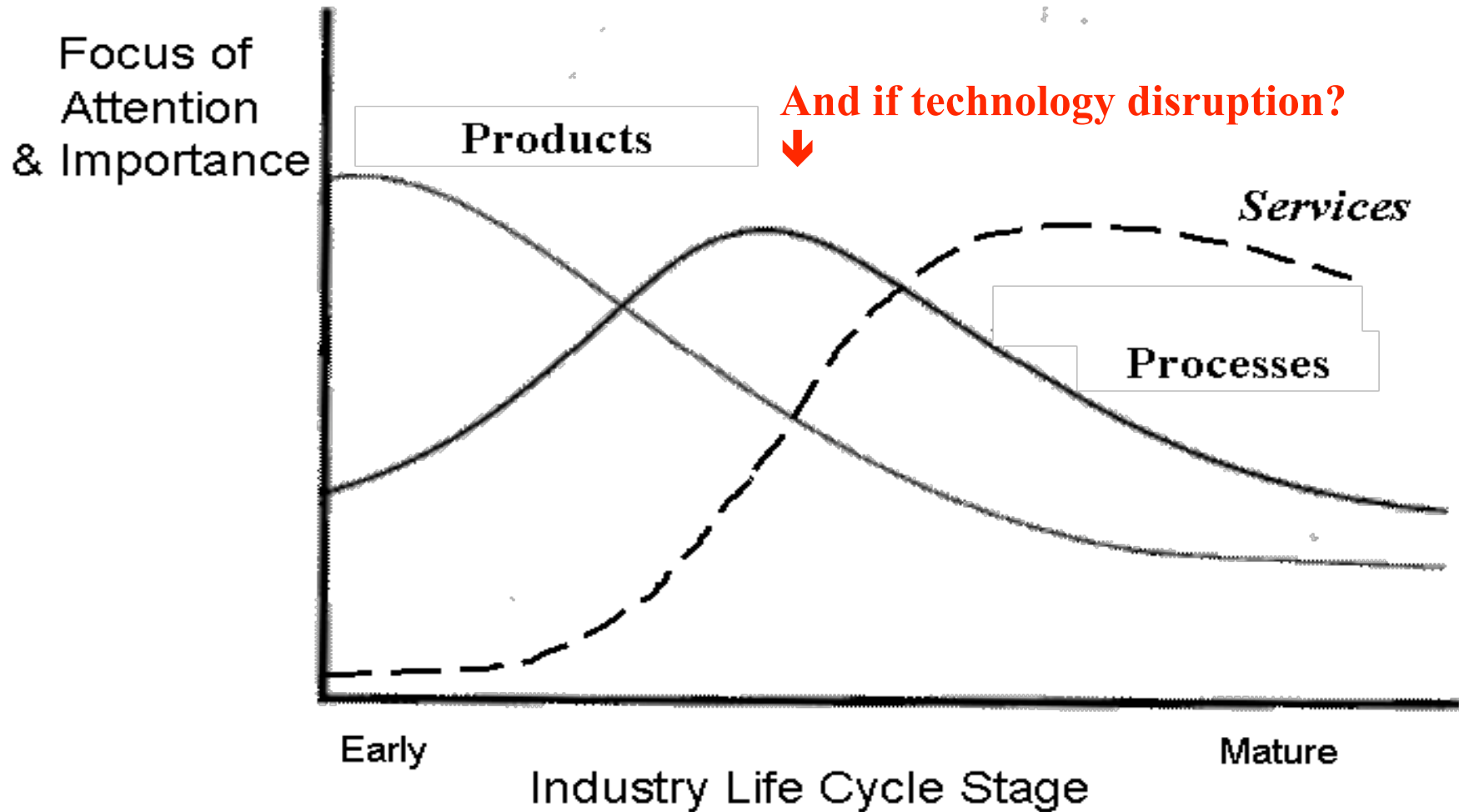
Specific Topics We Hope to Inform

- **Industry or Firm Evolution & Lifecycles** – changing level of products vs. services over time, and causes
 - *Theory Paper: “Product, Process and Service: A New Industry Life Cycle” (under review)*
- **“Business Models” & Performance** – general differences and “best” revenue mix in terms of profits and market value (and other measures) for product firms selling products & services
 - *Empirical Paper: “Service and Firm Performance over the Industry Life Cycle” (in progress)*

Lifecycles Literature

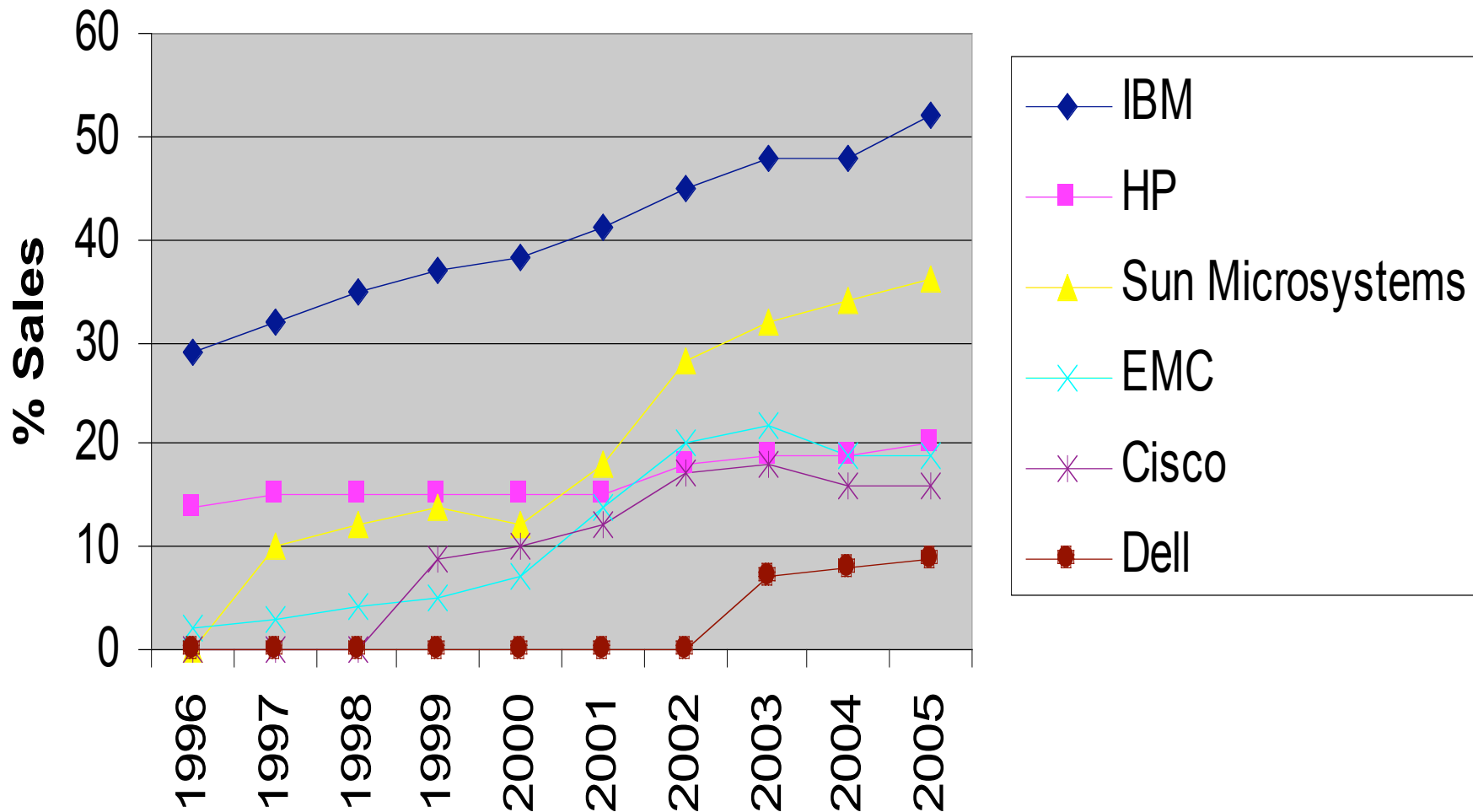
- Product to process evolution in mfg (Utterback & Abernathy 1975, 1978; Klepper, 1996, 1997)
- Technological discontinuities can restart the cycles (Tushman & Anderson 1986, 1990; Christenson, 1992, other)
- Services not in the lifecycle stories but seem to appear with maturity, and are clearly important to economic growth (Clark, 1940; Fuchs, 1968; Bell, 1973; Quinn, 1992)
- Services can be an important source of revenues & profits in a mature industry (Wise & Baumgartner, 1999; Oliva & Kallenberg 2003; Davis, 2004; Quinn et al. 1990; Bowen et al. 1991)
 - Product prices fall w/ maturity (Utterback, 1994)
 - Service revenues may continue beyond product revenues and generate up to 3x the revenues of product sales (Knecht et al., 1993)

Our Enhanced Lifecycle Model



Adapted from Abernathy and Utterback

Services % of Sales at Select Hardware Firms



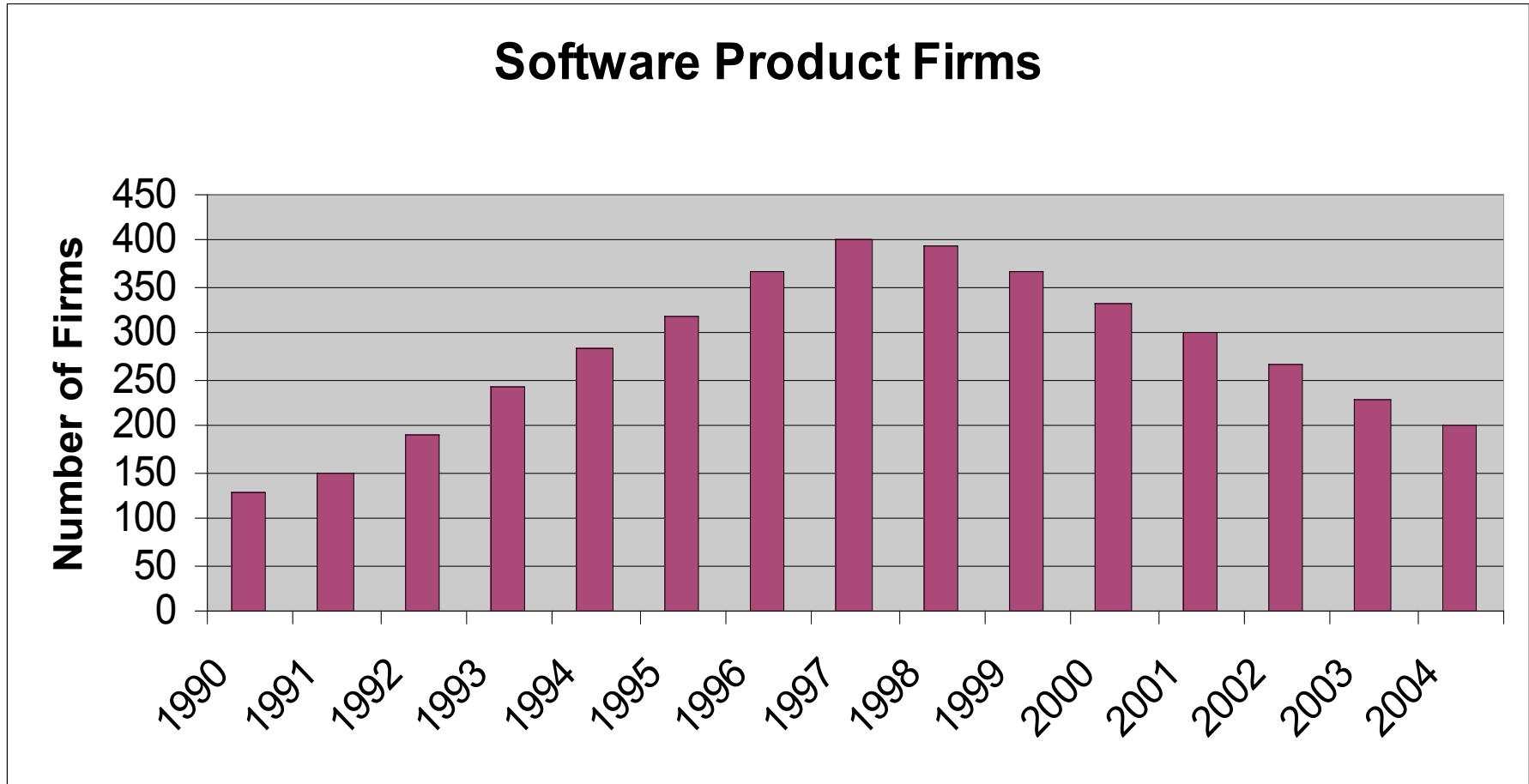
Software Products Company Database Study

- Identified **485** public software “products firms” under SIC code 7372 – **PrePackaged Software** (NAICS #51121)
- Since 2003, downloaded data from Compustat, Mergent, and directly from 10K reports
- Nearly 400 firms and 3000 yearly usable observations (89 firms excluded because of no breakout of revenues)
- Average 9 years maximum 15 years of detailed financials from 1990 or later
- Now doing analysis of life cycle affects & performance
- *Also analyzing pure IT services firms and selected industrial (non-software) firms*

Lifecycle in the Software Industry

Software Firms Listed on US Stock Exchanges

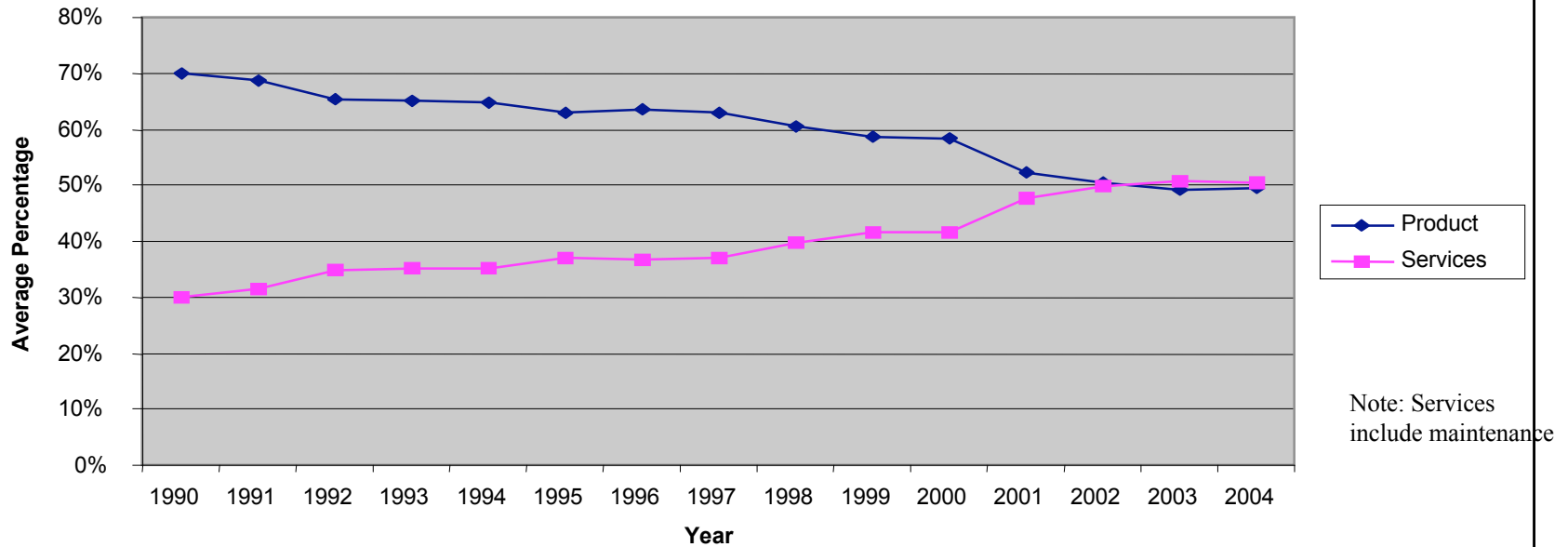
(SIC 7372)



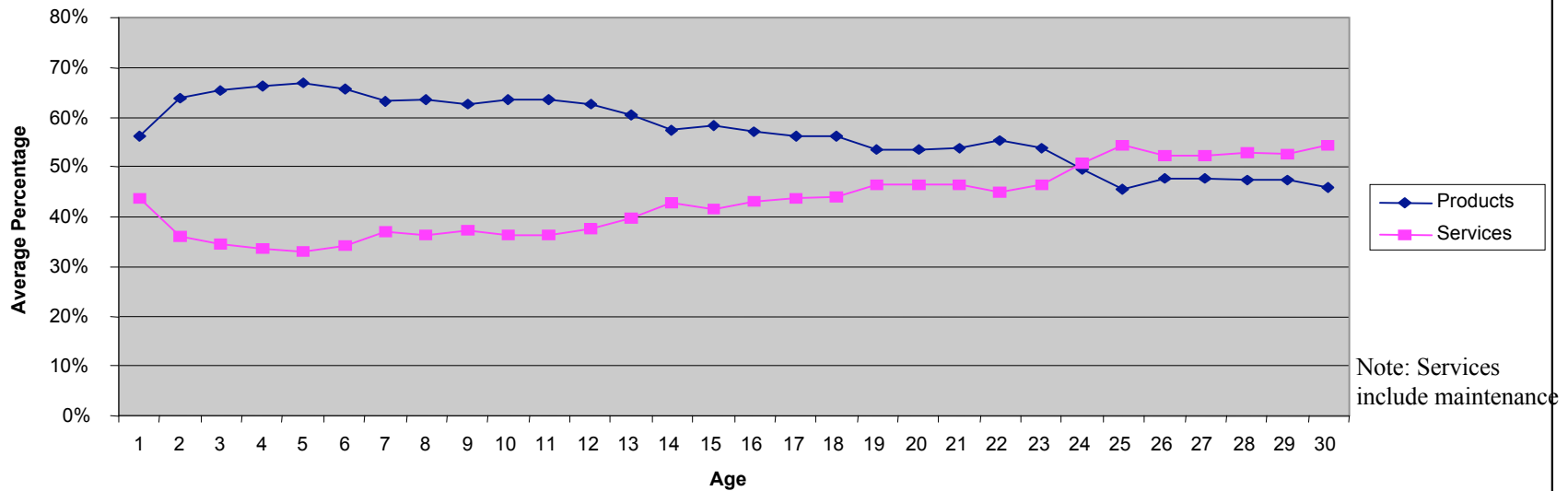
The software industry seems to follow the pattern suggested by ILC

The onset of maturity seems to occur around 1998

Average Product Firm Revenue Breakout by Year



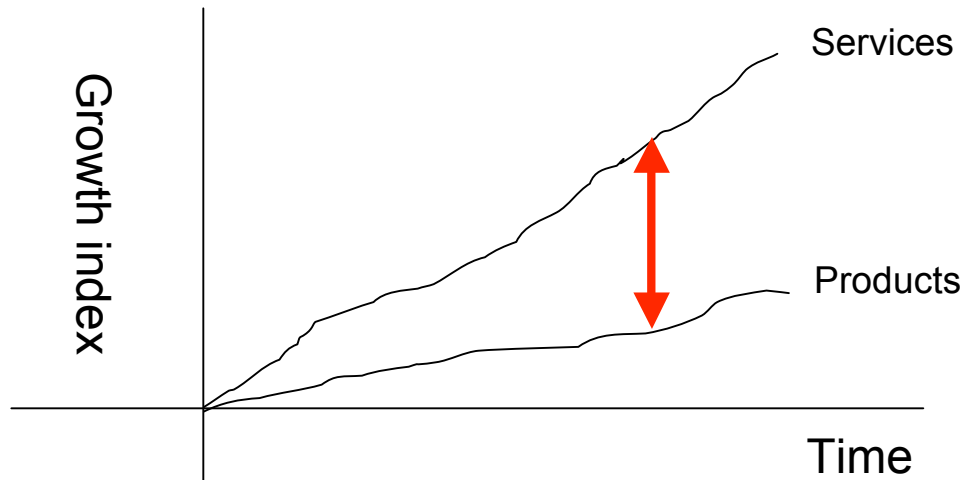
Average Revenue Breakout by Firm Age



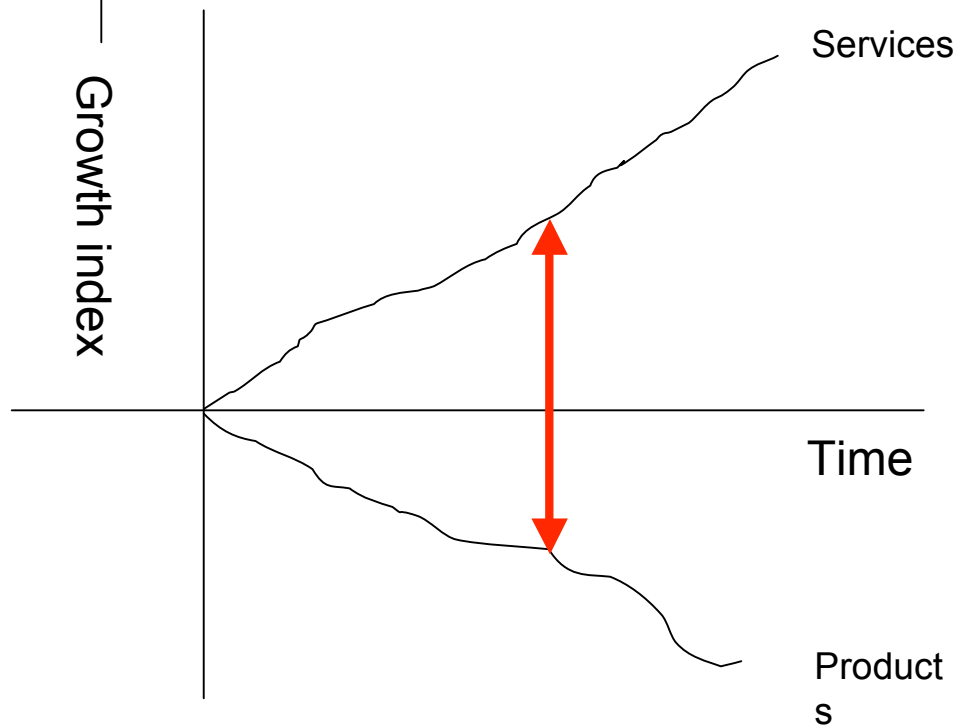
Exploratory Regression of Services & Lifecycle

Services as % of total sales rise as...

- Firms age (1.8%/yr)
- Product sales growth lags
- Industry consolidates
- Industry hits recession (2001-2003)
- Internet products (**disruption?**) introduced
 - *though firm effects – age, product growth lag, total sales lag – dominate this effect*



A: Case of a firm where products and services revenues reinforce each other



B: Case of a firm where products and services revenues do not reinforce each other

Performance Paper – Data & Methods

- Approx. 370 firms / 2,900 data points
- Panel Data Analysis, fixed effects models
- Dependent variable: Operating income (transformed)
- Independent variables
 - Service as % of sales (main effect and polynomials)
 - Maturity 1998 Dummy (interaction with service variables)
 - Discontinuity 1995 Dummy (interaction with service variables)
- Control Variables
 - Firm age
 - Market share in categ.
 - Firm sales (ln)
 - Maintenance %
 - Product category age
 - Annual performance sample
 - Average perform. Category
 - Year dummies

Our Maturity Variable

- Maturity as the inverse of industry density (number of firms)
 - Negative values before the onset of maturity
 - Positive values after the onset of maturity
- The maturity measure then is more directly to industry dynamics
 - Different industries mature at different rates
 - More closely associated with industry life cycle (ILC) theory

Summary of Results

*** p<.001, **p<.01, * p<.05, t p<.10	Model I Best-Fitted Model	Model II (maintenance)	Model III (Market Cap)
Dependent Variables	Op income (transformed)	Op income (transformed)	Ln market cap
Services Contr. to Sales	0.309**	0.402	3.914**
Services Contr. to Sales Squared	-0.947***	-1.163	-13.059***
Services Contr. to Sales Cubic	0.743***	0.693	8.943***
Age of the Firm		0.023	-0.331**
Age of the Firm Squared		0.000	0.004***
Annual Performance Sample	0.016***	0.003	0.081*
Ln Sales	0.064***	0.030***	0.560***
Maturity	-0.047*	-0.101	2.390**
Interac Serv Contr-Maturity	0.064*	-0.042	-1.313***
Market Share in Category	-0.364**	-0.052	3.484***
Maintenance % of Services		-0.010	
Interac. Maint – Maturity		-0.056	
No of Observations	2864	607	2036
Number of Firms	377	85	348
F-Test	19.48***	3.08***	57.33***
R2 Within	0.136	0.129	0.430
R2 Between	0.311	0.141	0.351
R2 Overall	0.223	0.098	0.342

Note: Time dummies included but not reported in the table

Contribution of Services % of Sales to Operating Income

	Service Contribution Variable			Inflection Points		Shape of the Curve		
	Main	Squared	Cubic	First	Second	first	then	then
All Product Categories	0.310*	-0.947**	0.743***	22%	63%	up	down	up
Business Applications	1.422***	-2.955***	1.830***	36%	71%	up	down	up
Business Intelligence	2.181***	-5.603***	4.258***	29%	59%	up	down	up
Multimedia	0.617	-2.169	1.975	19%	54%	up	down	up
Operating Systems	0.779	-1.650	1.007	35%	75%	up	down	up
<i>Database</i>	<i>-0.908*</i>	<i>1.531</i>	<i>-0.852</i>	<i>54%</i>	<i>66%</i>	<i>down</i>	<i>up</i>	<i>down</i>
<i>Networking</i>	<i>-0.661</i>	<i>1.004</i>	<i>-0.371</i>	<i>43%</i>	<i>n/a</i>	<i>down</i>	<i>up</i>	<i>--</i>

Shape of the Curve:

Up: Rise in service % improves operating income

Down: Rise in service % worsens operating income

Significance: *** p<.001, **p<.01, * p<.05, t p<.10

Contribution of Services % of Sales to Market Cap

	Service Contribution Variables			Inflection Points		Shape of the Curve		
	Main	Squared	Cubic	First	Second	first	then	then
All Product Categories	3.915**	-13.060***	8.943***	19%	79%	up	down	up
Business Applications	8.410***	-22.479***	13.945**	24%	83%	up	down	up
Operating Systems	5.573	-14.832	9.494	25%	80%	up	down	up
Networking	0.559	-7.029	7.310	4%	60%	up	down	up
<i>Business Intelligence</i>	<i>-7.768</i>	<i>12.542</i>	<i>-10.799</i>	<i>n/a</i>	<i>n/a</i>	<i>down</i>	<i>up</i>	<i>down</i>
<i>Multimedia</i>	<i>-16.404**</i>	<i>49.974***</i>	<i>45.676***</i>	<i>25%</i>	<i>48%</i>	<i>down</i>	<i>up</i>	<i>down</i>
<i>Database</i>	<i>19.332***</i>	<i>42.850**</i>	<i>-30.121**</i>	<i>37%</i>	<i>58%</i>	<i>down</i>	<i>up</i>	<i>down</i>

Shape of the Curve:

Up: Rise in service % improves market cap

Down: Rise in service % worsens market cap

Significance: *** p<.001, **p<.01, * p<.05, t p<.10

Services & Profitability

- Services contribute to operating margins but **relationship is non-linear**. “Sweet spots” at low and high ends of the spectrum.
- *First effect positive but at **22%** services turn negative. Then, at **63%** turns positive again.*
 - Intuition: For product firms, some level of services makes product offerings more attractive (complementarity). But services tend to have lower margins, so they can hurt profits if they become too important. But for more service-oriented firms, higher services can increase profitability.
- Maturity is associated with lower profits (as expected) but services during onset of “mature” stage (from 1998) contribute to higher margins.

Services & Profitability cont'd

- Internet discontinuity (1995) does not seem to affect profitability.
- But three control variables significant:
 - Larger firm size (sales) → higher firm margins
 - Higher annual industry performance → higher firm margins
 - Higher market share → lower firm margins (*why?*)
- Similar non-linear relationship in most individual product categories (low & high levels of services good, while in between is a “sour spot”):
 - But Database and Networking show opposite trend – little value to profits from services. These firms better off as “pure” product companies?

Services % & Market Cap

- Services effect on market cap again non-linear
- *First effect positive but at 19% services turn negative. Then, at 79% turns positive again.*
- Services in mature stage associated with lower market cap (even though services increase profits here)
 - This may reflect the higher value investors tend to place on products over services
- Services & market cap again varies by product
- Other variables that affect market cap:
 - Firm Age (+)
 - Annual Industry Performance (+)
 - Firm Sales (+)
 - Industry Maturity (+)
 - Firm Market Share (+)

Conclusions on Performance?

- There seem to exist “sweet spots” where and when services can increase firm performance:
 - Some services to complement offerings by product-oriented firms (low service %)
 - Greater scale/specialization for service-oriented firms (high service %)
 - Services seem particularly important for firm performance at the late stage of the industry lifecycle.
 - But the “sweet and source spots” vary by product category
- For profits (and survival?), most software product firms can & should exploit services
 - Managers should plan to take advantage of the “sweet spots,” not simply let services “happen” to them over time
 - Similar strategies possible for firms in other industries?