Cox Communications (COX, $35, Overweight, Industry View: Attractive, Target $45)

Our forecast has been adjusted to reflect the change in the way Cox now books high-speed data revenues. Historically, Cox booked the data revenues net of the affiliate fee paid to @Home. Now that the transition to its own backbone has been completed, Cox will book gross revenues, which is consistent with the way the other multiple systems operators (MSOs) book data service revenues.

Our pro forma 2000 and 2001 annual results (not quarters) also reflect this change. This change will affect data revenue, data gross profit margin, and EBITDA margin. Total EBITDA will remain unchanged, but margins will be lower due to the higher revenue base from booking gross, not net, revenues.

We rate the shares of Cox Overweight with a 12-month price target of $45. At current levels, Cox trades at 11.2 times 2003E EBITDA.

We expect total revenue and EBITDA growth in 2002 of 14.0-15.0% and 13.5-14.0%, respectively. We believe Cox will lead the industry by 100-200 basis points with regard to revenue and EBITDA growth, largely due to improving margins on the residential telephony product.

Cox has the ability to demonstrate the value of its competitive advantage in telephony in 2002, in our view. We estimate that 22-25% of the total incremental revenue growth in 2002 and 2003 is from residential and commercial telephony (equal to 3.2-3.4% of the 14-15% average revenue growth). Furthermore, we see Cox as the company best positioned to demonstrate that product bundles can reduce churn and win back customers lost to DBS.

EBITDA margins should begin to stabilize by 4Q02. In 2001, the reported EBITDA margin was 38.6%: we expect a margin of 37.4% in 2002. The majority of the anticipated decrease in margins should be due to the company's change in accounting for cable modem revenues. Also, its decision to launch one more telephony market also creates some start-up losses. which we expect will lower margins by about 40 basis points. In 2001, the company reported cable modem revenues net of the affiliate fee. Now that the transition to its own backbone has been completed. Cox will begin reporting these revenues gross of the affiliate fee (which is the way that the other MSOs book revenue).

Digital Subscribers

Cox was the only MSO to announce on its 4Q01 earnings call that digital additions in 2002 should not decline relative to 2001. We believe the company will average 11,750 per week during 1Q02, versus 12,156 in 4Q01. For 2002, we expect additions to average just fewer than 12,000. By the end of 1Q02, we expect penetration of basic subscribers will be almost 25%.

Cox currently has three announced trials of VOD — in San Diego, Hampton Roads, VA and Phoenix. The company indicated on its 4Q01 earnings call that it would launch VOD service to 43% of its homes passed by the end of 3Q02.

Cable Modem Subscribers

We expect Cox to end 1Q02 with 990,000-995,000 cable modem subscribers, representing average weekly additions of 8,500. This compares to weekly additions of just over 8,000 in 4Q01.

We expect margins on the high-speed data business to improve in 2002, largely due to the savings from Cox using its own backbone. We estimate that the cost for Cox to provide its own backbone, tier 2 customer service .and provisioning will be about 20% of gross data revenue. The potential risk in our forecast is that the company does not get this margin enhancement due to higher customer service costs. @Home previously dealt with all tier 2 customer service issues, which Cox will now handle.

Residential Telephony

We expect residential telephony additions to continue strong during 2002. We estimate that Cox will end 1Q02 with 500,000-510,000 residential telephony subscribers, representing average weekly additions of 4,000. The residential telephony product has not exhibited the large seasonal swings that the digital video and cable modem products have. We project average weekly additions to average just over 4,000 during 2002.

Residential telephony margins in 2001 were 20%. and we believe the margins in existing markets could rise to 30% in 2002. The New Orleans market and any other markets launched in 2002 should create start-up losses of about $20 million. which would reduce total telephony margins to an estimated 26%.

Capital Expenditures and Plant Upgrades

The company should incur $2.0 billion in capital expenditures. Cox ended 2001 with 81% of its plant upgraded for 750 MHz or higher and 90% ready for digital and data service. The company expects to end 2002 with 89% of its plant upgraded for 750 MHz or higher and 96% digital and data-ready.

Exhibit 132

Cox Communications
Broadband Cable Drivers

Dollars In Millions	Pro Forma 2000	Pro Forma 2001E	2002E	2003E	1Q01	2Q01	3Q01	4Q01	1Q02E	2Q02E	3Q02E	4Q02E
Broadband Subscribers												
Basic	6,193,317	6,237,888	6,281,553	6,325,524	6,213,994	6,166,614	6,206,737	6,237,888	6,257,492	6,209,780	6,250,184	6,281,553
Pro Forma Basic Growth %	1.9%	0.7%	0.7%	0.7%	1.3%	0.5%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Basic ARPU	$31.22	$32.42	$33.64	$35.32	$32.32	$32.44	$32.40	$32.53	$33.29	$33.74	$33.69	$33.83
Program. Costs as % of Analog Rev.	27.4%	29.0%	30.5%	30.8%	29.5%	28.8%	28.8%	28.9%	31.6%	30.3%	30.1%	29.8%
Programming Costs per sub % Change	1.2%	8.7%	10.3%	7.0%	8.2%	8.8%	9.7%	8.3%	10.9%	10.3%	10.4%	9.6%
Digital Video Subscribers	841,824	1,386,039	2,008,815	2,534,873	960,507	1,071,322	1,228,015	1,386,039	1,538,789	1,667,489	1,833,239	2,008,815
Digital Weekly Additions	11,090	10,470	11,980	10,120	9,130	8,520	12,050	12,160	11,750	9,900	12,750	13,510
Digital ARPU	$11.00	$12.25	$12.50	$13.13	$12.00	$12.00	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50
Digital Penetration	13.6%	22.2%	32.0%	40.1%	15.5%	17.4%	19.8%	22.2%	24.6%	26.9%	29.3%	32.0%
Digital Prog. Costs as % of Dig. Rev.	15.0%	15.0%	24.1%	25.8%	15.0%	15.0%	15.0%	15.0%	20.0%	22.0%	25.0%	28.0%
Cable Modem Subscribers	481,947	883,562	1,364,562	1,945,440	587,170	668,038	779,499	883,562	994,062	1,098,062	1,228,062	1,364,562
Cable Modem Weekly Additions	5,670	7,720	9,250	11,170	8,090	6,220	8,570	8,000	8,500	8,000	10,000	10,500
Cable Modem ARPU	$40.10	$41.11	$39.00	$40.71	$42.25	$39.35	$36.74	$45.52	$39.00	$39.00	$39.00	$39.00
Cable Modem Penetration	7.8%	14.2%	21.7%	30.8%	9.4%	10.8%	12.6%	14.2%	15.9%	17.7%	19.6%	21.7%
Affiliate Fee as % of HSD service rev	35.0%	35.0%	23.5%	22.0%	35.0%	30.0%	27.5%	30.0%	27.0%	24.5%	23.5%	20.0%
Telephony Subscribers	244,653	453,572	663,198	894,416	292,230	344,524	398,813	453,572	505,572	558,222	610,872	663,198
Telephony Weekly Additions	2,750	4,020	4,030	4,450	3,660	4,020	4,180	4,210	4,000	4,050	4,050	4,030
Telephony ARPU	$52.03	$50.06	$47.81	$46.40	$49.85	$50.08	$50.18	$50.05	$47.81	$47.81	$47.81	$47.81
Telephony Penetration	4.0%	7.3%	10.6%	14.1%	4.7%	5.6%	6.4%	7.3%	8.1%	9.0%	9.8%	10.6%
Direct Costs as % of Telephony rev	60.9%	48.2%	46.5%	46.2%	54.0%	50.0%	45.0%	46.0%	47.0%	47.0%	47.0%	45.3%
Fixed Costs (1)	$1,171.8	$1,325.7	$1,473.5	$1,707.4	$309.5	$329.9	$342.1	$344.1	$340.5	$372.0	$381.4	$379.6
Fixed Costs (% Change)	16.5%	13.1%	11.2%	15.9%	NM	11.7%	14.5%	16.3%	10.0%	12.8%	11.5%	10.3%
Total Capital Expenditures	$2,188.1	$2,205.5	$2,020.3	$1,474.3	NA	NA	NA	NA	NA	NA	NA	NA
Broadband (Incl. Telephony)												
Revenue Growth %	13.4%	14.9%	14.3%	16.3%	21.6%	14.0%	14.4%	14.7%	16.5%	17.3%	17.6%	17.1%
EBITDA Growth %	10.3%	1.3%	25.2%	16.9%	19.5%	13.4%	11.9%	-26.4%	10.2%	13.4%	14.0%	75.5%
EBITDA Margin %	38.7%	34.1%	37.3%	37.5%	37.8%	38.1%	38.4%	26.2%	35.7%	36.9%	37.2%	39.3%

(1) G&A, marketing and plant operations for both cable and residential telephony operations

E= Morgan Stanley Research Estimates

Note: Pro forma results assume that data revenues are booked gross of the affiliate fee. In 2001 and prior years, Cox booked data revenues net of the affiliate fee, but the company began booking gross data revenues beginning in 2002. 2001 quarters are not pro forma for this adjustment.

Exhibit 133

Cox Communications
Estimated 2002 Fair Market Value

($ Millions Except Per Share Data)

Asset Description	Cable Operations	Programming Investments	Telecom. Investments	Technology Investments	Other	Total Cox Commications
Core Cable Television Operations	$26,294.4					$26,294.4
Telephony	2,564.5					2,564.5
Commercial Telephony - Fibernet	1,255.6					1,255.6
Other Assets						
Discovery Communications (24.6%)		4,022.1				4,022.1
Sprint PCS - 10.3 mm comm. stock equiv.			116.9			116.9
Motorola - 0.85 mm shs				12.1		12.1
Paxson Comm. - 0.71 mm shs				7.5		7.5
Liberate - 1.0 mm shs				6.8		6.8
Tivo, Inc. - 0.24 mm shares				1.6		1.6
Worldgate - 0.5 mm shares				0.8		0.8
Other Programming/Telecomm. Assets				15.0		15.0
Total Estimated Asset Value	**$30,114.5**	**$4,022.1**	**$116.9**	**$43.9**	**$0.0**	**$34,297.3**
Less:						
Debt (1)	8,533.1					8,533.1
Net Indexed Debt	(2,332.4)					(2,332.4)
Net Debt	6,200.8					6,200.8
Plus:						
Cash					86.9	86.9
Cash from Stock Options					149.8	149.8
Total Fair Market Value	**$23,913.7**	**$4,022.1**	**$116.9**	**$43.9**	**$236.6**	**$28,333.2**
Class A Shares Outstanding	573.568	573.568	573.568	573.568	573.568	573.568
Class C Shares Outstanding	27.598	27.598	27.598	27.598	27.598	27.598
Feline Prides	18.740	18.740	18.740	18.740	18.740	18.740
Convertible Preferred	5.000	5.000	5.000	5.000	5.000	5.000
Stock Options	7.541	7.541	7.541	7.541	7.541	7.541
Total Cox Comm. Shares Outstanding	632.447	632.447	632.447	632.447	632.447	632.447
Total Fair Market Value Per Share	**$37.81**	**$6.36**	**$0.18**	**$0.07**	**$0.37**	**$44.80**

Supplemental Valuation Data	Incl. Teleph.	Excl. Teleph.	Total
Estimated Asset Value	$30,114.5	$26,294.4	$30,114.5
2002E EBITDA	1,788.7	1,638.7	1,778.8
Asset Value /EBITDA	16.8x	16.0x	16.9x
2003E EBITDA	2,079.0	1,864.8	2,079.0
Asset Value /EBITDA	14.5x	14.1x	14.5x
2002E Basic Subscribers	6,281,553	6,281,553	
Est. Asset Value per Basic Subscriber	$4,794	$4,186	

(1) Assumes full dilution of Feline PRIDES.

E= Morgan Stanley Research Estimates

Exhibit 134

Cox Communications
Consolidated Annual Income Statement

($ Millions Except Per Share)

	Actual		Pro Forma						
	2000	2001	2000	2001E	2002E	2003E	2004E	2005E	2006E
Revenues	$3,506.9	$4,067.0	$3,628.6	$4,168.9	$4,764.3	$5,540.6	$6,341.5	$7,184.9	$8,039.9
Operating Expenses	2,129.6	2,646.0	2,225.5	2,748.0	2,985.5	3,461.6	3,893.3	4,347.0	4,796.0
EBITDA	$1,377.3	$1,421.0	$1,403.1	$1,421.0	$1,778.8	$2,079.0	$2,448.2	$2,837.9	$3,243.9
Operating Cash Flow Margin	39.3%	34.9%	38.7%	34.1%	37.3%	37.5%	38.6%	39.5%	40.3%
Depreciation	873.4	1,185.8	944.6	1,185.8	1,370.0	1,470.3	1,509.1	1,545.6	1,589.4
EBITA	503.9	235.2	458.5	235.2	408.7	608.7	939.1	1,292.3	1,654.5
Amortization	363.1	353.4	398.7	353.4	35.3	35.3	35.3	35.3	35.3
EBIT	$140.8	($118.2)	$59.8	($118.2)	$373.4	$573.4	$903.7	$1,256.9	$1,619.2
Cash Interest Expense	540.2	533.8	533.9	533.8	539.8	479.6	445.7	384.4	308.7
Non-cash Interest Expense	21.3	32.1	21.3	32.1	33.8	35.5	37.3	39.2	41.1
Operating Profit after Interest	(420.6)	(684.2)	(495.5)	(684.2)	(200.1)	58.3	420.8	833.4	1,269.4
Interest Income and Other	3,219.6	856.2	(57.1)	856.2	1,248.2	(45.7)	(45.7)	(45.7)	(45.7)
Pretax Profit Before Equity Interest	$2,798.9	$172.0	($552.5)	$172.0	$1,048.0	$12.6	$375.0	$787.6	$1,223.6
Income (Loss) from Equity Interests	(7.3)	(40.0)	(70.5)	(40.0)	(20.0)	(0.0)	20.0	40.0	60.0
Income/(Loss) Before Taxes	2,791.6	132.0	(623.1)	132.0	1,028.0	12.6	395.0	827.6	1,283.6
Deferred Taxes	877.0	94.0	(158.0)	94.0	288.4	(87.3)	54.1	214.2	382.9
Current Taxes	426.0	400.9	(79.0)	400.9	144.2	(43.7)	27.1	107.1	191.5
Income (Loss) Before Extra. Items	$1,914.6	$37.9	($465.0)	$37.9	$739.6	$99.9	$340.8	$613.4	$900.6
Extraordinary Items (After Taxes)	0.0	717.1	0.0	717.1	0.0	0.0	0.0	0.0	0.0
Net Income/(Loss)	$1,914.6	$755.0	($465.0)	$755.0	$739.6	$99.9	$340.8	$613.4	$900.6
Average Basic Shares Outstanding	602.0	600.4	602.0	600.4	601.0	601.6	602.5	603.3	604.1
Reported Basic EPS	$3.15	$1.26	($0.77)	$1.26	$1.23	$0.17	$0.57	$1.02	$1.49
Average Fully Diluted Shares Outstanding	608.5	608.8	608.5	608.8	610.3	611.0	611.9	612.7	613.5
Reported Fully Diluted EPS	$3.15	$1.24	($0.76)	$1.24	$1.21	$0.16	$0.56	$1.00	$1.47
Less: Extraordinary and Nonrecurring Items per S	3.39	0.96	0.00	0.96	1.34	0.00	0.00	0.00	0.00
Adjusted Fully Diluted EPS	($0.25)	$0.28	($0.76)	$0.28	($0.12)	$0.16	$0.56	$1.00	$1.47
Plus: Amortization per Share	0.60	0.58	0.66	0.58	0.06	0.06	0.06	0.06	0.06
Less: Equity Income / (Losses) from Affiliates	(0.01)	(0.07)	(0.12)	(0.07)	(0.03)	(0.00)	0.03	0.07	0.10
Adjusted Fully Diluted Cash EPS	$0.36	$0.93	$0.01	$0.93	($0.03)	$0.22	$0.58	$0.99	$1.43

E= Morgan Stanley Research Estimates

Note: Pro forma results assume that data revenues are booked gross of the affiliate fee. In 2001 and prior years, Cox booked data revenues net of the affiliate fee, but the company began booking gross data revenues beginning in 2002.

Exhibit 135

Cox Communications
Balance Sheet Forecasts

	2000	2001	2002E	2003E	2004E	2005E	2006E
Cash & Marketable Securities	$78.4	$86.9	$86.9	$86.9	$236.9	$436.9	$736.9
Accounts Receivable	358.3	421.1	486.0	565.1	646.8	732.9	820.1
Total Current Assets	436.8	508.0	572.8	652.0	883.7	1,169.7	1,556.9
Prop., Plant, & Equip. (Rpt)	8,369.4	10,328.5	11,548.8	12,223.2	12,477.8	12,821.3	13,194.7
Less: Accumulated Depreciation	2,453.0	3,200.6	3,770.7	4,441.0	5,150.0	5,895.6	6,685.0
Net Prop., Plant, & Equip.	5,916.4	7,127.9	7,778.2	7,782.2	7,327.7	6,925.7	6,509.7
Investments in Uncon. Operations	3,896.4	3,515.2	2,495.2	2,495.1	2,515.1	2,555.1	2,615.0
Intangible Assets	13,951.2	13,510.9	13,475.6	13,440.2	13,404.9	13,369.5	13,334.2
Other Assets	520.0	399.4	399.4	399.4	399.4	399.4	399.4
Total Assets	$24,720.8	$25,061.4	$24,721.1	$24,769.0	$24,530.8	$24,419.4	$24,415.2
Short-term Debt	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Accounts Payable and Defered Income	714.2	674.4	790.1	872.9	949.1	1,021.5	1,085.9
Total Current Liabilities	714.2	674.4	790.1	872.9	949.1	1,021.5	1,085.9
Long-term Debt	8,543.8	8,417.7	8,533.1	8,393.8	7,663.2	6,710.6	5,501.7
Deferred Taxes	4,592.7	4,538.3	4,682.5	4,638.8	4,665.9	4,773.0	4,964.4
Other Liabilities	1,653.9	1,760.2	305.0	353.2	401.4	449.7	497.9
Preferred Equity	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Common Equity	9,211.4	9,666.0	10,405.7	10,505.6	10,846.4	11,459.8	12,360.4
Total Equity	9,216.3	9,670.9	10,410.5	10,510.4	10,851.2	11,464.6	12,365.3
Total Liabilities & Equity	$24,720.8	$25,061.4	$24,721.1	$24,769.0	$24,530.8	$24,419.4	$24,415.2

E= Morgan Stanley Research Estimates

Exhibit 136

Cox Communications
Debt Capitalization

($ Million)

	2000E	2001	2002E	2003E	2004E	2005E	2006E
Bank Debt/ Commercial Paper/Other	$1,524.8	$727.4	$1,408.9	$1,205.0	$781.9	$514.9	$28.7
Medium Term Notes	424.1	391.2	391.2	391.2	391.2	0.0	0.0
6.875% Senior Notes due 2005	365.2	365.2	365.2	365.2	365.2	0.0	0.0
7.625% Senior Notes due 2025	132.4	132.4	132.4	132.4	132.4	132.4	132.4
6.500% Senior Notes due 2002	200.0	200.0	0.0	0.0	0.0	0.0	0.0
7.250% Sub. Debentures due 2015	100.0	100.0	100.0	100.0	100.0	100.0	0.8
6.4% Notes due 8/08	200.0	200.0	200.0	200.0	200.0	200.0	100.8
6.8% Debentures 8/28	200.0	200.0	200.0	200.0	200.0	200.0	100.8
6.15% Reset Put Securities 8/33	250.0	250.0	250.0	250.0	250.0	250.0	150.8
7.0% Due 2001	299.7	0.0	0.0	0.0	0.0	0.0	0.0
7.5% Due 2004	373.8	375.0	375.0	375.0	0.0	0.0	0.0
7.75 Due 2006	399.2	400.0	400.0	400.0	400.0	400.0	0.0
7.875 Due 2009	400.0	400.0	400.0	400.0	400.0	400.0	400.0
7.75% Notes Due 2010	800.0	800.0	800.0	800.0	800.0	800.0	800.0
MOPPRS/CHEERS	200.0	200.0	0.0	0.0	0.0	0.0	0.0
6.53% Debentures due 2/28	190.0	200.0	200.0	200.0	200.0	200.0	200.0
6.75% Senior Notes due 3/20/11	0.0	500.0	500.0	500.0	500.0	500.0	500.0
Convertible Senior Notes	0.0	545.0	324.5	331.8	339.2	346.9	354.7
Capital Lease Obligations/Other	132.7	153.6	153.6	153.6	153.6	153.6	153.6
Total Debt	**$6,191.9**	**$6,139.8**	**$6,200.8**	**$6,004.1**	**$5,213.5**	**$4,197.8**	**$2,922.5**
Indexed Debt							
Discount Debentures	804.6	837.4	871.2	906.6	943.9	983.1	1,024.2
Premium Phones	275.0	275.0	275.0	275.0	275.0	275.0	275.0
Prizes	1,272.2	1,272.2	1,272.2	1,272.2	1,272.2	1,272.2	1,272.2
Forward Contracts	0.0	414.3	435.0	456.8	479.6	503.6	528.8
Reserve (FAS 133 Adjustment)	0.0	(521.0)	(521.0)	(521.0)	(521.0)	(521.0)	(521.0)
Total Debt	**$8,543.8**	**$8,417.7**	**$8,533.1**	**$8,393.8**	**$7,663.2**	**$6,710.6**	**$5,501.7**
EBITDA	$1,377.3	$1,421.0	$1,778.8	$2,079.0	$2,448.2	$2,837.9	$3,243.9
Total Debt / EBITDA	4.5x	4.3x	3.5x	2.9x	2.1x	1.5x	0.9x
Total Debt and Indexed Debt / EBITDA	6.2x	5.9x	4.8x	4.0x	3.1x	2.4x	1.7x

E= Morgan Stanley Research Estimates

Exhibit 137

Cox Communications
Revenue and Operating Cash Flow Comparisons, Quarterly

($ Millions)

	2001				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Cable/Telephony Revenue								
Analog	$788.2	$819.8	$819.6	$838.1	$822.3	$864.5	$871.5	$895.4
Digital Cable	32.4	36.6	43.1	49.0	54.8	60.1	65.6	72.0
High Speed Data	56.6	62.3	75.2	91.7	117.1	129.6	144.8	160.9
Total Cable Television Revenue	$877.2	$918.7	$937.9	$978.8	$994.2	$1,054.2	$1,081.9	$1,128.3
Residential Telephony	40.1	47.8	55.9	64.0	68.8	76.3	83.8	91.4
Cox Business Services	30.6	35.3	38.2	40.3	41.7	45.0	47.6	51.0
Total Cable/Telephony Revenue	**$947.9**	**$1,001.8**	**$1,032.0**	**$1,083.0**	**$1,104.7**	**$1,175.4**	**$1,213.4**	**$1,270.7**
% Change	21.6%	14.0%	14.4%	14.5%	16.5%	17.3%	17.6%	17.3%
Cable/Telephony Gross Profit								
Analog	$555.3	$583.6	$583.8	$596.1	$562.2	$602.2	$609.4	$628.2
Digital Cable	27.6	31.1	36.6	41.7	43.9	46.9	49.2	51.9
High Speed Data	56.6	62.3	75.2	91.7	87.5	99.6	112.8	130.6
Total Cable Television Gross Profit	$639.4	$677.0	$695.6	$729.4	$693.5	$748.7	$771.4	$810.6
Residential Telephony Gross Profit	10.8	16.2	32.3	48.5	17.1	25.7	51.4	77.1
Cox Business Services	4.6	6.8	13.7	20.5	6.7	10.0	20.0	30.0
Total Cable/Telephony Gross Profit	$654.7	$700.0	$741.5	$798.3	$717.3	$784.4	$842.8	$917.7
Gross Profit Margin	69.1%	69.9%	71.9%	73.7%	64.9%	66.7%	69.5%	72.2%
Cable/Telephony EBITDA								
Core Cable Television EBITDA	$343.1	$362.9	$373.1	$403.7	$374.3	$398.7	$411.8	$453.8
Video/Data Startup Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Telephony EBITDA	5.2	8.1	11.2	16.1	15.1	18.3	22.6	27.3
Cox Business Services EBITDA	9.8	11.1	12.0	12.7	15.0	16.2	17.1	18.3
Total Cable/Telephony EBITDA	**$358.1**	**$382.1**	**$396.3**	**$432.5**	**$404.5**	**$433.3**	**$451.6**	**$499.4**
% Change	19.5%	13.4%	11.9%	11.9%	12.9%	13.4%	14.0%	15.5%
Cable/Telephony EBITDA								
Total Cable Margins excl. Telephony	39.1%	39.5%	39.8%	41.2%	37.6%	37.8%	38.1%	40.2%
Residential Telephony	13.0%	17.0%	20.0%	25.2%	22.0%	24.0%	27.0%	29.8%
Cox Business Services	32.0%	31.4%	31.4%	31.5%	36.0%	36.0%	36.0%	35.9%
Total Cable/Telephony Margins	37.8%	38.1%	38.4%	39.9%	36.6%	36.9%	37.2%	39.3%
Other								
Revenues	$0.0	$0.0	$0.0	$2.2	$0.0	$0.0	$0.0	$0.0
Operating Cash Flow	0.0	0.0	0.0	(148.0)	(9.9)	0.0	0.0	0.0
Operating Cash Flow Margin								
Total Revenue	**$947.9**	**$1,001.8**	**$1,032.0**	**$1,085.3**	**$1,104.7**	**$1,175.4**	**$1,213.4**	**$1,270.7**
Total Operating Cash Flow	**358.1**	**382.1**	**396.3**	**284.5**	**394.6**	**433.3**	**451.6**	**499.4**
Total Cash Flow Margin	**37.8%**	**38.1%**	**38.4%**	**26.2%**	**35.7%**	**36.9%**	**37.2%**	**39.3%**

E = Morgan Stanley Research Estimates

Note: Data revenues in 2002 are shown gross of the affiliate fee; in 2001, these revenues are shown net of the affiliate fee.

Exhibit 138

Cox Communications
Revenue and Operating Cash Flow Comparisons, 2000-2006E

($ Millions)

	Actual		Pro Forma						
	2000	2001	2000	2001	2002E	2003E	2004E	2005E	2006E
Cable/Telephony Revenue									
Analog	$3,080.0	$3,265.7	$3,146.5	$3,265.7	$3,453.7	$3,689.7	$3,946.5	$4,224.3	$4,524.0
Digital Cable	74.0	161.1	74.0	161.1	252.6	357.8	458.5	558.8	658.7
High Speed Data	148.9	285.7	204.2	387.6	552.4	828.3	1,107.9	1,401.1	1,695.5
Total Cable Television Revenue	$3,303.0	$3,712.5	$3,424.7	$3,814.5	$4,258.7	$4,875.9	$5,512.9	$6,184.3	$6,878.1
Residential Telephony	106.1	207.9	106.1	207.9	320.3	433.7	549.4	683.3	807.3
Cox Business Services	97.8	144.3	97.8	144.3	185.3	231.0	279.2	317.3	354.6
Total Cable/Telephony Revenue	**$3,506.9**	**$4,064.7**	**$3,628.6**	**$4,166.7**	**$4,764.3**	**$5,540.6**	**$6,341.5**	**$7,184.9**	**$8,039.9**
% Change	51.3%	15.9%	13.4%	14.8%	14.3%	16.3%	14.5%	13.3%	11.9%
Cable/Telephony Gross Profit									
Analog	$2,235.4	$2,318.8	$2,283.2	$2,318.8	$2,401.9	$2,553.5	$2,716.0	$2,890.5	$3,077.5
Digital Cable	62.9	137.0	62.9	137.0	191.9	265.7	331.2	392.6	449.5
High Speed Data	148.9	285.7	148.9	285.7	430.4	650.4	890.9	1,126.1	1,362.1
Total Cable Television Gross Profit	$2,447.2	$2,741.4	$2,495.0	$2,741.4	$3,024.2	$3,469.6	$3,938.2	$4,409.2	$4,889.1
Residential Telephony Gross Profit	$41.5	$107.7	$41.5	$107.7	$171.4	$233.4	$294.4	$363.8	$428.5
Cox Business Services	38.4	45.5	38.4	45.5	66.6	83.3	102.0	118.5	135.2
Total Cable/Telephony Gross Profit	$2,527.1	$2,894.6	$2,574.9	$2,894.6	$3,262.2	$3,786.4	$4,334.6	$4,891.5	$5,452.7
Gross Profit Margin	72.1%	71.2%	71.0%	69.5%	68.5%	68.3%	68.4%	68.1%	67.8%
Cable/Telephony EBITDA									
Core Cable Television EBITDA	$1,356.1	$1,482.8	$1,381.9	$1,482.8	$1,638.7	$1,864.8	$2,163.0	$2,475.5	$2,798.6
Video/Data Startup Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Telephony EBITDA	(17.1)	40.7	(17.1)	40.7	83.3	130.9	183.1	243.9	310.1
Cox Business Services EBITDA	38.4	45.5	38.4	45.5	66.6	83.3	102.0	118.5	135.2
Total Cable/Telephony EBITDA	**$1,377.3**	**$1,569.0**	**$1,403.1**	**$1,569.0**	**$1,788.7**	**$2,079.0**	**$2,448.2**	**$2,837.9**	**$3,243.9**
% Change	52.8%	13.9%	10.3%	11.8%	14.0%	16.2%	17.8%	15.9%	14.3%
Cable/Telephony EBITDA									
Total Cable Margins excl. Telephony	41.1%	39.9%	40.3%	38.9%	38.5%	38.2%	39.2%	40.0%	40.7%
Residential Telephony	NM	NM	NM	19.6%	26.0%	30.2%	33.3%	35.7%	38.4%
Cox Business Services	39.3%	31.5%	39.3%	31.5%	36.0%	36.1%	36.5%	37.3%	38.1%
Total Cable/Telephony Margins	39.3%	38.6%	38.7%	37.7%	37.5%	37.5%	38.6%	39.5%	40.3%
Other									
Revenues	$0.0	$2.2	$0.0	$2.2	$0.0	$0.0	$0.0	$0.0	$0.0
Operating Cash Flow	0.0	(148.0)	$0.0	($148.0)	($9.9)	$0.0	$0.0	$0.0	$0.0
Operating Cash Flow Margin	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total Revenue	**$3,506.9**	**$4,067.0**	**$3,628.6**	**$4,168.9**	**$4,764.3**	**$5,540.6**	**$6,341.5**	**$7,184.9**	**$8,039.9**
Total Operating Cash Flow	**1,377.3**	**1,421.0**	**1,403.1**	**1,421.0**	**1,778.8**	**2,079.0**	**2,448.2**	**2,837.9**	**3,243.9**
Total Cash Flow Margin	**39.3%**	**34.9%**	**38.7%**	**34.1%**	**37.3%**	**37.5%**	**38.6%**	**39.5%**	**40.3%**

E= Morgan Stanley Research Estimates

Note: Pro forma results assume that data revenues are booked gross of the affiliate fee. In 2001 and prior years, Cox booked data revenues net of the affiliate fee, but the company began booking gross data revenues beginning in 2002.

Exhibit 139

Cox Communications
Cable Television Operations, Quarterly

($ Million except per data)

	2001				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Homes Passed	9,843,052	9,866,948	9,936,499	9,979,207	10,016,629	10,054,191	10,091,895	10,129,739
% Change	2.8%	2.4%	2.1%	2.8%	1.8%	1.9%	1.6%	1.5%
Basic Subscribers	6,213,994	6,166,614	6,206,737	6,237,888	6,257,492	6,209,780	6,250,184	6,281,553
% Change	1.3%	0.5%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Homes Passed Penetration	63.1%	62.5%	62.5%	62.5%	62.5%	61.8%	61.9%	62.0%
Premium Subscriptions	4,103,003	4,165,283	4,132,082	4,098,881	4,134,675	4,122,454	4,174,140	4,221,426
% Change	-0.8%	-3.3%	-2.2%	-1.8%	0.8%	-1.0%	1.0%	3.0%
Basic subscriber Penetration	66.0%	67.5%	66.6%	65.7%	66.1%	66.4%	66.8%	67.2%
Digital Subscriptions	960,507	1,071,322	1,228,015	1,386,039	1,538,789	1,667,489	1,833,239	2,008,815
% Change	114.8%	91.3%	79.8%	64.6%	60.2%	55.6%	49.3%	44.9%
Homes Passed Penetration	9.8%	10.9%	12.4%	13.9%	15.4%	16.6%	18.2%	19.8%
Basic subscriber Penetration	15.5%	17.4%	19.8%	22.2%	24.6%	26.9%	29.3%	32.0%
Premium Subscriber Penetration	23.4%	25.7%	29.7%	33.8%	37.2%	40.4%	43.9%	47.6%
HSCDS Subscribers	587,170	668,038	779,499	883,562	994,062	1,098,062	1,228,062	1,364,562
% Change	126.0%	108.5%	95.5%	83.3%	69.3%	64.4%	57.5%	54.4%
Homes Passed Penetration	6.0%	6.8%	7.8%	8.9%	9.9%	10.9%	12.2%	13.5%
Basic subscriber Penetration	9.4%	10.8%	12.6%	14.2%	15.9%	17.7%	19.6%	21.7%
Monthly Reg. Rev. per Basic Sub.	$32.32	$32.44	$32.40	$32.53	$33.29	$33.74	$33.69	$33.83
% Change	3.9%	4.6%	3.5%	3.6%	3.0%	4.0%	4.0%	4.0%
Monthly Reg. & Unreg. Rev. per Basic Sub.	42.35	44.14	44.16	44.90	43.87	46.23	46.63	47.63
% Change	1.4%	4.0%	3.8%	2.3%	3.6%	4.7%	5.6%	6.1%
Monthly Digital Video Rev. per Digital Sub.	12.00	12.00	12.50	12.50	12.50	12.50	12.50	12.50
% Change	9.1%	9.1%	13.6%	13.6%	4.2%	4.2%	0.0%	0.0%
Monthly HSCDS Rev. per HSCDS Sub.	35.27	33.09	34.62	36.74	41.59	41.28	41.49	41.38
% Change	-19.3%	-15.5%	-9.4%	9.6%	17.9%	24.7%	19.8%	12.6%
Regulated Analog Revenues	601.5	602.5	601.3	607.2	623.9	631.0	629.7	635.9
% Change	15.4%	5.5%	4.1%	4.3%	3.7%	4.7%	4.7%	4.7%
Premium and Non-regulated Revenues	186.7	217.3	218.3	230.9	198.4	233.5	241.8	259.4
% Change	4.3%	3.3%	5.2%	0.0%	6.2%	7.5%	10.8%	12.4%
Digtial Video Revenues	32.4	36.6	43.1	49.0	54.8	60.1	65.6	72.0
% Change	175.9%	120.1%	110.2%	94.8%	69.0%	64.4%	52.2%	47.0%
HSCDS Revenues	56.6	62.3	75.2	91.7	117.1	129.6	144.8	160.9
% Change	93.1%	82.8%	82.3%	106.9%	107.1%	107.9%	92.6%	75.6%
Total Revenue	**$877.2**	**$918.7**	**$937.9**	**$978.8**	**$994.2**	**$1,054.2**	**$1,081.9**	**$1,128.3**
% Change	18.3%	10.4%	10.7%	10.9%	13.3%	14.7%	15.4%	15.3%

E= Morgan Stanley Research Estimates

Note: Data revenues in 2002 are shown gross of the affiliate fee; in 2001, these revenues are shown net of the affiliate fee.

Exhibit 140

Cox Communications
Cable Television Operations, Quarterly (continued)

($ Million except per data)

	2001				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Total Revenue	**$877.2**	**$918.7**	**$937.9**	**$978.8**	**$994.2**	**$1,054.2**	**$1,081.9**	**$1,128.3**
% Change	18.3%	10.4%	10.7%	10.9%	13.3%	14.7%	15.4%	15.3%
Analog Programming Costs	232.9	236.2	235.8	242.0	$260.1	$262.3	$262.2	$267.2
% of Total Analog Revenue	29.5%	28.8%	28.8%	28.9%	31.6%	30.3%	30.1%	29.8%
Digital Prog. & Direct Costs	4.9	5.5	6.5	7.4	11.0	13.2	16.4	20.2
% of Total Digital Revenue	15.0%	15.0%	15.0%	15.0%	20.0%	22.0%	25.0%	28.0%
HSCDS Direct Operating Costs	0.0	0.0	0.0	0.0	29.7	30.0	32.0	30.3
% of Total HSCDS Revenue	0.0%	0.0%	0.0%	0.0%	25.3%	23.1%	22.1%	18.8%
Total Programming and Direct Costs	237.8	241.6	242.3	249.4	300.7	305.5	310.5	317.7
% of Total HSCDS Revenue	27.1%	26.3%	25.8%	25.5%	30.2%	29.0%	28.7%	28.2%
Analog Service Gross Profit	555.3	583.6	583.8	596.1	562.2	602.2	609.4	628.2
% of Total Analog Revenue	70.5%	71.2%	71.2%	71.1%	68.4%	69.7%	69.9%	70.2%
Digital Service Gross Profit	27.6	31.1	36.6	41.7	43.9	46.9	49.2	51.9
% of Total Digital Revenue	85.0%	85.0%	85.0%	85.0%	80.0%	78.0%	75.0%	72.0%
HSCDS Gross Profit	56.6	62.3	75.2	91.7	87.5	99.6	112.8	130.6
% of Total HSCDS Revenue	100.0%	100.0%	100.0%	100.0%	74.7%	76.9%	77.9%	81.2%
Total Gross Profit	**$639.4**	**$677.0**	**$695.6**	**$729.4**	**$693.5**	**$748.7**	**$771.4**	**$810.6**
% of Total Revenue	**72.9%**	**73.7%**	**74.2%**	**74.5%**	**69.8%**	**71.0%**	**71.3%**	**71.8%**
Other Operating Costs	$73.1	$70.9	$73.4	$71.5	$72.9	$75.4	$75.1	$77.8
% of Total Revenues	8.3%	7.7%	7.8%	7.3%	7.3%	7.2%	6.9%	6.9%
Marketing Costs	$44.9	$46.7	$47.6	$45.1	$49.7	$52.7	$53.9	$55.7
% of Total Revenues	5.1%	5.1%	5.1%	4.6%	5.0%	5.0%	5.0%	4.9%
Gen. & Admin. Costs	178.3	196.5	201.5	209.1	196.6	221.8	230.7	223.3
% of Total Revenues	20.3%	21.4%	21.5%	21.4%	19.8%	21.0%	21.3%	19.8%
Operating Costs	534.1	555.8	564.8	575.1	619.9	655.4	670.1	674.5
% of Revenues	60.9%	60.5%	60.2%	58.8%	62.4%	62.2%	61.9%	59.8%
EBITDA incl. New Serv. Start-up Losses x Telephony	**$343.1**	**$362.9**	**$373.1**	**$403.7**	**$374.3**	**$398.7**	**$411.8**	**$453.8**
Operating Margin	**39.1%**	**39.5%**	**39.8%**	**41.2%**	**37.6%**	**37.8%**	**38.1%**	**40.2%**
Add: Broadband Losses excl. Telephony	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
EBITDA excl. New Serv. Start-up Losses	**$343.1**	**$362.9**	**$373.1**	**$403.7**	**$374.3**	**$398.7**	**$411.8**	**$453.8**
Operating Margin	**39.1%**	**39.5%**	**39.8%**	**41.2%**	**37.6%**	**37.8%**	**38.1%**	**40.2%**
% Change	14.3%	8.6%	7.8%	7.5%	9.1%	9.9%	10.4%	12.4%

E= Morgan Stanley Research Estimates

Note: Data revenues in 2002 are shown gross of the affiliate fee; in 2001, these revenues are shown net of the affiliate fee.

Exhibit 141

Cox Communications
Cable Television Operations, 2000-2006E

($ Million except per data)

	Actual 2000	Actual 2001	Pro Forma 2000	Pro Forma 2001	2002E	2003E	2004E	2005E	2006E
Homes Passed	9.710.963	9.979.207	9.710.963	9.979.207	10.129.739	10.281.685	10.435.911	10.592.449	10.751.336
% Change	20.9%	2.8%	1.1%	2.8%	1.5%	1.5%	1.5%	1.5%	1.5%
Basic Subscribers	6.193.317	6.237.888	6.193.317	6.237.888	6.281.553	6.325.524	6.369.803	6.414.391	6.459.292
% Change	20.6%	0.7%	1.9%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Homes Passed Penetration	63.8%	62.5%	63.8%	62.5%	62.0%	61.5%	61.0%	60.6%	60.1%
Premium Subscriptions	4.174.447	4.098.881	4.174.447	4.098.881	4.097.162	4.080.976	4.057.472	4.025.913	3.988.117
% Change	29.0%	-1.8%	-0.8%	-1.8%	0.0%	-0.4%	-0.6%	-0.8%	-0.9%
Basic subscriber Penetration	67.4%	65.7%	67.4%	65.7%	65.2%	64.5%	63.7%	62.8%	61.7%
Digital Subscriptions	841.824	1.386.039	841.824	1.386.039	2.008.815	2.534.873	3.009.643	3.427.078	3.798.044
% Change	217.3%	64.6%	139.8%	64.6%	44.9%	26.2%	18.7%	13.9%	10.8%
Homes Passed Penetration	8.7%	13.9%	8.7%	13.9%	19.8%	24.7%	28.8%	32.4%	35.3%
Basic subscriber Penetration	13.6%	22.2%	13.6%	22.2%	32.0%	40.1%	47.2%	53.4%	58.8%
Premium Subscriber Penetration	20.2%	33.8%	20.2%	33.8%	49.0%	62.1%	74.2%	85.1%	95.2%
HSCDS Subscribers	481.947	883,562	481.947	883.562	1,364,562	1.945.440	2.549.877	3,187,511	3.802.113
% Change	157.8%	83.3%	136.5%	83.3%	54.4%	42.6%	31.1%	25.0%	19.3%
Homes Passed Penetration	5.0%	8.9%	5.0%	8.9%	13.5%	18.9%	24.4%	30.1%	35.4%
Basic subscriber Penetration	7.8%	14.2%	7.8%	14.2%	21.7%	30.8%	40.0%	49.7%	58.9%
Monthly Reg. Rev. per Basic Sub.	$31.21	$32.42	$31.22	$32.42	$33.64	$35.32	$37.09	$38.94	$40.89
% Change	0.0%	3.9%	0.1%	3.9%	3.8%	5.0%	5.0%	5.0%	5.0%
Monthly Reg. & Unreg. Rev. per Basic Sub.	42.68	43.89	42.69	43.89	46.09	48.78	51.81	55.07	58.57
% Change	0.2%	2.8%	0.3%	2.8%	5.0%	5.8%	6.2%	6.3%	6.3%
Monthly Digital Video Rev. per Digital Sub.	11.00	12.28	11.00	12.28	12.50	13.13	13.78	14.47	15.19
% Change	0.0%	11.6%	0.0%	11.6%	1.8%	5.0%	5.0%	5.0%	5.0%
Monthly HSCDS Rev. per HSCDS Sub.	37.79	35.04	51.83	47.55	41.43	41.71	41.08	40.70	40.43
% Change	-11.1%	-7.3%	21.9%	-8.3%	-12.9%	0.7%	-1.5%	-0.9%	-0.7%
Regulated Analog Revenues	$2,252.4	$2,412.5	$2,301.0	$2,412.5	$2,520.6	$2,671.7	$2,825.0	$2,987.0	$3,158.3
% Change	43.6%	7.1%	6.0%	4.8%	4.5%	6.0%	5.7%	5.7%	5.7%
Premium and Non-regulated Revenues	827.7	853.2	845.5	853.2	933.1	1018.0	1121.5	1237.3	1365.7
% Change	44.6%	3.1%	0.6%	0.9%	9.4%	9.1%	10.2%	10.3%	10.4%
Digtial Video Revenues	74.0	161.1	74.0	161.1	252.6	357.8	458.5	558.8	658.7
% Change	264.5%	117.6%	264.5%	117.6%	56.8%	41.6%	28.1%	21.9%	17.9%
HSCDS Revenues	148.9	285.7	204.2	387.6	552.4	828.3	1,107.9	1,401.1	1,695.5
% Change	149.2%	91.9%	241.8%	89.8%	42.5%	50.0%	33.8%	26.5%	21.0%
Total Revenue	**$3,303.0**	**$3,712.5**	**$3,424.7**	**$3,814.5**	**$4,258.7**	**$4,875.9**	**$5,512.9**	**$6,184.3**	**$6,878.1**
% Change	48.7%	12.4%	10.4%	11.4%	11.6%	14.5%	13.1%	12.2%	11.2%

E= Morgan Stanley Research Estimates

Note: Pro forma results assume that data revenues are booked gross of the affiliate fee. In 2001 and prior years, Cox booked data revenues net of the affiliate fee, but the company began booking gross data revenues beginning in 2002

Exhibit 142

Cox Communications
Cable Television Operations, 2000-2006E (continued)

($ Million except per data)

	Actual		Pro Forma						
	2000	2001	2000	2001	2002E	2003E	2004E	2005E	2006E
Total Revenue	**$3,303.0**	**$3,712.5**	**$3,424.7**	**$3,814.5**	**$4,258.7**	**$4,875.9**	**$5,512.9**	**$6,184.3**	**$6,878.1**
% Change	48.7%	12.4%	10.4%	11.4%	11.6%	14.5%	13.1%	12.2%	11.2%
Analog Programming Costs	844.6	946.9	863.3	946.9	1051.8	1136.2	1230.5	1333.8	1446.5
% of Total Analog Revenue	27.4%	29.0%	27.4%	29.0%	30.5%	30.8%	31.2%	31.6%	32.0%
Digital Prog. & Direct Costs	$11.1	$24.2	11.1	24.2	60.8	92.1	127.2	166.3	209.1
% of Total Digital Revenue	15.0%	15.0%	15.0%	15.0%	24.1%	25.8%	27.8%	29.8%	31.8%
HSCDS Direct Operating Costs	$0.0	0.0	55.3	101.9	122.0	177.9	217.0	275.0	333.4
% of Total HSCDS Revenue	0.0%	0.0%	27.1%	26.3%	22.1%	21.5%	19.6%	19.6%	19.7%
Total Programming and Direct Costs	855.8	971.1	929.7	1,073.1	1,234.5	1,406.2	1,574.7	1,775.0	1,989.0
% of Total HSCDS Revenue	25.9%	26.2%	27.1%	28.1%	29.0%	28.8%	28.6%	28.7%	28.9%
Analog Service Gross Profit	2,235.4	2,318.8	2,283.2	2,318.8	2,401.9	2,553.5	2,716.0	2,890.5	3,077.5
% of Total Analog Revenue	72.6%	71.0%	72.6%	71.0%	69.5%	69.2%	68.8%	68.4%	68.0%
Digital Service Gross Profit	62.9	137.0	62.9	137.0	191.9	265.7	331.2	392.6	449.5
% of Total Digital Revenue	85.0%	85.0%	85.0%	85.0%	75.9%	74.3%	72.3%	70.3%	68.3%
HSCDS Gross Profit	148.9	285.7	148.9	285.7	430.4	650.4	890.9	1,126.1	1,362.1
% of Total HSCDS Revenue	100.0%	100.0%	72.9%	73.7%	77.9%	78.5%	80.4%	80.4%	80.3%
Total Gross Profit	**$2,447.2**	**$2,741.4**	**$2,495.0**	**$2,741.4**	**$3,024.2**	**$3,469.6**	**$3,938.2**	**$4,409.2**	**$4,889.1**
% of Total Revenue	**74.1%**	**73.8%**	**72.9%**	**71.9%**	**71.0%**	**71.2%**	**71.4%**	**71.3%**	**71.1%**
Other Operating Costs	255.3	288.9	265.3	288.9	301.2	361.0	399.0	427.4	456.5
% of Total Revenues	7.7%	7.8%	7.7%	7.6%	7.1%	7.4%	7.2%	6.9%	6.6%
Marketing Costs	180.4	184.3	180.5	184.3	211.9	240.0	269.8	302.1	332.2
% of Total Revenues	5.5%	5.0%	5.3%	4.8%	5.0%	4.9%	4.9%	4.9%	4.8%
Gen. & Admin. Costs	655.5	785.4	667.4	785.4	872.4	1,003.8	1,106.3	1,204.3	1,301.8
% of Total Revenues	19.8%	21.2%	19.5%	20.6%	20.5%	20.6%	20.1%	19.5%	18.9%
Operating Costs	$1,946.9	$2,229.7	$2,042.9	$2,331.7	$2,620.0	$3,011.1	$3,349.9	$3,708.8	$4,079.5
% of Revenues	58.9%	60.1%	59.7%	61.1%	61.5%	61.8%	60.8%	60.0%	59.3%
EBITDA incl. New Serv. Start-up Losses x Telephony	**$1,356.1**	**$1,482.8**	**$1,381.9**	**$1,482.8**	**$1,638.7**	**$1,864.8**	**$2,163.0**	**$2,475.5**	**$2,798.6**
Operating Margin	**41.1%**	**39.9%**	**40.3%**	**38.9%**	**38.5%**	**38.2%**	**39.2%**	**40.0%**	**40.7%**
Add: Broadband Losses excl. Telephony	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EBITDA excl. New Serv. Start-up Losses	**$1,356.1**	**$1,482.8**	**$1,381.9**	**$1,482.8**	**$1,638.7**	**$1,864.8**	**$2,163.0**	**$2,475.5**	**$2,798.6**
Operating Margin	**41.1%**	**39.9%**	**40.3%**	**38.9%**	**38.5%**	**38.2%**	**39.2%**	**40.0%**	**40.7%**
% Change	51.3%	9.3%	9.0%	7.3%	10.5%	13.8%	16.0%	14.4%	13.1%

E= Morgan Stanley Research Estimates

Note: Pro forma results assume that data revenues are booked gross of the affiliate fee. In 2001 and prior years, Cox booked data revenues net of the affiliate fee, but the company began booking gross data revenues beginning in 2002

Exhibit 143

Cox Communications
Residential Telephony Summary, Quarterly

Dollars in Millions, Except Per Data

	2001				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
CATV Homes Passed	9,843,052	9,866,948	9,936,499	9,979,207	10,016,629	10,054,191	10,091,895	10,129,739
% Change								
Telephony Homes Passed	2,644,390	2,816,649	3,142,393	3,338,097	3,513,115	3,688,133	3,863,151	4,038,168
% Change	9.0%	6.5%	11.6%	6.2%	5.2%	5.0%	4.7%	4.5%
CATV Homes Passed Penetration	26.9%	28.5%	31.6%	33.5%	35.1%	36.7%	38.3%	39.9%
Residential Telephony Subscribers	292,230	344,524	398,813	453,572	505,572	558,222	610,872	663,198
% Change	19.4%	17.9%	15.8%	13.7%	11.5%	10.4%	9.4%	8.6%
CATV Homes Passed Penetration	3.0%	3.5%	4.0%	4.5%	5.0%	5.6%	6.1%	6.5%
Telephony Homes Passed Penetration	11.1%	12.2%	12.7%	13.6%	14.4%	15.1%	15.8%	16.4%
Residential Telephony Lines	393,705	456,084	518,922	583,114	649,965	714,524	775,807	835,630
% Change	17.7%	15.8%	13.8%	12.4%	11.5%	9.9%	8.6%	7.7%
CATV Homes Passed Penetration	4.0%	4.6%	5.2%	5.8%	6.5%	7.1%	7.7%	8.2%
Telephony Homes Passed Penetration	14.9%	16.2%	16.5%	17.5%	18.5%	19.4%	20.1%	20.7%
Residential Revenue	$40.1	$47.8	$55.9	$64.0	$68.8	$76.3	$83.8	$91.4
% Change	17.7%	19.1%	17.0%	14.4%	7.5%	10.9%	9.9%	9.0%
As % Of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Revenue per Line	$36.75	$37.53	$38.26	$38.72	$37.19	$37.28	$37.51	$37.80
% Change	0.7%	2.1%	1.9%	1.2%	-3.9%	0.2%	0.6%	0.8%
Average Revenue per Subscriber	$49.85	$50.08	$50.18	$50.05	$47.81	$47.81	$47.81	$47.81
% Change	-1.3%	0.5%	0.2%	-0.2%	-4.5%	0.0%	0.0%	0.0%
Total Variable Expenses	21.7	23.9	25.2	29.5	32.3	35.9	39.4	41.4
% of Revenue	54.0%	50.0%	45.0%	46.0%	47.0%	47.0%	47.0%	45.3%
Gross Profit	$18.5	$23.9	$30.8	$34.5	$36.5	$40.4	$44.4	$50.0
% of Revenue	46.0%	50.0%	55.0%	54.0%	53.0%	53.0%	53.0%	54.7%
Total Marketing Expense	4.1	4.2	4.1	3.9	4.4	4.6	4.7	5.2
% of Revenue	10.1%	8.8%	7.3%	6.1%	6.4%	6.0%	5.7%	5.7%
Total G&A (other)	5.8	7.6	10.8	9.2	12.5	12.6	11.7	11.7
% of Revenue	14.5%	15.9%	19.3%	14.3%	18.2%	16.6%	13.9%	12.8%
Total G & A Employee Expense	3.4	4.0	4.7	5.4	4.4	4.9	5.4	5.9
% of Revenue	8.4%	8.4%	8.4%	8.4%	6.4%	6.4%	6.4%	6.4%
Total Operating Expenses	$13.2	$15.8	$19.6	$18.4	$21.3	$22.1	$21.8	$22.8
% of Revenue	33.0%	33.0%	35.0%	28.8%	31.0%	29.0%	26.0%	24.9%
Residential Telephony EBITDA	**$5.2**	**$8.1**	**$11.2**	**$16.1**	**$15.1**	**$18.3**	**$22.6**	**$27.3**
% Change	NM	55.8%	37.6%	44.1%	-6.2%	21.0%	23.6%	20.4%
EBITDA Margin %	13.0%	17.0%	20.0%	25.2%	22.0%	24.0%	27.0%	29.8%
Annual EBITDA per Line / Subscriber	$19.4	$25.5	$30.1	$37.8	$31.6	$34.4	$38.7	$42.8
% Change	NM	31.4%	17.9%	25.7%	-16.6%	9.1%	12.5%	10.5%

E= Morgan Stanley Research Estimates

Exhibit 144

Cox Communications
Residential Telephony Summary, 2000-2006E

Dollars in Millions, Except Per Data

	2000	2001	2002E	2003E	2004E	2005E	2006E
CATV Homes Passed	9,710,963	9,979,207	10,129,739	10,281,685	10,435,911	10,592,449	10,751,336
% Change	1.1%	2.8%	1.5%	1.5%	1.5%	1.5%	1.5%
Telephony Homes Passed	2,426,580	3,338,097	4,038,168	4,748,741	5,469,972	6,202,022	6,295,052
% Change	110.9%	37.6%	21.0%	17.6%	15.2%	13.4%	1.5%
CATV Homes Passed Penetration	25.0%	33.5%	39.9%	46.2%	52.4%	58.6%	58.6%
Residential Telephony Subscribers	244,653	453,572	663,198	894,416	1,143,143	1,402,638	1,619,107
% Change	140.3%	85.4%	46.2%	34.9%	27.8%	22.7%	15.4%
CATV Homes Passed Penetration	2.5%	4.5%	6.5%	8.7%	11.0%	13.2%	15.1%
Telephony Homes Passed Penetration	10.1%	13.6%	16.4%	18.8%	20.9%	22.6%	25.7%
Residential Telephony Lines	334,589	596,200	844,849	1,139,397	1,456,251	1,786,822	2,062,582
% Change	121.9%	78.2%	41.7%	34.9%	27.8%	22.7%	15.4%
CATV Homes Passed Penetration	3.4%	6.0%	8.3%	11.1%	14.0%	16.9%	19.2%
Telephony Homes Passed Penetration	13.8%	17.9%	20.9%	24.0%	26.6%	28.8%	32.8%
Residential Revenue	$106.1	$207.9	$320.3	$433.7	$549.4	$683.3	$807.3
% Change	146.0%	95.9%	54.0%	35.4%	26.7%	24.4%	18.2%
As % Of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Revenue per Line	$36.64	$37.23	$37.04	$36.42	$35.27	$35.11	$34.95
% Change	-4.0%	1.6%	-0.5%	-1.7%	-3.2%	-0.5%	-0.5%
Average Revenue per Subscriber	$52.03	$50.06	$47.81	$46.40	$44.94	$44.73	$44.53
% Change	-10.3%	-3.8%	-4.5%	-3.0%	-3.2%	-0.5%	-0.5%
Total Variable Expenses	64.6	100.2	148.9	200.2	254.9	319.5	378.8
% of Revenue	60.9%	48.2%	46.5%	46.2%	46.4%	46.8%	46.9%
Gross Profit	$41.5	$107.7	$171.4	$233.4	$294.4	$363.8	$428.5
% of Revenue	39.1%	51.8%	53.5%	53.8%	53.6%	53.2%	53.1%
Total Marketing Expense	12.6	16.2	19.0	22.2	24.7	27.9	27.7
% of Revenue	11.9%	7.8%	5.9%	5.1%	4.5%	4.1%	3.4%
Total G&A (other)	29.1	33.4	48.5	57.0	60.2	62.0	56.7
% of Revenue	27.4%	16.1%	15.1%	13.1%	11.0%	9.1%	7.0%
Total G & A Employee Expense	16.9	17.4	20.6	23.3	26.4	30.0	33.9
% of Revenue	15.9%	8.4%	6.4%	5.4%	4.8%	4.4%	4.2%
Total Operating Expenses	$58.6	$67.0	$88.0	$102.5	$111.3	$119.9	$118.3
% of Revenue	55.2%	32.2%	27.5%	23.6%	20.3%	17.5%	14.7%
Residential Telephony EBITDA	**($17.1)**	**$40.7**	**$83.3**	**$130.9**	**$183.1**	**$243.9**	**$310.1**
% Change	NM	NM	104.9%	57.0%	39.9%	33.2%	27.1%
EBITDA Margin %	NM	19.6%	26.0%	30.2%	33.3%	35.7%	38.4%
Annual EBITDA per Line / Subscriber	($100.8)	$116.5	$149.2	$168.0	$179.7	$191.6	$205.3
% Change	NM	NM	28.1%	12.6%	7.0%	6.6%	7.1%

E= Morgan Stanley Research Estimates

Exhibit 145

Cox Communications
Commercial Telephony Operations, 2000-2006E

($ Thousands, except per-share data)

	2000	2001E	2002E	2003E	2004E	2005E	2006E
Summary Network Data							
Markets Launched	9	12	13	14	14	14	14
Switches Installed	9	12	13	14	14	14	14
Total Buildings On-Net	4,554	7,754	8,754	9,804	10,907	12,064	13,280
Revenue Build							
Year End VGE Circuits	1,200,684	1,773,340	2,100,960	2,230,964	2,481,845	2,731,544	3,006,757
Avg. VGE Circuits	855,932	1,405,358	1,937,150	2,165,962	2,356,405	2,606,695	2,869,151
VGE Circuits Per On-Net Building	264	229	229	228	228	226	226
Revenue VGE Circuit/Month	$5.00	$4.98	$4.73	$4.72	$4.72	$4.72	$4.71
Data Services	$51,356	$82,251	$106,137	$122,720	$133,510	$147,543	$162,236
As % of Total Revenue	53%	57%	57%	53%	48%	46%	46%
Dedicated Transport/Other	16,226	13,121	12,000	12,240	12,485	12,734	12,989
As % of Total Revenue	17%	9%	6%	5%	4%	4%	4%
% Growth Rate	102%	-19%	-9%	2%	2%	2%	2%
Total Data Revenues	$67,582	$95,373	$118,137	$134,960	$145,995	$160,278	$175,225
As % of Total Revenue	69%	66%	64%	58%	52%	51%	49%
% Growth Rate	83%	41%	24%	14%	8%	10%	9%
Year End Switched Access Lines	52,406	92,406	104,323	176,472	218,130	253,347	292,152
Avg. Switched Access Lines	42,406	72,406	98,364	140,397	197,301	235,738	272,749
Switched Lines Per Building	12	12	12	18	20	21	22
Revenue Access Line/Month	$48.00	$48.00	$48.00	$47.52	$47.04	$46.57	$46.11
Switched Access Revenue	$24,426	$40,474	$55,736	$80,060	$111,384	$131,752	$150,913
As % of Total Revenue	25%	28%	30%	35%	40%	42%	43%
% Take of Long Dist by Switched Lines	25%	20%	20%	20%	19%	19%	18%
Long Distance Revenue per Month/Line	$50.00	$50.00	$49.00	$48.51	$48.02	$47.54	$47.07
Long Distance Revenue	6,245	8,432	11,384	16,019	21,840	25,318	28,419
As % of Total Revenue	6%	6%	6%	7%	8%	8%	8%
Total Voice Revenues	$30,670	$48,906	$67,121	$96,079	$133,224	$157,070	$179,333
As % of Total Revenue	31%	34%	36%	42%	48%	49%	51%
% Growth Rate	83%	59%	37%	43%	39%	18%	14%
Total Revenue	$97,807	$144,279	$185,258	$231,039	$279,219	$317,347	$354,558
% Change	82.1%	47.5%	28.4%	24.7%	20.9%	13.7%	11.7%
Rolling 5-Year CAGR				51.3%	39.1%	26.5%	19.7%
Revenue per Customer	2,687	1,954	1,870	2,075	2,247	2,303	2,332
Data Services Direct Costs	5,136	8,225	10,614	12,272	13,351	14,754	16,224
Data Services Direct Costs as % Rev	10%	10%	10%	10%	10%	10%	10%
Dedicated Transport Direct Costs	3,245	2,624	2,280	2,302	2,325	2,348	2,371
Data Services Direct Costs as % Rev	20%	20%	19%	19%	19%	18%	18%
Switched Access Line Direct Costs	5,997	10,119	13,237	18,824	25,927	30,362	34,430
Switched Access Line Direct Costs as % Rev.	25%	25%	24%	24%	23%	23%	23%
Long-Distance Direct Costs	3,122	4,216	5,408	7,381	9,761	10,976	11,951
Long-Distance Direct Costs as % of LD Rev.	50%	50%	48%	46%	45%	43%	42%
Total Direct Costs	17,498	25,184	31,539	40,779	51,364	58,439	64,975
Total Direct Costs as % of Other Rev.	18%	17%	17%	18%	18%	18%	18%
Total Gross Profit	80,309	119,095	153,719	190,260	227,855	258,908	289,583
Gross Margin %	82%	83%	83%	82%	82%	82%	82%
Sales and Marketing	9,635	17,313	20,378	25,414	30,714	34,908	39,001
% of Revenue	10%	12%	11%	11%	11%	11%	11%
General and Admin. Expenses	32,276	56,269	66,693	81,526	95,127	105,519	115,417
% of Revenue	33%	39%	36%	35%	34%	33%	33%
Total Operating Expenses	41,911	73,582	87,071	106,940	125,841	140,427	154,418
% of Revenue	43%	51%	47%	46%	45%	44%	44%
Total EBITDA	$38,398	$45,513	$66,648	$83,319	$102,014	$118,481	$135,165
EBITDA %	39.3%	31.5%	36.0%	36.1%	36.5%	37.3%	38.1%
Change %	92%	19%	46%	25%	22%	16%	14%

E= Morgan Stanley Research Estimates

Insight Communications (ICCI, $19, Underweight, Industry View: Attractive, Target $22)

We rate Insight shares Underweight with a 12-month price target of $22. At current prices, Insight is trading at 15.8 times 2002E EBITDA and 13.5 times 2003E EBITDA on a proportionate basis. We believe continued interactive digital and VOD rollouts and basic rate increases are the key components for accelerated revenue and EBITDA growth in 2002.

We expect total revenue and system-level cash flow growth of 12.5-13.0% and 12.5-13.0%, respectively, in 2002. We project total revenue of $790-800 million and operating cash flow of $370-380 million. After corporate overhead expense, we estimate EBITDA growth of 14.0-14.5%, which excludes one-time charges related to the @Home transition. The company's guidance on operating cash flow growth in 2002 is 14-16%.

The acceleration in revenue and EBITDA growth in 2002 versus 2001 is largely due to the rebuild in the Illinois systems. Insight spent last year rebuilding and upgrading these systems that were acquired from AT&T in January 2001. These systems will require another year of rebuilds. As VOD and telephony are deployed in rebuilt systems, we estimate that Insight will be able to reach 15-16% EBITDA growth in 2003 and 2004.

The company made the decision not to market the Insight Digital product on the Illinois systems until the rebuild was complete. In addition, the company made the decision not to implement any rate increases on any of its systems until they were completely rebuilt. The rebuilds in the non-Illinois systems are largely completed and, thus, Insight indicated that it will implement larger rate increases on these systems in 2002. We believe rate increases will average about 5-6% during the year, which compares to an average of 2.4% in 2001. The company will not implement rate increases on the Illinois systems in 2002 as these systems are still being rebuilt (represents about 360,000 customers).

Digital Video Subscribers

We expect Insight to end 1Q02 with 280,000-290,000 digital video subscribers, representing weekly additions of 2,100. This compares to average weekly additions of 2,160 during 4Q01. Over 80% of Insight digital customers are Insight Digital customers, while the remainder are digital customers inherited through the AT&T systems acquired in January 2001. Insight should begin marketing its Insight Digital product to the Illinois systems during 2002. The company has spent the past year rebuilding and upgrading these systems in order to offer its interactive digital product.

Insight ended 2001 with 950,000 VOD-enabled customers, which represents about 75% of Insight's total customer base. The company indicated that it would trial S-VOD at some point during the year. It did not note pricing strategies, but the company did say that it would charge for the service.

Cable Modem Customers

Insight should add 8,500-9,500 high-speed data customers during 1Q02 to end the quarter with 96,000-99,000. In February 2002, Insight completed the transition from the @Home network to a backbone managed by AT&T Broadband. In December 2001, Insight signed an interim deal with @Home in which Insight paid $10 million for continuation of the cable-modem service through the end of February. During the transition, the company made the decision to stop marketing the service. Insight cable modem service is now branded "InsightBB."

Insight estimates that it will be able to reduce direct costs on the modem product to about $9 per customer, which compares to the $13 per customer that it paid to @Home as the affiliate fee.

Residential Telephony

At the end of 2001, Insight had approximately 210,000 homes passed for residential telephony, with 7,500 subscribers. The company has launched the service in Louisville, Kentucky and Evansville, Indiana, and has plans for launches in Columbus, Ohio, and Lexington, Kentucky. Unlike residential telephony deployments by other MSOs, Insight sells local bandwidth to AT&T under the agreement. Insight does not bear marketing and G&A expenses and therefore will not experience start-up losses. However, the telephony product is offered on a co-branded basis.

Capital Expenditures and Plant Upgrades

Insight ended the year with 79% of its plant (including the Illinois systems) upgraded for 750 MHz and two-way capabilities. Excluding the Illinois systems, the plant was about

97% upgraded. The company expects to end 2002 with 99% of its plant (including the Illinois systems) upgraded for two-way and 750 MHz.

We expect Insight to incur $300 million in capital expenditures in 2002, largely for rebuilds in the Illinois systems, telephony deployment, and interactive digital expansion.

Exhibit 146

Insight Communications
Broadband Cable Drivers

($ in Millions)

	Pro Forma with AT&T			Pro Forma with AT&T				Pro Forma with AT&T			
	2000	2001	2002	1Q01	2Q01	3Q01	4Q01	1Q02E	2Q02E	3Q02E	4Q02E
Broadband Subscribers											
Basic	1,278,500	1,283,700	1,296,537	1,284,900	1,270,100	1,275,500	1,283,700	1,288,835	1,290,119	1,291,402	1,296,537
Pro Forma Basic Growth %	0.5%	0.4%	1.0%								
Basic ARPU	$29.40	$30.97	$32.67	$30.37	$30.83	$31.25	$31.44	$32.07	$32.87	$32.87	$32.87
Program. Costs as % of Analog Rev	27.4%	27.2%	27.0%	28.5%	27.3%	26.9%	26.3%	28.3%	27.1%	26.7%	26.0%
Programming Costs per sub % Change	22.9%	8.8%	9.7%	9.1%	8.7%	8.6%	8.9%	8.5%	9.7%	10.3%	10.5%
Digital Video Subscribers	152,100	257,700	370,041	182,900	201,200	229,600	257,700	285,000	308,400	337,000	370,041
Weekly Additions	1,085	1,985	2,160	2,185	1,406	2,185	2,162	2,100	1,800	2,200	2,542
ARPU	$12.13	$19.16	$19.16	$18.78	$20.07	$18.70	$19.13	$19.16	$19.16	$19.16	$19.16
Basic Sub Penetration	11.9%	20.1%	28.5%	14.2%	15.8%	18.0%	20.1%	22.1%	23.9%	26.1%	28.5%
Digital Prog. Costs as % of Dig. Rev.	28.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Cable Modem Subscribers	51,800	88,100	170,650	63,300	73,300	84,900	88,100	97,200	113,450	142,050	170,650
Weekly Additions	NA	696	1,588	885	769	892	246	700	1,250	2,200	2,200
ARPU	$38.93	$39.56	$38.00	$35.45	$39.74	$39.96	$41.80	$38.00	$38.00	$38.00	$38.00
Basic Sub Penetration	4.1%	6.9%	13.2%	4.9%	5.8%	6.7%	6.9%	7.5%	8.8%	11.0%	13.2%
Affiliate Fee as % of HSD service rev	35.0%	36.3%	32.5%	35.0%	35.0%	35.0%	40.0%	40.0%	32.0%	32.0%	27.0%
Fixed Costs (1)	$159.4	$146.8	$155.5	$35.3	$39.0	$37.3	$35.0	$37.5	$41.2	$39.6	$39.8
Fixed Costs (% Change)	-10.5%	-7.9%	6.0%	NM	NM	NM	NM	NM	NM	NM	NM
Total Capital Expenditures	$262.2	$325.6	$310.2	NA	NA	NA	NA	NA	NA	NA	NA
Broadband (incl. Telephony)											
Revenue Growth %	7.6%	5.6%	12.6%	4.4%	6.4%	5.1%	5.9%	9.9%	11.5%	12.6%	12.9%
EBITDA Growth %	NA	NA	12.8%	5.5%	2.2%	4.2%	5.5%	8.0%	12.4%	13.2%	14.0%
EBITDA Margin %	0.0%	47.5%	47.5%	47.0%	46.2%	47.4%	49.1%	46.1%	46.8%	48.0%	48.9%

(1) G&A, marketing and plant operations for cable operations

E= Morgan Stanley Research Estimates

Exhibit 147

Insight Communications
Estimated 2002 Fair Market Value

($ Millions Except Per Share Data)

Asset Description	National Operations	Corporate & Other	Total
Core Cable Television Operations	$5,488.0		$5,488.0
Telephony	390.1		390.1
Management Fess		(123.9)	(123.9)
Other Assets			
Liberate (883,682 shares)		5.9	5.9
Total Estimated Asset Value	**$5,878.0**	**($117.9)**	**$5,760.1**
Less:			
Debt	2,603.1	274.9	$2,878.0
Preferred Stock	0.0	0.0	0.0
Minority Interest	1,637.5	0.0	1,637.5
Plus:			
Cash		216.6	216.6
Cash from Stock Options		0.0	0.0
Total Fair Market Value	**$1,637.5**	**($176.2)**	**$1,461.3**
Class A Shares Outstanding	50.967	50.967	50.967
Class C Shares Outstanding	10.226	10.226	10.226
Stock Options	4.158	4.158	4.158
Total Insight Comm. Shares Outstanding	65.351	65.351	65.351
Total Fair Market Value Per Share	**$25.06**	**($2.70)**	**$22.36**

Supplemental Valuation Data	Cable		Total
Estimated Asset Value	$5,878.0	($123.9)	$5,754.2
2002E Cable/Telephony EBITDA	377.0	(16.0)	361.0
Est. Asset Value / Est. 2002E EBITDA	15.6x	NA	15.9x
2003E Cable/Telephony EBITDA	435.4	(16.5)	418.9
Est. Asset Value / 2003E EBITDA	13.5x	NA	13.7x
2002E Basic Subscribers	1,296,537		
Est. Asset Value per Basic Subscriber	$4,534		

E= Morgan Stanley Research Estimates

Exhibit 148

Insight Communications
Consolidated Annual Income Statement

($ in millions)	Pro Forma With ATT Transaction 2000	2001	2002E	2003E	2004E	2005E	2006E
CABLE							
Service Revenues	667.4	703.9	786.8	905.9	1,040.1	1,194.0	1,352.1
Operating Expenses	349.2	369.6	416.5	488.3	564.4	648.3	736.1
Cable System Cash Flow	318.2	334.3	370.3	417.6	475.7	545.6	616.0
RESIDENTAL TELEPHONY OPERATIONS							
Revenue	0.0	0.7	6.8	21.2	42.9	66.2	88.2
Operating Expenses	0.0	0.7	0.0	3.5	12.2	23.7	30.7
Telephony Operating Cash Flow	0.0	0.1	6.7	17.8	30.8	42.6	57.6
CORPORATE/Other							
Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Expenses	13.8	17.9	16.0	16.5	17.0	17.5	18.0
Net Cash Corporate Expenses	(15.0)	(17.9)	(16.0)	(16.5)	(17.0)	(17.5)	(18.0)
TOTAL REVENUE	**$667.4**	**$704.6**	**$793.5**	**$927.1**	**$1,083.1**	**$1,260.2**	**$1,440.4**
TOTAL EBITDA	**$303.2**	**$316.4**	**$361.0**	**$418.9**	**$489.5**	**$570.7**	**$655.6**
Depreciation	144.2	178.4	199.0	208.4	210.1	217.6	225.8
EBITA	159.0	138.0	162.0	210.4	279.4	353.1	429.7
Amortization	138.0	205.0	8.0	8.0	8.0	8.0	8.0
EBIT	21.0	(67.0)	154.0	202.4	271.4	345.1	421.7
Cash Interest Expense	187.3	180.1	180.2	182.1	177.5	169.5	204.7
Noncash Interest Expense	4.7	32.9	36.1	40.2	41.1	42.4	0.0
Other Income		18.2	0.0	0.0	0.0	0.0	0.0
Interest Income	3.4	7.3	7.7	8.1	8.5	8.9	9.3
Pretax Profit before Equity Income	(167.6)	(254.6)	(54.6)	(11.7)	61.3	142.1	226.4
Income from Equity Interests	0.0	(2.0)	(2.0)	(2.0)	(2.0)	(2.0)	(2.0)
Minority Interest	90.1	141.3	20.3	(2.7)	(41.1)	(83.5)	(125.3)
Pretax Profit	(77.5)	(115.3)	(36.3)	(16.5)	18.2	56.5	99.0
Tax Provision	(31.0)	(46.6)	(11.3)	(3.4)	10.5	25.8	42.8
Current Taxes	(15.5)	0.0	(5.7)	(3.4)	10.5	25.8	42.8
Net Income before Extraordinary Items	(46.5)	(68.7)	(25.0)	(13.1)	7.7	30.7	56.2
Extraordinary Items (after-tax)	0.0	(6.1)	0.0	0.0	0.0	0.0	0.0
Net Income	(46.5)	(74.8)	(25.0)	(13.1)	7.7	30.7	56.2
Preferred Dividends	(18.7)	(19.4)	(19.5)	(19.6)	(19.7)	(19.8)	(19.9)
Net Income Available to Common Shareholders	(65.2)	(94.2)	(44.5)	(32.7)	(12.0)	10.9	36.3
Avg. Basic Shares Outstanding	59.703	60.202	61.406	65.479	65.734	65.991	66.249
Reported Basic EPS	($1.09)	($1.57)	($0.73)	($0.50)	($0.18)	$0.17	$0.55
Avg. Diluted Shares Outstanding	59.703	60.202	61.406	65.479	65.734	65.991	66.249
Reported Diluted EPS	($1.09)	($1.56)	($0.73)	($0.50)	($0.18)	$0.17	$0.55
Extraordinary Items per Diluted Share	$0.00	$0.10	$0.00	$0.00	$0.00	$0.00	$0.00
Nonrecurring Items (after-tax)	$0.00	($0.20)	$0.00	$0.00	$0.00	$0.00	$0.00
Adjusted Diluted EPS	($1.09)	($1.66)	($0.73)	($0.50)	($0.18)	$0.17	$0.55
Amortization per Diluted Share	$1.16	$1.02	$0.04	$0.04	$0.04	$0.04	$0.04
Equity Income per Diluted Share	$0.00	($0.03)	($0.03)	($0.03)	($0.03)	($0.03)	($0.03)
Diluted Cash EPS	$0.06	($0.67)	($0.72)	($0.49)	($0.18)	$0.17	$0.55

E= Morgan Stanley Research Estimates

Exhibit 149

Insight Communications
Balance Sheet Forecast

BALANCE SHEET ANALYSIS	2000	2001	2002E	2003E	2004E	2005E	2006E
Cash & Marketable Securities	61.6	216.6	216.6	216.6	216.6	216.6	341.6
Accounts Receivable	18.2	22.9	25.8	30.2	35.2	41.0	46.9
Other Current Assets	28.3	31.3	35.3	41.2	48.2	56.1	64.1
Total Current Assets	108.0	270.9	277.7	288.0	300.0	313.7	452.5
Prop., Plant, & Equip.	1,115.3	1,626.3	1,822.6	1,893.5	1,957.4	2,030.4	2,108.8
Accumulated Depreciation	294.4	474.5	382.4	463.3	540.8	621.4	705.1
Net Prop., Plant, & Equip. (Rpt)	820.9	1,151.7	1,440.1	1,430.3	1,416.5	1,409.0	1,403.8
Investments in Unconsolidated Investments	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Intangible Assets	1,270.6	2,397.1	2,389.1	2,381.1	2,373.1	2,365.1	2,357.1
Other Assets	42.8	47.7	47.7	47.7	47.7	47.7	47.7
Total Assets	2,244.6	3,867.4	4,154.7	4,147.1	4,137.4	4,135.5	4,261.1
Short-term Debt	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Account Payable	46.2	67.1	67.6	69.7	70.6	75.9	79.5
Other Current Liabilities	77.4	95.0	95.0	95.0	95.0	95.0	95.0
Total Current Liabilities	123.6	162.1	162.6	164.7	165.6	170.9	174.5
Long-term Debt	1,372.5	2,542.5	2,878.0	2,867.7	2,791.1	2,663.2	2,591.9
Minority Interest	(47.9)	255.9	235.6	238.3	279.4	362.9	488.2
Deferred Taxes	60.8	0.0	0.0	0.0	0.0	0.0	0.0
Other Liabilities	194.9	260.9	257.5	268.4	285.6	292.2	303.9
Preferred Equity	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Common Equity	540.7	646.0	621.0	607.9	615.7	646.4	702.6
Total Equity	540.7	646.0	621.0	607.9	615.7	646.4	702.6
Total Liabilities & Equity	2,244.6	3,867.4	4,154.7	4,147.1	4,137.4	4,135.5	4,261.1

E= Morgan Stanley Research Estimates

Exhibit 150
Insight Communications
Debt Capitalization

($ Million)

	Pro Forma 2000	2001	2002E	2003E	2004E	2005E	2006E
Insight Indiana Credit Facility	298.6	0.0	0.0	0.0	0.0	0.0	0.0
12 3/4% Senior Discount Notes due 2011	0.0	244.9	274.9	308.6	346.4	388.8	400.0
Subtotal For Insight Consolidated Excluding Kentucky	**$298.6**	**$244.9**	**$274.9**	**$308.6**	**$346.4**	**$388.8**	**$400.0**
Kentucky							
Midwest Holdings Credit Facility	685.5	1,580.0	1,693.7	1,643.2	1,528.8	1,358.4	1,276.0
Revolving Credit Facility - 8.38%	356.3	0.0	0.0	0.0	0.0	0.0	0.0
High Yield Offering - 8.5%	200.0	200.0	200.0	200.0	200.0	200.0	200.0
Insight Midwest Senior Notes - 10.5% - due 2010	492.6	492.6	492.6	492.6	492.6	492.6	492.6
Subtotal	**$1,734.4**	**$2,272.6**	**$2,386.3**	**$2,335.8**	**$2,221.4**	**$2,051.1**	**$1,968.6**
Ohio							
Notes to Banks and Insuitions	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Subtotal	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**
Total Debt	**$2,058.0**	**$2,542.5**	**$2,686.2**	**$2,669.4**	**$2,592.8**	**$2,464.9**	**$2,393.6**
Series A- 10%	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Series B - 12.875%	40.3	45.7	51.8	58.3	58.3	58.3	58.3
Total Debt and Preferred Stock	**$2,238.3**	**$2,728.2**	**$2,878.0**	**$2,867.7**	**$2,791.1**	**$2,663.2**	**$2,591.9**
EBITDA	$303.2	$316.4	$361.0	$418.9	$489.5	$570.7	$655.6
Total Debt / EBITDA	6.8x	8.0x	7.4x	6.4x	5.3x	4.3x	3.7x
Total Debt and Preferred Stock / EBITDA	7.4x	8.6x	8.0x	6.8x	5.7x	4.7x	4.0x

E= Morgan Stanley Research Estimates

Exhibit 151

Insight Communications
Revenue and Operating Cash Flow Comparison, Quarterly

($ Millions)

	2001				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Cable/Telephony Revenue								
Analog	$152.8	$155.3	$155.2	$157.7	$158.9	$166.0	$165.6	$167.3
Digital Cable	9.5	11.6	12.1	14.0	15.6	17.1	18.6	20.3
Cable Modem	6.5	8.5	9.9	11.0	10.9	12.5	15.4	18.7
Total Cable Television Revenue	$168.7	$175.3	$177.1	$182.7	$185.4	$195.5	$199.5	$206.3
Telephony	0.0	0.0	0.2	0.5	1.0	1.7	2.0	2.0
Total Cable/Telephony Revenue	$168.7	$175.3	$177.4	$183.1	$186.4	$197.2	$201.6	$208.3
					10.5%	12.5%	13.6%	13.7%
Cable/Telephony Gross Profit								
Analog	$104.6	$107.5	$107.6	$109.7	$106.5	$113.0	$112.4	$113.7
Digital Cable	5.7	6.9	7.3	8.4	9.4	10.2	11.1	12.2
Cable Modem	4.3	5.6	6.5	6.7	6.7	8.7	10.7	13.9
Total Cable Television Gross Profit	$114.7	$120.0	$121.4	$124.8	$122.5	$131.9	$134.2	$139.8
Telephony	0.0	0.0	0.2	0.5	1.0	1.7	2.0	2.0
Total Cable/Telephony Gross Profit	$114.7	$120.0	$121.7	$125.2	$123.5	$133.6	$136.3	$141.8
Gross Profit Margin	67.9%	68.5%	68.6%	68.4%	66.3%	67.7%	67.6%	68.1%
Cable/Telephony EBITDA								
Core Cable Television EBITDA	79.3	81.0	84.1	89.8	85.0	90.7	94.7	99.9
Video/Data Startup Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Telephony EBITDA	0.0	0.0	0.0	0.0	1.0	1.7	2.0	2.0
Total Cable/Telephony EBITDA	79.3	81.0	84.1	89.9	86.0	92.4	96.7	101.9
					8.4%	14.0%	14.9%	13.4%
Cable/Telephony EBITDA								
Total Cable Margins excl. Telephony	47.0%	46.2%	47.5%	49.2%	45.8%	46.4%	47.4%	48.4%
Telephony Margins	0.0%	0.0%	NM	NM	99.4%	99.4%	99.4%	99.4%
Total Cable/Telephony Margins	47.0%	46.2%	47.4%	49.1%	46.1%	46.8%	48.0%	48.9%
Corporate/Other								
Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EBITDA	(4.3)	(3.9)	(4.0)	(9.5)	(4.0)	(4.0)	(4.0)	(4.0)
Total Revenue	$168.7	$175.3	$177.4	$183.1	$186.4	$197.2	$201.6	$208.3
% Growth	NA	NA	NA	NA	10.5%	12.5%	13.6%	13.7%
Total EBITDA (Operating Cash Flow)	75.0	77.1	80.1	80.4	82.0	88.4	92.7	97.9
% Growth	NA	NA	NA	NA	9.3%	14.6%	15.7%	21.9%
EBITDA Margins	44.5%	44.0%	45.2%	43.9%	44.0%	44.8%	46.0%	47.0%

E: Morgan Stanley Research Estimate

Exhibit 152

Insight Communications
Revenue and Operating Cash Flow Comparisons, 2000-2006E

($ Millions)

	Pro Forma 2000	2001	2002E	2003E	2004E	2005E	2006E
Cable/Telephony Revenue							
Analog	$638.4	$620.9	$657.8	$697.9	$744.7	$801.0	$860.2
Digital Cable	13.6	47.1	71.5	102.3	138.6	180.7	219.5
Cable Modem	15.4	35.8	57.4	105.7	156.9	212.3	272.5
Total Cable Television Revenue	$667.4	$703.9	$786.8	$905.9	$1,040.1	$1,194.0	$1,352.1
Telephony	0.0	0.7	6.8	21.2	42.9	66.2	88.2
Total Cable/Telephony Revenue	$667.4	$704.6	$793.5	$927.1	$1,083.1	$1,260.2	$1,440.4
	7.6%	5.6%	12.6%	16.8%	16.8%	16.4%	14.3%
Cable/Telephony Gross Profit							
Analog	$463.2	$429.4	$445.6	$469.6	$496.8	$528.7	$562.1
Digital Cable	8.6	28.3	42.9	59.9	80.4	103.9	125.1
Cable Modem	5.7	23.2	39.9	75.1	111.1	150.1	192.5
Total Cable Television Gross Profit	$477.6	$480.9	$528.4	$604.5	$688.3	$782.7	$879.7
Telephony	0.0	0.7	6.8	21.2	42.9	66.2	88.2
Total Cable/Telephony Gross Profit	$477.6	$481.6	$535.2	$625.7	$731.2	$848.9	$968.0
Gross Profit Margin	71.6%	68.4%	67.4%	67.5%	67.5%	67.4%	67.2%
Cable/Telephony EBITDA							
Core Cable Television EBITDA	318.2	334.3	370.3	417.6	475.7	545.6	616.0
Video/Data Startup Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Telephony EBITDA	0.0	0.1	6.7	17.8	30.8	42.6	57.6
Total Cable/Telephony EBITDA	**318.2**	**334.3**	**377.0**	**435.4**	**506.5**	**588.2**	**673.6**
	9.0%	5.1%	12.8%	15.5%	16.3%	16.1%	14.5%
Cable/Telephony EBITDA							
Total Cable Margins excl. Telephony	47.7%	47.5%	47.1%	46.1%	45.7%	45.7%	45.6%
Telephony Margins		8.0%	99.4%	83.7%	71.7%	64.3%	65.2%
Total Cable/Telephony Margins	47.7%	47.5%	47.5%	47.0%	46.8%	46.7%	46.8%
Corporate/Other							
Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EBITDA	(15.0)	(17.9)	(16.0)	(16.5)	(17.0)	(17.5)	(18.0)
Total Revenue	$667.4	$704.6	$793.5	$927.1	$1,083.1	$1,260.2	$1,440.4
% Growth		5.6%	12.6%	16.8%	16.8%	16.4%	14.3%
Total EBITDA (Operating Cash Flow)	303.2	316.4	361.0	418.9	489.5	570.7	655.6
% Growth		4.4%	14.1%	16.0%	16.9%	16.6%	14.9%
EBITDA Margins		44.9%	45.5%	45.2%	45.2%	45.3%	45.5%

Note: 1Q01 adjusted to reflect consolidation of Greenwood Systems (which Insight acquired in mid-January 2001) for the entire quarter.

E= Morgan Stanley Research Estimates

Exhibit 153

Insight Communications

Consolidated Cable Television Operations, Quarterly

($ millions, except per-share data)

	2001 - With AT&T				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Homes Passed	2,158,000	2,166,000	2,181,000	2,200,800	2,209,053	2,217,306	2,225,559	2,233,812
% Change	2.1%	1.9%	2.4%	3.2%	2.4%	2.4%	2.0%	1.5%
Basic Subscribers	1,284,900	1,270,100	1,275,500	1,283,700	1,288,835	1,290,119	1,291,402	1,296,537
% Change	-0.3%	-0.4%	0.1%	0.4%	0.3%	1.6%	1.2%	1.0%
Homes Passed Penetration	59.5%	58.6%	58.5%	58.3%	58.3%	58.2%	58.0%	58.0%
Premium Subscriptions	750,382	741,738	744,892	749,681	754,377	755,128	755,880	758,885
% Change	-21.2%	-20.6%	-19.7%	-19.3%	0.5%	1.8%	1.5%	1.2%
Basic Susbcriber Penetration	58.4%	58.4%	58.4%	58.4%	58.5%	58.5%	58.5%	58.5%
Digital Subscriptions	182,900	201,200	229,600	257,700	285,000	308,400	337,000	370,041
% Change	158.0%	128.4%	88.2%	69.4%	55.8%	53.3%	46.8%	43.6%
Homes Passed Penetration	8.5%	9.3%	10.5%	11.7%	12.9%	13.9%	15.1%	16.6%
Basic Susbcriber Penetration	14.2%	15.8%	18.0%	20.1%	22.1%	23.9%	26.1%	28.5%
Premium Subscriber Penetration	24.4%	27.1%	30.8%	34.4%	37.8%	40.8%	44.6%	48.8%
HSCDS Subscribers	63,300	73,300	84,900	88,100	97,200	113,450	142,050	170,650
% Change	241.2%	160.2%	116.6%	70.1%	53.6%	54.8%	67.3%	93.7%
Homes Passed Penetration	2.9%	3.4%	3.9%	4.0%	4.4%	5.1%	6.4%	7.6%
Basic Susbcriber Penetration	4.9%	5.8%	6.7%	6.9%	7.5%	8.8%	11.0%	13.2%
Monthly Reg. Rev. per Basic Sub.	$30.80	$31.07	$31.50	$31.68	$32.36	$33.16	$33.16	$33.16
% Change	-1.0%	-0.1%	1.3%	1.9%	5.1%	6.7%	5.3%	4.7%
Monthly Reg. & Unreg. Rev. per Basic Sub.	$39.73	$40.52	$40.64	$41.07	$41.19	$42.90	$42.77	$43.10
% Change	-4.2%	-2.9%	-3.6%	-2.1%	3.7%	5.9%	5.2%	4.9%
Monthly Digital Video Rev. per Digital Sub.	$18.78	$20.07	$18.70	$19.13	$19.16	$19.16	$19.16	$19.16
% Change	68.7%	89.1%	57.8%	46.7%	2.1%	-4.5%	2.5%	0.2%
Monthly HSCDS Rev. per HSCDS Sub.	37.51	41.34	41.56	42.45	39.14	39.57	40.10	39.79
% Change	12.3%	-1.8%	-9.0%	-15.8%	4.3%	-4.3%	-3.5%	-6.3%
Regulated Analog Revenues	$118.4	$119.1	$120.3	$121.6	$124.9	$128.3	$128.4	$128.7
% Change	-0.9%	0.3%	1.8%	2.8%	5.4%	7.7%	6.8%	5.8%
Premium and Non-regulated Revenues	34.4	36.2	34.9	36.1	34.1	37.7	37.2	38.6
% Change	-13.8%	-10.8%	-16.8%	-12.8%	-0.8%	4.1%	6.5%	7.0%
Digtial Video Revenues	9.5	11.6	12.1	14.0	15.6	17.1	18.6	20.3
% Change	254.6%	309.7%	245.5%	202.6%	64.2%	47.5%	53.5%	45.4%
HSCDS Revenues	6.5	8.5	9.9	11.0	10.9	12.5	15.4	18.7
% Change	212.3%	157.6%	126.0%	93.0%	68.0%	47.6%	55.8%	69.4%
Total Revenue	**$168.7**	**$175.3**	**$177.1**	**$182.7**	**$185.4**	**$195.5**	**$199.5**	**$206.3**
% Change	4.4%	6.4%	5.1%	5.9%	9.9%	11.5%	12.6%	12.9%

E= Morgan Stanley Research Estimates

Exhibit 154

Insight Communications
Consolidated Cable Television Operations, Quarterly (continued)

($ millions, except per-share data)

	2001 - With AT&T				2002E			
	1Q	2Q	3Q	4Q	1QE	2QE	3QE	4QE
Total Revenue	**$168.7**	**$175.3**	**$177.1**	**$182.7**	**$185.4**	**$195.5**	**$199.5**	**$206.3**
% Change	4.4%	6.4%	5.1%	5.9%	9.9%	11.5%	12.6%	12.9%
Analog Programming Costs	$48.1	$47.8	$47.6	$48.0	$52.4	$52.9	$53.2	$53.6
% of Total Analog Revenue	28.5%	27.3%	26.9%	26.3%	28.3%	27.1%	26.7%	26.0%
Digital Prog. & Direct Costs	3.8	4.6	4.8	5.6	6.2	6.8	7.4	8.1
% of Total Digital Revenue	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
HSCDS Direct Operating Costs	2.1	2.9	3.3	4.3	4.2	3.8	4.7	4.8
% of Total HSCDS Revenue	33.1%	33.6%	33.7%	39.4%	38.8%	30.7%	30.3%	25.8%
Total Programming and Direct Costs	54.1	55.3	55.7	57.9	62.9	63.6	65.3	66.5
% of Total Revenue	32.1%	31.5%	31.5%	31.7%	33.9%	32.5%	32.7%	32.2%
Analog Service Gross Profit	104.6	107.5	107.6	109.7	106.5	113.0	112.4	113.7
% of Total Analog Revenue	68.5%	69.2%	69.3%	69.6%	67.0%	68.1%	67.9%	68.0%
Digital Service Gross Profit	5.7	6.9	7.3	8.4	9.4	10.2	11.1	12.2
% of Total Digital Revenue	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
HSCDS Gross Profit	4.3	5.6	6.5	6.7	6.7	8.7	10.7	13.9
% of Total HSCDS Revenue	66.9%	66.4%	66.3%	60.6%	61.2%	69.3%	69.7%	74.2%
Total Gross Profit	**114.7**	**120.0**	**121.4**	**124.8**	**122.5**	**131.9**	**134.2**	**139.8**
% of Total Revenue	**67.9%**	**68.5%**	**68.5%**	**68.3%**	**66.1%**	**67.5%**	**67.3%**	**67.8%**
% Change	39.7%	39.8%	40.1%	39.0%	6.0%	11.8%	11.1%	13.5%
Other Operating Costs	19.0	19.7	18.9	17.3	18.7	20.6	21.1	20.2
% of Total Revenues	11.3%	11.2%	10.7%	9.5%	10.1%	10.6%	10.6%	9.8%
Marketing Costs	3.0	3.2	2.8	2.6	3.3	3.5	3.2	3.5
% of Total Revenues	1.8%	1.8%	1.6%	1.4%	1.8%	1.8%	1.6%	1.7%
Gen. & Admin. Costs	13.3	16.2	15.5	15.1	15.4	17.0	15.3	16.2
% of Total Revenues	7.9%	9.2%	8.8%	8.3%	8.3%	8.7%	7.7%	7.8%
Operating Costs	89.4	94.3	93.0	92.9	100.4	104.8	104.9	106.4
% of Revenues	53.0%	53.8%	52.5%	50.8%	54.2%	53.6%	52.6%	51.6%
EBITDA (System Cash Flow)	**$79.3**	**$81.0**	**$84.1**	**$89.8**	**$85.0**	**$90.7**	**$94.7**	**$99.9**
Operating Margin	47.0%	46.2%	47.5%	49.2%	45.8%	46.4%	47.4%	48.4%
% Change	6.2%	2.6%	4.3%	7.0%	7.2%	11.9%	12.5%	11.2%

E= Morgan Stanley Research Estimates

Exhibit 155
Insight Communications
Consolidated Cable Television Operations, 2000-2006E

($ millions, except per-share data)	Pro Forma with ATT Transaction 2000	2001E	2002E	2003E	2004E	2005E	2006E
Homes Passed	2,133,300	2,200,800	2,233,812	2,267,319	2,301,329	2,335,849	2,370,887
% Change	2.4%	3.2%	1.5%	1.5%	1.5%	1.5%	1.5%
Basic Subscribers	1,278,500	1,283,700	1,296,537	1,309,000	1,321,000	1,333,000	1,345,000
% Change	0.5%	0.4%	1.0%	1.0%	0.9%	0.9%	0.9%
Homes Passed Penetration	59.9%	58.3%	58.0%	57.7%	57.4%	57.1%	56.7%
Premium Subscriptions	928,600	749,681	758,885	761,766	767,936	774,723	773,820
% Change	-1.8%	-19.3%	1.2%	0.4%	0.8%	0.9%	-0.1%
Basic Susbcriber Penetration	72.6%	58.4%	58.5%	58.2%	58.1%	58.1%	57.5%
Digital Subscriptions	152,100	257,700	370,041	493,853	642,175	795,902	899,727
% Change	87.3%	69.4%	43.6%	33.5%	30.0%	23.9%	13.0%
Homes Passed Penetration	7.1%	11.7%	16.6%	21.8%	27.9%	34.1%	37.9%
Basic Susbcriber Penetration	11.9%	20.1%	28.5%	37.7%	48.6%	59.7%	66.9%
Premium Subscriber Penetration	16.4%	34.4%	48.8%	64.8%	83.6%	102.7%	116.3%
HSCDS Subscribers	51,800	88,100	170,650	281,734	401,665	531,674	673,186
% Change	564.1%	70.1%	93.7%	65.1%	42.6%	32.4%	26.6%
Homes Passed Penetration	2.4%	4.0%	7.6%	12.4%	17.5%	22.8%	28.4%
Basic Susbcriber Penetration	4.1%	6.9%	13.2%	21.5%	30.4%	39.9%	50.1%
Monthly Reg. Rev. per Basic Sub.	$31.10	$31.26	$32.96	$34.34	$35.88	$37.50	$39.18
% Change	6.8%	0.5%	5.4%	4.2%	4.5%	4.5%	4.5%
Monthly Reg. & Unreg. Rev. per Basic Sub.	$41.83	$40.49	$42.49	$44.64	$47.19	$50.30	$53.53
% Change	4.8%	-3.2%	4.9%	5.1%	5.7%	6.6%	6.4%
Monthly Digital Video Rev. per Digital Sub.	$11.78	$19.17	$18.99	$19.74	$20.33	$20.94	$21.57
% Change	-17.0%	62.7%	-0.9%	3.9%	3.0%	3.0%	3.0%
Monthly HSCDS Rev. per HSCDS Sub.	44.21	42.68	36.98	38.94	38.26	37.91	37.69
% Change	-49.2%	-3.5%	-13.3%	5.3%	-1.7%	-0.9%	-0.6%
Regulated Analog Revenues	$474.6	$479.4	$510.3	$536.9	$566.2	$597.1	$629.6
% Change	7.1%	1.0%	6.4%	5.2%	5.5%	5.5%	5.4%
Premium and Non-regulated Revenues	163.8	141.5	147.5	161.0	178.5	203.9	230.6
% Change	-0.3%	-13.6%	4.2%	9.1%	10.9%	14.2%	13.1%
Digtial Video Revenues	13.6	47.1	71.5	102.3	138.6	180.7	219.5
% Change	0.0%	246.0%	51.8%	43.0%	35.4%	30.4%	21.4%
HSCDS Revenues	15.4	35.8	57.4	105.7	156.9	212.3	272.5
% Change	0.0%	132.1%	60.3%	84.1%	48.4%	35.3%	28.4%
Total Revenue	**$667.4**	**$703.9**	**$786.8**	**$905.9**	**$1,040.1**	**$1,194.0**	**$1,352.1**
% Change	7.6%	5.5%	11.8%	15.1%	14.8%	14.8%	13.2%

E= Morgan Stanley Research Estimates

Exhibit 156

Insight Communications
Consolidated Cable Television Operations, 2000-2006E (continued)

($ millions, except per-share data)	Pro Forma with ATT Transaction 2000	2001E	2002E	2003E	2004E	2005E	2006E
Total Revenue	**$667.4**	**$703.9**	**$786.8**	**$905.9**	**$1,040.1**	**$1,194.0**	**$1,352.1**
% Change	7.6%	5.5%	11.8%	15.1%	14.8%	14.8%	13.2%
Analog Programming Costs	175.2	191.5	212.2	228.3	247.9	272.3	298.1
% of Total Analog Revenue	27.4%	27.2%	27.0%	25.2%	23.8%	22.8%	22.0%
Digital Prog. & Direct Costs	5.0	18.9	28.6	42.5	58.2	76.8	94.4
% of Total Digital Revenue	36.8%	40.0%	40.0%	41.5%	42.0%	42.5%	43.0%
HSCDS Direct Operating Costs	9.7	12.6	17.5	30.6	45.8	62.1	79.9
% of Total HSCDS Revenue	62.8%	35.3%	30.5%	29.0%	29.2%	29.3%	29.3%
Total Programming and Direct Costs	**189.9**	**223.0**	**258.3**	**301.4**	**351.9**	**411.3**	**472.4**
% of Total Revenue	**28.4%**	**31.7%**	**32.8%**	**33.3%**	**33.8%**	**34.4%**	**34.9%**
Analog Service Gross Profit	463.2	429.4	445.6	469.6	496.8	528.7	562.1
% of Total Analog Revenue	72.6%	69.2%	67.7%	67.3%	66.7%	66.0%	65.3%
Digital Service Gross Profit	8.6	28.3	42.9	59.9	80.4	103.9	125.1
% of Total Digital Revenue	63.2%	60.0%	60.0%	58.5%	58.0%	57.5%	57.0%
HSCDS Gross Profit	5.7	23.2	39.9	75.1	111.1	150.1	192.5
% of Total HSCDS Revenue	NA	64.7%	69.5%	71.0%	70.8%	70.7%	70.7%
Total Gross Profit	**477.6**	**480.9**	**528.4**	**604.5**	**688.3**	**782.7**	**879.7**
% of Total Revenue	**71.6%**	**68.3%**	**67.2%**	**66.7%**	**66.2%**	**65.6%**	**65.1%**
% Change	1.6%	0.7%	9.9%	14.4%	13.9%	13.7%	12.4%
Other Operating Costs	66.6	74.9	80.7	94.1	106.2	119.4	134.1
% of Total Revenues	10.0%	10.6%	10.3%	10.4%	10.2%	10.0%	9.9%
Marketing Costs	18.0	11.6	13.6	18.1	21.0	24.4	27.9
% of Total Revenues	2.7%	1.6%	1.7%	2.0%	2.0%	2.0%	2.1%
Gen. & Admin. Costs	74.7	60.0	63.9	74.7	85.3	93.4	101.7
% of Total Revenues	11.2%	8.5%	8.1%	8.2%	8.2%	7.8%	7.5%
Operating Costs	$349.2	$369.6	$416.5	$488.3	$564.4	$648.3	$736.1
% of Revenues	52.3%	52.5%	52.9%	53.9%	54.3%	54.3%	54.4%
EBITDA (System Cash Flow)	**$318.2**	**$334.3**	**$370.3**	**$417.6**	**$475.7**	**$545.6**	**$616.0**
Operating Margin	**47.7%**	**47.5%**	**47.1%**	**46.1%**	**45.7%**	**45.7%**	**45.6%**
% Change	9.0%	5.1%	10.8%	12.8%	13.9%	14.7%	12.9%

E= Morgan Stanley Research Estimates

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Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

More volatile (V). We estimate that this stock has more than a 25% chance of a price move (up or down) of more than 25% in a month, based on a quantitative assessment of historical data, or in the analyst's view, it is likely to become materially more volatile over the next 1-12 months compared with the past three years. Stocks with less than one year of trading history are automatically rated as more volatile (unless otherwise noted). We note that securities that we do not currently consider "more volatile" can still perform in that manner.

ANALYST INDUSTRY VIEWS

Attractive (A). The analyst expects the performance of his or her industry coverage universe to be attractive vs. the relevant broad market benchmark over the next 12–18 months.

In-Line (I). The analyst expects the performance of his or her industry coverage universe to be in line with the relevant broad market benchmark over the next 12–18 months.

Cautious (C). The analyst views the performance of his or her industry coverage universe with caution vs. the relevant broad market benchmark over the next 12–18 months.

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Estimating discrete-choice models of product differentiation

Steven T. Berry*

This article considers the problem of "supply-and-demand" analysis on a cross section of oligopoly markets with differentiated products. The primary methodology is to assume that demand can be described by a discrete-choice model and that prices are endogenously determined by price-setting firms. In contrast to some previous empirical work, the techniques explicitly allow for the possibility that prices are correlated with unobserved demand factors in the cross section of markets. The article proposes estimation by "inverting" the market-share equation to find the implied mean levels of utility for each good. This method allows for estimation by traditional instrumental variables techniques.

1. Introduction

■ Traditional "supply-and-demand" analysis has long been a staple of empirical economics. This analysis attempts to uncover cost and demand information from market data under the assumption of a static, perfectly competitive equilibrium. In recent years, increasing attention has been paid to estimating demand and cost parameters under imperfect competition. Much, though not all, of this existing literature on estimation under imperfect competition is tied to homogeneous goods markets.

This article considers the problem of estimating supply-and-demand models in markets with product differentiation. In common with some previous articles, market demand is derived from a general class of discrete-choice models of consumer behavior. The utility of consumers depends on product characteristics and individual taste parameters; product-level market shares are then derived as the aggregate outcome of consumer decisions. Firms are modelled as price-setting oligopolists, and endogenous market outcomes are derived from an assumption of Nash equilibrium in prices.

The proposed estimation methods do not require the econometrician to observe all relevant product characteristics. The presence of unobserved product characteristics allows for a product-level source of sampling error. More importantly, it reintroduces the econometric problem of endogenous prices (or "simultaneity") that is familiar from studies of homogeneous goods markets. In these studies, the "error" in the demand equation is usually

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given an explicit structural interpretation as representing unobserved (by the econometrician) demand factors. These demand factors are, by inspection of the supply curve, seen to be correlated with prices. It is well known that ignoring the correlation between price and the demand error frequently leads to findings of upward sloping demand curves and other anomalies.

As is illustrated below, similar problems arise in the study of differentiated products markets when some product characteristics are unobserved. Importantly, unobserved product characteristics are a feature in many markets that economists study. Characteristics such as style are inherently difficult to quantify but are frequent determinants of demand. In some markets, products may be physically similar but differ in consumers' perceptions about quality, durability, status, or service at point-of-sale. Also, in practice, the number of product characteristics that are important to consumers may be much larger than the number of observations available to the econometrician, making it impossible to estimate the separate effects of each characteristic.

The endogeneity of prices that follows from the presence of unobserved product characteristics is not just an econometric quibble. A later set of Monte Carlo results will demonstrate that (as in the homogeneous goods case) estimation methods that ignore the endogeneity of prices in the presence of unobserved product characteristics can be severely misleading. In a more concrete example, the importance of price endogeneity is illustrated by Trajtenberg's (1989) careful study of the medical CT scanner market. This study notes that, in some cases, prices appear to have a positive effect on demand. In Trajtenberg's model, this finding implies that an increase in price increases consumer benefits. Consistent with the arguments made here for the importance of unobserved product characteristics, Trajtenberg attributes this anomaly to the presence of unobserved product quality. Empirical results on the automobile industry, reported in Berry, Levinsohn, and Pakes (1993), are also consistent with the importance of accounting for unobserved product characteristics.

In the homogeneous goods case, demand parameters can be consistently estimated in the presence of unobserved demand factors via the use of traditional instrumental variables methods. However, in the context of discrete-choice models, both prices and unobserved product characteristics enter demand equations in a nonlinear fashion. This frustrates any straightforward application of instrumental variables methods.

This article introduces a method for avoiding the nonlinear instrumental variables problem. This method inverts the function defining market shares to uncover the mean utility levels of various products as specified by the primitives of the model. These mean utility levels can then be related to product characteristics and prices using instrumental variables techniques. The mean utility method is applicable to a wide class of discrete-choice models, does not rely on the existence of a unique equilibrium, and frequently involves a smaller computational burden as compared to previously used alternatives.

After a brief description of related models, I shall outline the basic framework of discrete-choice demand and oligopolistic pricing. The method of recovering mean utility levels is then introduced and discussed. To illustrate, I show how to implement the method in several special cases, including logit, nested logit, and the vertical differentiation model. Final sections of the article discuss some problems with and extensions of this approach and also provide some Monte Carlo evidence.

2. Previous empirical models of differentiated products oligopoly

■ Markets with perfectly homogeneous goods are empirically rare, although not unknown. Accordingly, empirical models of differentiated products oligopoly have received some attention. Empirical studies of differentiated products oligopoly address topics as varied as the mode of market conduct (e.g., Bresnahan, 1987), the welfare effects of the introduction of new products (Trajtenberg, 1989), or of deregulation (Morrison and Winston, 1986). The focus in this article will be on estimating structural demand and cost parameters without reference to specific applications; applications that are related to the concerns of this article include those of Berry (1990), who estimates separate cost and demand effects of airline hubbing, and Berry, Levinsohn, and Pakes (1993), whose article embodies and extends the ideas of this article in an empirical study of the automobile industry.[1]

Perhaps the simplest approach for dealing with endogenous prices in a differentiated products industry is to posit simple aggregate (that is, market level) demand curves in which quantity demanded is decreasing in a firm's own price and increasing in the price of its rivals. Consider, for example, the constant elasticity framework:

$$\ln (q_j) = \alpha_j + \sum_k \eta_{jk} \ln (p_k) + \epsilon_j, \tag{1}$$

where η_{jk} is the elasticity of good j with respect to the price of good k. When ϵ and p are correlated, the demand system described by (1) can be easily estimated by traditional instrumental variables techniques. The well-known problem, however, is that a system of N goods gives N^2 elasticities to estimate, which is a very large number in many real-world applications. For example, in the automobile industry model of Bresnahan (1987), there are close to 100 distinct products, implying almost 10,000 separate elasticities.

It is possible to avoid the problem of "too many elasticities" by placing *a priori* restrictions on the pattern of cross-price elasticities. For example, a researcher could decide that many of the cross-price elasticities are equal to zero or that many sets of cross-price elasticities are equal to each other. This approach is obviously arbitrary, and in many markets, economic theory will provide little guidance on such restrictions.

It is desirable, therefore, to put some structure on the demand problem in order to reduce the number of demand parameters. This article will impose such structure by making assumptions on consumer utility. The utility of a given consumer is assumed to depend on the characteristics of the chosen product, on random consumer "tastes," and on a small set of parameters to be estimated. Market demand is then derived as the aggregation of individual consumer choices. Explicitly deriving aggregate demand from consumer choices has several advantages. This approach avoids the problems of (1) by deriving all the relevant demand elasticities from a much smaller number of utility parameters. Also, the resulting model can make predictions about the demand for new products and about the demand for dissimilar products found in different markets. Finally, such a model allows us to move easily between statements about aggregate demand and statements about consumer utility.

Discrete-choice models are a common, tractable, and parsimonious method for obtaining the desired structure on demand. This parsimony comes at some cost, as the models rule out the purchase of multiple items and do not easily incorporate dynamic aspects of demand. Furthermore, they typically place important parametric restrictions on the demand structure. Discrete-choice models of product demand have, of course, a long history in econometrics, most notably influenced by McFadden (e.g., McFadden (1974)). Recently, discrete-choice models have received increasing attention in the theoretical literature on differentiated products oligopoly, either as a means of justifying particular assumptions on aggregate demand or as an independent focus of analysis.[2]

[1] The model of this article is also related to the hedonic pricing models of Griliches (1971), Rosen (1974), and Epple (1987). Indeed, my model implicitly produces a hedonic equilibrium pricing function that depends on product characteristics. However, the focus in this article on structural estimation with price-setting firms and unobserved demand characteristics differs from the typical focus in the hedonic literature.

[2] Theoretical works that apply discrete-choice models to the study of oligopoly product differentiation include Shaked and Sutton (1982), Sattinger (1984), Perloff and Salop (1985), Anderson, DePalma, and Thisse (1989), and Caplin and Nalebuff (1991).

In an empirical study that is related to the approach taken here, Bresnahan (1987) uses a discrete-choice model with vertically differentiated products to study the automobile market. In this model, consumers care about product quality, which is modelled as depending on observed product characteristics. Bresnahan's model has several features that I shall also employ below. Consumer utility will be modelled as depending on product characteristics, consumers will be allowed to purchase an "outside good," and explicit use can be made of the first-order conditions of price-setting firms. In a defect shared with Bresnahan (and with nearly all empirical studies of differentiated products), product characteristics will be treated as exogenous, although product prices are determined within the model. However, in contrast to Bresnahan's model, I shall consider the presence of unobserved product characteristics and shall discuss a much broader class of discrete-choice demand models. Both of these issues will suggest the use of estimation methods that are substantially different than those used by Bresnahan.

3. The model

■ The primitives of the model are the characteristics of products, consumer preferences, and the equilibrium notion. All characteristics and all decisions are assumed to be observable by all participants in the market. However, the econometrician does not observe all of the product characteristics and may not observe the decisions of individual consumers. The econometrician is assumed to observe the market outcomes of price and quantities sold by each firm.

For now, I shall assume that we observe a large number, R, of independent markets. There are N_r firms in market r, with each firm producing one product. For product j in market r, observed characteristics are denoted by the vector $z_{jr} \in \mathbf{R}^{K_z}$. (For simplicity, I often drop the market subscript r.) The elements of z_j include characteristics that affect demand (x_j) and marginal costs (w_j). The characteristics of all firms in the market are included in the vector $\mathbf{z} = (z_1, \ldots, z_N)$. Similarly, $\mathbf{x} = (x_1, \ldots, x_N)$ and $\mathbf{w} = (w_1, \ldots, w_N)$.

The unobserved characteristics of product j are (ξ_j, ω_j), where ξ_j is an unobserved demand characteristic and ω_j is an unobserved cost variable. The unobserved characteristics in a market are assumed to be mean independent of $\mathbf{z}$ and independent across markets. Together, $\mathbf{z}$, $\boldsymbol{\xi}$, and $\boldsymbol{\omega}$ define the data that are causally "exogenous" to the firm's pricing decisions. Assuming that the unobservables are mean independent of the product characteristics amounts to treating the product characteristics as econometrically exogenous. While common, this assumption is unreasonable in many cases. The problems raised by models with endogenous product characteristics are discussed in Section 9.

□ **The discrete choice model.** The utility of consumer i for product j depends on the characteristics of the product and the consumer: $U(x_j, \xi_j, p_j, \nu_i, \theta_d)$, where x_j, ξ_j, p_j, and θ_d are observed product characteristics, unobserved (by the econometrician) product characteristics, and price and demand parameters, respectively. The term ν_i captures consumer-specific terms that are not observed by the econometrician. All the estimators discussed below require parametric assumptions on the consumer-specific variables; these assumptions are analogous to the choice of a functional form for a homogeneous goods demand equation. Different choices for the utility function and for the density of ν will have important implications for the resulting model.

I shall focus on a simple random coefficients specification for utility, which is quite simple, yet flexible enough to illustrate the main points of the article. In this specification, the utility of consumer i for product j is given by

$$u_{ij} = x_j\tilde{\beta}_i - \alpha p_j + \xi_j + \epsilon_{ij}, \tag{2}$$

where the (unobserved to the econometrician) consumer-specific taste parameters are $\tilde{\beta}_i$ and ϵ_{ij}. The parameter α is written as invariant across consumers, although this is not necessary. The term ξ_j might be thought of as the mean of consumers' valuations of an unobserved product characteristic such as product quality, while the ϵ_{ij} represents the distribution of consumer preferences about this mean.

For simplicity, I shall decompose consumer i's taste parameter for characteristic k as

$$\tilde{\beta}_{ik} = \beta_k + \sigma_k \zeta_{ik}, \tag{3}$$

where β_k is the mean level of the taste parameter for product k and the mean-zero ζ_{ik} has, e.g., an identically and independently distributed standard normal distribution across individuals and characteristics. Combining (2) with (3), we can write

$$u_{ij} = x_j\beta + \xi_j - \alpha p_j + \nu_{ij},$$

with

$$\nu_{ij} = [\sum_k x_{jk}\sigma_k\zeta_{ik}] + \epsilon_{ij}. \tag{4}$$

The term ν_{ij} is thus a mean-zero, heteroskedastic error that captures the effects of the random taste parameters. I denote the mean utility level of product j, which will play an important role below, as

$$\delta_j \equiv x_j\beta - \alpha p_j + \xi_j. \tag{5}$$

It is common in traditional logit and probit models to assume that the variation in consumer tastes enters only through the additive term ϵ_{ij}, which is assumed to be identically and independently distributed across consumers and choices. While parsimonious, it is rarely noticed that this assumption places very strong restrictions on the pattern of cross-price elasticities from the estimated model. I shall here summarize the more detailed discussion of this problem that is found in Berry, Levinsohn, and Pakes (1993).[3] In the model with identically and independently distributed consumer tastes, only the mean utility levels, δ_j, differentiate the products. Therefore, all properties of market demand, including market shares and elasticities, are determined solely by the δ_j. In particular, cross-price elasticities can only depend on the value of δ_j, with no additional effect from individual product characteristics or prices. In the automobile market, for example, this property implies that any pair of cars (j, k) with the same pair of market shares (s_j, s_k) will have the same cross-price elasticity with any given third product. This property will hold regardless of whether both j and k are small inexpensive cars or one car is a subcompact and one is a luxury car. It is important to note that this property is a function of the identically and independently distributed additive error and not of any specific distributional assumption (such as logit) on the errors.

Models that have random coefficients, $\tilde{\beta}_i$, on the product characteristics avoid the problem of *a priori* unreasonable substitution effects. An increase in the price of product j affects only those consumers who currently purchase good j. In the random coefficients model, these consumers will typically have values for $\tilde{\beta}_i$ that differ from the mean. These selected consumers will therefore substitute toward a particular group of products; generally, these products will "resemble" product j. This same property will hold for many

[3] See also the earlier, related discussions in Tversky (1972), Hausman and Wise (1978), and McFadden (1981).

specifications in which consumer and product characteristics are interacted, so that differences between consumers have a systematic effect on their preferences. For example, this property will hold in studies that use consumer data and interact observed characteristics of consumers with product characteristics.

Given the functional form assumptions, the discrete-choice market share function, s, is derived in the usual way. Each consumer purchases one unit of the good that gives the highest utility. That is, conditional on the characteristics $(\mathbf{x}, \boldsymbol{\xi})$ and prices $\mathbf{p}$, consumer i will purchase one unit of good j if and only if for all $k \geq 0$ and $k \neq j$, $U(x_j, \xi_j, p_j, \boldsymbol{\nu}_i, \theta_d) > U(x_k, \xi_k, p_k, \boldsymbol{\nu}_i, \theta_d)$. This implicitly defines the set of unobservable taste parameters, ν_{ij}, that result in the purchase of good j. Define the set of consumer unobservables that lead to the consumption of good j as $A_j(\boldsymbol{\delta}) = \{\boldsymbol{\nu}_i \setminus \delta_j + \nu_{ij} > \delta_k + \nu_{ik}, \forall k \neq j\}$. The market share of the jth firm is then the probability that $\boldsymbol{\nu}_i$ falls into the region A_j. Given a distribution, $F(\cdot, \mathbf{x}, \sigma)$, for $\boldsymbol{\nu}$, with density $f(\cdot, \mathbf{x}, \sigma)$, this market share is

$$s_j(\boldsymbol{\delta}(\mathbf{x}, \mathbf{p}, \boldsymbol{\xi}), \mathbf{x}, \boldsymbol{\theta}) = \int_{A_j(\boldsymbol{\delta})} f(\boldsymbol{\nu}, \mathbf{x}, \sigma_\nu)\, d\boldsymbol{\nu}, \tag{6}$$

where the integral is over the set of consumer unobservables implicitly defined by A_j.

To complete the specification of the demand system, we should discuss the size of the market that allows us to move between market shares and observed quantities in the presence of an outside alternative.

□ **Market size and the outside good.** The measure of consumers in a market is denoted M. This number is either observed as the population of a market or left as a parameter to be estimated. The observed output quantity of the firm is then[4]

$$q_j = M s_j(\mathbf{x}, \boldsymbol{\xi}, \mathbf{p}, \theta_d). \tag{7}$$

In addition to the competing products $j = 1, \ldots, N$, I shall also assume the existence of an outside good, $j = 0$. Consumers may choose to purchase the outside good instead of one of the N "inside" products. The distinction is that the price of the outside good is not set in response to the prices of the inside goods. In the absence of an outside good, consumers are forced to choose from the inside good and demand depends only on differences in prices. Therefore, a general increase in prices will not decrease aggregate output; this is an unfortunate feature of some discrete models that have been applied to the empirical study of differentiated products markets (e.g., Morrison and Winston (1986)).

However, the presence of the outside good with market share s_o means that observations on the output quantities of the N firms $(q_1, \ldots, q_N)$ are not sufficient to calculate the market shares of the $N + 1$ total alternatives. If the total market size M is directly observed, then s_j can be calculated easily as $s_j = q_j/M$. For example, Berry, Levinsohn, and Pakes (1993) set market size equal to the number of households in the economy. Otherwise, M will have to be estimated. When there is information on a number of markets, M can be parameterized as depending on market-level data (such as population) that vary across markets and that affect the aggregate level of output (e.g., Berry (1990)). Methods for estimating M will be application specific, and in the remainder of this article, I assume that M is observed.

[4] If output quantity is formed as the sum of M distinct draws on consumer preferences, then (7) represents only the expected output quantity. Observed market shares would include a random error with a variance of $s_j(1 - s_j)/M$. I shall treat (7) as the observed output quantity, which is consistent with assuming a continuous measure of consumers, rather than M distinct consumers.

□ **The supply side.** The N firms in a market are assumed to be price setters, although alternate models of firm behavior are easy to incorporate. Total costs for firm j are given by the function $C_j(q_j, w_j, \omega_j, \gamma)$, and marginal costs are $c_j(q_j, w_j, \omega_j, \gamma)$, where γ is a vector of unknown parameters. Profits for firm j are then

$$\pi_j(\mathbf{p}, \mathbf{z}, \xi, \omega_j, \theta) = p_j M s_j(\mathbf{x}, \xi, \mathbf{p}, \theta_d) - C_j(q_j, w_j, \omega_j, \gamma), \tag{8}$$

where $\theta = (\theta_d, \gamma)$.

Assuming the existence of a pure-strategy interior equilibrium, the price vector satisfies the usual first-order conditions[5]

$$[p_j - c_j(q_j, w_j, \omega_j, \gamma)][\partial s_j(\mathbf{x}, \xi, \mathbf{p}, \theta_d)/\partial p_j] + s_j(\mathbf{x}, \xi, \mathbf{p}, \theta_d) = 0$$

or

$$p_j = c_j + s_j / \mid \partial s_j/\partial p_j \mid . \tag{9}$$

If the N such first-order conditions define a unique equilibrium for all possible values of the observed and unobserved data and for all possible values of the parameters, then the first-order conditions implicitly define the "reduced-form" price, $p_j(\mathbf{z}, \xi, \omega, \theta)$, as a function of the exogenous data and the parameters. The equilibrium price, together with the demand function, then defines the reduced-form expression for equilibrium quantities: $q_j(\mathbf{z}, \xi, \omega, \theta) = M s_j(\mathbf{x}, \xi, p(\mathbf{z}, \xi, \omega, \theta), \theta_d)$. In a later section, I shall note that these reduced forms could be used as the basis of an estimation routine. The next section, however, introduces a simpler and more general method.

4. Estimating from the mean utility levels

■ The discrete-choice model of the last section is entirely traditional except for the unobserved product characteristic ξ_j. However, the presence of ξ_j raises a difficult econometric problem. Consider a demand equation that relates observed market shares, s_j, to the market shares that are predicted by the model, s_j:

$$s_j = s_j(\mathbf{x}, \mathbf{p}, \xi, \theta). \tag{10}$$

The right-hand side of this equation contains both prices and product level demand errors. We expect the unobserved product characteristics to be correlated with prices; thus, the right-hand side prices are endogenous in the sense that they are correlated with the unobservables. Instrumental variables methods are a traditional solution to this problem of endogenous prices. However, the unobservables enter (10) in a nonlinear fashion, thus frustrating the application of traditional instrumental variables methods.

To solve this problem, I propose transforming the market shares so that the unobserved product characteristics appear as a linear term. Let us begin with the simple case in which the distribution of consumer unobservables is known, so that market shares depend only on mean utility levels:

$$s_j = s_j(\delta)(j = 1, \ldots, N). \tag{11}$$

At the true values of δ and of market shares, s, these equations must hold exactly. (The

[5] I shall consider only pure strategy equilibria in this article; mixed strategy equilibria would complicate the analysis considerably. Caplin and Nalebuff (1991) provide a useful discussion of the existence of equilibrium in this class of models.

distinction between the observed market shares s_j and the market share function $\mathcal{s}_j(\boldsymbol{\delta})$ is important here.) The point is that the mean utility levels δ_j contain the aggregate error ξ_j; therefore, conditional on the true values of $\boldsymbol{\delta}$ (and given a density, f) the model should fit the data exactly.

The exact fit of the model conditional on the mean utility levels $\boldsymbol{\delta}$ can be exploited in an estimation procedure. If the vector-valued equation $\mathbf{s} = \mathcal{s}(\boldsymbol{\delta})$ can be inverted to produce the vector $\boldsymbol{\delta} = \mathcal{s}^{-1}(\mathbf{s})$, then the observed market shares (together with the distributional assumption on ν) uniquely determine the means of consumer utility for each good.

Under weak regularity conditions on the density of consumer unobservables, the existence of a unique $\boldsymbol{\delta}^*(\mathbf{s})$ that satisfies $\mathbf{s} = \mathcal{s}(\boldsymbol{\delta}^*(\mathbf{s}))$ is established in the Appendix. There, I show that (conditional on setting the mean utility of the outside good, δ_o, equal to zero) the market share function is one-to-one. I also establish that, for every possibly observed vector of market shares, $\mathbf{s}$, there is a vector of utility means $\boldsymbol{\delta} \in \mathbb{R}^{N+1}$ that will create that observed vector by the relation $\mathbf{s} = \mathcal{s}(\boldsymbol{\delta})$. Thus, every vector of observed market shares can be explained by one and only one vector of utility means. For any density $f(\cdot, x)$, we can therefore calculate the vector $\boldsymbol{\delta}$ from observations on the market shares alone.

The unique, calculated vector $\boldsymbol{\delta}(\mathbf{s})$ can then be used in a simple estimation procedure. When the density of ν is known exactly, so that the market share function depends on no unknown parameters other than the vector $\boldsymbol{\delta}$, then the calculated mean utility levels can be treated as a known, nonlinear transformation of the market shares, $\mathbf{s}$. From (5), for the true values of (β, α),

$$\delta_j(\mathbf{s}) = x_j\beta - \alpha p_j + \xi_j. \tag{12}$$

We can treat (12) as an estimation equation and use standard instrumental variables techniques to estimate the unknown parameters. That is, we can run an appropriate instrumental variables regression of $\delta_j(\mathbf{s})$ on (x_j, p_j) to estimate (β, α), treating ξ_j as an unobserved error term. The fact that $\delta_j(\mathbf{s})$ is a transformation of the original data on market shares is not important; except for the computational problem of inverting the market share function, this is little different than similar estimation procedures that take some other transformation of the observed data (e.g., logarithms) as a dependent variable.

The correlation of p_j with ξ_j suggests the use of instruments for prices. Cost variables that are excluded from x_j, such as input prices that vary across firms, are traditional instruments in homogeneous goods markets and they continue to be appropriate in the present context. Interestingly, in product differentiation models with exogenous characteristics, the characteristics of other firms $(x_k, k \neq j)$ are also appropriate instruments. These are appropriate because they are excluded from the utility function (u_{ij} does not depend on x_k) and they are correlated with prices via the markups in the first-order conditions. This is a specific example of the general proposition that, in imperfectly competitive markets, demand-side instruments can be variables that affect markups as well as variables that affect marginal cost. Thus, it may be possible to obtain consistent estimates of demand parameters even in the absence of excluded "cost-side" variables. This idea was developed in detail by Berry, Levinsohn, and Pakes (1993).

The idea of estimating the demand parameters β and α by an instrumental variables regression of δ_j on characteristics and prices is similar to the homogeneous goods regression of output quantities on demand factors and prices. In the homogeneous goods case, demand parameters can be estimated with cost-side instruments under the relatively weak assumption that the demand error is uncorrelated with the instruments. Similarly, estimates of the demand parameters (β, α) can be obtained in the present case by inverting the market share function without the need for assumptions on either the parametric distribution of the unobservables, $\boldsymbol{\xi}$, or on the actual process that generates prices.

In the differentiated products model, there is one demand equation, of the form in (12), for each good in each market. If we have access to a large sample of independent markets, then we can obtain consistent estimates of demand parameters by treating each market as a separate observation. This approach allows for arbitrary correlation between demand unobservables within markets. If, instead, we assume that the ξ_j are independent across firms, then the demand parameters β and α might be estimated from a dataset containing cross-sectional information on a large number of firms within a single market. This contrasts with the homogeneous goods case, in which a single market and single time period imply a single observation on demand.[6]

Next I present two simple special cases, in which it is quite easy to solve for mean utility levels as a function of observed market shares. Logit, the first example, is the best-known special case of the model in Section 3. The second example, the vertical differentiation model, is a simple variant of the random coefficients model which has been prominent in the empirical literature (e.g., Bresnahan (1987)).

Example: the logit model. Suppose we begin with the utility function in (2) and make the familiar assumption that $\bar{\beta}_i = \beta$ (no random coefficients) and that ϵ_{ij} is identically and independently distributed across products and consumers with the "extreme value" distribution function exp $(-\exp(-\epsilon))$. The market share of product j is then given by the well-known logit formula

$$s_j(\boldsymbol{\delta}) = e^{\delta_j} \Big/ \left(\sum_{k=0}^{N} e^{\delta_k}\right). \tag{13}$$

With the mean utility of the outside good normalized to zero,

$$\ln(s_j) - \ln(s_o) = \delta_j \equiv x_j\beta - \alpha p_j + \xi_j, \tag{14}$$

so δ_j is uniquely identified directly from a simple algebraic calculation involving market shares. Thus, the logit case suggests a simple instrumental variables regression of differences in log market shares on (x_j, p_j). This case is unusual as, in many cases, $\boldsymbol{\delta}$ must be solved for numerically. Unfortunately, as noted, the logit model produces unreasonable substitution patterns.

Example: the vertical differentiation model. In the vertical model of product differentiation (see Shaked and Sutton (1982) and Bresnahan (1987)) consumers agree about the quality of each good but disagree about the value of quality. Consider the utility function

$$u_{ij} = \psi_j \nu_i - p_j, \tag{15}$$

with ψ_j representing the quality of product j and ν_i a scalar random variable representing the value that consumer i places on quality. Assume that quality depends linearly on the observed and unobserved characteristics of product j:

$$\psi_j = x_j\beta + \xi_j. \tag{16}$$

Also, order the products in increasing quality, $\psi_o < \psi_1 < \ldots < \psi_N$, and denote the cumulative distribution of ν as $F(\nu)$, with density $f(\nu)$.

[6] However, in the case of a single market, prices are correlated across firms (via the first-order conditions) even if the ξ_j are independent across firms. This raises important econometric issues of dependence that I shall not address here.

If ν_i is assumed to have mean one (which is just a normalization on the units of quality), then mean utility is still $\delta_j = x_j\beta - \alpha p_j + \xi_j$, with $\alpha \equiv 1$. In this model, ν_i is effectively a single random coefficient that interacts with observed and unobserved characteristics. That is, we can write utility as a slight variant of (4):

$$u_{ij} = \left[\sum_k x_{jk}\beta_k\nu_i\right] - p_j + \nu_i\xi_j.$$

In some respects, the vertical model is the opposite extreme of the logit model. In the logit model, there are as many consumer characteristics, ϵ_{ij}, as there are products. In the vertical model, there is only one consumer characteristic: ν_i, the "taste" for quality. In the logit model, all products are strict substitutes for one another, while in the vertical model, only products that are adjacent in the quality dimension are substitutes.

It is well known that market shares in the vertical model are defined by the cutoff points:

$$\Delta_j = (p_j - p_{j-1})/(\psi_j - \psi_{j-1}), \qquad 1 \le j \le N. \tag{17}$$

For consistency of notation, also define cutoffs $\Delta_0 = -\infty$ and $\Delta_{N+1} = \infty$. In equilibrium, Δ_j is increasing in j and consumer i purchases good j if and only if $\Delta_{j+1} > \nu_i > \Delta_j$, giving market shares of

$$s_j = F(\Delta_{j+1}) - F(\Delta_j). \tag{18}$$

We can use this market share equation to solve recursively for the cutoff points and then, from prices together with the definition of the cutoffs, can solve for the implied quality levels. Solving for Δ_j in the market share equation gives the recursive relationship

$$\Delta_j = F^{-1}(F(\Delta_{j+1}) - s_j), \tag{19}$$

with initial value $\Delta_N = F^{-1}(1 - s_N)$ (3). Given values for the price and quality of the outside good, p_o and ψ_o, the remaining values for quality can then be recursively determined from

$$\psi_j = \psi_{j-1} + (p_j - p_{j-1})/\Delta_j. \tag{20}$$

Since $\delta_j = \psi_j - p_j$, solving for the quality levels in (20) is equivalent to solving for mean utility levels. Note that (16) and (20) do not separately identify ψ_o from the mean of $x_j\beta$, so we can normalize ψ_o to zero. In a more complicated framework, the price of the outside good could be estimated, but for simplicity, I assume $p_o \equiv 0$.

If we then maintain the assumption that the ξ's have mean zero conditional on the x's, β can be estimated by regressing the calculated ψ_j's on the product characteristics. If the distribution of the taste for quality depends on any unknown parameters to be estimated, then the estimation procedure must be modified, as discussed in the next section.

As noted, both the logit and the vertical differentiation model place very strong restrictions on the pattern of estimated cross-price elasticities. The following section will discuss the extension to richer models.

5. Estimating density parameters

■ In the immediately preceding discussion, I have assumed that the density of the vector of consumer characteristics is known to the researcher. While this assumption is imposed by much of the existing literature, one might prefer to assume a parametric family of densities. In this section, I shall assume that the density of ν_{ij}, $f(\cdot, \mathbf{x}, \sigma)$, depends on a vector of unknown parameters, σ, which is to be estimated.

In many cases, we may have no particular interest in σ itself but are instead concerned that a narrow distributional assumption on tastes will yield unreasonable estimates of economically interesting values, such as cross-price elasticities. For example, as in the random coefficients model, one may wish to specify a set of parameters that allow us to estimate the relationship between product characteristics and substitution patterns.

Once the distribution of consumer characteristics is parameterized to depend on density parameters σ, the market share function and the implied mean utility levels will also vary with σ. The mean utility levels are implicitly defined from the vector of equation $\mathbf{s} = \mathscr{s}(\boldsymbol{\delta}, \sigma)$. Inverting, the demand equation is

$$\delta_j(\mathbf{s}, \sigma) = x_j\beta + \alpha p_j + \xi_j. \tag{21}$$

We can continue to use an instrumental variables technique to estimate (σ, β, α). However, note that the parameters σ will now frequently enter the estimating equation in a nonlinear fashion, so nonlinear least-squares (or generalized method of moments (Hansen, (1982)) techniques may be necessary to estimate the model parameters. Furthermore, the presence of σ increases the number of parameters to be estimated and so increases the number of required instruments.

To illustrate, I next consider two models, the nested logit and the full random coefficients model, in which the distribution of consumer tastes depends on unknown parameters to be estimated. Each of these models involves interactions between consumer and product characteristics, where the interactions are modelled as depending on a small number of parameters.

Example: nested logit. In contrast to the simple logit model, the nested logit model or "tree extreme value" model (McFadden, 1978; and Cardell, 1991) preserves the assumption that consumer tastes have an extreme value distribution but allows consumer tastes to be correlated (in a restricted fashion) across products j. This allows for more reasonable substitution patterns as compared to the simple logit model. In this section, I shall briefly review the nested logit model and show how to analytically invert the market share function.

I follow Cardell's (1991) exposition of the nested logit, which has the advantage of using an explicit factor structure that is similar to the random coefficients model. First group the products into $G + 1$ exhaustive and mutually exclusive sets, $g = 0, 1, \ldots, G$. Denote the set of products in group g as $\mathscr{J}_g$. The outside good, $j = 0$, is assumed to be the only member of group 0. For product $j \in \mathscr{J}_g$, assume that the utility of consumer i is

$$u_{ij} = \delta_j + \zeta_{ig} + (1 - \sigma)\epsilon_{ij}, \tag{22}$$

where, once again, $\delta_j = x_j\beta - \alpha p_j + \xi_j$ and ϵ_{ij} is an identically and independently distributed extreme value. For consumer i, the variable ζ is common to all products in group g and has a distribution function that depends on σ, with $0 \leq \sigma < 1$. Cardell shows that the distribution of ζ is the unique distribution with the property that, if ϵ is an extreme value random variable, then $[\zeta + (1 - \sigma)\epsilon]$ is also an extreme value random variable. As the parameter σ approaches one, the within group correlation of utility levels goes to one, and as σ approaches zero, the within group correlation goes to zero.

We can interpret (22) as a random coefficients model involving random coefficients ζ_{ig} only on group-specific dummy variables. That is, if d_{jg} is a dummy variable equal to one if $j \in \mathscr{J}_g$ and equal to zero otherwise, we can rewrite (22) as

$$u_{ij} = \delta_j + \sum_g [d_{jg}\zeta_{ig}] + (1 - \sigma)\epsilon_{ij},$$

which is similar to (4). Thus, the nested logit model allows us to model correlation between groups of similar products in a simple way. However, unlike the more general random coefficients model, the nested logit allows correlation patterns to depend only on groupings of products that are determined prior to estimation and not on the values of continuous variables.

If product j is in group g, the well-known formula for the market share of product j as a fraction of the total group share is

$$\bar{s}_{j/g}(\delta, \sigma) = [e^{\delta_j/(1-\sigma)}]/D_g, \tag{23}$$

where the denominator of this expression for a product in group g is

$$D_g \equiv \sum_{j \in \mathcal{J}_g} e^{\delta_j/(1-\sigma)}.$$

Similarly, the probability of choosing one of the group g products (the group share) is

$$\bar{s}_g(\delta, \sigma) = \frac{D_g^{(1-\sigma)}}{\left[\sum_g D_g^{(1-\sigma)}\right]}, \tag{24}$$

giving a market share of

$$s_j(\boldsymbol{\delta}, \sigma) = \bar{s}_{j/g}(\boldsymbol{\delta}, \sigma)\, \bar{s}_g(\boldsymbol{\delta}, \sigma) = \frac{e^{\delta_j/(1-\sigma)}}{D_g^{\sigma}\left[\sum_g D_g^{(1-\sigma)}\right]}. \tag{25}$$

With the outside good as the only member of group zero and with $\delta_o \equiv 0$, $D_o = 1$ and so

$$s_o(\boldsymbol{\delta}, \sigma) = 1 \Big/ \left[\sum_g D_g^{(1-\sigma)}\right].$$

Having set out the basic model, we can now derive a simple analytic expression for mean utility levels. Taking logs of market shares,

$$\ln(s_j) - \ln(s_o) = \delta_j/(1-\sigma) - \sigma \ln(D_g). \tag{26}$$

This expression depends on the unknown value of D_g. Taking the log of the group share in (24), $\ln(D_g) = [\ln(\bar{s}_g) - \ln(s_o)]/(1-\sigma)$, where the observed group share is denoted $\bar{s}_g$. Substituting this into (26) and combining terms gives the analytic expression for $s_j^{-1}(\mathbf{s}, \sigma)$:[7]

$$\delta_j(\mathbf{s}, \sigma) = \ln(s_j) - \sigma \ln(\bar{s}_{j/g}) - \ln(s_o). \tag{27}$$

This is the same as the logit equation (14), except for the additional term $\sigma \ln(\bar{s}_{j/g})$.

Setting $\delta_j = x_j\beta - \alpha p_j + \xi_j$ and substituting in from (27) for δ_j gives

$$\ln(s_j) - \ln(s_o) = x_j\beta - \alpha p_j + \sigma \ln(\bar{s}_{j/g}) + \xi_j, \tag{28}$$

so that estimates of β, α, and σ can be obtained from a linear instrumental variables regression of differences in log market shares on product characteristics, prices, and the log of the within group share. This last term is endogenous, suggesting the need for additional

[7] This formula can be easily (but somewhat tediously) extended to the case of multiple levels of nests and different correlation parameters, σ_g, for different groups.

exogenous variables that are correlated with the within group share. These variables might include the characteristics of other firms in the group.

Note that the nested logit model is an example with nontrivial interactions between product and consumer characteristics that, on the demand side, still allows for linear estimation techniques. Because the nested logit only allows for simple patterns of correlation between products, I shall briefly return to the full random coefficients model, which allows for more complicated patterns.

Example: the full random coefficients model. In this model, the market share equation is now difficult to calculate, but the general discussion of solving for the vector $\boldsymbol{\delta}$ does not substantially change. Each set of values for the σ_k, the standard deviations of the random coefficients in (4), will imply a different relationship between the observed market shares $\mathbf{s}$ and the utility means $\boldsymbol{\delta}$. Typically, one will have to solve for the δ's numerically.

There remains the problem that, for a large number of products, and for arbitrary assumptions on consumer tastes, the integral defining market share in the random coefficients model may be difficult to calculate. In the context of market level data, this is effectively an aggregation problem. Pakes (1986) suggests the use of simulation methods to solve such aggregation problems, and an extension of this technique is employed in Berry, Levinsohn, and Pakes (1993). This last article also shows how to incorporate information on the empirical distribution of consumer characteristics (such as the actual distribution of income) into the random coefficients framework. Interested readers are referred to that article for details on using simulation to calculate market shares and to solve for δ_j.

Obviously, there is a tradeoff between the larger (but still feasible) computational burden of the Berry, Levinsohn, and Pakes algorithm versus the simple, but still quite restrictive, nested logit. The nested logit may be preferred when a heavy penalty is placed on computational complexity, or when a researcher wants to model substitution effects as depending only on predetermined classes of products. The random coefficients model will be preferred when a premium is placed on estimating richer patterns of demand.

6. The pricing equation and the supply side

■ Sections 4 and 5 used no information from the price-setting process. If we are willing to assume that observed prices are the result of an interior, pure strategy Nash equilibrium in prices, then we can also make use of the information contained in the first-order equations for equilibrium prices in (9). Note that, under the assumptions of Section 3, $\partial s_j/\partial p_j = -\alpha \partial s_j/\partial \delta_j$, so the first-order conditions can be rewritten as depending on $\partial s_j/\partial \delta_j$. Then, given the vector of utility levels as derived from the inverse market share function, the term $\partial s_j/\partial \delta_j$ can be obtained by simple analytic or numeric differentiation of the market share function evaluated at the appropriate value of $\boldsymbol{\delta}$. Thus, given the distribution of consumer tastes, both δ_j and $\partial s_j/\partial \delta_j$ can be treated as known transformations of the data.

The discussion of cost-side estimation is eased if we assume that marginal cost is linear in the unobservable cost term ω_j. If we make the simple assumption $c_j = \bar{c}(q_j, w_j, \gamma) + \omega_j$, then the first-order condition implies that[8]

$$p_j = \bar{c}(q_j, w_j, \gamma) + \frac{1}{\alpha}[s_j/(\partial s_j/\partial \delta_j)] + \omega_j. \tag{29}$$

Equation (29) can now be treated as an estimation equation in much the same manner as (21). The observable right-hand-side variables of (29) are the terms defining the mean marginal cost function, $\bar{c}(q_j, w_j, \gamma)$, and the markup term, $s_j/[\partial s_j/\partial \delta_j]$. The parameters to

[8] While not necessary, the assumption that marginal cost is linear in the unobservable is useful because it produces a linear error in (29).

be estimated are the cost function parameters, γ, and the marginal disutility of price increase, α. Note that the right-hand side of (29) includes variables that are econometrically endogenous in the sense that they are correlated with ω_j; these endogenous variables are outputs, q_j, market share, s_j, and the market share derivatives, $\partial s_j/\partial\delta_j$. Therefore, appropriate instruments must once again be found.

Excluded demand-side parameters (elements of x_j that are not included in w_j) are, as usual, available as cost-side instruments. However, it may be unreasonable to assume the existence of x variables that are valued by consumers but do not affect marginal costs. Once again, the characteristics of other firms are also available as instruments. In equilibrium, these characterisitics will be correlated with own-firm output and therefore correlated with market shares and with $\partial s_j/\partial\delta_j$. Also, in a cross section or time series of markets with differing populations, population is a potential instrument for output quantities, q_j.

Finally, it is obviously possible to jointly estimate the demand and supply equations, (21) and (29). Joint estimation would take into account the cross-equation restrictions on parameters: α and the substitution parameter, σ, affect both demand and supply. Once again, an example of joint estimation is found in Berry, Levinsohn, and Pakes (1993).

Examples of first-order conditions. In this subsection, I shall discuss the supply equations that are implied by the simple special cases discussed above. To simplify the examples, I make the assumption that marginal cost is constant in output and linear in product characteristics,

$$c_j = w_j\gamma + \omega_j. \tag{30}$$

It is easy to derive the first-order conditions for the logit model. Because in this model $\partial s_j/\partial\delta_j = s_j(1 - s_j)$, the first-order condition is

$$p_j = \frac{1}{\alpha(1 - s_j)} + c_j,$$

which, given (30), implies a supply equation for the logit model of

$$p_j = w_j\gamma + \frac{1}{\alpha}\frac{1}{(1 - s_j)} + \omega_j, \tag{31}$$

where the parameters to be estimated are γ and $(1/\alpha)$. The logit joint estimation problem is then defined by this equation together with the logit demand equation from (14).

In the vertical model, which departs slightly from the model of Section 3, the first-order conditions can be derived from $\partial s_j/\partial p_j = -[f(\Delta_{j+1})/(\psi_{j+1} - \psi_j) + f(\Delta_j)/(\psi_j - \psi_{j-1})]$. Defining price minus markup as

$$y_j \equiv p_j - s_j/\,|\,\partial s_j/\partial p_j\,| = p_j - s_j/[f(\Delta_{j+1})/(\psi_{j+1} - \psi_j) + f(\Delta_j)/(\psi_j - \psi_{j-1})], \tag{32}$$

estimates of γ can be found from an OLS regression of y_j on w_j. Further instruments are necessary in this model only when the density, f, is assumed to depend on unknown parameters. In this case, nonlinear instrumental variable methods may be necessary.

In the nested logit model, differentiating the market share equation (25) gives

$$\partial s_j/\partial\delta_j = \frac{1}{(1 - \sigma)} s_j\,[1 - \sigma\bar{s}_{j/g} - (1 - \sigma)s_j].$$

The implied pricing equation is

$$p_j = w_j\gamma + \left[\frac{(1 - \sigma)}{\alpha}\Big/[1 - \sigma\bar{s}_{j/g} - (1 - \sigma)s_j]\right] + \omega_j. \tag{33}$$

If $\sigma = 0$, it is only the product share, s_j, and not the within group share, $\bar{s}_{j/g}$, that affects the markup. Conversely, as σ approaches one, it is only $\bar{s}_{j/g}$ that matters. Thus, the relationship in the data between prices, product shares, and group shares will help to identify the substitution parameter, σ.

Thus, in the three previously discussed cases with analytic solutions for δ_j—logit, nested logit, and vertical differentiation—there are also analytic solutions for the supply-side first-order conditions. In the full random coefficients model, however, the term $\partial s_j/\partial \delta_j$ must often be obtained by numeric differentiation of the market share function.

7. Alternative methods of estimation

■ While the method of inverting for mean utility levels is very easy for some of the outlined special cases, in other cases, the procedure may appear to be overly burdensome. In this section I shall briefly discuss two methods that may appear to be obvious, simpler solutions to this problem but which are not. I shall also compare the mean utility method to the reduced form method of estimating differentiated products models. The reduced form method, which has been used in the past, imposes a very severe computational burden and also requires more restrictive assumptions.

Perhaps the most obvious econometric approaches for dealing with the unobserved characteristic are either to estimate ξ_j as a "fixed effect" or to "integrate out" over some assumed exogenous distribution for the unobserved heterogeneity ξ. Regarding the latter suggestion, the price-setting model is inconsistent with any assumption of an exogenous distribution for $\boldsymbol{\xi}$, conditional on $\mathbf{x}$ and $\mathbf{p}$. This follows from the first-order conditions for optimal prices, which imply that different values for $\boldsymbol{\xi}$ result in different levels of prices. Thus, integrating (6) over the distribution of $\boldsymbol{\xi}$ while holding prices fixed will not give the average level of market share that would be observed as $\boldsymbol{\xi}$ varies.

Neither is it possible to separately estimate values of ξ_j together with estimates of the coefficients on x_j and p_j. Remember that mean utility is given by $\delta_j = x_j\beta + \xi_j - \alpha p_j$. Obviously, combinations of values for $(\xi_1, \ldots, \xi_N, \beta, \alpha)$ that give the same values of δ_j must also yield the same predictions for consumer behavior. Therefore, the vector $\boldsymbol{\xi}$ is not identified separately from the coefficients on firm-specific characteristics and prices. This result is familiar from any analysis of grouped data: it is not possible to estimate an individual group mean together with coefficients on variables that do not vary within the group.

Another approach to estimation, which has been used by Bresnahan (1987) and Berry (1990), requires solving for the reduced form of the model. Suppose we have established the existence of a unique equilibrium and are willing to assume the existence of a family of probability measures, $\Phi(\cdot/\mathbf{z}, \theta_u)$, for the random variables $(\boldsymbol{\xi}, \boldsymbol{\omega})$. A nonlinear least-squares (or method of moments) estimator can then be based on the difference between the observed price and the mean of the reduced-form price.

To obtain this estimator, write the expected values (conditional on product characteristics) of equilibrium prices and quantities as

$$\bar{p}(\mathbf{z}, \theta, \theta_u) = \int p(\mathbf{z}, \boldsymbol{\xi}, \boldsymbol{\omega}, \theta)\, \Phi(d(\boldsymbol{\xi}, \boldsymbol{\omega})/\mathbf{z}, \theta_u)$$

and

$$\bar{q}(\mathbf{z}, \theta, \theta_u) = \int q(\mathbf{z}, \boldsymbol{\xi}, \boldsymbol{\omega}, \theta)\, \Phi(d(\boldsymbol{\xi}, \boldsymbol{\omega})/\mathbf{z}, \theta_u), \tag{34}$$

where, once again, $\not{p}(\mathbf{z}, \xi, \omega, \theta)$ is the reduced form function defining price and $\not{\varphi}(\mathbf{z}, \xi, \omega, \theta)$ is the reduced form for quantities. We can use these equations to rewrite the model as

$$\mathbf{p} = \tilde{\not{p}}(\mathbf{z}, \theta^*, \theta_u^*) + \mathbf{v}$$

and

$$\mathbf{q} = \tilde{\not{\varphi}}(\mathbf{z}, \theta^*, \theta_u^*) + \mathbf{e}, \tag{35}$$

where the "prediction errors" (**e**, **v**) are, by construction, mean zero conditional on the observed firm characteristics **z**. Thus, (35) can be used as the basis for a traditional nonlinear least-squares estimator of the model parameters.

The reduced form method is linear in observed prices and quantities, which allows us to easily incorporate measurement error in prices and quantities. Indeed, Bresnahan (1987) models measurement error, instead of unobserved product characteristics, and adopts a reduced form approach to estimation.

However, there are several problems with the reduced form approach. The expected values in (34) are defined as integrals over implicitly defined functions. These are typically very difficult to calculate, especially because a nonlinear estimation routine will need to evaluate this function at many possible parameter values. Also, the integrals defining these expected values implicitly depend on the existence of a unique equilibrium for all observed values of **x** and for almost all values of the unobservables (ξ, ω). Thus, existence of a unique equilibrium at a particular set of values for (ξ, ω) is not sufficient. As noted by Caplin and Nalebuff (1991), it is very difficult to establish uniqueness in this class of models. Interestingly, Caplin and Nalebuff establish uniqueness of equilibrium in the special cases of the logit and vertical differentiation model. However, we have seen that the mean utility method is easy in these cases, especially when compared to solving the integrals in (34).

8. Monte Carlo experiments

■ In the introduction, I noted that Trajtenberg (1989) provided an example of empirical work in which unobserved characteristics appear to have a dramatic effect on some real-world parameter estimates. In order to provide a simple example of how the methods of this article can correct for such a bias, Table 1 supplies Monte Carlo results for estimation

TABLE 1 **Monte Carlo Parameter Estimates 100 Random Samples of 500 Duopoly Markets Logit Utility**

		($\sigma_{\xi d} = 1$)		($\sigma_{\xi d} = 3$)	
Parameter	True Value	(1) OLS	(2) IV	(3) OLS	(4) IV
β_o	5	3.46	4.98	0.378	4.89
		(.158)	(.226)	(.415)	(.738)
β_x	2	1.41	1.99	.325	1.95
		(.058)	(.091)	(.127)	(.272)
α	1	.726	.995	.181	.979
		(.029)	(.039)	(.076)	(.128)

Notes: The values given in the table are empirical means and (standard errors).
The utility function is $u_{ij} = \beta_o + \beta_x x_j + \sigma_{\xi d}\xi_j - \alpha p_j + \epsilon_{ij}$.
Marginal cost is $c_j = e^{\gamma_o + \gamma_x x_j + \sigma_{\xi c}\xi_j + \gamma_w w_j + \sigma_\omega \omega_j}$.

of the logit model with an unobserved characteristic. The data for these experiments were created as follows. Each simulated sample consists of 500 duopoly markets (a reasonable number of markets for the airline examples of Morrison and Winston (1986) and Berry (1990)).

With a slight abuse of the notation for ξ and ω, the utility of each consumer in each market is given by $u_{ij} = \beta_o + \beta_x x_j + \sigma_d \xi_j - \alpha p_j + \epsilon_{ij}$, with ϵ_{ij} being the appropriate logit error. The utility of the outside good is given by $u_{io} = \epsilon_{io}$, where the ϵ_{io} has the same distribution as the other ϵ_{ij}. Marginal cost is constrained to be positive and is given by $c_j = e^{\gamma_o + \gamma_x x_j + \sigma_c \xi_j + \gamma_w w_j + \sigma_\omega \omega_j}$.

The exogenous data x_j, ξ_j, w_j, and ω_j are all created as independent standard normal random variables. The term ξ is here a product characteristic that affects both demand and cost, while ω is some variable (such as an input price) that affects only costs. Note that β_o, β_x, α, γ_o, γ_x, and γ_w are parameters to be estimated, whereas the parameters σ_d, σ_c, and σ_ω help to describe the effect of the unobservables ξ and ω. Values for the parameters were chosen by ad hoc experimentation to yield a moderate variance in market shares and prices across markets, without driving market shares of the duopolists toward zero in too many markets. The chosen values are $\beta_o = 5$, $\beta_x = 2$, $\alpha = 1$, $\gamma_o = 1$, $\gamma_x = .5$, and $\gamma_w = \sigma_\omega = \sigma_c = .25$. Columns 1 and 2 of Table 1 present Monte Carlo estimation results from samples of markets, with the standard deviation of the unobserved characteristics in the utility function set to $\sigma_d = 1$. Since the coefficient on x_j is set to 2, the total variance in the implied mean, δ_j, is 5, 80% of which is accounted for by the observed term x_j. In contrast, columns 2–4 present results for samples of markets with $\sigma_d = 3$, so that the variance of δ_j is 13, almost 70% of which is accounted for by the unobserved term $\sigma_d \xi_j$.

For each market, I first calculate the equilibrium values of prices and market shares. I assume that the hypothetical econometrician observes these data (including the market share of the outside good, s_o) along with x and w. The terms ξ and ω are, as usual, unobserved by the econometrician. As in (14), the mean utility level of good j can be found as $\delta_j = \ln(s_j) - \ln(s_o)$.

Two estimation methods for the demand parameters are presented. In the first method, δ_j is regressed on x_j and p_j without regard to the endogeneity of prices. These results, in columns 1 and 3, are comparable to those differentiated product studies that do not consider unobserved characteristics. In the second method, the observed cost factors, w_j, and the demand characteristic of the rival firm are used as instruments for price. These results are in columns 2 and 4. We see that, even when the observed characteristic accounts for 80% of the variance in mean utility levels, the coefficient on price is systematically underestimated by OLS. Simple calculations show that, for many samples, the OLS estimate of α implies that firms are pricing on an inelastic portion of their demand curves, thus falsely appearing to reject relevant economic theory. In column 3, where the observed characteristic accounts for only 25% of the variation in mean utility levels, the OLS estimates sometimes indicate that consumers prefer to pay higher prices (i.e., $-\hat{\alpha} > 0$). The instrumental variable method, in contrast, provides reasonable estimates of the coefficients, thus correcting for the bias in the OLS estimates.

9. Extensions

■ This article leaves many estimation issues yet to be explored. Much of this exploration will be most fruitful in the context of a particular industry study. Issues that might be examined include questions of how to estimate market size, M, when this is not directly observed and how to make optimal use of potential instruments, such as the characteristics of other firms. The first question is taken up in Berry (1990) and Greenstein (1992), while approximations to the optimal instruments are developed in Berry, Levinsohn, and Pakes (1993). In the remainder of this section, I shall briefly discuss some additional extensions.

□ **Consumer data.** Researchers increasingly have access to data on individual consumer decisions. In this case, we might parameterize utility as $u_{ij} = \delta_j + y_i\beta_y + \epsilon_{ij}$, where y_i is a vector of observed consumer characteristics. Individual consumer data could be used to estimate the product-specific means δ_j. Call these estimates $\hat{\delta}_j$. The estimated $\hat{\delta}_j$ could then be treated in much the same way as the δ_j derived from aggregate data on market shares (although additional complications now arise from the estimation error in $\hat{\delta}_j$). That is, the $\hat{\delta}_j$ could be "regressed" (using instrumental variables techniques to account for the endogeneity of prices) on product characteristics and prices. This procedure is analogous to techniques that are familiar from the empirical literature on linear grouped data models, in which estimates of individual group means might be explained via a regression on group characteristics. The nonlinear nature of the discrete-choice market-share function prevents us from using the obvious alternative in linear models, which is to include the group-specific data directly in a linear regression equation.

□ **Different specifications for utility.** It would be useful to extend the methodology above to incorporate yet more general models of consumer utility and firm behavior. As long as they incorporate unobserved product characteristics, such models will likely continue to face a nonlinear instrumental variables problem of the sort discussed above. The method of this article suggests solving backward from observed data to uncover the product specific unobservables, ξ and ω; this method may also be useful in more general specifications. To extend the methodology on the demand side, it is necessary to prove a result similar to that found in the Appendix: namely, that given parameters, each vector of observed data can be explained by only one vector of product-specific unobservable demand characteristics. Similarly, on the pricing side, it will be necessary to provide an analog to (29), which demonstrates that the data and parameters together uniquely determine the cost-side unobservable.

□ **Measurement error.** Measurement error in observed prices, characteristics, or quantities may also create difficulties for the estimation procedure outlined above. Because prices are already treated as endogenous variables, measurement error in prices may not be a serious problem (as long as the only effect of price is as a linear term in δ_j.) However, measurement error in output quantities presents a more serious problem. The nonlinear inversion of market shares to uncover δ_j may be quite sensitive to measurement error in observed market shares. As noted, the reduced-form method is not sensitive to measurement error in the left-hand-side variables, price and quantity, and thus, this method may be preferable (when feasible) in the presence of mismeasured quantities.

□ **Endogenous product characteristics.** The estimation techniques of this article rely on the traditional assumption that the unobserved product-level errors are uncorrelated with observed product characteristics. Given that firms choose the characteristics of their products, this assumption may be unreasonable. However, a solution to the problem of "endogenous x's" requires a reasonable model of the dynamic process that generates product characteristics. This project goes well beyond the static framework of the current article. Similarly, there are other circumstances that call the static demand model into question, such as the modelling of consumer dynamics and durable goods.

In one useful advance, Pakes and McGuire (1991) show that simple discrete-choice product differentiation models have useful properties when employed as models of single-period profits in dynamic models of equilibrium firm behavior, such as that of Ericson and Pakes (1989). Combining the endogenous pricing models of this article with dynamic models of investment in product quality would allow for the endogeneity of both market characteristics and market prices. I shall leave this as a topic for future research.

10. Conclusions

■ In this article, I have considered methods for estimating product differentiation models in the presence of unobserved product characteristics. While homogeneous goods models are almost never estimated while ignoring the correlation of prices and demand errors, it has been commonplace to ignore this correlation in more complex studies of differentiated products markets with discrete-choice demand models. I suggest "inverting" the discrete-choice market-share function to find implied levels of mean utility. These mean utility levels can then be treated in much the same fashion as observed output quantities in the homogeneous goods model. For some leading special cases, it is quite easy to invert the market-share function. More complicated models impose a greater computational burden, but this burden may still be less than what is required by alternative estimation methods, such as solving for the reduced form.

The worth of the methods suggested here must ultimately be established in empirical applications. Some early success can be reported in this regard. Berry, Levinsohn, and Pakes (1993) extend the methods of this article in several directions in order to estimate the parameters of an equilibrium model of differentiated products supply and demand in the automobile industry. Consistent with the Monte Carlo results reported here, they show that allowing for unobserved product characteristics, which are correlated with prices, improves estimates of own-price elasticities. They also extend the random coefficients framework of this article and obtain plausible estimates of product-level cross-price elasticities. Greenstein (1992) has also reported plausible demand estimates in a study of the computer industry that employs a vertical differentiation model with unobserved product characteristics. Thus, while much work remains to be done, there are potentially useful empirical applications for the methods presented here.

I should emphasize in closing that the techniques of this article rely on a number of restrictive assumptions. These include assumptions that demand is well approximated by a static discrete-choice model and that the distribution of consumer tastes is known up to a parameter vector. More importantly, and more difficult to solve, I assume that product characteristics are econometrically exogenous. A solution to this last problem awaits further progress on dynamic models of firm behavior.

Appendix

■ **The inverse of the market-share equation.** As in Section 3, consider the utility function $u_{ij} = \delta_j + \nu_{ij}$. Holding $\delta_o = 0$, I shall prove that a unique vector $\boldsymbol{\delta} = \mathscr{s}^{-1}(\mathbf{s})$ exists. Assume that the market share function, $\mathscr{s}(\boldsymbol{\delta})$, has the following properties, which are sufficient, but not necessary, for the results which follow: $\mathscr{s}$ is everywhere differentiable with respect to $\boldsymbol{\delta}$, and its derivatives obey the following strict inequalities—$\partial \mathscr{s}_j / \partial \delta_j > 0$ and $\partial \mathscr{s}_j / \partial \delta_k < 0$, $k \neq j$. A sufficient (but not necessary) condition for these properties is that for all possible values of $\mathbf{x}$, the density of consumer characteristics, $f(\boldsymbol{\nu}, \mathbf{x})$, is strictly positive and continuous for all $\boldsymbol{\nu} \in \mathbf{R}^{N-1}$. Also note that for any finite values of $\{\delta_k, k \neq j\}$, $\mathscr{s}_j$ approaches arbitrarily close to zero as δ_j goes to $-\infty$, while $\mathscr{s}_j$ approaches arbitrarily close to one as δ_j goes to ∞.

I begin by defining the element-by-element inverse, $r_j(\boldsymbol{\delta}, s_j)$. This function is defined as the value for the mean utility of the *jth* product such that the predicted value $\mathscr{s}_j$ exactly equals the observed value s_j. That is, r_j is implicitly defined as

$$s_j = \mathscr{s}_j(\delta_1, \delta_2, \ldots, r_j(\boldsymbol{\delta}, s_j), \ldots, \delta_N). \tag{A1}$$

By the assumptions on the market-share function, this element-by-element inverse exists and is continuous and differentiable. Note that r_j is strictly increasing in δ_k and does not depend on δ_j. Also define the vector valued function $\mathbf{r} = (r_1, \ldots, r_J)$.

The element-by-element inverse allows us to transform the problem of solving for the vector inverse into a fixed-point problem, for a vector $\boldsymbol{\delta}$ satisfies $\mathscr{s}(\boldsymbol{\delta}) = \mathbf{s}$ if and only if $\boldsymbol{\delta} = \mathbf{r}(\boldsymbol{\delta}, \mathbf{s})$. The method of proof is to use a slight variant of Brouwer's fixed-point theorem to prove existence of a fixed point of the element-by-element inverse. It is then necessary to show that there cannot be two such fixed points.

To establish existence, first hold $\delta_o = 0$ and note that $r_j(\boldsymbol{\delta}, s_j)$ has a lower bound. This lower bound is $r_j(\boldsymbol{\delta}', s_j)$, with $\boldsymbol{\delta}'$ set equal to any vector in $\mathbf{R}^{N+1}$ such that $\delta_k = -\infty$ for $k \neq (j, 0)$. Define $\underline{\delta}$ as the smallest value across products of these lower bounds. There is no upper bound for r_j, but the following lemma allows one to establish existence in the absence of an upper bound.

Lemma. There is a value $\bar{\delta}$, with the property that if one element of $\boldsymbol{\delta}$, say δ_j, is greater than $\bar{\delta}$, then there is a product index k such that $r_k(\boldsymbol{\delta}, \mathbf{s}) < \delta_k$.

Proof. To construct $\bar{\delta}$, again set $\delta_k = -\infty$, $\forall\, k \neq (j, 0)$. Then define $\bar{\delta}_j$ as the value of δ_j that sets the market share function for the outside good, $\mathscr{s}_o$, equal to the observed share s_o. Define $\bar{\delta}$ as any value greater than the maximum of the $\bar{\delta}_j$. Now, if for the vector $\boldsymbol{\delta}$ there is an element j such that $\delta_j > \bar{\delta}$, then $\mathscr{s}_o(\boldsymbol{\delta}) < s_o$, which implies $\Sigma_{j=1}^{N} \mathscr{s}_j(\boldsymbol{\delta}) > \Sigma_{j=1}^{N} s_j$, so there is at least one element k with $\mathscr{s}_k(\boldsymbol{\delta}) > s_k$. For this k, $r_k(\boldsymbol{\delta}, \mathbf{s}) < \delta_k$.

Now define a new function which is a truncated version of r_j: $\tilde{r}_j(\boldsymbol{\delta}, \mathbf{s}) = \min\{r_j(\delta, s), \bar{\delta}\}$. Clearly, $\tilde{\mathbf{r}}(\boldsymbol{\delta}, \mathbf{s})$ is a continuous function which maps $[\underline{\delta}, \bar{\delta}]^N$ into itself, so, by Brouwer's fixed-point theorem, $\tilde{\mathbf{r}}(\boldsymbol{\delta}, \mathbf{s})$ has a fixed point, $\boldsymbol{\delta}^*$. By the definition of $\underline{\delta}$ and $\bar{\delta}$, $\boldsymbol{\delta}^*$ cannot have a value at the upper bound, so $\boldsymbol{\delta}^*$ is in the interior of $[\underline{\delta}, \bar{\delta}]^N$. This implies that $\boldsymbol{\delta}^*$ is also a fixed point of the unrestricted function $\mathbf{r}(\boldsymbol{\delta}, \mathbf{s})$, which establishes existence.

A well-known sufficient condition for uniqueness is $\Sigma_k \mid \partial r_j/\delta_k \mid\; < 1$. By the implicit function theorem, $\partial r_j/\partial\delta_k = -[\partial\mathscr{s}_j/\partial\delta_k]/[\partial\mathscr{s}_j/\partial\delta_j]$. From this, $\Sigma_k \mid \partial r_j/\delta_k \mid\; < 1$ if and only if a dominant diagonal condition holds:

$$\sum_{k \neq (j,0)}^{N} \mid \partial\mathscr{s}_j/\delta_k \mid \; < \partial\mathscr{s}_j/\delta_j. \tag{A2}$$

To establish this condition, note that increasing all the mean utility levels (including δ_o) by the same amount will not change any market share. Then, (A2) follows from

$$\sum_{k=0}^{N} \partial\mathscr{s}_j/\delta_k = 0 \Rightarrow \sum_{k=1}^{N} \partial\mathscr{s}_j/\delta_k = -\partial\mathscr{s}_j/\delta_o > 0.$$

Q.E.D.

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