MORGAN STANLEY DEAN WITTER

Equity Research
Global Telecommunications

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Global Telecommunications Primer

A Guide to the Information Superhighway

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Introduction

Welcome to the Information Superhighway! It sounds great, but what does it really mean? To help you navigate the complicated terrain of global telecommunications, we offer the first edition of our Global Telecom Primer. Our aim is to provide a road map to telecom markets and communications technology that has some shelf life, while highlighting our global telecom team's best investment ideas for the longer term.

Our Primer has two sections: a region-by-region analysis of wireline and wireless telecom markets, and a review of key nuts-and-bolts issues in the sector. After highlighting investment themes and top picks, the regional sections focus on market size and growth, describe the competitive environment, discuss key industry trends, and highlight the pace and impact of regulatory changes. The discussions cover virtually the entire telecom world, from the Americas and Greater Europe to Japan, Asia, and the rest of the Pacific Rim. For those looking to skim the report quickly, each region has an overview summarizing key points and top picks.

The nuts and bolts section offers an in-depth look at three topics we view as critical to understanding the sector: the history of telecom deregulation in the U.S., techniques for analyzing and valuing wireless companies, and changes in telecommunications technology. The deregulation of the U.S. telecom market, and the intense competition we are witnessing there today, offer an excellent case study for other telecom markets as they, too, accelerate the pace of deregulation. Analyzing wireless companies can often make you feel as if you're drowning in alphabet soup. Our discussion walks you through the do's and don'ts of valuing a wireless company. As for technology, it could be alphabet soup all over again for those who haven't been following the technological changes minute-by-minute. We go from the basics of how a telephone call is executed to an explanation of new technologies that deliver high-speed Internet access over traditional copper telephone wires. We also provide a glossary of industry terms.

Some key themes cut across global regions:

- Wireless growth is outpacing wireline, although the seemingly insatiable demand for data continues to drive wireline growth rates higher.

- The infrastructure for data services is requiring major capital investment.

- While it's no secret that deregulation is laying waste to existing business models, countries that think they are doing their incumbents a favor by deregulating slowly may well be creating an opening for aggressive global operators. Asia, in particular, may suffer from its relatively slow deregulation efforts.

Competition is accelerating in every market, making it critical to know what to look for in telecom winners. We boil these ingredients down to excellent management, organizational flexibility, ownership of the customer or of superior proprietary technology that can build customers quickly, and a strong capital structure (in the emerging markets) or access to capital (in developed markets). These, we believe, are the criteria that investors should use in picking long-term winners in global telecom markets. Our top picks, listed in the table below, are companies that we believe have

the right mix of these key ingredients to create a competitive advantage and become long-term winners in their space.

We hope that you find this Global Telecom Primer useful in assessing which telecom stocks to invest in. We expect to update our work next year and look forward to incorporating your feedback. Please let us know what was particularly helpful and what else you would like us to provide.

Table 1
Morgan Stanley's Top Global Telecom Picks

Asia/Pacific
- *Wireline*
  - Telstra
  - TCNZ
  - Hongkong Telecom
  - SingTel
- *Wireless*
  - SmarTone
  - SK Telecom
  - China Telecom
  - Advanced Info Service

Canada
- *Wireline*
  - Bell Canada
  - AT&T/MetroNet
  - Sprint Canada
- *Wireless*
  - Clearnet
  - Rogers Cantel

Japan
- *Wireline*
  - NTT
  - Japan Telecom
- *Wireless*
  - NTT DoCoMo

Latin America
- *Wireline*
  - Telesp Par
  - Telmex
  - Embratel
- *Wireless*
  - Telesp Celular
  - Iusacell
  - Tele Sudeste Celular

U.K/Europe
- *Wireline*
  - British Telecom
  - Equant
  - KPN
  - NTL
  - Sonera
  - Telewest
- *Wireless*
  - Mannesmann
  - Securicor

Eastern Europe
- *Wireline*
  - MATAV

United States
- *Wireline*
  - AllTel
  - Bell Atlantic
  - CenturyTel
  - GTE
  - ITC^DeltaCom
  - MCI WorldCom
  - McLeodUSA
  - RSL Communications
  - Time Warner Telecom
- *Wireless*
  - Nextel
  - Powertel

U.S. Wireline: Beginning of a Golden Age?

Overview

The wireline telecom sector is enjoying a golden age that may only be just beginning. Over the last several years, industry growth has significantly accelerated with the growth of data and, in particular, the Internet. Local and long distance operators are being inundated with demand for high-capacity circuits. We expect data and Internet-related revenues to grow at close to 30% annually over the next several years. Additional demand for high-margin value-added services such as caller ID and call waiting is another key value driver.

We firmly believe that the communications sector is taking a larger and larger share of economic activity. Doomsday predictions of vicious competition following the Telecom Act of 1996 have failed to materialize, although there are certainly going to be periods of strong competition. The key takeaway is that this is not a zero sum game. New entrants are enjoying rapid growth and taking market share, but growth remains robust for the incumbents who are seeing accelerating spending on communications by their customers.

We forecast that the number of consumer access lines will continue to grow 2–3% per year for the next several years as demand for Internet and fax services fuels second-line growth**.** Although competitive offerings by wireless providers have led some consumers to abandon their secondary and even their primary lines, the new broadband services to be offered by the telcos and cable companies should more than offset wireless substitutions. We expect that competition in the local residential market will intensify with AT&T's cable initiatives, putting pressure on local service pricing. We also forecast that competition in traditional long distance service will remain high in the U.S. as the Baby Bells gain entry.

We estimate that business access lines will continue to grow 4–5% per year for the next several years. We expect Internet, frame relay, and ATM services to fuel growth in local and long distance revenues while the impact of traditional voice offerings on local and long distance business services revenue growth gradually declines. Competition in the local business market has been steadily increasing over the last two years, as the competitive local-access carriers (CLECs) continue to make inroads in the market.

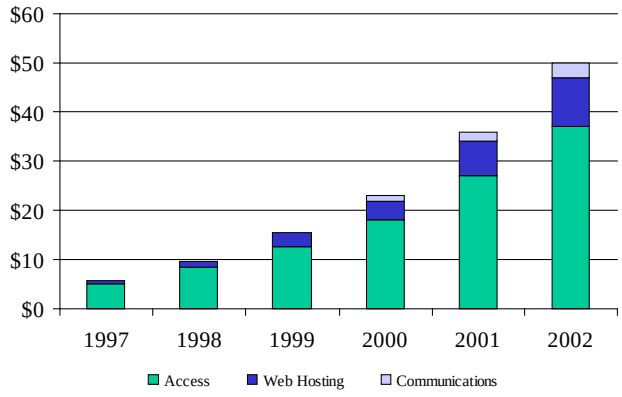
Competition may finally come to the residential market over the next couple of years with AT&T's purchase of TCI and planned purchase of MediaOne. We expect AT&T to offer consumers local and long distance phone service, multiple voice lines, cable TV, and Internet services all over one high-bandwidth cable pipe, starting in ten test markets in 1999. AT&T will use innovative pricing plans, and also intends to partner with other cable companies to deliver AT&T branded telephony services to residential consumers. In response, the local telcos have announced aggressive digital subscriber line (DSL) deployment plans to offer residential users high-speed Internet access over a copper loop. We expect some 600,000-plus DSL subscribers by the end of the year, with America Online acting as a key distributor. The Bells are also looking at VDSL and satellite TV to allow them to offer a video product as part of a competitive bundle.

Supply and demand for wireline services may not remain in equilibrium. Technology is driving exponential capacity gains on existing fiber plant and planned build-outs. For example, time division multiplexing (TDM) and wave division multiplexing (WDM) can expand bandwidth

Figure 1

Data Growth Drivers:
U.S. Internet Service Revenues

(US $ Billions)



Source: Morgan Stanley Dean Witter Equity Research

on existing fiber by as much as one hundred times. In the local arena, advances in DSL and cable modem technologies should translate into higher speeds in the last mile. As a result, we anticipate that bandwidth will swell and the industry will likely face periods of excess capacity, although over time, new data and broadband applications should expand to fill the broadband pipe.

We expect further consolidation in the telecom sector as companies seek the benefits of vertically integrating products over a fixed cost structure as well as gaining scale economies through broad geographic reach. Well-funded, aggressive players with state-of-the-art networks should emerge as strong competitors, particularly facilities-based providers with scalable or upgradable networks. We also look for companies that have a customer base, a product set, and back-office systems in place, and managements with a strong track record of executing, integrating, and competing in the sector. Companies like these are likely to remain leaders and continue to receive premium valuations helping them to consolidate the sector.

We favor Bell Atlantic, GTE, and MCI WorldCom, each of which has a strong market position and is aggressively staking out positions in all the key telecom segments.

Investment Themes

The telecom industry in the U.S. is undergoing profound change and is, we believe, at an important inflection point. Technological change has stimulated regulatory change and is transforming the industry. Traditionally dominant players are being eclipsed in speed to market, share of new products, and even market capitalization, by new, more nimble, entrants. Global Crossing for example now commands a market capitalization of more than $20 billion just two years after the company was founded.

Advances in price/performance and technology are opening the door to what will likely be explosive growth in wireline demand. Specifically, the market for data services (including dramatic growth in the Internet) is driving expansion in volumes, huge investment in the backbone (i.e., local and long distance facilities), and in software by telecom carriers. New entrants have important advantages around the incumbents' networks with newer, faster, and lower-cost technology. These bigger and faster pipes are opening the floodgates for new and higher-bandwidth applications — namely data and broadband.

The extreme view is that voice service will soon become a relatively small portion of a much richer overall communications package. Indeed, voice may even be given away for free. The trend is already under way, since over the past six years, domestic (U.S.) revenue per minute for voice has declined an average of 7% annually, while minutes have grown 10%. However, in 1997, revenue per minute declined by 13% — much less than the pace of voice minute growth of 8%, suggesting that voice revenues are declining overall.

As data begin to dominate the industry, we expect that several themes will play out. First, capacity — initially in the long-haul backbone and ultimately in the local loop — will swell. Second, competition will increase. And third, consolidation will continue at a similar, if not more rapid, pace.

Consolidation will be an important theme for investors playing the telecom sector. Regulatory and technological developments in the sector have driven broad consolidation and should continue to do so. The clear delineation in valuations between those who have successfully executed versus those who haven't will be an equally important contributor to consolidation, as players continue to amass valuable assets. Consolidation will also be stimulated by the need to vertically integrate products over a fixed cost structure as well as the benefits of gaining scale economies through broad geographic reach. Thus, mergers like AT&T and TCI suggest a broader product set (broadband, video, and data to the home) while mergers like Bell Atlantic/NYNEX suggest broader geographic coverage.

We believe that facilities-based providers with a scalable or upgradable network will have a competitive edge. We also look for companies that have a customer base, product set, and back office systems in place. The time, energy, and expertise to build these capabilities from scratch should not be minimized. Finally, we expect that the strong will get stronger. Specifically, managements that have demonstrated success in executing, integrating, and competing in the sector are likely to maintain their competitive position. They thus, in our view, should garner premium valuations, helping them drive industry consolidation.

Bell Atlantic and GTE and are our top picks in the local sector. MCI WorldCom is our top pick in the long distance segment. These companies all have strong market positions and are aggressively staking out positions in each of the key segments of telecom. We believe they will be among the top four or five telecommunications companies in the U.S. We believe the catalysts of merger approval and long distance entry will help unlock the value in Bell Atlantic and GTE. We expect MCI WorldCom to deliver the fastest earnings growth in the large cap telco sector over the next few years. We believe it is best positioned to capitalize on the explosive growth in the data market.

Market Growth

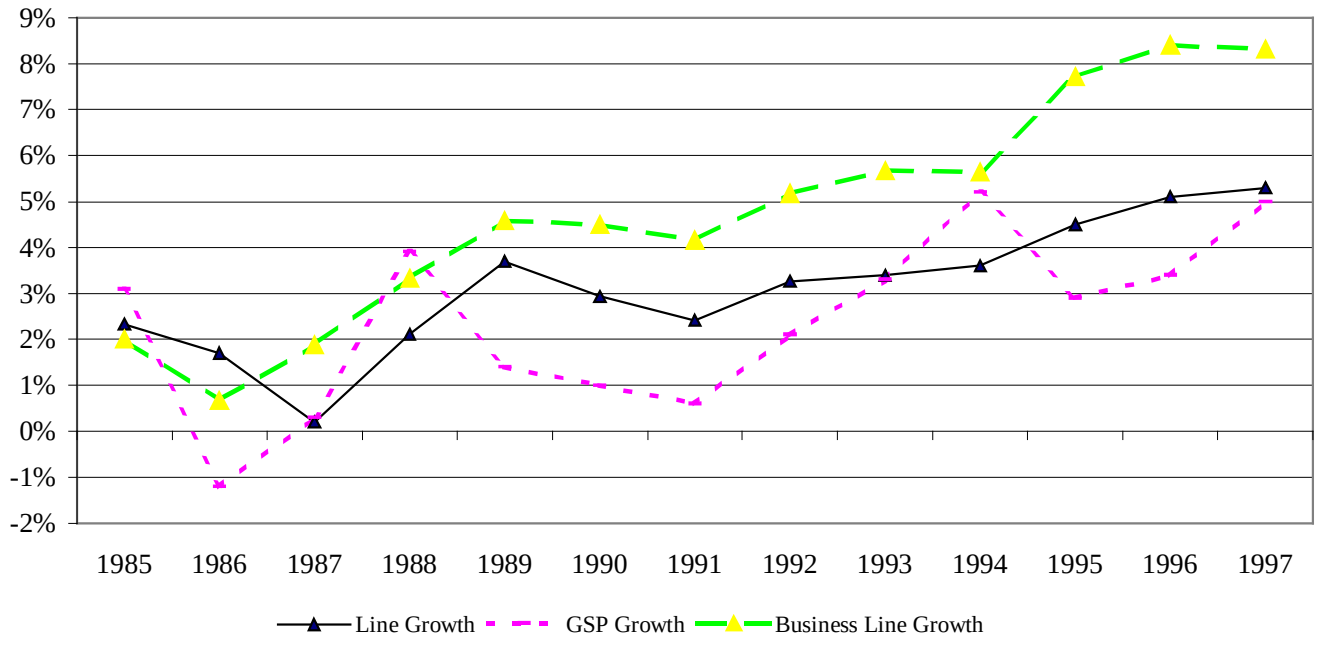
We expect that consumer access lines will continue to grow 2–3% per year for the next several years. Over the last ten years, residential access lines have increased at a CAGR of 3%, fueled by household growth (particularly in the southern, western, and southwestern United States) and the demand for additional lines. Additional-line penetration has increased from 2.7% in 1988 to approximately 20% today, driven in large part by demand for Internet and fax services. Historically, access line growth has been heavily correlated with GDP growth. More recently, however, the relationship has decoupled as the technology-driven demand for second lines has increased.

The need for more bandwidth to the home (more voice and data channels/lines) could spark an acceleration in residential access line growth. This increase could be offset by the substitution of wireless services. The competitive offerings in today's wireless market have enticed some consumers to abandon their secondary and, in some instances, their primary lines in favor of wireless. However, we expect that the new broadband services offered by the telcos and cable companies will more than offset any wireless substitution trend.

We estimate that business access lines will continue to grow 4–5% annually for the next several years. Over the last ten years, the compound annual growth rate of business access lines has been 4.4%, driven by economic expansion in the U.S., with the southern, western, and southwestern United States displaying the highest growth. Perhaps more

Figure 2

Growth of Access Lines and GSP in the Southwestern United States



GSP = Gross State Product
Source: Morgan Stanley Dean Witter Equity Research

Table 1
Data Services Offered by Telecom Carriers

Service	Customer
Internet Access	All
XDSL (Digital Subscriber Line)	Residential, Small Business
ISDN (Integrated Services Digital Network)	Residential, Small Business
Cable Modem	Residential, Small Business
Dedicated Access	Medium and Large Businesses
Intra-LATA Private Line	Medium and Large Businesses
Inter-LATA Private Line	Medium and Large Businesses
Virtual Private Networks (VPN)	Medium and Large Businesses
Network Solutions	Large Businesses
Frame Relay, ATM and IP Transport	Medium and Large Businesses
Customer Premise Equipment (CPE)	All

Source: Morgan Stanley Dean Witter Equity Research

importantly, businesses will buy more and more high-capacity circuits, such that voice grade equivalent (VGE) growth should average close to 15%.

Given the boom in data and Internet services, **we expect that the impact of traditional voice services on local and long distance business services revenue growth will decline over time.** A few long distance carriers have indicated that data traffic has surpassed voice traffic on their networks. We look for Internet, frame relay, and ATM services to fuel the growth in both local and long distance revenues. We expect the local exchange carriers to offer residential users high-speed xDSL services, providing voice and high-speed data channels (including Internet access) via a special modem over a copper loop. U.S. West Communications Group was the first telco to offer DSL services with its 1998 launch in Phoenix, and all of the major local exchange carriers have announced aggressive DSL deployments starting in 1999.

Back in 1993, the potential of cable telephony was first highlighted when Bell Atlantic and TCI announced plans to merge. Those plans were ultimately shelved, but six years later, AT&T is spending over $100 billion in acquiring TCI and MediaOne, and is entering into joint ventures with Time Warner and others, which should allow it to offer cable telephony services to as many as 60% of the households in America. The company is looking to use fixed wireless and resale of the ILEC networks to supplement this footprint.

We look for AT&T/TCI to offer consumers local and long distance phone service, multiple voice lines, cable TV, and Internet services, all over one high-bandwidth cable pipe. TCI and many other cable providers are currently upgrading their cable plants to offer two-way high-speed Internet services and telephony. AT&T is expected to market a bundle of telecommunications services, including local, long distance, cable TV, and Internet services in ten test markets in 1999, and recently started service in the first market, Fremont, California.

The increased bandwidth offerings to the home proposed by the local telcos and cable companies will increase the number of residential "local lines" in service. This will likely occur over the long term, but of more immediate significance, in our view, will be the impact on pricing. For example, a potential "all-distance" offering by AT&T/TCI could include 1,000 domestic long distance minutes, unlimited local calling, three calling features, and three separate voice lines, all for $99 per month — a 40% discount to similar services from incumbent local provider Pac Bell and MCI WorldCom. Over time, we expect that the use of access lines as a measure of revenues and market share will become less relevant, replaced by more appropriate metrics used by cable providers, such as the number of households passed and revenue per household.

Competitive Environment

Competitive inroads into the consumer local services market have been relatively insignificant to date. The

authors of the Telecommunications Act of 1996 envisioned multiple service providers (local telcos, cable companies, wireless carriers, electric utilities, and long distance carriers) competing for the residential consumer's telecommunications spending with innovative pricing plans and enhanced data services offerings. However, competition has been slow to materialize.

As yet, not one regional Bell operating company (RBOC) has received the state and federal approvals necessary to offer long distance services within its region. The long distance carriers have realized that building out their own networks to service residential consumers is prohibitively expensive, and that margins on re-sold local services are unprofitable. As for the cable companies, until recently their cash flow generation was not sufficient to fund an upgrade of their plants to offer two-way broadband or telephony services.

The next couple of years could see much more intense competition, however. The Baby Bells should gain long distance entry, AT&T will roll out its cable telephony offering, CLECs should continue to take share, and new long distance networks should come on stream.

Our top rural picks are AllTel and CenturyTel. Both benefit from their rural marketplaces, which offer good growth, loyal customer bases, and low levels of competition. We believe AllTel is well positioned in higher-growth rural markets and offers an attractive set of communications services. CenturyTel's rural and suburban properties have attractive growth prospects with little worry about potential competitors in the short-term, in our view. The company has successfully carved out a name as an effective consolidator of rural telephone properties.

The competitive local exchange carriers continue to make inroads in the local market. Many of the largest CLECs have been acquired by the interexchange carriers. For example, WorldCom acquired MFS Communications and Brooks Fiber Properties, and AT&T acquired Teleport. We estimate that local competitors have captured more than 5% of the business lines in the U.S.

Our top CLEC picks are ITC^DeltaCom, McLeodUSA, and Time Warner Telecom. These are the three U.S. CLECs we have designated as "Tier One." We believe these companies meet our Tier One criteria, which are high revenue quality (on-net revenues), solid back office, strong sales and marketing distribution, and solid near-term visibility (minimal financing risk, at/near EBITDA positive, good financial controls, and proven track record). While the macro opportunity (regulatory and technology shifts) remains bullish for the new entrants, we believe that a selective approach should further enhance investor performance in this sector, with management and execution being key determinants of success.

We believe international long distance offers attractive investment opportunities in telecommunications, with strong growth and high gross margins. In our view, RSL Communications is one of the best-positioned competitive international carriers to capture market share in the international long distance sector.

In contrast to consumer local services, the consumer long distance market has experienced intense competition over the last few years, with significant decreases in calling rates and the introduction of simple, flat-rate calling plans. Dramatic increases in backbone capacity to handle the bandwidth demands of data services have led to lower network costs for narrow-band voice services.

Industry Trends

Access to capital has been an important driver of the industry's development. By the end of 1998, the CLECs had raised over $30 billion in equity and debt securities, dozens of new companies in the local, long distance, and data transmission spaces have gone public with great success. To top it all off, AT&T was able to raise $30 billion in debt for its MediaOne bid.

Much of this capital has been plowed into network facilities — both local and long distance. We estimate that the physical number of fiber miles in the long distance backbone will more than double in 1999 from 1997 levels. Moreover, the bulk of the growth is coming from new entrants such as Qwest, Level 3, and IXC. In the local arena, scores of new entrants have built fiber rings in cities around the country.

Technology is driving exponential capacity increases in existing and planned fiber build-outs. The advent of time division multiplexing (TDM) and wave division multiplexing (WDM) can expand bandwidth on existing fiber by as much as 100 times. In the local arena, the advancement of

DSL and cable modem technology should translate into higher speeds in the last mile. As a result, network capacity will swell and the industry will likely face periods of glut and constraint. Over the longer term, we expect that the advent of new data and broadband applications will accommodate the increase in capacity. However, there will certainly be periods of time when supply is ahead of demand and vice versa.

To remain competitive, companies will need to spend cash on capacity. At the same time, shorter technology cycles suggest faster replacement and thus higher depreciation. AT&T recently proclaimed, "No more spending on circuit switches" and plans to deploy Internet Protocol (IP) switches exclusively from now on. Similarly, Sprint's plan for an integrated switching platform further highlights these trends. As voice, data, and Internet services migrate onto one common platform, the traditional voice switches will ultimately be phased out.

The key regulatory issues at hand are the review of mergers and of long distance applications. The authorities will take a very close look at the Bell Atlantic/GTE, SBC/Ameritech, and AT&T/MediaOne mergers. They may potentially impose pro-competitive conditions on some or all of these mergers. Toward the end of this year, we expect the FCC to rule on a number of pivotal long distance applications for New York, Texas, and a couple of other states. Allowing the Bells into long distance would have a significant impact on the industry.

Well-funded, aggressive players with state-of-the-art networks should emerge as strong competitors and regulatory barriers fall. Just as we saw in the long distance industry in the late 1970s and early 1980s, the competitive opportunity was significant as "no-name" providers like LDDS and ALC began to amass significant collective market share (over 20%) and were a large force behind consolidation. Moreover, the new entrants were more successful in gaining market share in new products and services (i.e., data) than their incumbent competition.

North American Wireless: PCS Changes the Landscape

Overview

Over the past three years, increased competition has transformed the economic structure of the North American wireless market. The FCC's auctioning additional radio spectrum and the introduction of personal communications service (PCS) in the U.S. have altered the competitive landscape of the wireless telecommunications market. In most service areas, the former duopoly has seen competition from at least two new PCS entrants. We continue to project that the incumbent cellular operators will see significant market share loss to the new entrants from 2000 through 2006.

Major cellular providers are accelerating the conversion of their subscriber bases to digital to remain competitive with the "buckets" of minutes offered by PCS providers. With capacity constraints on analog systems in many of the big metropolitan regions, the cellular carriers typically offer competing buckets only for their digital service. Prepaid offerings have also started to gain momentum, particularly in areas where operators have seen high churn rates related to non-pay disconnects. Prepaid service has emerged as a major driver of international customer growth (including Canada).

As wireless pricing quickly approaches wireline per-minute pricing (especially for long distance calling), **we are starting to see a migration of minutes from landline to wireless.** Nevertheless, we believe pricing has stabilized as most of the PCS companies' build-out has been completed in the top tier markets (for the time being). Most major markets now have the ten-cent minute, and we believe that operators will hold rates at these levels until technological advances or lower long distance prices further cut the costs of providing a wireless minute.

Consolidation in the industry should continue as service providers look to expand their footprints and/or enhance their product offerings. From a cost perspective, companies can benefit from economies of scale with nationwide networks. By owning the networks, operators have more flexibility with national pricing plans since they are not subject to the typically higher roaming rates charged by other operators.

Huge growth opportunities remain for wireless. The U.S. finished 1998 with about 69 million wireless subscribers for a penetration rate of about 25.5%. We project aggregate wireless penetration of about 36% by 2000 and about 53% by 2006. Our assumptions for Canada are quite similar, though our total wireless penetration estimate is lower, at 25.3% for the year 2000 and 44.1% in 2006, as Canada has traditionally lagged the U.S. in wireless penetration.

We prefer the new entrants to the incumbent cellular operators. On the national front, we believe Nextel is well positioned, as well as Sprint PCS (which we currently rate Neutral based on its current valuation). Among the regional operators, we favor Powertel, one of the best funded of the regional players with a strong regional footprint (in the Southeast) relative to its competition. In Canada, we believe that Clearnet and Rogers Cantel, both of whom are national players, are well positioned to capitalize on wireless trends.

Investment Themes

Consolidation in the industry should continue as service providers look to expand their footprints and/or enhance their product offerings. There has been rapid consolidation in the wireless industry in the United States, with Alltel

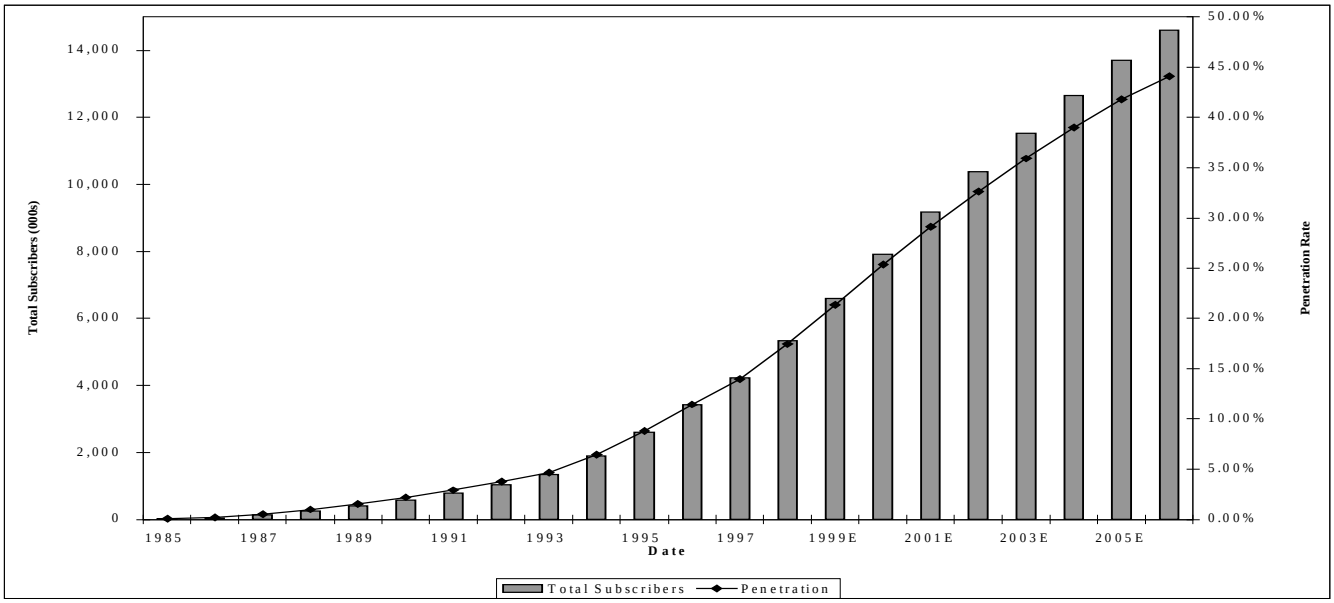
Table 1
Wireless Penetration: North America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Canada	4.6%	6.4%	8.8%	11.4%	13.9%	17.4%	21.1%	25.1%	28.9%	32.4%	35.4%	38.3%	41.1%	43.9%
Growth		*39.1%*	*36.4%*	*30.2%*	*22.0%*	*25.1%*	*21.4%*	*19.0%*	*14.9%*	*12.1%*	*9.3%*	*8.2%*	*7.3%*	*6.8%*
US	6.2%	9.3%	12.9%	16.6%	20.6%	25.5%	30.7%	36.0%	40.7%	44.9%	48.1%	50.2%	51.9%	53.1%
Growth		*49.9%*	*39.0%*	*28.7%*	*24.0%*	*23.8%*	*20.5%*	*17.0%*	*13.2%*	*10.3%*	*7.1%*	*4.6%*	*3.4%*	*2.3%*

Source: CTIA (Cellular Telecommunications Industry Association), Morgan Stanley Dean Witter Research

Figure 1

Historical and Projected Penetration and Subscriber Levels of Canadian Wireless Industry (1985–2006E)



E = Morgan Stanley Dean Witter Research Estimates

purchasing 360 Communications, AT&T purchasing Vanguard Cellular, and SBC Communications recently acquiring Comcast's and Southern New England Telephone's cellular properties. Consolidation in the wireless sector in Canada has been limited by the national license structure and the current spectrum cap, which limits the amount of spectrum a single operator can own (45Mhz in the U.S. and 40 MHz in Canada). There has been movement in both the United States and Canada toward raising the spectrum cap or eliminating it entirely, which we believe would accelerate consolidation.

Nationwide networks provide economies of scale. As service providers offer bundled minute plans that include national or regional roaming at local rates (AT&T, Sprint PCS, and Nextel), owning networks provides more flexibility with national pricing plans, since carriers are not subject to the typically higher roaming rates charged by other operators. Large carriers can exert negotiating leverage on handset and infrastructure equipment manufacturers, as well as on wholesale long distance providers and on roaming charges where they don't own networks. A nationwide network helps a carrier by spreading marketing and operating costs over a bigger base of subscribers. And from an ease of use standpoint, nationwide coverage could make a wireless service offering more marketable to business customers who may have heavy roaming patterns.

Given increases in wireless minutes of use, the expected glut of spectrum capacity may not develop. Major cellular providers have increasingly been converting their subscriber bases to digital to remain competitive with personal communications services carriers, which offer big bundles of minutes for a fixed monthly charge. Because of capacity constraints on analog systems in many of the big metropolitan regions, cellular carriers typically provide these buckets only in their digital offerings. Usage has been higher than expected as prices have fallen dramatically, offsetting digital capacity increases. Bell Atlantic Mobile, for example, recently reported that its digital minutes of use (MOUs) are three times higher than analog in the 300-minute range. We believe that the glut of spectrum may not be as large as had been anticipated.

As most of the PCS companies have completed initial build-outs in the top-tier markets, we believe pricing has stabilized. Most major markets now have the $0.10 minute. Given the costs associated with providing a minute of wireless service — interconnection, long distance (which in some cases is priced at local rates *a la* Digital One Rate),

and capital expenditures — we believe that operators will hold rates at these levels until technological advances or lower long distance prices further reduce costs.

We continue to prefer the predators (the new entrants) to the prey (the incumbent cellular operators). We believe that huge growth opportunities for the North American wireless market still exist and that the new entrants have ample spectrum capacity to accommodate the projected growth in minutes and subscribers. In addition, we believe that the footprint advantage that the incumbent cellular operators have enjoyed in the past is rapidly eroding, given the new entrants' more expansive build-outs and the rollout of dual band/dual mode phones. Moreover, we continue to believe that the market may be underestimating the market share shifts between incumbent cellular and PCS operators. Finally, as consolidation in the telecom industry continues, we believe that the strategic importance of the new entrants in wireless will increase.

In the United States, we believe that several of the new entrants are poised for strong growth over the next few years. On the national front, both Nextel and Sprint PCS (which we currently rate Neutral based on valuation) are well positioned, in our opinion. Among the regional operators, we favor Powertel, one of the best-funded of the regional players and boasting a strong regional footprint in the Southeast relative to its competition. In Canada, we believe that Clearnet and Rogers Cantel, both of which are national players, are well positioned to capitalize on the favorable trends in wireless.

Market Growth

Over the past three years, the economic structure of the North American wireless market has undergone major changes as a result of increased competition. In most service areas, the former duopoly has seen competition from at least two new PCS entrants, in addition to Nextel's ESMR (enhanced specialized mobile radio) service in the U.S. and Clearnet's similar service in Canada.

The wireless "pie" is starting to show signs of growth. Until 1998, demand growth resulting from heightened competition and lower price points came more in the form of increased usage than in accelerated subscriber penetration. However, during 1998, competition intensified as new service offerings were introduced. We saw widespread offers for $0.10 minutes, free service at night and on weekends, and minutes that included long distance and, in some cases, in-network and/or out-of-network roaming. As a result of these attractive service offerings, we believe that the "pie" is starting to expand in terms of both minutes and incremental penetration.

As wireless pricing quickly approaches wireline per-minute pricing (especially for long distance), we are starting to see a migration of minutes from landline to wireless. The attractive bucket minute plans (e.g., $50 for 500 minutes) are leading some customers to use their wireless phones in lieu of wireline — for example, instead of a hotel or pay phone or in place of a second line.

Prepaid offerings have also started to gain momentum, particularly in areas where operators have seen high churn rates related to non-pay disconnects. Also, we believe that prepaid service offerings are (slowly) starting to become more competitive with post-paid rates (in other words, the new plans are not gouging the users on a price-per-minute basis). As a result, prepaid wireless service should increase in visibility. U.S. wireless operators have estimated that roughly 30% of customers seeking to sign up for wireless service are rejected for credit reasons. Prepaid offerings represent an economic way of signing up these customers if the offering is properly structured (i.e., the handset and selling expenses are captured up front). As wireless service providers continue to dip further into the consumer market, we believe that prepaid will take a larger slice of wireless subscriber additions.

While still in their infancy, wireless phones with Internet access and e-mail applications are gaining popularity. We believe that wireless data usage will begin to accelerate in 2000 and beyond as data transmission speeds increase dramatically.

Huge growth opportunities remain. We estimate that the U.S. finished 1998 with approximately 69 million subscribers for a penetration rate of about 25.5% and an incremental penetration rate of 5%. We believe the first meaningful increase in the incremental penetration rate since the new entrants came into the market occurred in 1998. We estimate that at year-end 1998, Canada had about 5.3 million subscribers, for a penetration rate of roughly 17.4%.

Table 2
Wireless Subscribers (Thousands): North America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Canada	1,327	1,877	2,585	3,415	4,207	5,317	6,517	7,830	9,089	10,294	11,361	12,416	13,458	14,519
Growth		*41.5%*	*37.7%*	*32.1%*	*23.2%*	*26.4%*	*22.6%*	*20.1%*	*16.1%*	*13.3%*	*10.4%*	*9.3%*	*8.4%*	*7.9%*
US	16,009	24,134	33,786	44,043	55,312	69,209	84,213	99,518	113,782	126,705	137,042	144,712	151,087	156,126
Growth		*50.8%*	*40.0%*	*30.4%*	*25.6%*	*25.1%*	*21.7%*	*18.2%*	*14.3%*	*11.4%*	*8.2%*	*5.6%*	*4.4%*	*3.3%*

Source: CTIA (Cellular Telecommunications Industry Association), Morgan Stanley Dean Witter Research

We project total addressable penetration in the U.S. for the aggregate wireless market of about 36% by 2000 and about 53% by 2006, including incumbent cellular, PCS, and ESMR (enhanced specialized mobile radio). It should be noted that our calculations for ESMR subscribers include potential two-way radio conversions to digital ESMR service. We are forecasting that PCS will capture about 19.5% of the overall wireless market by 2000, with ESMR holding about 5.9% and cellular keeping the remaining 74.6%. However, we project that PCS will hold roughly 40.2% of the aggregate market by 2006, with ESMR commanding about 8.1% and cellular the remaining 51.7%. We continue to project that the incumbent cellular operators will see significant market share loss to the new entrants from 2000 through 2006.

Our assumptions for Canada are similar, though our total wireless penetration estimate is lower, at 25.3% for the year 2000 and 44.1% in 2006. Canada has traditionally lagged the U.S. in wireless penetration. Our U.S. and Canadian wireless projections are detailed in Tables 3 and 10. The historical data for the U.S. and Canada are detailed in Tables 8 and 9.

Competitive Environment — United States

The FCC's auctioning additional radio spectrum significantly increased competition in the wireless industry. Current regulations allow two to four PCS operators to provide commercial service in the major metropolitan areas. In addition, Nextel has emerged as a very serious contender for market share with its nationwide footprint and differentiated service offering. As a result, there are now five to seven competitors in most major markets. Due to the increased competition, incumbent cellular operators have been faced with the challenge of upgrading their subscriber bases to digital, or losing their high-end users to lower per minute offerings of the new entrants. Consequently, we have seen a significant acceleration of digital migration from the incumbent cellular operators.

The introduction of PCS in the U.S. has altered the competitive landscape of the wireless telecommunications market, creating great opportunities for some companies and intense pressure for others. After just over two years of PCS competition, we have seen significant changes in operators' pricing and marketing strategies. In Canada, we have seen similar trends. Cellular incumbents have been forced to upgrade their subscriber bases to digital. The resulting increase in cost of acquisition (COA) from digital handset subsidies has had a negative effect on margins. Pricing and marketing strategies have also changed. Bucket plans became the norm, causing continued negative pressure on per-subscriber revenue.

The license structure in the U.S. is fragmented. Unlike many countries, where national licenses are prevalent, the U.S. issues wireless licenses on a regional basis. The FCC's original rules governing cellular telephony services identified two geographic regions: metropolitan statistical areas (MSAs) and rural service areas (RSAs). The FCC created 306 MSAs in the most densely populated areas, as per 1980 census data, and 428 RSAs. This created a total of 734 cellular markets, including the U.S. possessions and territories. For PCS, the government elected to issue licenses on the basis of major trading areas (MTAs) and basic trading areas (BTAs). The FCC's geographic segregation of U.S. PCS properties identified 51 MTAs and 493 BTAs. As a result of the fragmented license structure for both cellular and PCS, consolidation has been a major theme in the U.S. as operators look to enhance their footprints.

Lifting the spectrum cap could fuel further industry consolidation. On November 19, 1998, the FCC adopted a notice of proposed rulemaking (NPRM) seeking comments on whether it should modify or eliminate the current restrictions on the amount of spectrum that wireless phone companies can control in any one market. Currently, wireless operators can control no more than 45 MHz of radio spectrum in any market. The cap was established in 1994 at the

Table 3
Canadian Wireless Penetration Assumptions (1996E–2006E)

(Figures are in thousands, except where noted)	1996E	1997E	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Macro Assumptions											
Total Canadian Population (Mil)	30.0	30.3	30.6	30.9	31.2	31.5	31.8	32.1	32.5	32.8	33.1
Percent Growth	1.4%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Penetration Assumptions											
Wireless Subscribers (in Thous.)	3,415	4,207	5,317	6,577	7,891	9,151	10,356	11,520	12,641	13,685	14,583
Wireless Penetration (gross POPs)	11.4%	13.9%	17.4%	21.3%	25.3%	29.1%	32.6%	35.9%	39.0%	41.8%	44.1%
Penetration Gain	2.6%	2.5%	3.5%	3.9%	4.0%	3.8%	3.5%	3.3%	3.1%	2.8%	2.3%
Net Wireless Adds	829	792	1,110	1,260	1,313	1,260	1,205	1,164	1,121	1,044	898
Average Subscribers	2,998	3,735	4,637	5,942	7,234	8,521	9,753	10,938	12,080	13,163	14,134
Industry Churn	1.49%	1.36%	1.58%	1.64%	1.66%	1.70%	1.74%	1.74%	1.76%	1.76%	1.77%
# of Disconnects	535	608	876	1,167	1,443	1,742	2,037	2,289	2,547	2,783	2,995
# of Gross Additions	1,365	1,401	1,987	2,427	2,756	3,002	3,242	3,453	3,668	3,827	3,893

E = Morgan Stanley Dean Witter Research Estimates

same time the service rules for broadband PCS were put in place. The purpose of the rule was, in part, to enhance competition by restricting incumbent cellular providers' ability to bid on new spectrum.

Now that 60% of the U.S. population has access to at least five wireless services, many believe that the spectrum cap has served its purpose and should be abolished. As part of Section 11 of the Telecommunications Act of 1996, the FCC pledged to reevaluate the need for the limitation on a biennial basis. FCC Chairman William Kennard and several of the agency's commissioners have publicly stated their support for a review of the spectrum cap. The FCC could take a number of actions, including maintaining the cap, modifying it, eliminating it, or eliminating the cap after a "sunset period." Alternatively, the commission could leave the cap in place and use its regulatory forbearance authority to determine the appropriateness of the cap on a case-by-case basis.

We believe that carriers with capacity constraints (particularly those with large installed bases in 800 MHz markets) have been lobbying the FCC hard to use its forbearance authority, at a minimum. We also believe that Bell Atlantic Mobile, BellSouth, AirTouch, and Western Wireless have filed comments with the FCC supporting a modification of the spectrum cap. On the other hand, we believe that carriers with excess spectrum capacity are in no rush to see the cap removed. In particular, Sprint PCS has publicly stated its support for the cap on the basis that competition has yet to reach rural regions of the country in any meaningful way. **We believe that the spectrum cap could be lifted sometime this year and that its elimination could lead to massive consolidation in the industry.**

Competitive Environment — Canada

In Canada, wireless licenses were issued, rather than auctioned as in the U.S. Industry Canada, the country's general regulatory body, allocated licenses in the 800 MHz and 2 GHz range for cellular and PCS, respectively. The license holders pay about C$45 per year, per subscriber (which is passed on to the user) for use of the spectrum. As in the U.S., the introduction of PCS competition in Canada greatly increased competition even though there are only four competitors in each Canadian market.

The cellular incumbents (Mobility Canada and Rogers Cantel) each have cellular and PCS licenses. The new entrants, Clearnet and Microcell, both hold PCS licenses. With the exception of Mobility Canada, the wireless players offer services on a national basis. Mobility Canada is made up of the wireless subsidiaries of the Canadian incumbent telephone companies. BCE Mobile is the largest member, operating in Ontario and Quebec. Clearnet also operates a national ESMR service, known as Mike.

PCS competition has pressured cellular incumbents in Canada as well, forcing them to upgrade their subscriber bases to digital service. The increase in acquisition costs as a result of digital handset subsidies has put pressure on margins. Marketing strategies have also changed, with bucket plans becoming the norm, putting negative pressure on per subscriber revenue.

Table 4
Cellular Digital Subscribers For Selected U.S. and Canadian Operators

(Figures in Thousands)	4Q98E	4Q97E
AT&T[1]	4,355	1,747
Bell Atlantic Mobile	950	154
SBC Communications[2]	660	40
BellSouth	1,376	600
GTE[1]	265	50
Rogers Cantel	500	NAV

Table 5
Digital Subscribers as a % of Total Subscriber Base For Selected U.S. and Canadian Operators

	4Q98E	4Q97E
AT&T	60.5%	29.3%
Bell Atlantic Mobile	15.3%	2.9%
SBC Communications	10.4%	0.8%
BellSouth	30.0%	15.2%
GTE	5.5%	1.1%
Rogers Cantel	28.8%	NAV

Notes for Tables 4 and 5:
(1) Includes subscribers in 1.9 GHz markets.
(2)Excludes subscribers in 1.9 GHz markets.
E = Morgan Stanley Dean Witter Research NAV = Not Available

Industry Canada is considering lifting the spectrum cap. In Canada, no individual wireless player is allowed to control more than 40 MHz of spectrum. However, given the level of competition in the marketplace, it is possible to argue that this restriction should be abolished. We believe this would have the effect of fueling consolidation, which we have yet to see in Canada. Wireline consolidation has resulted in Canada's two major ILECs (Telus and Bell Canada) declaring their intention to compete on a national basis.

Trends and Developments

Conversion of the analog subscriber base to digital is picking up steam. North America — unlike Europe, where the majority of subscribers are digital — has been very slow to transition analog subscribers to digital. At the end of 1997, we estimate that about 94% of the wireless subscribers in the U.S. were still analog users and only 6% were digital. Today, we estimate that over 25% of the U.S. subscriber base is using digital offerings. We believe that digital conversion ratios in Canada have been similar to those in the U.S. We estimate that roughly 29% of subscribers for Rogers Cantel, an incumbent cellular operator in Canada, had digital service at year-end 1998 (Table 5).

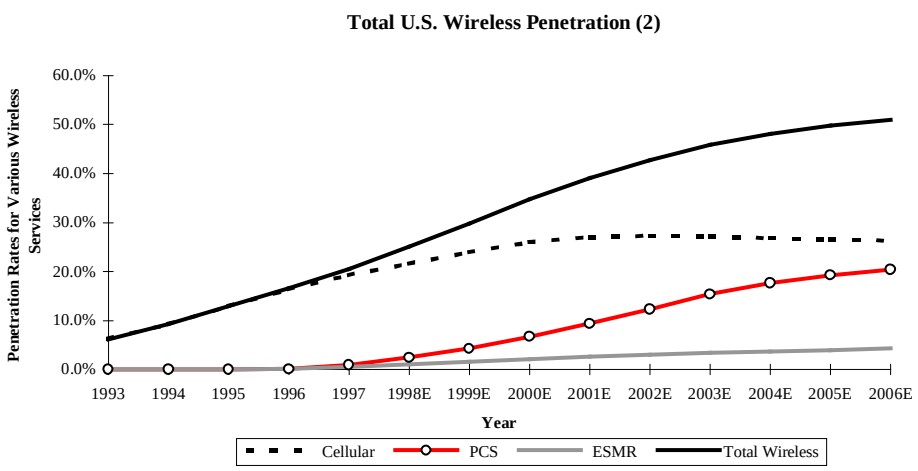
We believe that lack of a single digital standard primarily explains the delay in the digital efforts of the U.S. cellular operators. Competing standards, we believe, have resulted in a slower-than-anticipated rollout of cellular digital networks, since it took more time than was anticipated to perfect each one of them. This problem was compounded by the limited number of code division multiple access (CDMA) handset vendors and the scarcity of CDMA handsets, which initially kept prices high. As a result, cellular operators' original attempts to sell digital service were lackluster. In 1998, equipment manufacturers began channeling more of their efforts into manufacturing CDMA handsets, with the result that CDMA handset prices began to fall significantly for both the cellular operators and the CDMA-based PCS operators.

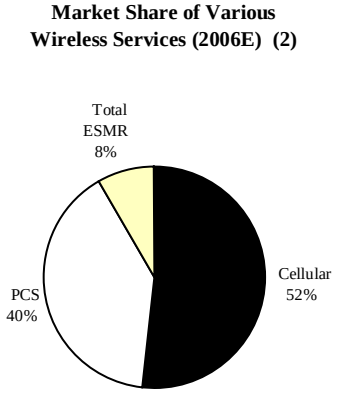
In the meantime, new entrants have been building digital networks as fast as the zoning and cell site approval process has allowed. They have also been aggressively marketing digital service offerings. As the new entrants have expanded their footprints, the cellular operators have been forced to more aggressively market their digital products, or lose their higher-end users, as well as prospective buyers, to the competition. As Table 4 shows, AT&T and BellSouth (both time division multiple access [TDMA]-based cellular operators) began more aggressively selling digital cellular service in 1997. The CDMA-based providers such as Bell Atlantic, GTE, and Ameritech ramped up their digital efforts later because only one type of handset was available for most of 1997 and part of 1998. The CDMA-based incumbent cellular providers in Canada (e.g., Mobility Canada) experienced similar handset difficulties.

We believe wireline minutes will continue to be transferred to wireless as a result of the lower price points. The lower price points for wireless service have sparked a debate over whether the per-minute charges for wireless have gotten low enough to displace wireline service altogether. We do not believe that the masses will disconnect their landline phones and rely solely on their wireless handsets over the near term, but substitution makes sense for certain segments of the population, notably college students. College telephone numbers are temporary, and college students are frequently on the move. As prices fall (and night and weekend service is increasingly offered for free or sold at a deep discount), we see this segment as the first logical market for wireline displacement. A wireless phone may also be used as the primary means of communications for

Figure 2

Historical and Projected Penetration Levels and Market Shares of Gross Additions (1993–2006E)





	1993	1994	1995	1996	1997	1998	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
% of Gross Additions (1)														
Cellular	100.0%	100.0%	99.8%	98.8%	86.0%	73.5%	69.5%	64.5%	59.5%	54.5%	49.5%	49.5%	49.5%	49.5%
PCS	0.0%	0.0%	0.3%	1.0%	12.0%	22.5%	26.5%	31.5%	36.5%	41.5%	46.5%	46.5%	46.5%	46.5%
ESMR	0.0%	0.0%	0.0%	0.3%	2.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Total Wireless	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Penetration Rates (2)														
Cellular	6.2%	9.2%	12.8%	16.3%	19.2%	21.9%	24.6%	26.8%	28.1%	28.7%	28.4%	28.0%	27.8%	27.5%
PCS	0.0%	0.0%	0.0%	0.1%	0.9%	2.6%	4.5%	7.0%	9.9%	13.1%	16.3%	18.5%	20.2%	21.4%
ESMR	0.0%	0.0%	0.0%	0.1%	0.5%	1.0%	1.6%	2.1%	2.7%	3.1%	3.4%	3.7%	4.0%	4.3%
Total Wireless	6.2%	9.2%	12.8%	16.5%	20.6%	25.5%	30.7%	36.0%	40.7%	44.9%	48.1%	50.2%	51.9%	53.1%

Notes:
(1) Excluding two-way radio converts (2) Including 2-way radio converts
E = Morgan Stanley Dean Witter Research Estimate

single, mobile professionals, such as national accounts salesmen or consultants.

We also expect minutes to continue to migrate from the landline network to the wireless networks as a result of the lower price points and bucket minute offerings by the wireless providers. With bucket minute plans offering a large number of minutes (300–1,600-plus) for a flat price, subscribers are more inclined to use up their "free" minutes in their down time while they are mobile (i.e., car, cab, walking, airport, etc.)

ARPU trends should begin to improve for the incumbent cellular operators as lower pricing stimulates usage. We are expecting average revenue per user declines for the incumbent cellular operators to start to decelerate as the lower per-minute pricing for both their analog and digital offerings should stimulate minutes demand. Also, we believe that the bulk of the re-rating of cellular operators' subscriber bases to counteract the lower pricing offered by the competition is behind them, although we expect the process to be ongoing.

For the incumbent cellular operators that have been more aggressive in migrating the bulk of their customers to digital offerings, such as AT&T and BellSouth, we have already seen lower ARPU declines (or actually ARPU increases) relative to operators who are primarily adding analog subscribers (such as the CDMA-based cellular operators). Therefore, we believe that ARPU declines will continue to moderate as the cellular operators continue to more aggressively sell their digital service.

ARPU and usage levels for the new entrants have been higher than expected, evidence that there is strong elasticity between price and demand. ARPU levels for the PCS operators and Nextel have been a very pleasant sur-

Table 6
Expiration Period for Prepaid Cards For Selective Wireless Operators

Carrier	Days before card expires
Bell Atlantic Mobile (NYC)	60 days
AT&T Wireless (NYC)	30/60 days[1]
Sprint PCS (NYC)	60 days
Omnipoint (NYC)	60+ days[2]
Nextel (NYC)	Prepaid not available
Powertel (Atlanta)	30/60/90 days[3]
OPI – Italy	10 months[4]
Telecel – Portugal	6 months[5]
Europolitan-Sweden	1 year[6]

1-Expiration in 30 days ($25 card) or 60 days ($50 card).
2-Minutes can be rolled over as long as more money is deposited in the account within 60 days.
3-Expiration in 30 days ($30 card), 60 days ($60 card), or 90 days ($90 card).
4-Nine month card life plus one month grace period for incoming calls
5-Three month card life plus three month grace period for incoming calls.
6-Six month card life plus six month grace period for incoming calls.
Source: Company information and Morgan Stanley Dean Witter Research.

prise. Figures have not only come in higher than Street expectations, but the ARPU levels have remained high. We believe that the lower price-per-minute and bucket-minute offerings have encouraged users to dial away. And we believe that not only have usage levels exceeded their expectations, but other revenue streams connected with higher usage (such as long distance and reciprocal termination for incoming phone calls) have also come in higher than budget. We expect that local revenue per subscriber (which excludes roaming revenues and other revenues such as installation charges) for the PCS operators will decline gradually from today's levels and stabilize in the $45–50 range, depending upon the operator.

The new entrants' marketing costs per gross addition (including the subsidy for the handsets) are rapidly approaching the levels of the incumbent cellular operators. The price of digital handsets has been coming down much faster than expected. For example, PCS operators using the GSM (Global System for Mobile communications) digital protocol are getting single-mode handsets in the low to mid-$100 range from several equipment manufacturers. This compares with initial quotes back in 1996 of $350–400. And not only are the prices for GSM handsets falling quickly, but we believe that other TDMA digital protocols such as IS-136 or iDEN (Nextel's and Clearnet's digital protocol), which share many of the same components as GSM, are also benefiting greatly from lower handset costs. In addition, CDMA handsets have started to see significant reductions throughout the past year.

The rapidly declining marketing costs per gross addition for the new entrants are dispelling initial concerns that they would have difficulties securing the necessary distribution channels to compete effectively or that digital handsets would be too expensive. As marketing costs per gross addition continue to fall, the PCS operators should move toward positive operating cash flow in the 1999–2000 time frame, and by 2000–2001 should have operating cash flow margins that closely resemble those of incumbent cellular operators. We expect Nextel's domestic business to achieve these milestones one year earlier.

Calling-party-pays is easier said than done, and we do not expect it to be implemented nationwide in the near future (year 2000 at the earliest). There has been much talk about calling-party-pays and its implications for the revenue prospects of the wireless operators. We believe that from a technical standpoint, calling-party-pays could be implemented tomorrow, but it could be extremely problematic to administer. In Europe, all mobile numbers have a distinctly different area code than landline, but in the United States, there generally is no such distinction. Therefore, callers might not know whether they are calling a mobile phone or whether it is long distance, which could result in an additional charge. This problem would have to be addressed, along with responsibility for billing and collecting fees.

Finally, with wireless rates declining rapidly, we question whether calling-party-pays will have as big an impact as some are hoping for. We also believe it's questionable that U.S. customers will be willing to pay on a metered basis to reach a local mobile number. Whereas European customers are used to metered billing for landline calls, most U.S. residents pay a fixed charge for unlimited local calls.

Prepaid service offerings should gain momentum as operators seek to reduce bad debt expense and minimize the impact of churn. Some PCS carriers relaxed credit terms when they initiated service, creating problems with bad debt. These carriers in particular have adopted prepaid service as a way to address this issue and minimize the impact of churn (i.e., recover handset and other acquisition costs). But credit risk is also increasing for incumbent cel-

lular carriers as they penetrate further into the consumer market. By offering prepaid, carriers reduce credit risk and pass along handset costs to the consumer. Prepaid also eliminates the cost of processing and mailing a bill (about $3 per month per customer), and up-front payments improve cash flow.

The negatives of prepaid include lower monthly usage and higher churn, the rate at which customers disconnect service. Churn is typically higher for prepaid customers because they tend to use the service more sporadically. If their accounts are inactive for a couple of months because they have not "recharged" their phones (i.e., bought additional airtime), they are counted as disconnects. Also, prepaid customers are not tied to contracts as are most traditional wireless customers in the U.S. and Canada.

Although prepaid service has emerged as a major driver of international customer growth, it hasn't taken hold in the U.S., primarily because pricing and the terms of prepaid in the U.S. have not been competitive with traditional post-pay rate plans. For the most part, the $0.10 wireless minute and reduced-rate or free off-peak calling are not available with prepaid. Per-minute rates with prepaid have been in the $0.60–0.99/minute range, regardless of the time of day the call is made, but prepaid rates now are beginning to decline, following the pattern of post-pay rates. As for the terms, prepaid cards typically expire more quickly in the U.S. than in Europe after they are activated. In Europe, the long shelf life of prepaid minutes, combined with the availability of calling-party-pays, allows a subscriber to stay accessible at very little cost.

We have noted that incumbent cellular carriers are slowly modifying prepaid's terms to be more customer-friendly. In the fall of 1998, AirTouch improved its Southern California prepaid calling program by extending the usage period of its $30, $50, and $100 cards from 30 to 60 days. This gives prepaid customers more time to use their prepaid service as the user loses the minutes if they are not used during the specified period.

Table 7

Wireless Average Revenue Per User ($ US): North America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Canada	NA	NA	NA	$47.1	$41.0	$34.3	$34.7	$34.3	$34.4	$34.5	$34.6	$34.9	$35.1	$35.3
Growth		*NA*	*NA*	*NA*	*-13.1%*	*-16.3%*	*1.3%*	*-1.1%*	*0.1%*	*0.3%*	*0.5%*	*0.7%*	*0.7%*	*0.6%*
US	$67	$59	$55	$51	$46	$45	$45	$45	$45	$45	$45	$45	$45	$45
Growth		*-12.0%*	*-7.1%*	*-7.8%*	*-8.9%*	*-2.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*

Source: CTIA (Cellular Telecommunications Industry Association), Morgan Stanley Dean Witter Research

Table 8

U.S. Wireless Industry — Selected Historical Data (1984–1998E)

	Year Ended December 31,														
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996 (5)	1997 (5)	1998E (5)
Data															
Est. Total Subscribers (000s)	92	340	682	1,231	2,069	3,509	5,283	7,557	11,033	16,009	24,134	33,786	44,043	55,312	69,209
Revenues (US$, MM) (1)	--	482	823	1,152	1,960	3,341	4,549	5,709	7,823	10,892	14,230	19,081	23,635	27,486	33,133
Roamer Services (US$, MM) (5)	--	--	--	--	--	295	456	704	974	1,365	1,831	2,543	2,781	2,974	3,500
Cell Sites	346	913	1,531	2,305	3,209	4,169	5,616	7,847	10,307	12,802	17,920	22,663	30,045	51,600	65,887
Employees	1,404	2,727	4,334	7,147	11,400	15,927	21,382	26,327	34,348	39,775	53,902	68,165	84,161	109,387	134,754
Cum. Cap. Ex. ($US, MM)	355	911	1,437	2,235	3,274	4,480	6,282	8,672	11,262	13,946	18,939	24,080	32,574	46,058	60,543
Number of Systems	32	102	166	312	517	584	751	1,252	1,506	1,529	1,581	1,627	1,740	NAV	NAV
Average Bill (Monthly) (2)	--	--	--	$96.83	$98.02	$89.30	$80.90	$72.74	$68.68	$61.48	$56.21	$51.00	$47.70	$42.78	$39.43
Average Call (Minutes)	--	--	--	2.33	2.26	2.48	2.20	2.38	2.58	2.41	2.24	2.15	2.32	2.31	2.39
Population (3) (MM)	237	239	241	243	246	248	251	254	256	259	262	264	266	269	271
Calculations															
Cellular Penetration	0.04%	0.14%	0.28%	0.51%	0.84%	1.41%	2.11%	2.98%	4.30%	6.18%	9.23%	12.80%	16.53%	20.57%	25.51%
Incremental Penetration		0.10%	0.14%	0.22%	0.34%	0.57%	0.69%	0.87%	1.32%	1.88%	3.05%	3.57%	3.73%	4.04%	4.94%
Cum Capex per Cell Site (US$, 000s)	$1,025	$998	$938	$969	$1,020	$1,075	$1,119	$1,105	$1,093	$1,089	$1,057	$1,063	$1,084	$893	$919
# of Subscribers per Cell Site	265	373	445	534	645	842	941	963	1,070	1,251	1,347	1,491	1,466	1,072	1,050
# of Subscribers per Employee	65	125	157	172	182	220	247	287	321	403	448	496	523	506	514
Revenue per Subscriber (4)		$186	$134	$100	$99	$100	$86	$74	$70	$67	$59	$55	$51	$46	$40
Est. Total Subscribers (000s)	92	340	682	1,231	2,069	3,509	5,283	7,557	11,033	16,009	24,134	33,786	44,043	55,312	68,131

Notes:
(1) Includes airtime, roaming, and vertical services(2) Excludes roaming revenues.(3) Source: U.S. Bureau of the Census, Current Population Reports.
(4) Includes roaming revenues.(5) Figures for 1996-1998 include PCS and ESMR.
Source: CTIA (Cellular Telecommunications Industry Association), Morgan Stanley Dean Witter Research
E= Morgan Stanley Dean Witter Research Estimate

Table 9

Canadian Wireless Industry — Selected Historical Data (1985E–1998E)

	1985E	1986E	1987E	1988E	1989E	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Market														
Population (in Millions)	25.2	25.4	25.6	25.9	26.2	26.6	27.0	27.4	28.8	29.3	29.5	30.0	30.3	30.6
Penetration of Total POPs	0.04%	0.16%	0.50%	0.95%	1.51%	2.17%	2.86%	3.73%	4.61%	6.42%	8.75%	11.39%	13.90%	17.39%
Penetration Lift	0.04%	0.12%	0.34%	0.45%	0.56%	0.66%	0.69%	0.87%	0.89%	1.80%	2.33%	2.64%	2.50%	3.49%
Subscribers (in Thousands)														
Total Subscribers	10	42	129	246	396	578	773	1,023	1,327	1,877	2,585	3,415	4,207	5,317
Rogers Cantel	5	20	61	116	184	266	346	460	573	794	1,049	1,370	1,552	1,738
Mobility Canada	5	22	68	130	212	312	427	563	753	1,083	1,536	2,038	2,494	2,989
BCE Mobility						209	263	329	421	592	798	1,044	1,221	1,475
Other Mobility Canada						103	164	234	332	491	738	994	1,273	1,514
Microcell						0	0	0	0	0	0	2	66	282
Clearnet - Total						0	0	0	0	0	0	5	95	308
Clearnet - MiKe						0	0	0	0	0	0	5	45	114
Clearnet - PCS						0	0	0	0	0	0	0	51	194
Subscriber Growth		308.1%	213.4%	92.1%	62.6%	47.3%	36.8%	31.8%	33.8%	43.8%	41.8%	32.7%	22.4%	19.8%
Net Additions (in Thousands)														
Rogers Cantel		15	41	54	69	81	80	114	114	220	256	320	183	186
Mobility Canada		16	46	63	82	100	115	136	190	330	453	502	456	495
BCE Mobility							54	66	92	171	206	246	177	254
Other Mobility Canada							61	70	98	159	247	256	279	241
Microcell							0	0	0	0	0	2	64	217
Clearnet - Total							0	0	0	0	0	5	90	213
Clearnet - MiKe							0	0	0	0	0	5	39	70
Clearnet - PCS							0	0	0	0	0	0	51	144
Total Net Additions		31	88	117	150	182	195	249	304	550	709	829	792	1,110
Growth in Net Additions			179.6%	33.2%	28.7%	20.9%	7.5%	27.7%	21.9%	81.1%	28.8%	17.1%	-4.5%	40.1%
Gross Additions (in Thousands)														
Rogers Cantel									218	372	478	564	468	552
Mobility Canada									302	464	649	793	770	924
BCE Mobility									156	245	311	379	330	473
Other Mobility Canada									147	219	338	414	440	451
Microcell									0	0	0	2	66	254
Clearnet - Total									0	0	0	5	96	257
Clearnet - MiKe									0	0	0	5	43	81
Clearnet - PCS									0	0	0	0	53	176
Total Gross Additions									520	835	1,127	1,365	1,401	1,987
Growth in Gross Additions										60.7%	34.8%	21.1%	2.6%	41.8%
Market Share of Gross Additions														
Rogers Cantel									41.9%	44.5%	42.4%	41.3%	33.4%	27.8%
Mobility Canada									58.1%	55.5%	57.6%	58.1%	55.0%	46.5%
BCE Mobility									30.0%	29.3%	27.6%	27.8%	23.6%	23.8%
Other Mobility Canada									28.2%	26.2%	30.0%	30.4%	31.4%	22.7%
Microcell									0.0%	0.0%	0.0%	0.1%	4.7%	12.8%
Clearnet - Total									0.0%	0.0%	0.0%	0.4%	6.9%	12.9%
Clearnet - MiKe									0.0%	0.0%	0.0%	0.4%	3.1%	4.1%
Clearnet - PCS									0.0%	0.0%	0.0%	0.0%	3.8%	8.8%
Market Share of Net Additions														
Rogers Cantel		47.8%	47.3%	46.4%	45.7%	44.8%	41.2%	45.6%	37.4%	40.1%	36.1%	38.6%	23.0%	16.7%
Mobility Canada		52.2%	52.7%	53.6%	54.3%	55.2%	58.8%	54.4%	62.6%	59.9%	63.9%	60.5%	57.6%	44.6%
BCE Mobility							27.7%	26.5%	30.3%	31.1%	29.1%	29.7%	22.3%	22.9%
Other Mobility Canada							31.2%	27.9%	32.3%	28.9%	34.9%	30.9%	35.2%	21.7%
Microcell							0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	8.0%	19.5%
Clearnet - Total							0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	11.4%	19.2%
Clearnet - MiKe							0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	5.0%	6.3%
Clearnet - PCS							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.4%	12.9%
Overall Market Share														
Rogers Cantel		48.0%	47.5%	47.0%	46.5%	46.0%	44.8%	45.0%	43.2%	42.3%	40.6%	40.1%	36.9%	32.7%
Mobility Canada		52.0%	52.5%	53.0%	53.5%	54.0%	55.2%	55.0%	56.8%	57.7%	59.4%	59.7%	59.3%	56.2%
Microcell						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	1.6%	5.3%
Clearnet - Total						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	2.3%	5.8%

E = Morgan Stanley Dean Witter Research Estimate

Table 10

U.S. Wireless Penetration Assumptions (1996E–2006E) Including the Impact of Analog Two-Way Radio Converts

(Figures are in thousands, except where noted)	1996E	1997E	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Total Wireless Market											
Market Population	266,487	268,922	271,342	274,056	276,796	279,564	282,360	285,183	288,035	290,916	293,825
Population Growth Rate	0.9%	0.9%	0.9%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Total Wireless Penetration	16.53%	20.57%	25.51%	30.73%	35.95%	40.70%	44.87%	48.05%	50.24%	51.93%	53.14%
Penetration Lift	3.73%	4.04%	4.94%	5.22%	5.23%	4.75%	4.17%	3.18%	2.19%	1.69%	1.20%
Total Wireless Subscribers	44,043	55,312	69,209	84,213	99,518	113,782	126,705	137,042	144,712	151,087	156,126
Total Wireless											
Wireless Subs (Excl. 2-way)	43,789	54,504	67,904	82,286	96,949	110,499	122,898	132,682	139,770	145,531	149,925
Plus: 2-way radio converts	254	808	1,305	1,927	2,570	3,283	3,807	4,360	4,942	5,556	6,201
Total Wireless Subscribers (1)	44,043	55,312	69,209	84,213	99,518	113,782	126,705	137,042	144,712	151,087	156,126
Total Wireless Penetration (1)	16.5%	20.6%	25.5%	30.7%	36.0%	40.7%	44.9%	48.1%	50.2%	51.9%	53.1%
Subscriber Summary											
Cellular Subscribers	43,554	51,666	59,497	67,421	74,230	78,668	80,973	80,959	80,760	80,781	80,794
PCS Subscribers	188	2,376	6,960	12,441	19,378	27,701	37,116	46,369	53,243	58,644	62,758
Total ESMR Subscribers	300	1,271	2,751	4,351	5,910	7,413	8,616	9,714	10,710	11,662	12,574
Total Wireless Subscribers	44,043	55,312	69,209	84,213	99,518	113,782	126,705	137,042	144,712	151,087	156,126
Penetration Summary											
Cellular	16.3%	19.2%	21.9%	24.6%	26.8%	28.1%	28.7%	28.4%	28.0%	27.8%	27.5%
PCS	0.1%	0.9%	2.6%	4.5%	7.0%	9.9%	13.1%	16.3%	18.5%	20.2%	21.4%
Total ESMR	0.1%	0.5%	1.0%	1.6%	2.1%	2.7%	3.1%	3.4%	3.7%	4.0%	4.3%
Total Wireless Penetration	16.5%	20.6%	25.5%	30.7%	36.0%	40.7%	44.9%	48.1%	50.2%	51.9%	53.1%
Market Share Summary											
Cellular	98.9%	93.4%	86.0%	80.1%	74.6%	69.1%	63.9%	59.1%	55.8%	53.5%	51.7%
PCS	0.4%	4.3%	10.1%	14.8%	19.5%	24.3%	29.3%	33.8%	36.8%	38.8%	40.2%
Total ESMR	0.7%	2.3%	4.0%	5.2%	5.9%	6.5%	6.8%	7.1%	7.4%	7.7%	8.1%

Note:
(1) assumes no overlap between 2-way radio and other wireless.
E = Morgan Stanley Dean Witter Research Estimates

Canadian Wireline: Controlled Transition to Competition

Overview

The wireline market in Canada mirrors the U.S. in several respects . . . In general, wireline growth in Canada has been driven by housing, GDP, and income growth, as in the U.S. Both countries have fully deregulated long distance markets and are transitioning to full competition in the local loop, with well-funded new entrants targeting the incumbents. Data services growth in Canada also mirrors the U.S., and is taking center stage in telecommunications. We project flat revenues for voice services in Canada over the next ten years but see data growing at a 13% CAGR over that time span.

. . . With some important differences. The number of major players in Canada is smaller, likely because the incumbents have never been shut out of the long distance market. National players include long distance companies Call-Net Enterprises (Sprint Canada) and AT&T Canada, which recently merged with MetroNet Communications. The two major incumbent local exchange carriers are Bell Canada, which serves the provinces of Ontario and Quebec and also owns a national fiber network, and TELUS (26%-owned by GTE), serving British Columbia and Alberta. Local service rates are artificially low, a legacy of a historical regulatory mandate.

Canadian regulators generally welcome competition. The federal Canadian Radio-Television and Telecommunications Commission (CRTC) has set the stage for a smooth transition to local service competition, clearly defining the terms for co-location and interconnection of network equipment, with costs to be shared by new entrants and incumbents. Given the small number of players and the incumbents' limited legal recourse (there is no regulation at the provincial level), we believe that shifts in market share will be relatively predictable, meaning less risk for capital investment by new entrants.

Foreign ownership restrictions are likely to ease sooner rather than later, creating an opportunity for investors with long time horizons. Most senior Canadian telecom managers acknowledge that relaxation of the limits on foreign investment in the country's telecommunications carriers is inevitable — within two to five years, according to the consensus. In our view, and to the consternation of telecom management, Canadian telecom carriers tend to command lower multiples than their U.S. counterparts in large part because they have less appeal as acquisitions. We believe the short end of the range is more likely since consolidation and the advent of competition in the local loop should result in streamlining, in turn limiting the potential political fallout from putting Canadian jobs at risk.

To be competitive, players in the Canadian wireline markets need a strong balance sheet and strength and depth of management. We believe that companies pursuing a facilities-based strategy will be well positioned since low-cost provider status is key in what has become a commodity business. Over time, sustainable growth should emerge as a source of competitive advantage, with strong brands the key in residential service and value-added in the business space. Due to these factors, we believe that over the near term, Bell Canada and AT&T/MetroNet will be the winners on the business side and Sprint Canada in residential.

Investment Themes

Balance sheet strength will be a requirement for players hoping to be around in ten years, in our view. It has become evident that even senior telecom managers can be surprised by the pace of change in the telecom world. Financing flexibility allows companies to react to short-term competitive pressures, accelerate capital expenditure budgets, or make opportunistic strategic acquisitions. In addition, this uncertain environment is not lost on investors, who seem to flee leveraged telecom stocks en masse at any sign of short-term trouble. One look at the volatility of Canadian wireless stocks supports this claim, in our view.

The strength and depth of the management team is also important. Rapid change also tends to place a premium on management's ability to stay ahead of the technology and customer demand curve. One example, we believe, is wireline provider MetroNet Communications. Although this

Table 1
Access Lines (Thousands): North America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Canada	16,572	17,099	17,633	18,159	18,815	19,438	20,092	20,793	21,516	22,292	23,100	23,954	24,794	25,649
Growth		*3.2%*	*3.1%*	*3.0%*	*3.6%*	*3.3%*	*3.4%*	*3.5%*	*3.5%*	*3.6%*	*3.6%*	*3.7%*	*3.5%*	*3.5%*
US	142,809	148,479	152,601	158,672	164,144	169,805	175,661	181,719	187,986	194,469	201,175	208,113	215,290	222,715
Growth		*4.0%*	*2.8%*	*4.0%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*	*3.4%*

Source: Federal Communications Commission and Morgan Stanley Dean Witter Equity Reseach

Table 2
Wireline Penetration: North America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Canada	57.7%	58.9%	60.1%	61.2%	62.7%	64.2%	65.5%	67.0%	68.5%	70.1%	71.8%	73.6%	75.3%	76.9%
Growth		*2.1%*	*2.0%*	*1.9%*	*2.5%*	*2.3%*	*2.1%*	*2.3%*	*2.2%*	*2.4%*	*2.4%*	*2.5%*	*2.3%*	*2.2%*
US	55.5%	57.2%	58.2%	59.9%	61.3%	62.8%	64.3%	65.9%	67.5%	69.1%	70.8%	72.5%	74.3%	76.1%
Growth		*2.9%*	*1.7%*	*2.9%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*	*2.4%*

Source: Federal Communications Commission and Morgan Stanley Dean Witter Equity Reseach

company is more highly leveraged than the incumbent telcos and is just starting to ramp up revenues, we believe it has been able to raise capital largely on the strength of its management team. Specifically, MetroNet's management team has extensive ties to the founders and previous senior executives of Brooks Fiber Properties, which was consolidated by WorldCom.

Companies pursuing a facilities-based strategy will be particularly well positioned, we believe. Telecom is now a commodity business. In essence, we believe low-cost provision is now table stakes to be in the game. By owning the network, carriers can fix a large portion of their carrier costs. This adds operating leverage, and, in our view, is most evident when the carrier reaches critical mass. In addition, by owning the network, carriers move expenses below the EBITDA line, from lease expense into depreciation. Though investors are supposed to see through accounting issues, evidence suggests that stronger EBITDA margins tend to command investor applause. Finally, given our view that foreign ownership restrictions will be eased in the short term, we believe it makes sense for Canadian telcos to own network facilities in a market that will likely see further consolidation.

If we look past the short term, the competitive advantage of service providers should shift from low cost provision to sustainable revenue growth. We believe that strong branding will be important in the residential space, where bundling products will become the norm. Alternatively, we believe value added service will determine success in the business space. These issues should become more important as market shares begin to stabilize and companies focus more on lowering churn than growing share. We believe that investors should look for companies that demonstrate strength in marketing for long-term sustainable growth.

To be competitive, players in the Canadian wireline markets need a strong balance sheet and strength and depth of management. We believe that companies pursuing a facilities-based strategy will be well positioned since low-cost provider status is key in what has become a commodity business. Over time, sustainable growth should emerge as a source of competitive advantage, with strong brands the key in residential service and value-added in the business space. Due to these factors, we believe that over the near term, Bell Canada and AT&T/MetroNet will be the winners on the business side and Sprint Canada in residential.

We believe Bell Canada and AT&T/MetroNet in the business space and Sprint Canada in the residential space are best positioned to win in the short term. These companies have a facilities-based strategy, strong brands, and sustainable growth that should lead to a competitive advantage.

Market Growth

With few exceptions, we believe wireline growth in Canada has traditionally been driven by the same factors as the U.S.: housing, GDP, and income growth. This is not surprising, given that roughly 80% of Canada's trade is with the U.S. More importantly, data services growth is also mirroring that of the U.S., and should command the major-

ity of attention going forward. Where we expect voice service revenue growth to be relatively flat over the next ten years, data revenue should grow at a 13% rate over the same period.

The Canadian regulatory environment has encouraged facilities-based competition. Subsequently, a number of well-funded competitive carriers have built both local and long haul networks, greatly expanding the available bandwidth in the process. For example, Bell Canada, AT&T/MetroNet, and Sprint Canada all have trans-Canadian OC192 (Big Pipes!) fiber networks This excess capacity should depress unit costs and encourage traffic growth in the future.

Competitive Environment

Again, the competitive environment for telecom in Canada is similar to that in the U.S. Both have fully deregulated long distance markets and are currently experiencing the transition to full competition in local services. Both also have well-funded new entrant competitors already targeting the incumbent's markets. However, there are also a few exceptions.

There are relatively few major players in Canada, probably because the incumbents have never been precluded from serving the long distance market. National players include long distance companies Call-Net Enterprises (Sprint Canada) and AT&T Canada, which has recently merged with MetroNet Communications. Both Call-Net and AT&T Canada have plans to enter the local services market. There are two major ILECs: Bell Canada (owned by BCE Inc.), which serves the provinces of Ontario and Quebec and also owns a national fiber network, and TELUS, the result of a merger between BCTel and Telus, which serves the provinces of British Columbia and Alberta.

Local competition in Canada should roll out in a more orderly fashion than in the U.S., as Canadian carriers are regulated only at the federal level. As a result, we anticipate that much less of the Canadian telecom war will be fought in the courts. We expect the ILECs to collectively lose 20% market share in local services over a five-year period.

Another distinguishing feature is that Canadian local service rates are artificially low going into competition (about C$25 per month in major cities and lower in rural areas). This is the result of a historical regulatory mandate. Therefore, there is not much room for price competition, at least in residential services. Local service rates in Canada are also flat, meaning no per-minute charges. We believe that Canada's low residential wireline rates have constrained cannibalization and are the major reason that Canadian wireless penetration lags that of other developed countries.

Trends and Developments

Competitive carrier entrance. As there are fewer new entrants in Canada, it is easier for each player to assess the field. However, most players are well financed and have reached critical mass. In our view, the four top players all have staying power, leading us to believe that the Canadian market should be no less competitive than any other region.

Technology. In our opinion, technology is driving every major issue in telecom today, from network deployment (both local and long haul) to deregulation. Advances in technology make new entrant penetration possible by lowering the barriers to entry. A good example is long distance, where pricing is dropping like a stone due to low-cost network capacity, with help from advances in capacity-expanding technology like wave division multiplexing and improvements in router intelligence and processing speed. We believe these trends make it inevitable that traffic eventually will be charged on the basis of bits, not minutes (voice over IP).

Deregulation. Finally, deregulation in Canada is progressing on many fronts. One of particular importance to investors is the inevitable easing of foreign ownership restrictions. Non-Canadian companies are currently precluded from owning more than 33-1/3% of an operating company and 20% of a holding company (for a total maximum effective ownership of 46.7% of an operating company). These restrictions apply to facilities-based telecom companies. Canada is currently one of a very few industrialized countries that has not yet agreed to allow foreigners to exceed the 50% threshold, but we believe that this restriction will be eased in 2–3 years. We therefore believe that investors need to include an estimate of Canadian telcos' potential acquisition value, in addition to their other qualities, when considering an investment.

Latin American Wireline: Accelerating Penetration from a Low Base

Overview

Wireline penetration in Latin America remains very low . . . In the six largest economies (Brazil, Mexico, Argentina, Chile, Peru, and Venezuela), it averages only 11%. The lack of investment in the sector over the years is to blame for low penetration rates — a legacy of monopolies controlled by cash-strapped governments. Pent-up demand in the region is high: Brazil's waiting list is 10 million lines long.

. . . But growth is accelerating as privatization attracts capital to the region. Line growth is expected to average some 5–10% per year even in the more mature economies of Mexico, Chile, Peru, Venezuela, and Argentina, while Brazil should enjoy average growth in the 15–25% range, despite the economic crisis. Moreover, the Internet now accounts for as much as 30% of new fixed line demand in Mexico, Chile, and Argentina.

Although telecom competition is on the increase in Latin America, wireline incumbents still have a significant edge. Local service competition is still limited in the region, but Chile's and Mexico's markets are open to new competitors, and the first new entrants in Brazil are in the start-up phase. Only in Chile and Mexico are long distance markets totally open to competition, though Argentina, Brazil, and Peru should open their markets this year, and Venezuela next year. Within three years, we expect that all segments in all major countries in the region should be open to competition. That said, high barriers to entry (particularly access to capital), the incumbent telco's inherent advantage, and the absence (for now) of economically competitive technologies should provide the incumbents some running room.

Deregulation in Latin America has opened the door to consolidation as well. The long distance market in Chile is consolidating, and we expect other liberalized markets to follow suit. We anticipate significant consolidation in the Brazilian cellular sector after the year 2001 as companies seek to gain greater economies of scale and to offer uniform service over a large zone of operations.

Companies with access to capital and strong, shareholder-friendly management enjoy an edge, in our view. With the economic downturn in the region, capital has become scarcer, or at least more expensive. Companies with strong balance sheets (generally the incumbents) clearly have an advantage over new entrants. Competent managers who promote transparency and look after minority shareholder interests can also make a critical difference, in our view. In our opinion, Telesp Par, Telmex, and Embratel are among the Latin American companies best positioned to prosper over the next several years.

Investment Themes

Telecom industry deregulation in Latin America has opened the door to consolidation as well as competition. The long distance market in Chile is consolidating, and we expect other liberalized markets to follow suit. We anticipate significant consolidation in the Brazilian cellular sector after the year 2001 as companies seek to gain greater economies of scale and to offer uniform service over a larger area of operations.

Structural changes should have a very positive economic impact in the future. The economic crisis that the region is going through today will not reverse the significant progress that has been achieved over the past few years, in our view. All telecom companies in Latin America are private, regulations have improved, markets continue to open, and both fixed line and cellular penetration has risen significantly across our universe. We believe the long-term prospects are positive.

Access to capital is key in Latin America. With the economic downturn in the region, capital has become scarcer, or at least a more expensive resource for telecom development. This tends to favor incumbents and hurt new entrants that most often must seek external financing, as it has in the Mexican market. Many wireless new entrants who participated in Mexico's spectrum auction process in May 1998 have since found it difficult to finance their projects, to the benefit of Telmex and Iusacell.

Table 1
Access Lines (Thousands): Latin America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Argentina	4,123	4,887	5,622	6,227	6,852	7,328	7,841	8,468	9,148	9,837	10,578	11,319	12,111	12,959
Growth		*18.5%*	*15.1%*	*10.7%*	*10.0%*	*6.9%*	*7.0%*	*8.0%*	*8.0%*	*7.5%*	*7.5%*	*7.0%*	*7.0%*	*7.0%*
Brazil	11,040	11,666	12,643	14,156	16,010	17,797	22,176	26,012	29,860	33,638	36,715	39,624	42,305	45,154
Growth		*5.7%*	*8.4%*	*12.0%*	*13.1%*	*11.2%*	*24.6%*	*17.3%*	*14.8%*	*12.7%*	*9.1%*	*7.9%*	*6.8%*	*6.7%*
Chile	1,513	1,626	1,846	2,211	2,630	2,977	3,192	3,551	3,952	4,358	4,707	5,036	5,389	5,766
Growth		*7.5%*	*13.5%*	*19.8%*	*19.0%*	*13.2%*	*7.2%*	*11.3%*	*11.3%*	*10.3%*	*8.0%*	*7.0%*	*7.0%*	*7.0%*
Mexico	7,621	8,493	8,801	8,826	9,254	9,901	10,962	12,181	13,539	15,019	16,677	18,528	20,578	22,828
Growth		*11.4%*	*3.6%*	*0.3%*	*4.8%*	*7.0%*	*10.7%*	*11.1%*	*11.1%*	*10.9%*	*11.0%*	*11.1%*	*11.1%*	*10.9%*
Peru	673	772	1,088	1,404	1,608	1,720	1,823	1,969	2,127	2,297	2,481	2,679	2,893	3,125
Growth		*14.8%*	*40.9%*	*29.0%*	*14.5%*	*7.0%*	*6.0%*	*8.0%*	*8.0%*	*8.0%*	*8.0%*	*8.0%*	*8.0%*	*8.0%*
Venezuela	2,083	2,334	2,387	2,495	2,703	2,703	2,784	2,951	3,128	3,315	3,514	3,725	3,949	4,186
Growth		*12.1%*	*2.3%*	*4.5%*	*8.3%*	*0.0%*	*3.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*

E = Morgan Stanley Dean Witter Equity Research Estimates

Strong, shareholder-friendly management teams can add significant value. Competent management that promotes transparency and is concerned about minority shareholder interests can be a critical differentiating factor, in our view.

Based on these criteria, Telesp Par, Telmex, and Embratel are among the companies best positioned to thrive over the next several years, in our opinion.

Market Growth

Significant pent-up demand for new lines exists in Latin America. The average wireline penetration rate in Latin America is still very low, averaging only some 11% in the six largest economies (Brazil, Mexico, Argentina, Chile, Peru, and Venezuela). In some countries, consumers still have to wait years to get telephones, and the waiting list in Brazil is estimated at some 10 million lines.

The low penetration rate is partially explained by the lack of investment in the sector over the years. Until the early 1990s, the region's governments controlled most of the telephone companies, and they could not afford the heavy investment needed to develop the telecom infrastructure. Only recently has privatization brought new capital and an acceleration in growth. Even in more "mature" Latin American countries, line growth is still expected to average some 5–10% per year over the next five years. Telmex, CTC, Telefónica del Peru, CANTV, and the Argentine carriers, Telefonica de Argentina and Telecom Argentina, are expected to deliver growth within that range. For Brazil, average growth over this five-year time span should be in the 15–25% range, despite the economic crisis.

Competition should help the market grow. Latin American countries are now liberalizing their local telephone service. Upcoming competition should help boost growth as the supply of lines increases and installation fees decline. Chile and Mexico have already opened their markets to local competition, while limited local competition starts this year in Brazil and Argentina. Installation prices have declined substantially, but there is still a long way to go. This decline should help line growth as users in the region tend to be very sensitive to installation fees. Competition also helps to increase overall market growth as expenditures in marketing go up.

Telecommunications is strategic for most countries in the region. Good telecommunications infrastructure helps countries attract foreign investment to other sectors of the economy, providing local governments with an incentive to develop a strong telecom sector. In our view, investments in the service sector of the economy are particularly dependent on telecommunications. Data and the Internet service will also be key areas for development and should be high-growth sectors. The Internet has already taken off in countries like Mexico, Argentina, and Chile and accounts for as much as 30% of new fixed line demand in those countries.

Governments have primarily used rate rebalancing and market liberalization to encourage telecommunications development in Latin America. This approach has been embraced basically in every country in the region. With rate rebalancing, countries have ended cross-subsidization of local service and made local service a profitable business on

Table 2
Wireline Penetration: Latin America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Argentina	12.7%	14.8%	16.9%	18.6%	20.3%	21.5%	22.7%	24.1%	25.5%	27.0%	28.6%	30.3%	32.1%	34.1%
Growth		*17.1%*	*14.2%*	*10.0%*	*9.1%*	*5.6%*	*5.9%*	*5.9%*	*5.9%*	*5.9%*	*5.9%*	*5.9%*	*5.9%*	*5.9%*
Brazil	9.1%	9.4%	10.0%	11.0%	12.1%	13.3%	16.4%	19.1%	21.7%	24.2%	26.1%	27.8%	29.3%	30.9%
Growth		*4.2%*	*5.7%*	*10.6%*	*9.7%*	*9.7%*	*23.0%*	*16.6%*	*13.9%*	*11.5%*	*7.7%*	*6.5%*	*5.4%*	*5.3%*
Chile	11.0%	11.6%	13.0%	15.3%	17.9%	20.0%	21.2%	23.2%	25.5%	27.8%	29.5%	31.1%	32.8%	34.6%
Growth		*5.9%*	*11.8%*	*18.0%*	*17.3%*	*11.6%*	*5.7%*	*9.7%*	*9.8%*	*8.8%*	*6.4%*	*5.4%*	*5.4%*	*5.4%*
Mexico	8.7%	9.5%	9.6%	9.5%	9.8%	10.3%	11.2%	12.2%	13.4%	14.6%	16.0%	17.5%	19.1%	20.9%
Growth		*9.3%*	*1.6%*	*-1.7%*	*2.9%*	*5.1%*	*8.9%*	*9.4%*	*9.5%*	*9.3%*	*9.4%*	*9.5%*	*9.4%*	*9.3%*
Peru	3.0%	3.4%	4.6%	5.9%	6.7%	7.0%	7.3%	7.7%	8.2%	8.7%	9.2%	9.8%	10.4%	11.1%
Growth		*12.5%*	*38.1%*	*26.5%*	*14.4%*	*4.9%*	*3.9%*	*5.9%*	*6.1%*	*6.1%*	*6.2%*	*6.2%*	*6.3%*	*6.4%*
Venezuela	10.1%	11.0%	10.9%	11.1%	11.8%	11.6%	11.7%	12.2%	12.7%	13.2%	13.8%	14.3%	14.9%	15.6%
Growth		*9.6%*	*-1.1%*	*2.2%*	*6.2%*	*-2.0%*	*1.1%*	*4.1%*	*4.1%*	*4.1%*	*4.1%*	*4.1%*	*4.1%*	*4.1%*

E = Morgan Stanley Dean Witter Equity Research Estimates

a stand-alone basis. In doing so, incumbents have been impelled to continue investing in the sector and local competition has become viable.

Competitive Environment

The level of competition is increasing in the region. Latin American wireline markets are moving away from the de facto monopolies that existed until the mid-1990s. Within the next three years, we expect every major country in the region to open all of its telecom segments — local and long distance, wireless, and data — to competition. Competition already exists in the cellular segment in Latin American countries, and spectrum auctions continue. In long distance, only markets in Chile and Mexico are totally open to competition, but Argentina, Brazil, and Peru should open their markets this year and Venezuela, in 2000.

Local service competition is very limited in Latin America, but Chile's and Mexico's markets are open to new entrants. In Brazil, the first new entrants are in the start-up phase, and in other countries, competition should begin later this year or in 2000.

Incumbents still enjoy an edge and should continue to dominate fixed telephony. The industry's high barriers to entry (particularly economic barriers), the inherent competitive advantage of incumbents over new entrants, and the absence of a definitive, viable alternative technology — whether wireless local loop or cable telephony — should help to protect incumbents from competition for now. Despite increasing competitive pressures, incumbents still dominate fixed telephony in Latin America. In Chile and Mexico (the most open countries in the region), CTC and Telmex rule the market. As noted, one of the main reasons for the incumbents' dominance is the high cost of capital.

Regulations have improved. Rate rebalancing has occurred in many countries, but long distance rates are still higher than normal in countries that don't have many players in the telecom segment. Prices for local services are currently low, in global terms. Most Latin American countries now have tariff adjustments — price-cap formulas that link telecom rates to inflation. Settlement rates are still high but declining quickly. All countries should be below $0.19 per minute by the year 2000, versus an average of some $0.35 today. Access charges continue to be brought down to more reasonable levels in the region. Today, the average access charge is around $0.02–0.025 per minute.

Trends and Developments

Coping with weaker economies during 1999 should be a significant issue for telecom service providers in Latin America. The economic slowdown in the region should pose a significant challenge to wireline incumbents. On the positive side, most of the region's operators have carried out aggressive house cleaning efforts during 1998. Nonpaying customers have been disconnected, and companies have taken charges for uncollectibles, efforts that should pave the way for healthier, albeit still modest growth in 1999.

We expect mid-single-digit fixed line growth in Mexico, Argentina, Chile, Venezuela, and Peru in 1999. Despite an expected contraction in GDP in 1999, we believe Brazilian operators should still be able to achieve 15–25% fixed line growth this year, thanks to significant pent-up demand and mandatory build-out requirements.

Managing collectibles is key for telecom providers. We believe tighter collection policies are in order, too, dictated by the difficult economic environment. Many operators in the region have adjusted their collection policies in accordance with the new economic realities. They are now rating customers based on default risk measures and better tailoring products to customers' ability to pay. Telefónica del Peru and others are also provisioning more to help reflect a more accurate financial reality on a recurring basis.

We expect to see increased competition in all sectors. Market liberalization and deregulation have opened the door to competition in Latin America, and are on the rise in most telecom segments. Competition exists in Chile and Mexico and should get off the ground in Brazil, Peru, and Argentina later this year.

Wireline incumbents are most vulnerable to international long distance competition since barriers to entry are relatively low. Long distance service is also becoming increasingly commoditized, with price as the main differentiating factor among providers. Incumbents should be relatively insulated from local competition in residential service, although CLEC- and CAP-type operators could pose a challenge in the more profitable business segment.

More efficiency lies ahead, we believe. We expect Latin American operators to achieve gains in efficiency over the next several years. We project that lines in service per employee should rise to more than 400 by the year 2001, from an average of about 275 today and around 175 in 1995.

An improving regulatory climate should continue to benefit the overall earnings visibility of the Latin telecom providers. With privatization, deregulation, and market liberalization, the rules and regulations governing telecommunications in Latin America have become much more transparent over the past several years. The biggest recent step toward transparency was the establishment of an independent regulatory body in Brazil, and regulatory clarity has also improved in Mexico over the past year, especially regarding tariffs. New guidelines for tariff adjustments in Mexico over the next four years were introduced in March 1999. Under the new scheme, tariffs will be adjusted according to a price-cap formula, which should mean that Telmex will be allowed to raise its prices in line with inflation, minus a productivity factor of 4.5%. Nevertheless, more progress is needed in Mexico, in our view. We've seen new and transparent regulatory schemes emerge in Argentina and Peru to address telecom market liberalization.

The data boom is coming to the region. With Internet rollout and increasing demand for bandwidth, the data market is growing very rapidly in Latin America. Data represents some 5% of Telmex's total revenues today and probably a similar level for other integrated incumbents. Telmex's data revenues are growing at a pace of over 25% annually, however, and we estimate a similar rate of growth for other operators.

Latin American Wireless: Low Penetration and Pent-Up Demand

Overview

Wireless penetration levels remain relatively low in Latin America, compared with the rest of the world, averaging roughly 6% in the countries we follow. We expect average penetration levels to rise above 15% over the next three years as existing operators invest aggressively, alternate providers enter the field, and pricing comes down. In Brazil, we see pent-up demand as a catalyst for annual growth rates of over 30% for the next several years, though in most other countries of the region, customers with adequate resources have relatively easy access to service. Nevertheless, with wireless calling rates in Latin America still at ten times the level of local rates or more, significant substitution for wireline appears unlikely in the near term.

Competitive pressures are increasing in Latin wireless markets. Further spectrum auctions should fuel wireless competition in Latin America and put an end to the duopoly structures in most countries. New entrants could spur price cuts and more aggressive build-out efforts by incumbents, who can no longer count on keeping a large piece of the pie. In 1998, new competitors got off the ground in Brazil and Chile (where the market doubled as prices fell 40%). We expect PCS service to be launched in Mexico toward the end of 1999, and the introduction of prepaid service in Brazil has proven a big catalyst for subscriber growth. The implementation of calling-party-pays in Mexico and Chile should also drive growth in those markets**.**

Balancing growth against profitability will be critical over the long haul, in our view. Scale is important in wireless, however, and sometimes market share gains must take precedence over margins in the short term, as we've seen in Mexico and Chile in the face of competitive threats from new entrants. As competition increases, operators may be forced to provide increasingly attractive incentives to lure subscribers away from rivals, with more sustained pressure on margins.

We believe that wireless consolidation represents an opportunity for broader coverage that will likely lead to greater competitiveness and higher growth. This is especially true in Brazil, with a highly fragmented cellular market. The restrictions on combining the eight cellular holding companies in Brazil expire in 2002, and we will likely see mergers or acquisitions of some cellular companies at that time. Our top wireless picks in the region are Telesp Celular, Iusacell, and Tele Sudeste Celular, as all three operate in areas with high pent-up demand and higher-than-average GDP per capita.

Investment Themes

Balancing growth and profitability will be an important factor to monitor. We believe that the operators' success is dependent on their ability to strike a balance between achieving penetration gains and maintaining profitability levels over the longer term. However, sometimes profit-

Table 1
Wireless Subscribers (Thousands): Latin America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Argentina	132	190	362	1,221	1,785	2,231	2,566	2,823	3,048	3,231	3,425	3,631	3,849	4,080
Growth		*44.4%*	*90.5%*	*237.2%*	*46.2%*	*25.0%*	*15.0%*	*10.0%*	*8.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*	*6.0%*
Brazil	NA	NA	NA	NA	4,102	5,418	7,795	9,868	12,012	14,128	15,764	17,252	18,680	19,866
Growth		*NA*	*NA*	*NA*	*NA*	*32.1%*	*43.9%*	*26.6%*	*21.7%*	*17.6%*	*11.6%*	*9.4%*	*8.3%*	*6.3%*
Chile	NA	NA	NA	306	408	960	1,336	1,719	2,172	2,605	3,048	3,536	4,066	4,676
Growth		*NA*	*NA*	*NA*	*33.1%*	*135.6%*	*39.2%*	*28.7%*	*26.3%*	*19.9%*	*17.0%*	*16.0%*	*15.0%*	*15.0%*
Mexico	NA	676	797	1,015	1,713	2,925	4,055	5,495	7,253	9,369	11,556	13,679	15,512	17,208
Growth		*NA*	*17.9%*	*27.3%*	*68.8%*	*70.8%*	*38.7%*	*35.5%*	*32.0%*	*29.2%*	*23.3%*	*18.4%*	*13.4%*	*10.9%*
Peru	NA	NA	NA	NA	430	661	922	1,240	1,518	1,817	2,121	2,397	2,701	3,045
Growth		*NA*	*NA*	*NA*	*NA*	*53.8%*	*39.4%*	*34.5%*	*22.4%*	*19.7%*	*16.7%*	*13.0%*	*12.7%*	*12.7%*
Venezuela	NA	NA	170	214	780	1,306	1,732	2,115	2,541	3,036	3,504	4,029	4,523	5,077
Growth		*NA*	*NA*	*25.9%*	*264.9%*	*67.6%*	*32.6%*	*22.1%*	*20.1%*	*19.5%*	*15.4%*	*15.0%*	*12.2%*	*12.3%*

E = Morgan Stanley Dean Witter Equity Research Estimates

Table 2
Wireless Penetration: Latin America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Argentina	NA	NA	NA	NA	7.6%	11.9%	15.3%	20.4%	24.7%	27.1%	29.0%	30.9%	32.4%	34.0%
Growth		*NA*	*NA*	*NA*	*NA*	*57.2%*	*28.8%*	*33.7%*	*20.9%*	*9.8%*	*6.9%*	*6.5%*	*5.0%*	*5.0%*
Brazil	NA	NA	NA	1.8%	2.9%	5.3%	8.3%	11.1%	13.5%	15.6%	17.4%	20.4%	21.4%	22.5%
Growth		*NA*	*NA*	*NA*	*66.9%*	*78.7%*	*57.5%*	*33.4%*	*21.7%*	*16.1%*	*11.3%*	*17.0%*	*5.2%*	*5.1%*
Chile	NA	NA	NA	2.1%	2.8%	6.5%	8.9%	11.3%	14.0%	16.6%	19.1%	21.9%	24.8%	28.1%
Growth		*NA*	*NA*	*NA*	*31.2%*	*132.3%*	*37.3%*	*26.9%*	*24.6%*	*18.3%*	*15.3%*	*14.3%*	*13.3%*	*13.3%*
Mexico	NA	NA	NA	NA	1.8%	3.0%	4.1%	5.5%	7.2%	9.1%	11.1%	12.9%	14.4%	15.8%
Growth		*NA*	*NA*	*NA*	*NA*	*67.7%*	*36.3%*	*33.4%*	*30.0%*	*27.3%*	*21.5%*	*16.6%*	*11.7%*	*9.3%*
Peru	NA	NA	NA	0.8%	1.8%	2.7%	3.7%	4.9%	5.9%	6.9%	7.9%	8.8%	9.7%	10.8%
Growth		*NA*	*NA*	*NA*	*134.7%*	*50.8%*	*36.7%*	*31.9%*	*20.3%*	*17.7%*	*14.8%*	*11.2%*	*10.9%*	*11.0%*
Venezuela	NA	NA	0.8%	1.0%	3.4%	5.6%	7.3%	8.7%	10.3%	12.1%	13.7%	15.5%	17.1%	18.9%
Growth		*NA*	*NA*	*23.0%*	*257.8%*	*64.3%*	*30.1%*	*19.9%*	*18.0%*	*17.4%*	*13.4%*	*13.0%*	*10.3%*	*10.3%*

E = Morgan Stanley Dean Witter Equity Research Estimates

ability must take a back seat to short-term market share issues, as economies of scale do matter in the cellular business. In Mexico and Chile, for instance, we've seen operators sacrifice near-term profitability at one point or another in an effort to drive up penetration rapidly as new entrants have rolled out service. Here, beating the competition to the punch has made sense, in our view.

Competition could drive acquisition costs to high levels. We believe that investors need to monitor acquisition cost trends. As competition increases, operators may need to offer customers ever better incentives to lure them away from rivals. As it is, handset subsidization has shot up over the past several years in Latin America. Higher costs could dampen margins even before lower ARPUs do.

Wireline substitution could be the ultimate success for wireless companies. Could subscribers one day trade in their wireline equipment for cellular phones? Are we already seeing a transfer of minutes from the landline network to the wireless network? Wireless calling rates in Latin America still typically are at least ten times local wireline rates, so any significant substitution seems unlikely in the near term. But even in Latin America, where GDP per capita averages under US$10,000, wireless telephony seems to pose a real challenge to landline service for capturing both user and traffic growth. In the case of both Chile and Mexico, for example, cellular subscriber growth has remained robust while fixed line growth and local traffic have decelerated significantly as these economies have slowed. CANTV of Venezuela has also shown resilient wireless growth, while fixed line growth has softened dramatically.

Consolidation appears to be unavoidable. Consolidation in the wireless world, in our view, represents an opportunity for broader coverage that will likely mean greater competitiveness and better growth potential. This applies particularly to Brazil, which has a fragmented cellular market today. After 2002, when the restrictions on combining the eight cellular holding companies in Brazil expire, we expect to see mergers or acquisitions among the cellular providers.

Our top wireless picks in the region are Telesp Celular, Iusacell, and Tele Sudeste Celular, which we view as the best positioned to thrive in the coming years. The three companies operate in areas that have high pent-up demand and higher-than-average GDP per capita.

Market Growth

Low penetration and pent-up demand should drive growth in the cellular market. Penetration levels remain relatively low in Latin America by world standards, averaging some 6% in the countries we follow. Average penetration levels should rise to upward of 15% over the next three years. We believe this will occur as existing operators continue to invest aggressively in the sector, alternative providers enter the playing field, and pricing falls (enabling lower-income segments of the population to access service).

There is still significant pent-up demand in Brazil, which should serve as a catalyst for annual growth rates of over 30% for the next several years. Pent-up demand is more modest in most other Latin American countries, where customers with adequate resources have relatively easy access to service.

Table 3
Wireless Average Revenue Per user ($ US): Latin America

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Argentina	NA	NA	NA	$111.6	$84.4	$79.4	$69.8	$61.3	$55.3	$49.9	$45.1	$42.8	$40.7	$38.6
Growth		*NA*	*NA*	*NA*	*-24.4%*	*-6.0%*	*-12.1%*	*-12.1%*	*-9.8%*	*-9.8%*	*-9.8%*	*-5.0%*	*-5.0%*	*-5.0%*
Brazil	NA	NA	NA	$100.0	$85.8	$75.1	$63.5	$56.3	$52.1	$49.3	$47.2	$44.3	$43.4	$42.5
Growth		*NA*	*NA*	*NA*	*-14.2%*	*-12.4%*	*-15.5%*	*-11.4%*	*-7.4%*	*-5.3%*	*-4.5%*	*-6.0%*	*-2.2%*	*-2.0%*
Chile	NA	NA	NA	$77.8	$59.5	$34.2	$24.9	$23.2	$21.7	$21.2	$20.9	$20.7	$20.4	$20.3
Growth		*NA*	*NA*	*NA*	*NA*	*-42.5%*	*-27.1%*	*-6.9%*	*-6.5%*	*-2.1%*	*-1.4%*	*-1.3%*	*-1.0%*	*-0.8%*
Mexico	NA	NA	NA	$88.4	$60.7	$44.3	$37.8	$31.0	$27.7	$26.0	$24.9	$24.2	$23.7	$23.5
Growth		*NA*	*NA*	*NA*	*NA*	*-27.0%*	*-14.6%*	*-18.1%*	*-10.6%*	*-6.0%*	*-4.4%*	*-2.7%*	*-2.1%*	*-1.1%*
Peru	NA	NA	$119.8	$122.0	$88.5	$50.5	$41.1	$35.2	$30.8	$27.5	$25.9	$24.6	$23.6	$22.9
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*-14.3%*	*-12.5%*	*-10.7%*	*-6.0%*	*-5.0%*	*-4.0%*	*-3.0%*
Venezuela	NA	NA	NA	NA	$75.2	$62.9	$47.1	$46.0	$47.7	$45.9	$44.1	$42.4	$40.6	$39.0
Growth		*NA*	*NA*	*NA*	*NA*	*-16.4%*	*-25.1%*	*-2.5%*	*3.9%*	*-3.8%*	*-3.9%*	*-4.0%*	*-4.1%*	*-4.1%*

E = Morgan Stanley Dean Witter Equity Research Estimates

New concessions are likely to increase competition and drive prices down. New spectrum auctions are opening the door to increased wireless competition in Latin America and putting an end to the duopoly structures that have reigned over the past two to three years in most countries. Wireless competition could spur price cuts and more aggressive build-out efforts by incumbents that can no longer count on maintaining a large piece of the pie.

In 1998, new competition got off the ground in Chile and Brazil, and PCS operators should launch service in Mexico toward the end of 1999. In Chile, pricing was off by more than 40% in 1998, and the market more than doubled in size. High wireless churn rates should make for fairly easy market share gains by new entrants. Low customer fidelity in the wireless segment means that there is a steady supply of potential users.

The introduction of prepaid services in Brazil should drive growth there. The launch of prepaid service in Brazil has proven a big catalyst for subscriber growth. The absence of credit quality issues enables operators to target a much broader cross-section of the market, and consumers must sacrifice little if anything in terms of convenience and quality. Prepaid service is nascent in Brazil and is offered only in parts of the northeastern region, but it should be pervasive by year-end 1999.

The implementation of calling-party-pays in Mexico and Chile should also drive growth in those markets. Calling-party-pays is likely to be implemented in Mexico and Chile in 1Q99, helping to boost both penetration levels and per subscriber minutes of use levels in these markets. Calling-party-pays increases the attractiveness of cellular service to consumers by significantly decreasing its cost to the user, since inbound calls are no longer paid for. We expect per-subscriber minutes of use to advance 15–20% in both markets upon its implementation.

Competitive Environment

The market is beginning to move away from duopolies. In most Latin American countries, mobile markets have traditionally operated under a duopoly framework, with two cellular companies per region. This has begun to change over the past 12 months with the rollout of PCS service in certain markets, raising the number of operators competing in one zone to 3–5.

In Mexico, we anticipate a ramp-up of competition in the coming months with the recent debut of PCS operators in the market. Pegaso PCS, which is controlled by Leap Wireless (formerly a part of Qualcomm), was recently spun off and is the most prominent new entrant to the cellular market. We believe that Telmex and Iusacell are vulnerable to new competition, since prices may come under further pressure in an environment already characterized by low ARPUs.

Brazil is in the first phase of a two-phase competitive rollout. Each of the eight privatized band-A cellular firms is now facing competition from one new entrant, and there has been some pricing pressure in parts of Brazil. This duopoly phase should last until December 31, 1999, after which the government will likely sell new concessions for mobile service in the 1,900 MHz band, which is reserved for PCS operators.

PCS operators are up and running in Chile, where price competition has already been fairly stiff. PCS auctions are likely to take place in Argentina later this year, and the auction process for a third cellular license appears to be on the way in Venezuela.

Competition and prepaid service are driving ARPUs down. The rollout of prepaid service and increasing competition are taking a toll on ARPU levels, which were down an average of about 25% in 1998 from 1997. CTC and Telmex's ARPU declines were at the high end of the range, declining 43% and 28%, respectively. Prepaid customers tend to generate as much as 50% less traffic than contract customers. In the case of CANTV, for example, average monthly minutes of use for contract customers amounted to 179 in 1998 versus 113 for prepaid

The handset market: defining some battles. The greater availability of TDMA (time division multiple access) handsets and their lower cost has given new entrant BCP in São Paulo an advantage over incumbent Telesp Cellular, which uses CDMA technology. BCP achieved a 45% market share in six months, as Telesp was not able to grow due to the lack of handset supply.

Longer term, consolidation should intensify. Consolidation in the cellular market should occur over the medium to long term, as national coverage could become a defining competitive advantage. We expect this to occur in Brazil, where the market is highly fragmented today. Cellular operators will be able to merge in Brazil after the year 2002, potentially reducing the number of operators from 20 to five, we believe, in just three years. In Argentina, PCS auctions should enable the two strongest players, TAR and TEO, to gain nationwide footprints. Telmex of Mexico, CTC of Chile, CANTV of Venezuela, and Telefónica del Peru of Chile already enjoy nationwide footprints.

Trends and Developments

Implementation of a calling-party-pays system in Chile and Mexico could improve ARPU and margins. Expected implementation of calling-party-pays in Chile and Mexico will likely lift wireless ARPU and margins in those countries. ARPU should rise 15–20% on increased inbound traffic to the cellular network. The impact may not be as great as in other markets where calling-party-pays has been implemented, since pricing is already low in these two countries and discounts are already offered on inbound traffic.

The cost of digital conversion could hurt incumbents. Competition may force incumbents to invest more in upgrading their networks than they would have otherwise, adding to their overhead and pressuring margins. To remain competitive, we believe incumbents will be compelled to provide the same value-added and quality of service as new entrants.

Difficulties in accessing capital may hurt new entrants. The weakened economic environment in Latin America has made it more difficult for new entrants to garner financing for their investment plans. This is epitomized by the experience of Unefon in Mexico, which was unable to carry out a high yield bond offering for its PCS fixed wireless project. Assessing the financing prospects of new entrants has become key in determining the potential viability of their projects, in our view.

Prepaids in Brazil: Lower ARPU but big subscriber growth? Are prepaids the answer to achieving high sustainable growth rates in Brazil? Although prepaid plans tend to generate lower ARPUs than contract plans, the benefit of taking out the credit risk may be worthwhile. We expect that prepaid plans will be promoted on a broad scale throughout Brazil by year-end 1999. Migration of existing contract customers to prepaid plans poses a risk to the wireless operators as margins could decline.

Problems with collections: The art of managing receivables. Keeping churn to a minimum and holding down disconnections are key to financial success in the telecom world. We believe operators should adhere to highly conservative credit policies, such as applying strict credit measures before signing on new users. Prepaid systems help to avoid problems, but at a cost (lower ARPUs). It seems that Latin American operators are taking the right steps to avert heavy uncollectibles. Most important, they are applying stricter vetting processes for new customers and tougher disconnect policies to treat payment delinquency. We expect a reduction in wireline churn during 1999 relative to 1998, when operators like CANTV and TDP lost more fixed line customers than they added, and all operators saw a huge jump in disconnections.

United Kingdom/Ireland Telecoms: Intense Competition, Strong Growth

Overview

U.K. volume growth has accelerated in recent years, driven by the onset of competition and the development of cellular, data, and Internet services. Overall, we estimate average three-year growth of 5–6% in the installed line base, 9–10% in domestic call volumes, and 12–13% in international call volumes. Business line growth continues to be driven mainly by ISDN line take-up in the short/medium term, and penetration is accelerating.

We expect near-term consumer wireline penetration to be driven by increasing competition (primarily from cable operators), falling prices, and take-up of telephone service. We do not yet assume that cellular substitution for fixed will have a significant impact on consumer fixed-line growth. With the end of the price-cap regime in 1997, it is still unclear whether prices will stabilize, though we expect that the rate of decline should slow. The outlook should be clearer by the end of 1999. We believe investors should be on the alert for new sources of competition.

The trend of improving profitability for the telecoms sector overall is likely to continue. Stable to mildly declining margins in core voice telephony are being offset by growth in cellular, data, and Internet services, which is improving the industry's revenue mix toward higher-margin services.

The U.K. telecommunications market is currently very fragmented, with about 200 small competitors, by our estimates. We believe that a stable and transparent competitive environment is helping to foster growth, and that the U.K. market demonstrates that competitive intensity is about more than access to capital and technology. Overall, competition has been fiercest in long distance, international direct-dial, and the London corporate market, but competitive pressures are likely to build in the consumer local access market. The main competitive successes have been cable operators, who have used their franchises to bundle telephony with cable-TV offerings, and the cellular operators, who have successfully expanded the market for communications services.

U.K. operators have been, and look set to continue to be, leaders in the internationalisation of telecoms. U.K. operators have also been at the heart of industry corporate activity (BT and AT&T joint venture, Vodafone/Airtouch merger, U.K. cable industry consolidation), and we believe clear scope exists for the sector to benefit from further corporate activity. Our favourite stocks are: BT for coping with competition while developing new growth businesses and implementing a sound international expansion strategy; Telewest, which is positioned to exploit mass market demand for new media; and NTL, with a strong shareholder focus, leading position in U.K. cable and other markets, and opportunities in high-bandwidth services.

Investment Themes

Strong growth. The U.K. telecommunications sector is characterised by above-average growth in the fixed wire, cellular, and alternative carrier sector. We estimate average medium-term U.K. operator revenue growth of 20–25%. U.K. operators are increasingly visible in the international telecommunications environment, and so their financial performance is increasingly a function of both domestic and international trends. Strong domestic growth in fixed lines, minutes, ISDN, Internet access, and cellular subscribers is therefore being supplemented by additional growth from international expansion.

Stable and transparent competitive environment. Growth is helped, in our view, by a stable and transparent competitive environment. We believe that the U.K. market, though it has about 200 competitors, demonstrates that competitive intensity is about more than access to capital and technology. Few of the numerous new entrants are managing to successfully execute on their strategy and win significant business away from BT. This is despite the existence of a fair and balanced regulatory regime in the U.K., which was among the first countries in the world to introduce an open licensing process, low interconnect rates, number portability, indirect access, and international facilities liberalisation.

The main competitive successes are (1) the cable communication operators, who have used their cable franchises to bundle telephony with the cable-TV product to win residential customer business away from BT, COLT, Energis, and WorldCom, who have exploited their own infrastructure and the latest technology to provide an integrated portfolio of telecommunications services to the corporate customer; and (2) the cellular operators Vodafone, Cellnet, Orange, and One 2 One, who have successfully expanded the market for communications services

Declining regulatory involvement. In 1996, the U.K.'s regulatory body, Oftel, brought to an end a long period of severe and unpredictable regulation in the U.K. It adopted a "competitive authority" style of regulation, disposing of the old-style price-based regulatory model in favour of new powers to prevent and control abuse of dominant position and anticompetitive practises. The move marked a turning point in the U.K. sector's prospects, in our view, and significantly increased the sector's attractiveness for investors. The U.K. continues to be one of the more predictable regulatory environments in Europe, and we believe that Oftel's current plans for the industry will do little to shift the balance of power in the marketplace.

Increasing internationalisation. U.K. operators have been, and look set to continue to be, leaders in the internationalisation of the telecom world. BT is building up what we view as an admirable portfolio of international in-country assets connected via the global Concert network in joint venture with AT&T; Vodafone owns the most extensive portfolio of international cellular assets; Cable & Wireless has major positions in the U.K., the U.S., Hong Kong, and Australia; and COLT has operations in every major European country. In the cable sector, NTL is very active in exploring opportunities outside the U.K., recently acquiring an Australian broadcast-towers business. As such, the quoted U.K. sector offers investors more than exposure to just the U.K. telecommunications market. In fact, we estimate that, at our price targets, 39% of the U.K.'s $280 billion equity capitalisation can be attributed to non-U.K. operations.

Consolidation. U.K. operators have also been at the heart of industry corporate activity (BT and AT&T joint venture, Vodafone/Airtouch merger, U.K. cable industry consolidation), and we believe clear scope exists for the sector to benefit from further corporate activity.

Improving profitability. The above factors all underpin the trend of improving profitability for the sector. Stable to mildly declining margins in core voice telephony are being offset by increased cellular, data, and Internet growth, which is improving the industry's revenue mix toward higher-margin services. Further productivity gains are likely through consolidation and new technology, and improving domestic profitability likely will be boosted by declining losses from overseas investments.

In the context of the above investment themes, we favour

- BT for its progress in containing competition whilst developing new growth areas in cellular, data, and Internet, together with possibly the most progressive and sensible international expansion strategy of any major telco globally;

- Telewest for its opportunity to exploit the mass market for digital TV, interactive TV services, broadband Internet access, and telephony;

- NTL for its innovative and value-focused management team; its position in the U.K. cable communications, national carrier, and broadcast towers markets; and its potential to exploit both corporate and consumer demand for a portfolio of high-bandwidth network services.

Market Growth

U.K. market volume growth has accelerated in recent years, driven by the onset of competition and the development of cellular, data, and Internet services. Overall, we estimate average three-year growth of 5–6% in the installed line base, 9–10% in domestic call volumes, and 12–13% in international call volumes. U.K. cellular penetration is currently at 26%, or 15 million subscribers, a figure that we expect will double within the next five years. U.K. Internet penetration stands at 5–15% (depending on which forecasts you believe), and with the expected launch of DSL and cable modem technologies in 1999/2000, we expect to see significant further growth in this area.

In the business segment, recent growth has been driven by strong take-up of ISDN connections and increasing demand for higher-bandwidth services. In the residential segment, growth is being driven by new connections, second line connections (for fax and Internet access), and an increasing number of fixed-to-mobile calls. Sector-wide strong volume growth is partially offset by continued price declines in both the fixed wire and wireless segments. Overall, though, for fixed wire services it seems that we are past the worst of the price declines. In cellular, we believe there is clear scope for further price declines as competition increases and penetration rises. However, we expect elasticity (and possibly some cross-elasticity from the fixed universe) to provide a volume offset to price declines.

Business line growth continues to be driven mainly by ISDN line take-up in the short/medium term, and penetration is accelerating. Farther out, line growth should return to the longer-term trend. We believe this will occur as leased line prices fall, bandwidth per line increases, and traffic migrates to private circuit-based networks.

Consumer penetration is driven in the short term by increasing competition (mainly from cable operators), falling prices, and ongoing take-up of telephone service. We do not, as yet, assume that cellular substitution for fixed makes a noticeable impact on consumer fixed-line growth. We believe that other drivers of fixed-line growth are bundling of telephony with pay-TV and digital interactive service; the launch of cable modems (we count coax cable modem connections as telco connections); and dual lines (fax, Internet access, etc.).

Table 1
Expected Spend Trend over Two and Three Years

(%)	Total Telecoms	Voice PSTN	Internet	WAN	LAN	Mobile	Desk Top IT
Up	54	32	71	42	47	58	62
Down	20	30	6	11	9	15	7
Level	24	33	19	36	37	25	24
Not Sure	1	6	4	12	7	1	6

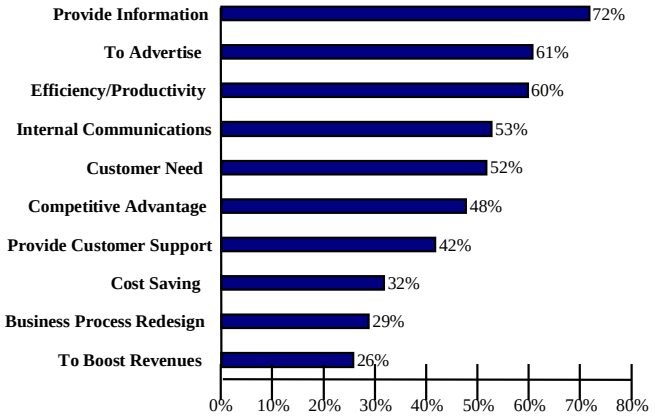
Source: NOP

While telecom prices are falling, in the U.K. the pace of decline seems set to slow with the ending (in 1997) of formal RPI-X price controls on 75% of the market. (RPI-X refers to the price cap on BT.) In addition, spend per customer seems set to rise, although the makeup of spend is broadening to include Internet access and usage, increasing fixed-to-mobile calls, and increasing spend on interactive services, on-line games, home shopping and banking, and pay TV. Growth in corporate spend is shifting away from PSTN and toward data, Internet, intranet, LAN connections, desktop IT and networks, and mobile.

Competitive Environment

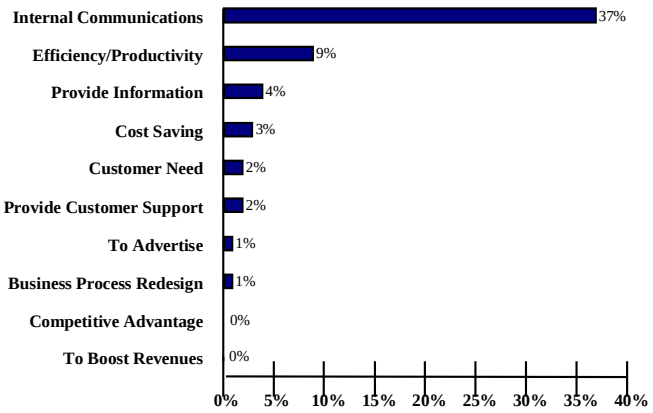
The U.K. telecommunications market is currently very fragmented. We estimate that there are over 200 small competitors. With so many competitors, it's not surprising that there are many different business models in use. These include CLEC, long-distance resale (switched and switchless), infrastructure-based long-distance, and cable teleph-

Figure 1
Drivers of Internet Adoption (% Who Cited)



Source: NOP

Figure 2
Intranet Uses (% Who Cited)



Source: NOP

ony. Most of the firms can't compete on this level due to poor technology, poor management, and lack of attention to customer care. Only a few names, we believe, have gained a share of customers' "mindspace": BT, CWC, Energis, WorldCom, AT&T, Telewest, and NTL. We expect the fragmented "tail" of the market to consolidate in due course.

Overall, competition has been fiercest in long distance, international direct-dial, and the London corporate market. The pressure of competition is likely to build in the consumer local access market. As the cable communications companies start to get their act together, competition should intensify even further.

Trends and Developments

Fixed-mobile convergence is a development that bears close watching in the U.K. Will cellular really become a substitute for fixed-line technology? If so, we believe there will be dramatic implications for fixed operators' strategic choices (e.g., does BT need to fully own and integrate Cellnet?).

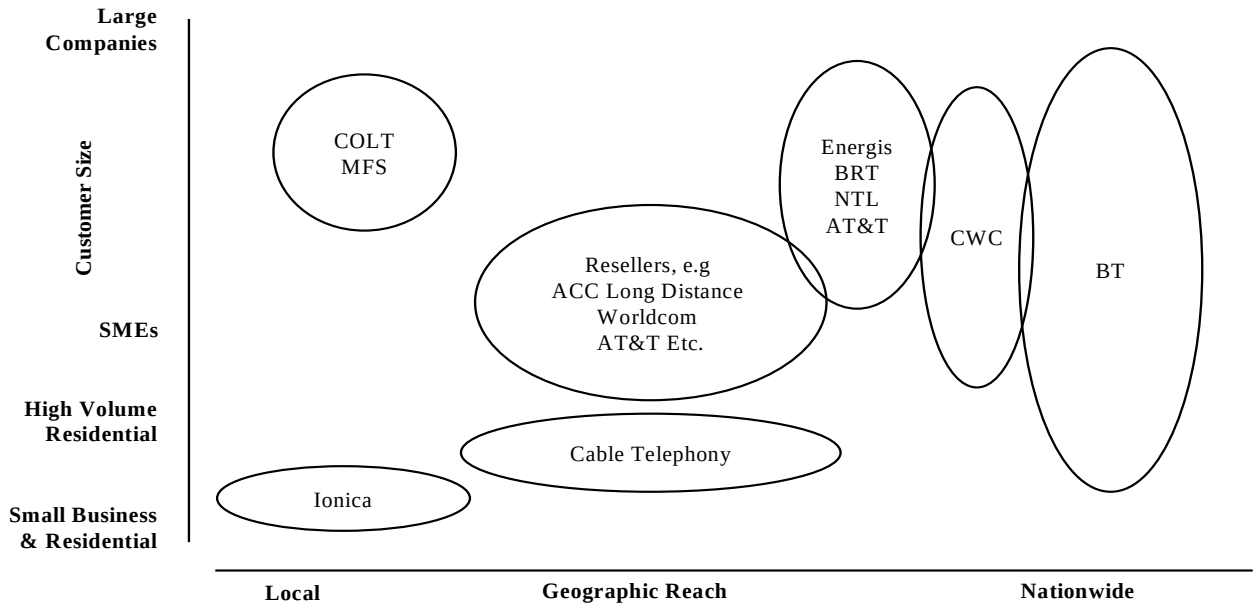
Growth in Internet, multimedia, and interactive services in the U.K. also merits attention. This is likely to be the year of set-top boxes, cable modems, ADSL, ADSL-lite, etc. We believe the key issue is how affordable access to on-line services will change customer behavior and spending patterns.

Competition has the potential to take over where regulators left off in terms of pricing trends. With the end of the price-cap regime in 1997, it is as yet unclear whether prices will stabilize — this should be clear by the end of 1999. We believe investors should closely monitor where the next stage of competitive entry will come from. We believe potential threats include Deutsche Telekom/France Telecom, Mannesmann, Cegetel, and NTT. Greenfield entry seems unlikely.

Regulatory issues. Unbundling the local loop is one divisive area of regulation. So far, regulators view this as "drastic" action and appear unlikely to follow a U.S.-like unbundling. As far as fixed-mobile convergence is concerned, we believe a policy framework is needed and will be addressed by regulators. In 1999, there likely will be a review of cellular competition. Lastly, carrier pre-selection (a standard regulatory mechanism for giving consumers access to a selected long distance operator's services through nomination) is likely to be made mandatory by 2001.

Figure 3

United Kingdom Industry Structure



Source: Morgan Stanley Dean Witter Equity Research

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