MORGAN STANLEY DEAN WITTER

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Global Telecommunications Primer

A Guide to the Information Superhighway

The Global Telecommunications Team

Western European Wireline: New Players Change the Landscape

Overview

The European telecommunications industry is in ferment, as the "triple whammy" of privatisation, liberalisation, and new technology is dramatically reshaping old structures and relationships. Until recently, the traditional incumbent telcos — vertically integrated national carriers — have been enjoying a wonderfully benign operating environment, characterised by accelerating growth, improved efficiency, often passive regulators and minimal competitive pain — with consequently super-normal returns to shareholders. Pressures are mounting on these traditional players, however, as evidenced by the current spate of industry alliances, mergers, and takeovers.

Increasingly, the industry is being reshaped and redefined, not by the telcos, but by a new breed of emerging carriers and service providers. These new players, unencumbered by legacy networks, cost structures, or working practices, are profoundly altering the economics of the industry and forcing incumbent telcos to redefine their basic strategies.

Until now, the European industry has seen few real failures or corporate disasters, thanks to the saving grace of growth. Winners and losers will undoubtedly emerge, however, as the competitive stakes rise ever higher. Essential characteristics of the "winning strategy" will be inspired leadership, a precise understanding of technology effects, and a resolute focus on the needs of the customer, be it small, medium, or large and retail or wholesale.

The business of investing in European telecoms has changed as much as the business itself. In the more challenging and dynamic competitive environment that is emerging, it is clear to us that the old investment rules no longer apply. While "worst is best" used to be a useful guide to investing in telecoms at a time when restructuring and interest rate convergence were the main value drivers, the more efficient and progressive Northern European operators and the new breed of alternative carriers have clearly come out on top in terms of value creation since 1/1/98.

Our top picks now therefore include the "best in class" and most progressive telcos such as Sonera, KPN, BT, together with new entrants that have what we consider the strongest value-added — such as Equant — or the strongest regional position, such as Mannesmann.

Key Investment Themes

The European telecommunications industry is experiencing profound change, stimulated by the simultaneous impact of privatisation, market liberalisation, technology shifts, and, at the continent-wide level, economic and political convergence. While many of these factors are also affecting other regions, the fact that Europe's past history is one of state intervention, protectionism, and general resistance to change — the "open-air museum" as it has been characterised by Byron Wien — means that when change does occur, it is all the more shocking.

State ownership of telecoms is coming to an end in Europe . . . Historically, European telecommunications have been organised on a conventional state-owned, vertically integrated, monopoly structure, except in Finland. This *dirigiste* approach has been progressively abandoned by successive European governments, and now virtually all European telcos have been or are subject to a formal plan to be privatised. The U.K., Italian, and Spanish telcos are all effectively in full private ownership; the Swedish and Norwegian administrations are committed to begin the privatisation process within the year; and all other countries have begun the process of reducing state ownership and, with it, state influence.

. . . and competition has extended to all telecom sectors across most of the continent. Nearly all European countries began the formal process of introducing competition in the late 1980s. First, the sale of basic telecommunications equipment was liberalised. Then competition was introduced in mobile services in the early 1990s, thanks to the development of the pan-European GSM digital cellular standard. Subsequently, value-added services were opened for competition, with various loopholes allowing the simple resale of voice services within closed user groups. Ultimately, full market liberalisation was authorised in most countries from 1/1/98, with only Spain, Portugal, and Greece being granted waivers to delay liberalisation.

Table 1
Access Lines (Thousands): Western Europe

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
France	30,564	31,400	32,260	33,210	33,941	34,552	34,966	35,316	35,669	36,026	36,386	36,750	37,117	37,488
Growth		*2.7%*	*2.7%*	*2.9%*	*2.2%*	*1.8%*	*1.2%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*
Germany	43,452	43,923	44,393	44,200	45,200	46,104	46,657	47,031	47,407	47,786	48,168	48,554	48,942	49,334
Growth		*1.1%*	*1.1%*	*-0.4%*	*2.3%*	*2.0%*	*1.2%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*	*0.8%*
Italy	24,224	24,398	24,622	25,052	25,553	25,809	26,330	26,865	27,413	28,571	30,139	31,856	33,338	34,934
Growth		*0.7%*	*0.9%*	*1.7%*	*2.0%*	*1.0%*	*2.0%*	*2.0%*	*2.0%*	*4.2%*	*5.5%*	*5.7%*	*4.7%*	*4.8%*
Spain	15,235	15,645	16,055	16,200	16,798	17,249	17,725	18,213	18,752	19,188	19,524	19,762	19,992	20,236
Growth		*2.7%*	*2.6%*	*0.9%*	*3.7%*	*2.7%*	*2.8%*	*2.8%*	*3.0%*	*2.3%*	*1.8%*	*1.2%*	*1.2%*	*1.2%*
Sweden	5,891	5,920	5,950	5,980	6,010	6,040	6,070	6,101	6,131	6,162	6,193	6,224	6,255	6,286
Growth		*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*
UK	27,336	28,358	29,411	30,677	31,563	32,646	34,012	35,561	36,956	38,143	39,237	40,000	40,779	41,575
Growth		*3.7%*	*3.7%*	*4.3%*	*2.9%*	*3.4%*	*4.2%*	*4.6%*	*3.9%*	*3.2%*	*2.9%*	*1.9%*	*1.9%*	*2.0%*

E = Morgan Stanley Dean Witter Equity Research Estimates

Moore's Law may understate the rate of change in European telecoms. It has been argued that, as the telecommunications industry has been held back by decades of government intervention, cash constraints, and stifling regulation, the process of technological revolution is even more dramatic and shocking than was the case, say, with the dawning of the age of the personal computer. According to this logic, Moore's Law — that price/performance doubles every 18 months, as suggested by Gordon Moore, founder of Intel — actually understates the speed of future development in telecommunications. Certainly, **evidence abounds that the technology gap that exists between Europe and the U.S. — lower PC penetration, lower IP usage, etc. — may be closing rapidly** and that in some areas, notably digital wireless, European telecommunications may already be substantially ahead of the U.S.

European economic and political union is driving strategic activity. The current move towards economic union across Europe is only the next stage in a process that began with the setting up of the European Coal and Steel Community back in the 1950s, and continued with, amongst other policy moves, the Europe 1992 initiative. There is no doubt, however, that the emergence of the Euro as a common currency on 1/1/99 has stimulated a new wave of industry consolidation — Vodafone's acquisition of Airtouch is one such corporate realignment carried out with the European, rather than the domestic, consumer in mind.

The industry is responding to change with rationalisation, internationalisation, and consolidation. There is not a single telco in Europe that has not put in place a workforce reduction plan. Historically, telcos in Europe have often been regarded by their government owners as employers of last resort, and this has led many to be chronically overstaffed, even by the standards of European industry. In the case of France Telecom, the cost of early retirements was negotiated pre-privatisation and partly borne by the French treasury; in most other cases, these costs have been charged to earnings and borne also by minority shareholders. Either way, cost cutting has been a recurrent theme for some years, with some telcos, such as Deutsche Telekom and Telecom Italia, deriving a large if not dominant part of their recent earnings growth from cost reduction.

The impact of organisational and cultural change on the competitiveness of the European telcos is less evident. British Telecom took years, and a number of false starts, following its own 1984 privatisation, before it was able to put in place a meaningful internal restructuring and improve responsiveness and customer orientation. Relatively few operators — only France Telecom, KPN of the Netherlands, Telia of Sweden, and Sonera of Finland — have been able to boast any sort of customer-oriented culture being in place for some years. Still others, notably Deutsche Telekom, are only now putting in place the necessary management and organisational changes, while unreconstructed monopolists, such as Telecom Italia, have barely begun the process.

Competitive pressures have made internationalisation essential for European operators. There have been three clear reasons for the telcos' drive to internationalise their businesses. First, faced with prospect of a certain loss of domestic market share, and with balance sheets fortified by years of monopoly-protected, efficiency-derived cash flow, the majority of European telcos have sought to diversify their earnings base by making overseas investments and

Table 2
Wireline Penetration: Western Europe

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
France	52.2%	53.6%	55.1%	56.4%	57.5%	58.4%	59.3%	60.0%	60.6%	61.2%	61.8%	62.4%	63.0%	63.7%
Growth		*2.7%*	*2.7%*	*2.5%*	*1.9%*	*1.6%*	*1.5%*	*1.1%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Germany	52.9%	53.5%	54.1%	53.8%	55.1%	56.2%	56.8%	57.3%	57.7%	58.2%	58.7%	59.1%	59.6%	60.1%
Growth		*1.1%*	*1.1%*	*-0.4%*	*2.3%*	*2.0%*	*1.2%*	*0.8%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Italy	42.6%	43.0%	43.3%	44.5%	45.0%	45.4%	45.9%	46.4%	46.8%	47.3%	47.8%	48.2%	48.9%	49.4%
Growth		*0.7%*	*0.9%*	*2.8%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Spain	39.0%	40.0%	41.1%	41.4%	43.0%	44.1%	45.3%	46.6%	48.0%	49.1%	49.9%	50.5%	51.1%	51.8%
Growth		*2.7%*	*2.6%*	*0.9%*	*3.7%*	*2.7%*	*2.8%*	*2.8%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Sweden	66.2%	66.5%	66.9%	67.2%	67.5%	67.9%	68.2%	68.5%	68.9%	69.2%	69.6%	69.9%	70.3%	70.6%
Growth		*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*0.5%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
UK	47.9%	49.5%	51.1%	53.0%	54.2%	55.8%	57.8%	60.2%	62.2%	63.9%	65.4%	66.3%	67.3%	68.3%
Growth		*3.4%*	*3.2%*	*3.8%*	*2.4%*	*2.9%*	*3.7%*	*4.0%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

E = Morgan Stanley Dean Witter Equity Research Estimates

acquisitions — some very successfully as with Telefónica in Latin America, some much less so, as with Deutsche Telekom. Second, telcos have sought to protect their multinational client business by following their customers into international markets. The old model achieved this through operator alliances such as Unisource (between KPN, Swisscom, and Telia and, for a while, AT&T) or Global One (between France Telecom, Deutsche Telekom, and Sprint), but these have generally proven to be unstable and unable to deliver meaningful returns to their owners — or even to their customers.

The new international model allows the telco to invest more selectively and to retain greater control — such as KPN's 50/50 joint-venture with Qwest of the U.S., to build out a pan-European, IP-based fibre network, or Swisscom's "hot spot" strategy of establishing points of presence in major traffic hubs across Europe and the U.S., in order to collect and deliver international traffic at locally determined interconnect rates rather than at exorbitantly high international accounting rates. BT seems to be migrating its earlier model of selective minority investments in alternate carriers across Europe — Cegetel in France, Viag Interkom in Germany, Albacom in Italy — to one that allows greater control by BT in an overlay IP-based network.

Competitive pressures combined with the prospect of a single Eurozone have stimulated a significant increase in consolidation across Europe. Some of this activity is driven by relatively straightforward scale considerations — for example, the planned merger between Telia of Sweden and Telenor of Norway, where two relatively small operators, sharing similar organisational and national cultures, would seem to have a high probability of achieving the benefits that consolidation promises. Some consolidation, however, appears to be driven more by old-style considerations of size for size's sake, where the sheer scale of the entities and the clear cultural dissimilarities suggest a high probability of failure.

The business of investing in European telecoms has changed as much as the business itself. In the more challenging and dynamic competitive environment that is emerging, it is clear to us that the old investment rules no longer apply. While "worst is best" used to be a useful guide to investing in telecoms at a time when restructuring and interest rate convergence were the main value drivers — Southern European operators outperformed Northern European operators by 148% during 1996 and 1997 — the more efficient and progressive Northern European operators and the new breed of alternative carriers have clearly come out on top in terms of value creation since 1/1/98.

Our top picks now therefore include the "best in class" and most progressive telcos such as Sonera (which we believe can be viewed either as an expensive telco or, more usefully, a very inexpensive cellular/data company); KPN, one of the best values of the more advanced operators; BT, finally emerging from years of competition- and regulation-induced revenue constraint; together with those new entrants that have what we consider the strongest value-added — such as Equant — or the strongest regional position, such as Mannesmann.

Market Growth

If the response of individual telcos to the triple challenge of privatisation, liberalisation, and new technology has varied,

the response of the marketplace to this new industry dynamism has been very consistent — an across-the-board acceleration in growth rates.

The reasons for the structural uplift in growth rates are not hard to see.

First, digitisation has brought higher functionality to the basic, traditional, voice telephone: higher-speed access through ISDN, plus network-based services such as caller ID, call diversion, voice mail, freephone, mobile, and many other service variants are all becoming ubiquitous, stimulative, and chargeable add-ons to the basic telephone package.

Second, more attractive (i.e., lower) prices and price plans have become available, with an increased focus on market segmentation yielding rich rewards to operators in the form of previously undreamt-of penetration levels. The pre-paid concept has been particularly successful in improving the affordability of basic cellular service, opening the possibility of a genuinely mass-market service.

Third, more intensive advertising by operators eager to establish their market presence has resulted in higher consumer awareness of telecommunications *per se*, and higher usage levels.

Fourth, the "old world" of plain old telephone service is rapidly evolving into a brave new world of converged, multimedia, content-rich services, where — to quote the current mythology — "the Internet changes everything," including, it seems, the capacity of individuals and corporations to spend money on telecommunications services.

Against this generally very supportive demand picture, what has been happening in individual markets?

In Germany, overall market growth was constrained in 1998/1999 by rapid price reductions in long distance (domestic and international). However, strong volume growth from an explosion of competitive activity and from sustained growth in ISDN lines and on-line services occurred. A similar pattern of price decline and volume growth was also present in the German mobile market.

In France, overall market growth was constrained in 1998 by the final effects of a deliberate policy by France Telecom of reducing the level of domestic long distance (DLD) and international long distance (ILD) prices. This policy began in 1996 as a means to head off the competitive/arbitrage threat. As in Germany, line growth driven by second lines to the home and online services increased demand. Price reductions, combined with more effective marketing and new service promotion by France Telecom (FT), have produced a significant pickup in volume growth (in both the fixed and mobile markets). Again like Germany, sophisticated but under-penetrated/under-exploited business and residential customer bases suggest a strong potential for high take-up of broadband services.

The Italian fixed line market experienced only modest growth in 1998. This occurred for several reasons: the impact of DLD/ILD price reductions; failure by Telecom Italia to develop and promote new network-based services; low penetration of PCs; low sophistication of corporate users; and significant migration of fixed line traffic to the mobile networks. From this low base, we anticipate acceleration in market growth rates, as the entry of new competitors stimulates higher usage rates.

The Spanish fixed line market has experienced extremely strong acceleration in growth over the last two years. This growth has been fueled by a very strong domestic economy; a highly effective rollout of new services (network-based voice mail, for example) and the rapid take-up of on-line services (TEF's Infovia dominates the market). Growth rates should remain strong as new entrants stimulate higher consumer awareness. Lastly, Spain is the only major country in Europe whose lines per capita are significantly below the Western European average.

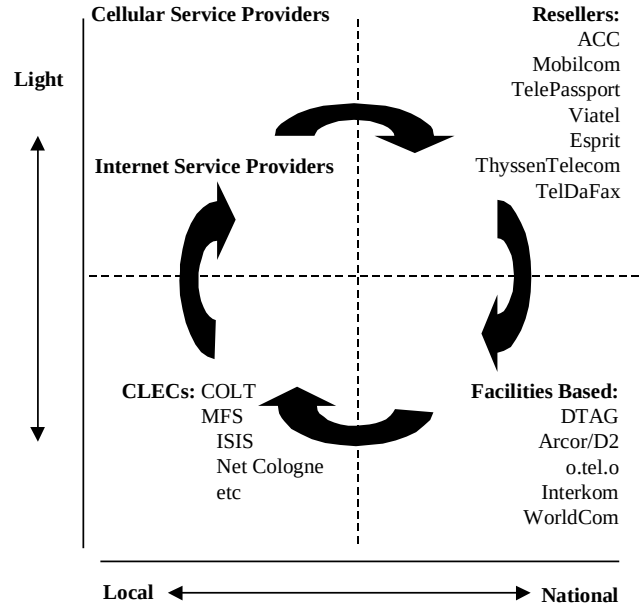
Regulatory and Competitive Environments

As noted, virtually all European markets opened formally to full competition on 1/1/98, after a lengthy period of pan-European policy coordination and following the general dictates of a series of European Directives.

However, while there has been considerable coordination of policymaking by Brussels and the European Commission, this does not mean that countries are approaching the business of implementing liberalisation uniformly. Indeed, while it is Brussels' role to set an overall policy framework for telecommunications liberalisation, it remains a matter for national regulators to enact these objectives in specific

Figure 1

The German Case Study



Source: Morgan Stanley Dean Witter Equity Research Estimates

national legislation, and to give practical effect to these Directives in day-to-day decision making.

We see a wide range of regulatory environments across Europe, from the strongly pro-competitive regime that has prevailed in the U.K., Germany, and the Netherlands, to the more subtly pro-incumbent stance adopted by the French regulatory authorities, right the way through to the regulatory vacuum that is only now beginning to be filled in Italy. Simply to judge by the number of companies operating in each country, it is easy to see the role that national regulators still have — even in this ostensibly "liberalised" world — in shaping the structure of the industry. It is therefore important for the investors to understand that regulators retain significant power to affect the economics of individual market segments as well as investor sentiment. Consider KPN's travails in the Dutch market, against a regulator determined, it seems, to deliver a consumer- and competitor-friendly package.

The German government is a very pro-competitive regulator. Consequently, Germany has experienced an explosion of competitive activity. This "bulge bucket" includes Mannesmann Arcor, using the Deutsche Bahn railway network; O tel O, using the electricity infrastructure of RWE and Veba, the principal owners; and Interkom, the BT/Viag joint venture, pioneering the use of a combined fixed/mobile network.

However, headlines and market share in Germany have been grabbed by the resellers — Mobilcom, TelDaFax, Talkline, ACC, etc. — which have been more aggressive and innovative in pricing (Mobilcom's 01019 access code reflects its 19 pfennig standard call rate, initially some 60% below DT's DLD rate). There are many competitive models in Europe's most competitive market. Several of those employed are facilities-based, switched-based and switchless resellers, CLECs (MFS, COLT, and many city networks), plus unbundled local loop (ULL), wireless local loop (WLL), and cable telephony.

The German market has been characterized by the rapid emergence of a complete range of competitive models. An extremely high current rate of new company formation should eventually give way to a period of consolidation as 1) scale seeks volume, 2) reach seeks access, and 3) bandwidth seeks content.

The French case is very different from the German. France Telecom has a history of high-quality basic service (government underwritten!). For this reason, in particular, there is a high degree of customer satisfaction and a low propensity to switch to alternate providers. The French regulator, the ART, also tends to be very France Telcom-friendly. Interconnect rates are essentially two-tiered, with only large, facilities-based competitors qualifying for the lower rates.

In France, there is only one major competitor for fixed services — Cegetel, owned by Vivendi (the utility), BT, and Mannesmann. There are a few resellers — Omnicom, Esprit among them, and even these have been acquired by a larger, facilities-based company. Cable TV is not very highly penetrated in France, and a large part of it is owned or operated by FT. Although FT (and its investors) believe FT enjoys the closest thing in Europe to a "natural monopoly," competitive pressures should intensify — witness COLT's success in the Paris region.

Competition has been slow to develop in Italy for many "non-tariff barrier" reasons. Historically, the regulatory infrastructure has been almost totally absent, so licenses have taken months or longer to be issued, and physical con-

nection with Telecom Italia's network has been delayed. The landscape is changing, however. The new regulator has at last been established, if not completely staffed up yet, and new entrants are having a relatively easy go at Telecom Italia's more vulnerable customers.

With high DLD/ILD prices (historically and even now), an inflexible organization, and 18 months of management distraction/hiatus, we believe Telecom Italia is certainly vulnerable — but the new management should force changes. In the meantime, major players include Infostrada (now wholly owned by Mannesmann), COLT, Albacom (owned by BT), and Wind (the FT/DT joint venture, using the third cellular license as an entry vehicle to the fixed market).

Competition was also late in coming to Spain, although by design rather than by default (as in Italy). Reflecting its less developed status, Telefónica won a concession from the Brussels authorities to face only limited competition starting on January 1, 1998. Competition came in the form of Retevisión, which is co-owned by Endesa (the utility) and Telecom Italia. Since December 1, 1998, however, the market has been open to all comers, and at least nine operators have been licensed to provide competitive LD services. Cable telephony is also emerging as a competitive threat to Telefónica. This is particularly true as multiple licenses have been awarded across a largely unpenetrated country.

Competition in the German DLD/ILD markets could be reduced. Huge (60%) reductions in Deutsche Telekom pricing could have the effect of choking off competition in DLD/ILD. We think this will not be the case, because DT has such a heavy cost burden to carry (labour, capital, debt, and dividends) that its pricing flexibility is far more limited than for most operators.

In France, we believe the Internet has significant potential. However, whether the French market will be as willing to adopt the Internet as is assumed, given cultural issues and FT's late conversion, will be an important factor in whether the French market experiences the data growth of other markets, in our opinion.

Competing digital TV platforms are an important development to watch in the Spanish telecom market. Telefónica and Canal +'s competing digital TV platforms will go head-to-head in this marketplace. A related, but distinct, issue is the vulnerability of TEF's corporate business. Historically, TEF has had a highly effective stranglehold on this business, but that seems to be weakening.

Western European Wireless: Fixed-Mobile Convergence Looms

Overview

We continue to see strong growth ahead in European cellular markets . . . Despite record growth in Scandinavia last year, penetration continues to rise. We believe that with expanded distribution, 60%-plus penetration in Scandinavia is achievable within three years. Germany is underpenetrated at 18%. Fundamentals appear strong for the two incumbents in Italy, where penetration is highest. Moreover, rising usage is offsetting price declines, putting paid to the conventional wisdom concerning the elasticity of demand. And new technologies are increasing transmission speeds, making wireless data transfer commercially viable.

. . . Despite the risk of increasing regulation. Although the limited amount of spectrum appears to put natural constraints on competition, concerns are increasing that regulators will force cellular operators to provide competitive access to their networks under a cost-based interconnect system, with Norway as a precedent. While the situation bears watching, we see little evidence of supernormal profits that would warrant intervention by the regulators over the near term, particularly with prices falling throughout Europe. In addition, opening the networks could create congestion and reduce the quality of service. That said, operating licenses will increasingly shape the wireless market in western Europe, with universal mobile telephony licenses potentially affecting operator capacity and expanding the range of service offerings.

The convergence of fixed and mobile communications presents threats and opportunities. Cellular operators will have to cut prices while investing in infrastructure to improve network coverage and quality, but face a huge opportunity and can use excess capacity on their networks. Public telephony operators need to integrate their cellular subsidiaries to protect their core markets, while exploiting their advantage in delivering broadband services over fixed lines. Our favorites in this evolving competitive landscape are Mannesmann and Securicor.

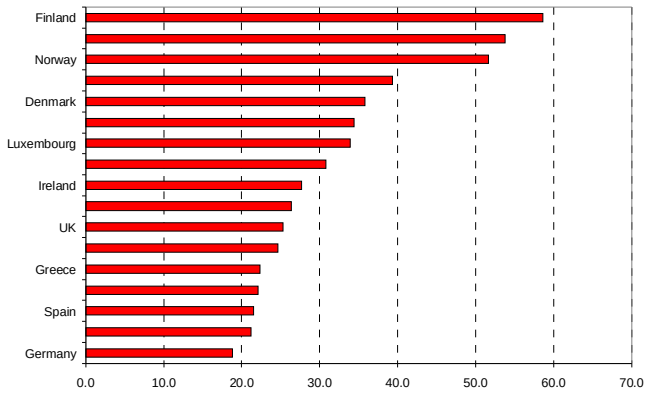
Investment Themes and Market Growth

The past year has seen very good growth in European cellular markets but there is more to come, in our view. A year ago, the Scandinavian wireless market was generally thought to be approaching post-growth status, with its penetration leading the rest of the world at 37.7%, but the consensus was far off the mark. One year later, after record growth, penetration in Scandinavia is 53.6% and rising.

A closer look at the age and gender profile of users in Norway provides further encouragement. Among 20- to 29-year-old men, nearly 100% currently have cellular phones, compared with only one-third of women in that age group. In our view, expanded distribution can only help to address the market's underpenetrated segments (young female and elderly), making 60%-plus penetration in Scandinavia within three years an achievable target.

Figure 1

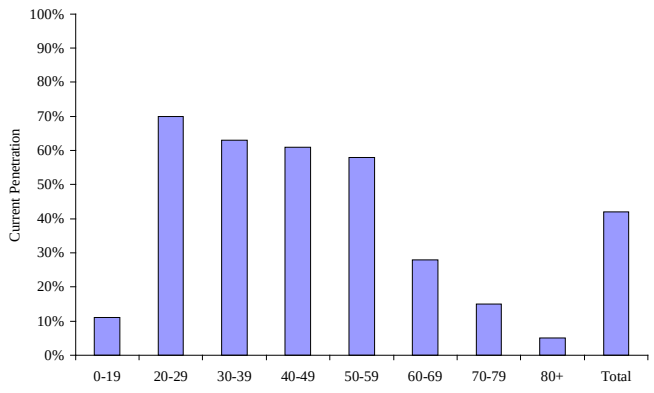
Year-End Penetration at 1 March 1999 (%)



Source: Mobile Communications, Morgan Stanley Dean Witter Research

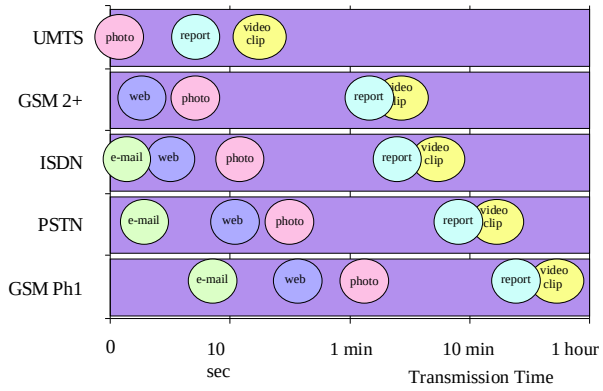
Figure 2

Penetration by Age Group



Source: NetCom ASA, Morgan Stanley Dean Witter Research

Figure 3
Cellular: Improving Data Capabilities

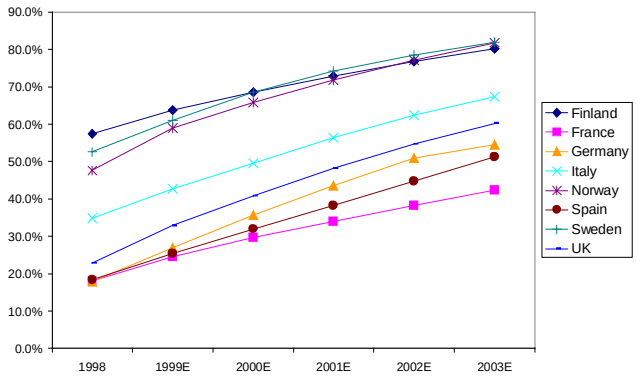


Source: UMTS Forum

Despite marked reductions in cellular pricing (by as much as 30% in the U.K. and Germany), ARPU has typically remained robust. Clearly, the consensus view of elasticity trends is being challenged. The old outlook, based on the experience of Vodafone and Mannesmann in 1996, was that a 10% reduction in pricing typically was accompanied by a 6% increase in usage, so that net ARPU fell by an average of 4%. It appears that this relationship no longer holds, as price declines are being offset by rising usage, with no difference between usage levels during peak and off-peak periods.

The data wave has yet to be experienced in cellular markets. We believe that cellular is not the only growth game in telecom. The European data market (which we forecast will be worth around $30 billion in 2002) is currently about the same size as the European cellular market. In the past, we have been very sceptical about the transfer of data over GSM, given the structural hurdles, including a lack of modem standardisation, prohibitive terminal costs, lack of dedicated applications combined with very slow data transmission speeds (at fax speeds of 9.6 kb per second). However, with the advent of new technologies such as high-speed circuit-switched data (HSCSD) and general packet radio services (GPRS), quantum leaps in transmission speeds of up to 64kb/s are likely. The development of SMS (short message service) in Scandinavia has led us to believe that data will play a very significant role over cellular networks. All of this potential growth has yet to be factored into forecasts, both operational and funding requirements, although early indications from European operators are that the investment required is moderate. We believe the data component of cellular will provide the main impetus for the next wave of cellular re-rating over the next year.

Figure 4
European Cellular: Penetration Outlook



E = Morgan Stanley Dean Witter Research Estimates
Source: Company data, Morgan Stanley Dean Witter Research

The conventional view on ARPU decline is already being challenged by the most basic of data services. We believe the take-up of SMS messaging in Finland (and elsewhere) is testament to the latent demand that exists for easily accessible data over mobile. Whilst the service involves multiple key entries, in Scandinavia, SMS accounts for 7% of cellular revenues.

Improving data speed should provide the technical catalyst to further growth. Current data speeds of 9.6kb/s should climb to 14.4kb/s by 3Q of this year with Sonera planning to launch HSCSD. This technology can be expanded through the use of multi-slot techniques to achieve data speeds at ISDN-equivalent levels. Within the next 12 months, with four time slots HSCSD can support data speeds of up to 57kb/s. While HSCSD reflects only an interim measure, given its circuit-based switching, inefficient use of spectrum, and lack of price flexibility, it nevertheless provides operators the chance to satisfy early adopters and promote more advanced data services prior to launch at an immaterial incremental cost — Sonera's network will be able to offer the service when terminal handsets become available in the third quarter of 1999.

Table 1
European Cellular: Churn, 1998-2002E

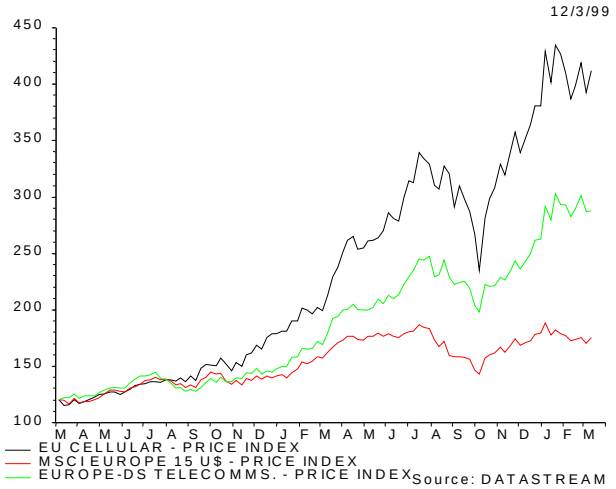
(%)	1998	1999E	2000E	2001E	2002E
Cellnet	28.8	25.9	24.5	23.3	22.1
D2 Mobilfunk	19.0	20.0	20.0	20.0	20.0
Europolitan	19.7	19.4	18.8	18.5	18.3
NetCom GSM	26.8	22.6	20.3	20.0	19.8
Orange	21.7	22.9	21.6	20.5	19.4
SFR	23.7	23.2	22.9	22.7	21.6
European Mean	***22.6***	***22.1***	***21.6***	***20.9***	***20.1***
European Median	***21.7***	***22.6***	***20.3***	***20.0***	***19.8***

E = Morgan Stanley Dean Witter Research Estimates
Source: Company data, Morgan Stanley Dean Witter Research

HSCSD provides some progress, but we believe the real breakthrough will be the rollout of general packet radio services (GPRS). GPRS will enable cellular operators to be more Internet Protocol (IP) transparent, providing seamless transfer into Internet networks. Data speeds of up to 120kb/s are achievable, with packet switching resulting in a more efficient use of capacity. Sonera aims to launch this service next year.

The final incremental development is the deployment of EDGE (Enhanced Data rates over GSM Evolution), which uses alternative modulation schemes, resulting in higher data speeds of around 200kb/s, although Nokia believes data speeds beyond 300kb/s should be achievable, making EDGE comparable with the early third-generation offerings. EDGE is likely to be implemented in 2000/01, at least one year prior to the commercial launch of universal mobile telephony licenses (UMTS).

Figure 5
European Cellular Performance



UMTS will allow 384kb/s in wide area usage and up to 2mb/s is available to stationary users. UMTS presents operators with additional spectrum, and at least the ability to support the rapid migration of voice traffic onto cellular networks.

The key concern, in our view, is that investors may not see the benefits of future growth and penalise companies for short-term earnings dilution. We believe those that benefited from first mover advantage at the cellular level and therefore dominate the corporate market will be less exposed to investor scepticism, as after all, it is the corporations who will likely be the early adopters of these services. Once scale economies, the availability of affordable handsets, and coverage and capacity investment allow for widespread consumer take-up, the visibility of the strong growth prospects should improve. In addition, we take comfort from the following;

- Cellular growth has not disappointed — our analysis indicates the re-rating of cellular stocks over the last two years almost wholly reflects estimates significantly exceeding all expectations.

- The successful take-up of SMS — accounting for 7% of ARPU in 1Q99 in Scandinavia — indicates a high acceptance for data services.

- The rollout of HSCSD and GPRS solutions should also provide a further guide toward incremental returns from higher capital expenditure.

Concerns about regulatory risk in the European wireless market are rising. Although we have seen a rapid lowering of entry barriers in the fixed line market, the same is not true of the mobile market. In fact, the current conventional

Table 2
Wireless Subscribers (Thousands): Europe

	1997	1998E	1999E	2000E	2001E
France	5,760	10,245	13,995	16,895	19,395
Growth	*NA*	*77.9%*	*36.6%*	*20.7%*	*14.8%*
Germany	8,393	14,547	21,213	27,728	33,591
Growth	*NA*	*73.3%*	*45.8%*	*30.7%*	*21.1%*
Italy	11,712	18,378	22,646	26,568	30,422
Growth	*NA*	*56.9%*	*23.2%*	*17.3%*	*14.5%*
Spain	4,290	6,873	9,651	11,981	14,022
Growth	*NA*	*60.2%*	*40.4%*	*24.1%*	*17.0%*
Sweden	3,300	4,526	5,265	5,913	6,409
Growth	*NA*	*37.2%*	*16.3%*	*12.3%*	*8.4%*
UK	7,083	9,027	14,619	19,711	24,162
Growth	*NA*	*27.4%*	*61.9%*	*34.8%*	*22.6%*

E = Morgan Stanley Dean Witter Equity Research Estimates

view of cellular is that finite spectrum constraints put a limit on competition. There is, however, increasing concern that regulators will force existing cellular operators to open up networks to competitors, using a cost-based interconnect system. A precedent for this has now been set in Norway. We are currently examining the Norwegian situation very closely, and, if the move is successful and is replicated throughout Europe, it could become a concern for many wireless operators.

At this stage, we do not believe that these fears are warranted, for three reasons. First, very few operators are exploiting consumers by making supernormal profits. If such a policy were adopted in many European markets, we believe it could seriously prejudice the viability of less-mature cellular operators. Second, prices are falling very sharply throughout Europe, without regulatory intervention. Finally, opening up networks could congest network capacity and reduce quality by making traffic flows less predictable and reducing operators' capital expenditures. However, if next-generation licenses are to be used to boost competition, we believe the issue of roaming onto GSM cellular networks will need to be clarified prior to their award.

Operating licenses in the cellular market should play an increasingly important role. Free-cash-flow generation is likely to be deferred significantly following the award of third-generation licenses next year. At the very least, universal mobile telephony licenses would ease problems of operator capacity, and at best, would offer a multitude of new high-bandwidth services. We believe the issue of UMTS will be at the forefront of most operators' attention as a result of the accelerated rollout within the U.K. Trials

Table 3
European Cellular:
Subscriber Growth in March 1999

Country	Net Additions (000)	Share of Net Additions (%)	Penetration at 1/2/1999
Germany	550	12.4	18.8
France	394	8.9	21.2
Spain	568	12.8	21.5
Belgium	178	4.0	22.1
Greece	155	3.5	22.3
Switzerland	83	1.9	24.7
UK	764	17.3	25.3
Netherlands	353	8.0	26.3
Ireland	29	0.6	27.7
Austria	101	2.3	30.8
Luxembourg	-2	0.0	33.9
Portugal	62	1.4	34.4
Denmark	54	1.2	35.8
Italy	953	21.6	39.3
Norway	118	2.7	51.6
Sweden	113	2.6	53.8
Finland	-50	-1.1	58.6
Europe	**4,421**	**100.0**	**26.8**

Source: Morgan Stanley Dean Witter Research

there will commence at the beginning of next year, with licenses set to be awarded in the latter half of the year, although this may be delayed. Early indications are that many parties are interested, and that U.K. license fees are likely to be costly (in the region of £500–750 million per successful operator). Network rollout costs for existing operators are likely to be around £1.25 billion each, with operations expected to be launched commercially in 2002/03.

We favor Mannesmann and Securicor. Mannesmann's asset portfolio in Germany, Italy, and France places it in an enviable competitive position, in our view. As a result of its 65.2% stake in D2 (the German cellular operator), its 55.1% control of Omnitel in Italy and through its recently reinforced relationship with Vivendi (which itself controls SFR in France), we believe Mannesmann is the piper playing the tune in the European cellular sector. The concept of Securicor as a value play on the U.K. cellular sector is firmly intact, in our view. Recent consolidation in the industry has highlighted the increasing importance of cellular in the telecom sector.

Trends and Developments

The worlds of fixed and mobile communications are hurtling toward each other at an ever increasing speed. "Convergigration" is here — almost. Fixed-mobile convergence (FMC) presents a major opportunity to the aggressive

Table 4
Wireless Average Revenue per User ($US): Europe

	1997	1998E	1999E	2000E	2001E
France	$85.5	$76.1	$68.1	$61.9	$57.0
Growth	*NA*	*-11.0%*	*-10.6%*	*-9.1%*	*-7.9%*
Germany	$92.6	$75.6	$61.6	$55.9	$52.6
Growth	*NA*	*-18.3%*	*-18.5%*	*-9.4%*	*-5.8%*
Italy	$67.1	$50.5	$45.8	$44.0	$42.8
Growth	*NA*	*-24.8%*	*-9.3%*	*-3.9%*	*-2.8%*
Spain	$54.4	$48.6	$44.0	$41.1	$38.9
Growth	*NA*	*-10.6%*	*-9.4%*	*-6.7%*	*-5.4%*
Sweden	$68.6	$68.1	$60.1	$56.4	$55.1
Growth	*NA*	*NA*	*NA*	*-6.2%*	*-2.3%*
UK	$64.9	$62.8	$56.6	$47.4	$43.3
Growth	*NA*	*-3.3%*	*-9.8%*	*-16.4%*	*-8.6%*

E = Morgan Stanley Dean Witter Equity Research Estimates

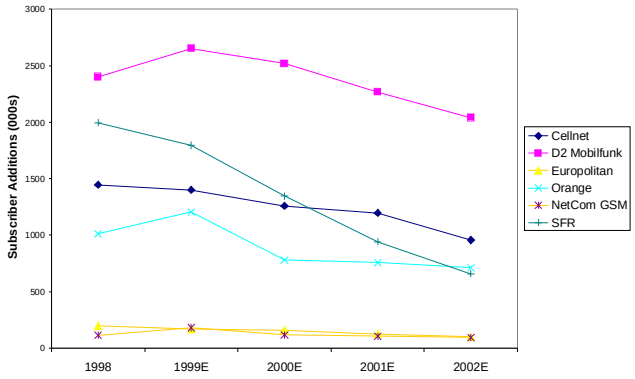
single-minded cellular operator and a significant defensive challenge to the fixed wire incumbent. To succeed, we believe cellular operators need to reduce prices and increase investment in network coverage and quality. If they do, the prize should be substantial. In our view, PTOs (public telephony operators) need to rapidly integrate their cellular subsidiaries to defend their core markets from cellular cannibalization. PTOs must also recognize and exploit their fixed networks' inherent advantages in providing broadband services as a source of growth to offset the pressure on their core business.

Fixed-mobile convergence makes sense in Europe for a multitude of reasons, in our view. Existing cellular customers will be the initial targets. This has been done through tariff strategies that attempt to capture fixed wire traffic (IDD, off-peak, weekend). FMC has the ability to exploit excess capacity on cellular networks. In some cases, the infrastructure is already in place, as commercial DECT (digital European caller's telephony)/GSM services have been launched (U.K., Scandinavia). FMC strategies vary depending on a carrier's starting point. A company could offer wireless service as a stand-alone cellular operator (Orange), a competitive fixed/cellular operator (Mannesmann and Arcor), or an incumbent PTO with a cellular subsidiary.

Issues

The European wireless market is likely to experience significant regulatory opening. A tightening regulatory stance is (and will) opening up networks to new entrants. This will likely lead to sharp reductions in fixed to mobile interconnect issues across Europe.

Figure 6
European Cellular: Net Additions



E = Morgan Stanley Dean Witter Research Estimates
Source: Company data, Morgan Stanley Dean Witter Research

Technology should play an increasingly important role going forward. Data capabilities, high-speed circuit-switched data (HSCSD), and general packet radio services (GPRS) will significantly boost bandwidth speeds.

Market Commentary

Germany is still relatively underpenetrated at 18%. The fourth-largest operator, BT/Viag, is currently providing the catalyst for price destabilization. We expect very aggressive price reductions of around 30% in 1998/99. Also, sharp declines in fixed-to-mobile interconnect rates should occur. The outlook for price elasticity is good, in our view, and should remain near its current level of 1:1.

There are currently four operators in the German market. Multiple service providers and distribution channels exist, however. As a result of competition, pricing differentials have narrowed, and three operators now have equal coverage. New entrants are therefore at a distinct disadvantage, in our opinion, although the issuance of third-generation licenses could bring new competitors into the market. Prepaid has yet to really take off but is likely to act as a catalyst for strong cellular growth in the future. Lastly, growth should benefit from low churn rates, which are currently less than 1.5% per month in Germany.

Price reductions have been well received by the German consumer base, and prepaid tariffs are becoming an increasingly important source of revenue for German wireless companies. These firms have managed to broaden the addressable market for their offerings by using different distri-

bution channels, such as retail supermarket outlets. The move to third-generation technology will have competitive, growth, and capital expenditure implications, which we believe bear close attention.

Italy is Europe's most penetrated wireless market after Scandinavia. Low SACs (subscriber acquisition costs) and low levels of price reductions should continue to fuel growth for the two existing wireless operators. A worry for these incumbents, however, is that new entrants could provide the stimulus for more rapid price declines. In Italy, fixed to mobile interconnect rates are high by European standards. In addition, with the high interconnect rates, growth has been hindered by acute capacity constraints. This should change as new spectrum is assigned. Also, Italian operators have industry-leading levels of innovation and what we view as strong management. Another driver of growth is prepaid service, which accounts for more than 95% of net additions.

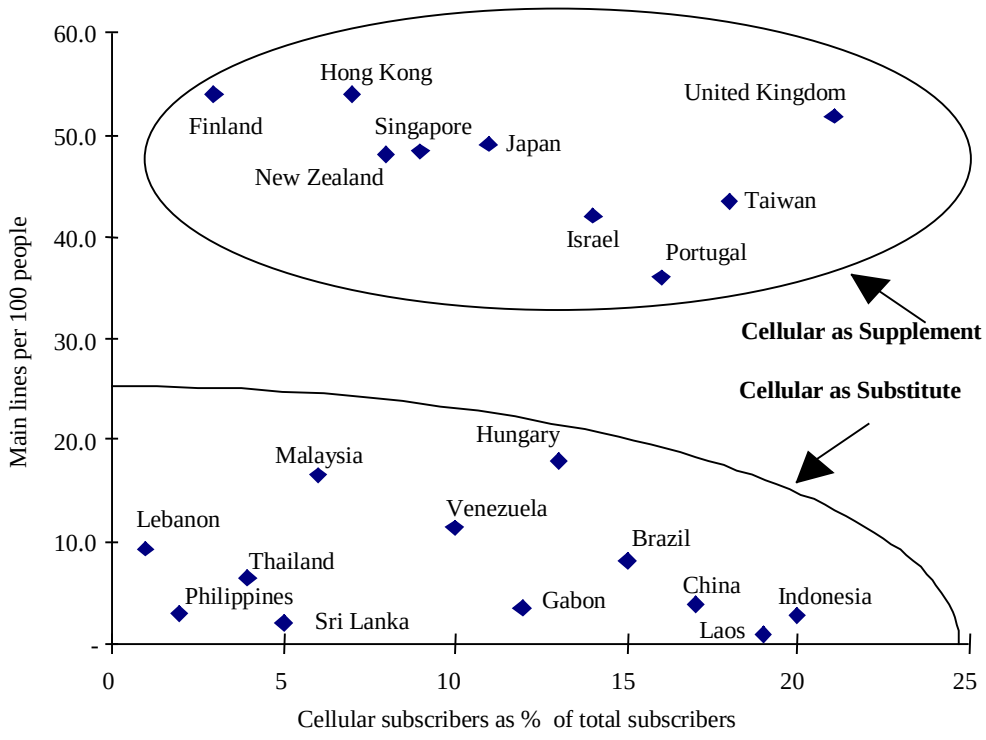
Currently, the Italian wireless market has two operators, with a new entrant scheduled to be launched in mid-1999. Further entrants may follow as third-generation licenses make the market more attractive. Even with new entrants, several factors should lead to continued growth in the Italian cellular market. First, segmented tariffing is likely to boost network utilization. Second, pricing differentials have narrowed. Finally, churn rates appear under control, currently less than 1.5% per month.

We expect fixed to mobile interconnect rates to fall sharply in Italy, and price reductions likely will occur when new entrants launch service. To maintain their dominant position, the current Italian wireless providers are expected to continue to develop new distribution channels to broaden their addressable markets. As the pace of liberalization quickens, closer cooperation between Telecom Italia and TIM is expected. The move to third-generation technology will have implications for competition, growth, and capital expenditure requirements, as in the German market.

Sweden. Scandinavia leads the world in terms of cellular penetration. Sweden is no exception, with current penetration of over 53.6%. High wealth, equal distribution of in-

Figure 7

Cellular as Supplement or Substitute



Source: ITU

come, high technological awareness, and a large number of second homes are the main drivers of cellular acceptance in Sweden. The three existing operators' growth has also been driven by high levels of SACs and the use of prepaid cards. Despite the perceived maturity of the market, the Swedish growth rate was 50% higher than the European average in 1998.

All three Swedish wireless operators launched service at the same time, resulting in a fiercely competitive market at the start. Each operator had a different entry strategy, however: Europolitan focused on the business market while Comviq targeted the consumer market and Telia addressed both the consumer and business markets. Since the inception of service, pricing differentials have narrowed, and the differences in the three operators' coverage and quality are less marked. Pricing pressure has been moderate over the last two years, and we expect it to remain so.

Norway currently has a penetration level of over 49%. The Norwegian and Swedish markets are very similar. High wealth, an even distribution of income, high technological awareness, and a large number of second homes are the main drivers of cellular acceptance. Growth at the two existing operators has been fueled by high levels of SACs and aggressive price declines. We expect prepaid to provide the main catalyst for future growth.

In the Norwegian market, the two current operators launched service at the same time, which created a fiercely competitive environment at the start. They also pursued different entry strategies: NetCom is consumer oriented, while TeleNor dominates the business market. Price pressure has been acute over the last two years, but distribution significantly expanded over the last six months, which should provide the basis for strong growth in 1999 and beyond. Although Norwegian wireless penetration is high by world standards, the young, elderly, and female markets remain underpenetrated and represent growth opportunities.

In both Norway and Sweden, government regulators are poised to open up the cellular market to new entrants. Capacity issues should facilitate the migration to dual-band handsets for both the incumbents and the new entrants. The move to third-generation technology will be another important issue to monitor.

Eastern European Wireline: Halfway Between Emerging and Developed

Overview

Fixed line subscriber growth is generally stronger in Emerging European countries than Western Europe. We project annually compounded fixed line subscriber growth of 4.2% from 1998 to 2005 in Emerging Europe, which includes Hungary, Poland, the Czech Republic, Greece, and Portugal. Average wireline penetration in the region should reach 44% by year-end 2005 versus 31% at year-end 1998, when there were 24.9 million lines in service. Other expected growth drivers include tariff rebalancing, which will help eliminate cross-subsidization of the local loop by long distance and of residential telephony by business subscribers. In revenue terms, we expect the Emerging European market of fixed line incumbents to grow from $11.7 billion in 1998 to $13.8 billion in 2000. Low nominal per-capita GDP effectively caps wireline and wireless penetration at lower levels in Eastern Europe than in the EU.

Wireline ARPU levels in Emerging Europe are still around 50% lower than the average for Western Europe. In Emerging Europe, ARPU levels range from $400 per year in the Czech Republic to $600 in Greece, with differences in spending power and access tariffs accounting for the spread. Among the key wireline ARPU drivers in Emerging Europe are changes in subscriber mix, the rapid rise of interconnect revenues (particularly with mobile operators), and the introduction of new services. Digitisation has reached an average level of 70% in the region, and significant new revenues are being generated from the use of voicemail and premium-rate numbers.

Competition should start in long distance and international voice once monopolies expire, generally in 2000 and 2001. In most countries, a couple of consortia, including major western telecom operators, have established positions in the data or private network markets while waiting for the fixed voice market to open up. Local access competition is expected to come mainly through substitution by mobile, since the fixed line local access entrants in both Hungary and Poland have found it difficult to finance the massive investments required in the local loop.

The substitution of mobile for fixed line service will continue to challenge the incumbents, but we expect their market-share losses to be more gradual than in Western Europe. We base this conclusion on the limited number of multinational businesses and the emphasis of Emerging European regulators on forcing competitors to build their own networks, rather than allowing reselling as in Western Europe. Incumbents should have more success in maintaining market share where they are permitted to rebalance tariffs aggressively (cutting vulnerable long distance rates), as MATAV has in Hungary.

Profitability should improve. Restructuring should boost the earnings of Emerging European incumbent telcos, mainly through elimination of redundancies and modernization. Lower levels of digitisation in Emerging Europe than in Western Europe leave substantial room for improvement. Over time, we believe that Eastern European telcos will reduce their gearing and turn free cash flow positive as modernization requirements diminish and the growth component of capital spending declines. The introduction of cost-based interconnect (starting in 2001 in Poland) should also help them turn cash flow positive.

Investor perceptions of Eastern European carriers should gradually align themselves with those of Western European carriers. EU convergence should help to reduce risks that investors attach to Emerging Europe, and trading multiples for Emerging European telcos should gradually trend toward those for Western European operators — particularly for the most advanced Eastern European operators like MATAV, our preferred choice among Emerging European telecom stocks.

Investment Themes

Deregulation and competition are important areas of investor interest. We believe liberalization and deregulation of different market segments will provide investors with many opportunities. We expect increasing competition to develop (especially in domestic long distance and international long distance), which may cause incumbents to lose market share. We believe that the rate of decline in market share will largely be determined by the quality of manage-

Table 1
Liberalisation Dates for Eastern European Telecommunications Markets

Market segment	TPSA (Poland)	MATAV[1] (Hungary)	SPT (Czech Republic)
Local access	Duopolies created 1993-98	Local monopolies (not all MATAV) until 2002	Monopoly until 2000 with some exceptions
Local market share (%)	96	75	98
DLD	Monopoly until 1999	Monopoly until 2002	Monopoly until 2000
ILD	Monopoly until 2003	Monopoly until 2002	Monopoly until 2000

Source: Company data, Morgan Stanley Dean Witter Research
1. Liberalisation may be brought forward to 2001 with the agreement of the operators

ment, its effectiveness in preempting or combating impending competition, and the regulators. Managements in the telcos that have foreign strategic partners (e.g., MATAV and SPT) are better positioned, we believe, as they can rely on their partners' expertise in tackling issues of competitive threat. For example, MATAV has reduced its long distance tariffs to levels where margins are similar to those in developed countries, thus making the sector less attractive to new entrants and effectively preempting competition.

Another variable is the regulatory framework. Initially, competition in Emerging Europe is likely to be infrastructure-based and to discourage reselling, especially in the countries where the state still retains large stakes in incumbent operators. However, regulators can impose more aggressive liberalisation in the form of unbundled local loop, subscriber pre-select, or number portability. For instance, TPSA's market share loss in domestic long distance, once the market is liberalised in 2H99, would depend greatly on whether the regulator imposes long distance access by means of subscriber pre-select (larger) or by using dialing pre-fix (smaller).

Eastern European telecommunications markets should gradually evolve from demand-driven to supply-driven. Restructuring, leading to greater efficiency (mainly through redundancies and modernization), should boost earnings of all Emerging European incumbent telcos, however, to a different extent across countries. The largest beneficiary would probably be TPSA, which still has a long way to go to rebalance its tariffs and reduce its workforce from the current level of 72,500 employees. MATAV and SPT have already reaped some benefits of restructuring and tariff rebalancing, and therefore their remaining efficiency and productivity gains should be smaller. The low level of digitisation in Emerging Europe relative to Western Europe generally leaves room for improvement: There are fewer value-added services, less capacity, and higher labour costs.

Tariff rebalancing and the elimination of cross-subsidization of the local loop by long distance and of the residential telephony by business subscribers are also likely to drive fixed line growth. In Poland, TPSA is due to announce the actual costs of various services it provides by March 2000. We expect such cost calculations to show that monthly fees and local call charges both fall short of meeting the actual costs of local telephony, and believe that gradual elimination of cross-subsidies is likely to follow. Polish long distance rates are already being rebalanced, and TPSA plans to achieve EU benchmark ratios by year-end 2003. In Hungary, MATAV continues with a well-established rebalancing program aimed at eliminating cross-subsidisation by 2001. SPT, in the Czech Republic, has more unbalanced tariffs, but it made a sharp rebalancing move for the first time in early 1999, which, if repeated in 2000 and 2001, should help slow the pace of market share loss when liberalisation occurs.

Eastern European telcos are turning free cash flow positive and will reduce their gearing, in our view, with the possible exception of TPSA (Poland). This deleveraging should occur as modernisation requirements and the growth component of capex decline. The introduction of cost-based interconnection (starting in 2001 in Poland) and more experienced management should also help companies turn free cash flow positive. They may spend their excess cash on paying higher dividends or investing in new projects to grow returns. To sustain an optimal level of gearing, companies likely will start investing internationally; OTE, for example, has acquired stakes in Armentel and Romtelecom.

The fixed/mobile convergence threat should increase. Fixed line operators will continue to be challenged as mobile is increasingly substituted for fixed. This trend is changing the underlying economics of the fixed line business, and bears close attention by investors. The initial impact of explosive mobile growth on incumbents' revenues is positive due to large interconnect payments; however, as the mobile subscriber base expands, it takes a larger proportion of traffic and customers away from fixed line operators. Fixed/mobile convergence diminishes the value of traditional fixed line networks.

Investors' perceptions of Eastern European carriers should gradually fall into line with those of Western European carriers. EU convergence should help to reduce risks that investors attach to Emerging European telcos (such as country and currency risks). Thus, trading multiples for Emerging European telcos likely will gradually trend toward those for Western European operators. This should be particularly true of the most advanced Eastern European operators (e.g., MATAV). In our view, this process will be country-specific as well as company-specific, since it will be highly dependent on the macroeconomic environment.

Our preferred choice among Emerging European telecom stocks is MATAV due to its low costs, fairly rebalanced tariffs, transparent per-second billing, and a high proportion of revenues from growth businesses.

Market Growth

Fixed line subscriber growth is typically stronger in emerging Europe than in mainstream Western Europe. We estimate subscriber growth in the Emerging European fixed line telecom market (including Hungary, Poland, Czech republic, Greece and Portugal), at a CAGR of 4.2% during 1998–2005. At year-end 1998, the region had 24.9 million lines in service, representing average wireline penetration of 31%. We project that average penetration will reach 44% by year-end 2005.

In revenue terms, we expect the Emerging European fixed line incumbent market to grow from $11.7 billion in 1998 to $13.8 billion in 2000 as a result of higher GDP growth and/or catch-up investment programs in the East. However, subscriber growth is now slowing in Hungary and the Czech Republic, as demand has been largely satisfied at the current GDP per capita levels (penetration is above 30%). As a result, real revenue growth is forecast to slow. We expect Poland to continue to show annual gains of more than 10%, owing to low current penetration (20%) and a long waiting list. In our view, low nominal GDP per capita effectively puts a lower cap on wireline and wireless penetration levels in Eastern European countries compared with levels in the EU.

Wireline ARPU levels in Eastern Europe are still around 50% below the Western European average. Levels in Emerging Europe range from $400 per year in the Czech Republic up to $600 in Greece. This difference is largely due to lower spending power and low access tariffs. Typically, ARPU levels fall in real terms during the period of strong subscriber growth and start to grow as line growth slows.

Some key wireline ARPU drivers that we believe merit investor attention include:

- **Changing subscriber mix.** Since the waiting lists of the Eastern European telcos consist almost entirely of residential customers, the proportion of business lines is falling steadily, resulting in lower revenues per line.

- **Tariffs.** Tariff levels are typically indexed to inflation, making it difficult to increase average tariffs in real terms. The ARPU benefits of rising subscription and local call fees have been offset by declining tariffs and volumes for long distance.

- **Rapid rise of interconnect revenues** (particularly with mobile operators). This rise helps to boost stagnant fixed line ARPU. Mobile interconnect revenue is the strongest source of growth for fixed line operators in the region, but has potential to put severe pressure on margins, as the proportion of revenue going to mobile is much higher than in Western Europe (even on fixed to mobile calls). New fixed line entrants are also paying growing interconnect fees to the incumbents in Poland and Hungary.

- **Introduction of new services.** Digitalization has reached an average level of 70% in the region, and significant new revenues are being generated from the use of voice mail and premium-rate numbers. Data usage is a smaller component of revenues than in Western Europe, but may help boost ARPUs in the long term.

Competitive Environment

Competition should develop in long distance and international voice once monopolies expire. This should generally occur on January 1, 2000, or January 1, 2001 (Table 1). In most countries, a couple of consortia that include major western telcos have positioned themselves in the data or private network markets while waiting to enter the fixed voice market. Local access competition is expected to come mainly from substitution by mobile, since the fixed line local access entrants in both Hungary and Poland have found it difficult to finance the massive investments required in the local loop.

We believe that market share losses by incumbent fixed line providers in Eastern Europe will be more gradual than in Western Europe. We expect this outcome based on the limited number of multinational businesses and the emphasis of regulators in forcing competitors to build their own networks, rather than allowing reselling as in Western Europe. Incumbents should retain most market share where they are permitted to rebalance tariffs aggressively (cutting vulnerable long distance rates). Rebalancing has made rapid progress in 1999, though much remains to be done in the Czech Republic, Poland, and Greece.

Despite the modest level of competition anticipated in Eastern Europe, the effects on incumbents could be damaging. We expect this to occur because incumbents typically depend on a small number of usage-intensive business subscribers to subsidise a large and poor residential base. We believe incumbents such as TPSA are ill equipped to defend business accounts, owing to their limited service offering, lack of marketing and service specialists, and their focus on residential-line building. As businesses migrate to the new entrants, margins at the incumbents are expected to fall.

Trends and Developments

Heavy turnaround investment is gradually giving way to a period of strong monopoly cash flows. These profits should allow incumbents to pay down their substantial debt burdens before they face competition. Poland is an exception, since TPSA already faces competition. The company's investment program is ongoing and gearing is rising steadily. We forecast that TPSA will remain significantly free cash flow negative at least until 2001.

Tariff rebalancing is an important trend to monitor. Rebalancing will likely be designed to eliminate cross-subsidisation of residential customers by business customers, which would reduce the impact losing business clients to competitors.

Data still represent a relatively small proportion of incumbents' revenues, but this could change. Demand for data services is still low in Emerging Europe, but rapid changes in technology clearly pose a major threat to operators that are still investing aggressively in basic circuit-switched networks, in our view. If building packet switched networks proves to be vital to competitiveness, the Emerging European operators will have to take write-downs for the large part of their circuit-switched assets, which has not yet been depreciated.

Asia/Pacific Telecoms: Progress in Fits and Starts

Background

The 1990s have represented a sea change in telecoms throughout the Asia-Pacific as virtually every market has opened its doors to competition. Today, even the most protected Asian market has at least two operators per sector, with several — indeed, too many — pressured by over-licensing and under-regulation that have dampened profits and investment returns in all but a few markets.

Telecom liberalization in the Asia-Pacific region began in the early 1990s, with competition in New Zealand and Australia. In bids to develop their respective telecom industries and reduce consumer tariffs, the governments of New Zealand and Australia saw new entrants begin competing with their incumbent carriers in 1990 and 1992, respectively. Telecom Corporation of New Zealand (TCNZ) — privatized through a 100% sale to Ameritech and Bell Atlantic — entered a completely unregulated market with no limits on the number or scope of new entrants. Newly created Telstra Corporation faced two new competitors — Optus Communications in long distance and mobile and Vodafone Australia in mobile only. As tariffs fell quickly in the early years of competition, telecom demand accelerated in both markets.

Other Southeast Asian countries, eager to quicken their own telecom development, began licensing multiple operators into fixed line and wireless services beginning in 1993–94. The Philippines became the first Asian country to open the competitive floodgates by licensing nine long distance and four new cellular operators to compete with incumbents Philippine Long Distance Telephone (PLDT) and Pilipino Telephone (Piltel), respectively. Malaysia followed soon thereafter, with four new licenses distributed in each of the fixed line and wireless sectors by the end of 1994.

Indonesia, India, and Korea sought more limited competition with their incumbents. Indonesian regulators divided the country into seven operating zones and allowed private joint venture ("KSO") partners into five of these (excluding the two largest cities). India's telecom authorities conducted what we view as a well intentioned but ultimately side-tracked auction for one new fixed line license in each of the country's 21 designated operating zones. Korea allowed one new long distance provider — DACOM — to compete with Korea Telecom beginning in 1991–92, with an additional competitor added in each of the long distance and local markets only in 1997–98.

Thailand has also seen a more controlled liberalization phase, where two separate Build-Transfer-Operate (BTO) concessions were issued for Bangkok and the provincial areas in 1992–93 and remain the only private fixed-line operations in Thailand to this date. Thailand's cellular segment has also been relatively closed since the early 1990s, with AIS and TAC sharing the market and new entrant Digital Phone Company arriving only in 1997. International long distance continues to be a monopoly under the Communication Authority of Thailand (CAT).

Hong Kong opened its long distance market to wider competition in 1995, with the entry of Hutchison, New World, and New T&T (a Wharf subsidiary) into the local and IDD wholesale market. Singapore introduced competition the latest, with SingTel's fixed line monopoly to end only in April 2000.

Regulation has lagged the issuance of new licenses, however; few Asian telecom markets have independent regulators, re-balanced tariffs, or defined rate-indexing mechanisms. Long distance continues to generate the majority of revenues for most Asian telecom incumbents. In most countries, local rates have risen little over the past decade; the few increases have come through in a very *ad hoc* fashion. Only the Philippines and Hong Kong maintain defined tariff indexation mechanisms. Indonesia also had a CPI-X formula to benchmark annual price changes; however, the system has become decreasingly transparent — or effective — since the beginning of Asia's economic crisis in 1997. In most Asian countries, the regulator remains a government-driven body, creating an inherent conflict of interest, given many states' continued majority ownership of their incumbent telcos.

Many Asian telecom markets have now seen the regional economic crisis push smaller operators to the verge of bankruptcy. Newer entrants in the Philippines, Malaysia, Thailand, and Indonesia face mounting financial burdens as

currency devaluation has raised the local-equivalent value of their U.S. dollar-denominated debt. Combined with weak cash flows from small and economically battered subscriber bases, these carriers now require substantial capital infusions, debt restructurings, or tariff increases to stay afloat. Incumbents have thus maintained their dominance over most markets — particularly the local telephony segment — even after 4–5 years of competition.

The Asian telecom market has thus branched into one sphere of developed markets in which data and cellular remain the key growth engines and another of emerging markets, where regulation must continue to catch up with historical over-licensing. In our opinion, Hong Kong, Singapore, Australia, New Zealand, and Korea are more likely to see their telecom markets develop along the lines of industries in North America and western Europe, with voice traffic soon to be surpassed by data, the Internet playing an increasing role in telecom services and revenues, and fixed-mobile convergence reshaping wireless growth.

We believe Indonesia, India, the Philippines, Malaysia, and Thailand must resolve lingering issues of tariff indexation, full privatization of incumbent carriers, and regulatory independence for their telecom markets to develop along more sustainable paths.

Asia/Pacific Wireline: Regulatory Transparency Is Key for Investors

Overview

The potential for wireline growth in Asian markets remains significant, though the region's economic crisis has slowed progress. Together, China, India, Vietnam, the Philippines, and Thailand represent roughly 40% of the world's population, but in aggregate, fixed-line penetration in these countries is less than 4%. However, equipment and financing costs for wireline networks rose during the Asian economic crisis as currencies fell, slowing or halting fixed line growth across the region in 1998. In addition, the crisis led operators to focus on higher-revenue producing customers rather than on broadening penetration. Moreover, the promise of wireless to enable more-economic fixed line build-outs has yet to materialize in Asia. Heavy debt and economic weakness have taken a toll on Asian competitors' business plans, and we expect to see consolidation in Asian wireline.

Competition looms larger in long distance than in the local loop. Many Asian operators continue to reap the benefits of large incoming/outgoing international call imbalances, which have made long distance a cash cow through large foreign-denominated net settlement payments. But pressures on these international revenues are intensifying: U.S. regulatory actions have caused settlement rates to drop across Asia, and competitors have been able to take international and domestic long distance share. Telephony over the Internet, still constrained by voice quality and/or regulations, also threatens long distance franchises. In contrast, few new operators have been able to achieve market share gains in the local loop, and incumbents still control over 75% of Asia's fixed lines. In addition, poor interconnection limits new entrants' ability to market their services.

An effective, transparent regulatory regime is key to limiting investment risk in Asian telecom. As international settlement revenues fall, the region's telcos are asking

Table 1

Access Lines (Thousands): Asia

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Australia	NA	8,695	9,094	9,440	9,740	10,077	10,444	10,842	11,255	11,685	12,131	12,594	13,076	13,576
Growth		*NA*	*4.6%*	*3.8%*	*3.2%*	*3.5%*	*3.6%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*	*3.8%*
China	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Hong Kong	2,992	3,149	3,275	3,464	3,659	3,687	3,752	3,879	4,030	4,248	4,438	4,647	4,875	5,125
Growth		*5.3%*	*4.0%*	*5.8%*	*5.7%*	*0.8%*	*1.8%*	*3.4%*	*3.9%*	*5.4%*	*4.5%*	*4.7%*	*4.9%*	*5.1%*
India	8,026	9,795	11,978	14,543	17,788	21,213	24,851	28,459	31,798	35,160	38,549	41,964	45,409	48,885
Growth		*22.1%*	*22.3%*	*21.4%*	*22.3%*	*19.3%*	*17.1%*	*14.5%*	*11.7%*	*10.6%*	*9.6%*	*8.9%*	*8.2%*	*7.7%*
Indonesia	1,864	2,463	3,291	4,186	4,982	5,572	5,972	6,597	7,272	7,997	8,722	9,447	10,172	10,897
Growth		*32.1%*	*33.6%*	*27.2%*	*19.0%*	*11.8%*	*7.2%*	*10.5%*	*10.2%*	*10.0%*	*9.1%*	*8.3%*	*7.7%*	*7.1%*
Korea	16,633	17,647	18,600	19,601	20,422	20,145	20,630	21,173	21,702	22,245	22,801	23,371	23,955	24,554
Growth		*6.1%*	*5.4%*	*5.4%*	*4.2%*	*-1.4%*	*2.4%*	*2.6%*	*2.5%*	*2.5%*	*2.5%*	*2.5%*	*2.5%*	*2.5%*
Malaysia	2,411	2,864	3,332	3,776	4,268	4,610	4,945	5,280	5,580	5,881	6,181	6,481	6,760	NA
Growth		*18.8%*	*16.4%*	*13.3%*	*13.0%*	*8.0%*	*7.3%*	*6.8%*	*5.7%*	*5.4%*	*5.1%*	*4.9%*	*4.3%*	*NA*
New Zealand	1,593	1,658	1,719	1,785	1,855	1,920	1,995	2,074	2,156	2,243	2,333	2,427	2,525	2,629
Growth		*4.1%*	*3.7%*	*3.9%*	*3.9%*	*3.5%*	*3.9%*	*3.9%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.1%*	*4.1%*
Philippines	903	1,039	1,320	1,852	2,255	2,526	2,829	3,253	3,579	3,937	4,330	4,763	5,240	5,764
Growth		*15.0%*	*27.0%*	*40.3%*	*21.8%*	*12.0%*	*12.0%*	*15.0%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*
Singapore	1,246	1,332	1,420	1,563	1,686	1,795	1,921	2,055	2,199	2,353	2,518	2,694	2,882	3,084
Growth		*6.9%*	*6.6%*	*10.1%*	*7.8%*	*6.5%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*
Thailand	NA	NA	3,841	4,680	5,041	5,141	6,066	6,366	6,691	6,991	7,241	7,241	7,241	7,241
Growth		*NA*	*NA*	*21.8%*	*7.7%*	*2.0%*	*18.0%*	*4.9%*	*5.1%*	*4.5%*	*3.6%*	*0.0%*	*0.0%*	*0.0%*
Japan	58,699	59,927	61,295	62,281	62,506	62,196	62,707	63,254	63,804	64,358	64,916	65,478	66,045	66,616
Growth		*2.1%*	*2.3%*	*1.6%*	*0.4%*	*-0.5%*	*0.8%*	*0.9%*	*0.9%*	*0.9%*	*0.9%*	*0.9%*	*0.9%*	*0.9%*

E = Morgan Stanley Dean Witter Equity Research Estimates

local regulators for help through tariff rebalancing (e.g., raising local rates and reducing international rates) to compensate. Independent regulators should provide investors some assurance concerning tariffs and fairness in interconnection and access. In addition, the process of liberalizing telecom markets and introducing competition should be transparent and rational. From this standpoint, we believe that Australia, Singapore, and New Zealand afford the best climate for telecom investors.

Based on company fundamentals, our top wireline picks in the region are Telstra, TCNZ, Hongkong Telecom, and SingTel. In our view, these carriers have the financial, operating, and management strength to compete in both domestic and foreign markets, although they are likely to face challenges from such global competitors as AT&T-BT and MCI WorldCom.

Key Investment Themes

Regulatory transparency is critical. Without a clearly defined set of regulations, we believe telco investment in Asia remains risky. The existence of an effective, independent regulator should provide some comfort for investors with respect to (i) indexed and re-balanced tariffs, in addition to (ii) fair interconnection and access policies.

Investors should also look for the "right" amount of competition. In Asia, the competitive environment has historically been either monopolistic or overly competitive. While a lack of competition limits market growth, too much competition can limit profitability. Market liberalization and the introduction of competitors should be logical and transparent, with the "right" amount of competition resulting. Currently, we believe the best examples of this situation are in Australia, Singapore, and New Zealand. In contrast, we view investment opportunities as much less favorable in the Philippines and Malaysia.

Foreign investors now have greater leverage. Asia's first wave of foreign investment saw the usual suspects (DT, U.S. West, etc.) develop numerous small stakes in a host of Asian telecom operators. In few cases was this approach successful, however, as the foreign operators wielded little management and operational influence. Post-crisis foreign operators (BT, SingTel) have been showing greater restraint, looking instead to take larger stakes in Asian operators and greater management control. We expect this trend to continue, with experienced management teams helping to turn local operators into world-class service providers and acting as regional points of presence for global voice/data networks.

We see three prerequisites for Asian telecom operators to succeed over the medium term: financial scale, operating efficiency, and experienced and dynamic management. Winning players will need to build off strong positions in their domestic markets and apply them elsewhere in the region, or the globe, to maintain a competitive advantage. Experience in data and cellular will be especially important, given the exceptional growth anticipated in both sectors over the medium term.

From a company standpoint, we believe the greatest potential among the Asia-Pacific telcos lies with Telstra, TCNZ, Hongkong Telecom, and SingTel, all three of

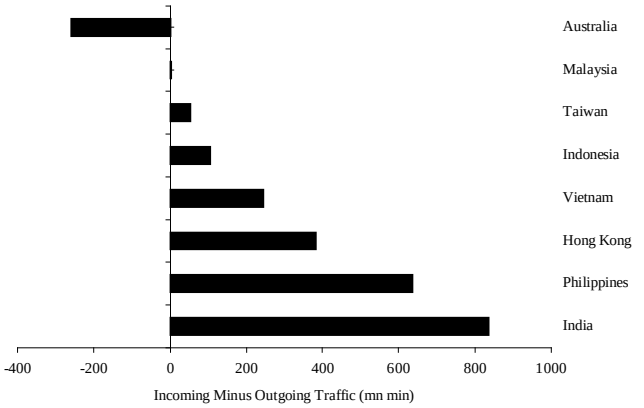
Table 2

Global Emerging Market Telecommunications: Levels of Competition — Number of Licensed Operators by Segment

Region/Country	Cellular	Local	Long-distance
Asia			
China	3	3	3
Hong Kong	6	4	4*
India	4	2/region	1
Indonesia	3	1/region	2
Korea	5	2	3
Malaysia	5	5	5
The Philippines	5	2/region	10
Singapore	2**	1**	1**
Taiwan	5/region	1	1
Thailand	4	2/region	1

**Excludes 70 ISR (Int'l Simple Re-Sale) licensees. **StarHub consortium to enter cellular, local and L-D markets in April 2000.*
Source: Morgan Stanley Dean Witter Research

Figure 1
1997 Asian Telephone Traffic Balance



Source: Telegeography 1999

which we believe have the wherewithal to invest and compete effectively both within and outside their home markets. Nonetheless, over the medium term, we see the greatest challenge for these operators due to prospective competition from the likes of AT&T-BT and MCI WorldCom — threats that we believe call for accelerated efforts by the Asia-Pacific players to establish greater geographic scope and size as the Asian markets deregulate.

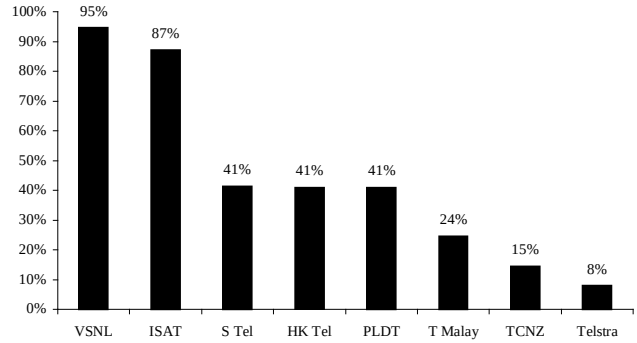
Market Growth

We feel that significant potential for wireline market growth remains in Asia for several reasons. The combined population of China, India, Vietnam, the Philippines, and Thailand is roughly 2.4 billion, or 40% of the world total. Fixed line penetration in these countries, however, is less than 4% on a combined basis.

However, the Asian economic crisis hit fixed line service operators more severely than wireless operators. Equipment and financing costs for capital-intensive wireline networks greatly expanded as currencies fell. Wireless growth was relatively resilient during 1998, yet fixed line growth slowed significantly or stopped. This was most notable in developing Asian markets like the Philippines, Indonesia, and Thailand. Even in developed Asia, a marked slowdown in line growth occurred in Hong Kong and Singapore, and the total number of wireline subscribers actually *decreased* in Korea.

In addition, efforts to expand fixed line services beyond the major cities have generally fallen short of their goals.

Figure 2
International Long Distance as a Percentage of 1998E Total Revenues



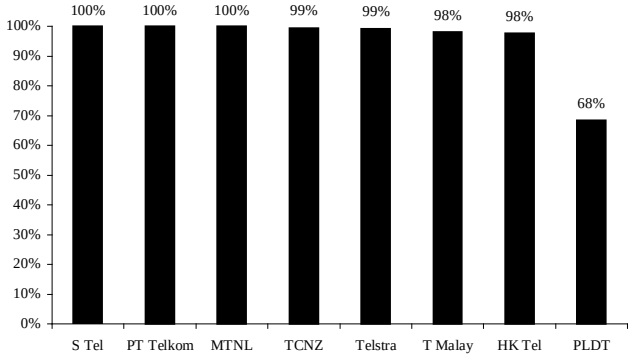
Source: Morgan Stanley Dean Witter Equity Research Estimates

Universal service is a great idea, but someone has to pay for it. Unfortunately, the Asian crisis further narrowed operators' focus on higher-revenue producing customers. Despite having more than ten players in the Philippines, simple economics have led operators to build out more extensively in Manila and other major cities. Also, the promise of WiLL (Wireless local loop) for more economic fixed line build-out has yet to materialize in Asia.

International long distance revenues have long been the cash cow of Asian incumbents. Many operators in Asia continue to enjoy large incoming/outgoing international call imbalances. This has resulted in large foreign-denominated net settlement payments accruing to Asian operators. In contrast, basic telephony (i.e., monthly subscription and usage) tariffs have rarely adjusted enough to keep the economics of local build-out attractive in the face of real tariff declines due to inflation. As a result, outgoing international calls have generally cross-subsidized the provision of the largely unprofitable local service.

The pressure on these international long distance revenues is increasing, however. U.S. courts have approved the Federal Communications Commission's (FCC) pricing and timing benchmarks, causing settlement rates to drop quickly across Asia. As a result, Asia's operators are appealing to local regulators for tariff rebalancing (generally raising local monthly rates and decreasing international rates) to make up for falling international revenues. In addition, market liberalization, such as Hong Kong's (January 1, 1999), has led to massive cuts in collection and accounting rates. A similar situation is developing in Singapore due

Figure 3
1998E Local Market Share



Source: Morgan Stanley Dean Witter Research Estimate

to the ramp-up in competition. IP telephony also threatens international long distance revenues, with the promise of far lower tariffs to consumers. Currently, only voice quality and/or regulation is inhibiting more widespread implementation of IP telephony.

Business lines provide much of the revenue to Asian operators. Business lines typically represent only 20–30% of total fixed line networks, yet much more in revenue terms. In India, it is estimated that the top 10% of MTNL's customers provide 80% of its revenues. Situations like this occur because monthly business rates are generally twice those of residential rates, with usage also being much higher.

In an increasingly liberalized telecom world, however, the risk of key-customer dependency is rapidly increasing. Asian operators are particularly vulnerable, as global operators such as MCI WorldCom and BT/AT&T look to poach large accounts.

Competitive Environment

In Asia, the impact of wireline competition has been limited so far. In very few cases have new operators been successful in making large local market share gains. In fact, incumbents still control over 95% of Asia's fixed lines. It is extremely expensive and time consuming to replicate the incumbents' network infrastructure. In addition, the Asian crisis has made the strong (incumbents) stronger and the weak (new competitors) weaker, or indeed, bankrupt.

Competitors have greater success taking international and domestic long distance market share, but falling tariffs threaten to undermine these revenues. Nonetheless, local competition is set to begin soon in Korea and Singapore.

Consolidation will likely follow in the wake of the financial crisis. Competitors' business plans have fallen apart under heavy debts and weak economies. In many cases, returns on equity are lower than the *cost* of equity. We believe economies of scale will drive competitors together to save on capex/marketing costs and improve access to capital. The Philippines and Malaysia appear to be the markets ripest for consolidation. Some form of restructuring is also necessary to resurrect fixed line build-out in Indonesia, in our opinion.

Interconnection problems are pervasive in Asia. Ineffective interconnection severely limits the ability of a competitor to market its services. Pricing issues dominate the interconnection debate: what is a fair price to pay for access

Table 3
Global Emerging Market Telecommunications: Regulatory Development

Country	Autonomous Regulator	Rate Rebalance Agenda	Competition Agenda	Tariff Indexing
Asia				
China	No	No	No	No
Hong Kong	Yes	No	Yes	Yes
India	No	No	Yes/No	No
Indonesia	Yes	No	Yes	No
Korea	Yes	No	Yes	No
Malaysia	Yes	No	Yes	No
The Philippines	Yes	Yes	Yes/No	Yes
Singapore	Yes	No	Yes	No
Taiwan	No	No	Yes	No
Thailand	No	No	No	No

Source: Morgan Stanley Dean Witter Research

to the incumbent's network? In the Hong Kong market, the three wireline competitors have taken only 2–3% market share in four years of operations. Their major gripe is ineffective interconnection. In the Philippines, a market saturated with over ten players, bilateral negotiations have been protracted and often ineffective.

In sum, we believe the regulator must play a key role in setting interconnection prices for various network elements before the interconnection issue will be solved.

Trends and Developments

The search for "optimal" tariff regimes will likely pick up speed. Falling international revenues and continued low penetration are forcing governments and operators to re-examine existing tariff structures. In few Asian economies has a good balance between consumer affordability and corporate profitability been struck. Effective interconnection at fair prices must occur, in our view. In most cases, we believe the regulator will need to be heavily involved selecting the "optimal" tariff.

Improving regulatory clarity will develop. We believe regulatory agencies will become more independent. This would allow for quicker and more objective reactions to shifting market dynamics. Clear frameworks for market liberalization and tariffs will likely be established. We believe this will be a precondition before foreign operators or financial buyers make large investments in Asian telcos.

We expect to see increasing foreign involvement in Asian wireline carriers. In Latin America, the post-crisis period (1995–98) saw almost every incumbent seek a foreign partner. In Asia, currently only Hong Kong Telecom (C&W) and TCNZ (Bell Atlantic) among the top 20 regional telcos have foreign partners with significant ownership stakes; we expect this to change.

Long protected by their governments, wireline companies (especially incumbents) in Asia are now increasingly looking to foreign strategic investors for fresh capital and management aid. This is most notable in Korea, Thailand (CAT, TOT), and Indonesia (PT Telkom, PT Indosat),

Table 4
Wireline Penetration: Asia

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Australia	NA	48.7%	50.4%	51.7%	52.7%	53.9%	55.3%	56.7%	58.2%	59.7%	61.3%	62.9%	64.6%	66.3%
Growth		*NA*	*3.4%*	*2.6%*	*2.0%*	*2.3%*	*2.5%*	*2.6%*	*2.6%*	*2.6%*	*2.6%*	*2.6%*	*2.6%*	*2.6%*
China*	NA	NA	NA	NA	5.6%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Hong Kong	NA	51.2%	51.9%	53.9%	55.3%	55.2%	55.6%	56.9%	58.6%	61.1%	63.2%	65.5%	68.1%	70.9%
Growth		*NA*	*1.4%*	*3.8%*	*2.6%*	*-0.2%*	*0.8%*	*2.4%*	*2.9%*	*4.3%*	*3.4%*	*3.7%*	*3.9%*	*4.1%*
India	0.9%	1.1%	1.3%	1.5%	1.8%	2.2%	2.5%	2.8%	3.0%	3.3%	3.6%	3.8%	4.0%	4.3%
Growth		*20.0%*	*20.2%*	*19.1%*	*20.0%*	*17.0%*	*14.9%*	*12.3%*	*9.6%*	*8.5%*	*7.5%*	*6.8%*	*6.1%*	*5.6%*
Indonesia	1.0%	1.3%	1.7%	2.1%	2.5%	2.7%	2.9%	3.1%	3.4%	3.7%	3.9%	4.2%	4.4%	4.7%
Growth		*30.0%*	*31.4%*	*25.1%*	*17.0%*	*10.6%*	*5.4%*	*8.7%*	*8.4%*	*8.2%*	*7.3%*	*6.5%*	*5.9%*	*5.4%*
Korea	37.8%	39.7%	41.7%	43.2%	44.4%	43.2%	43.7%	44.3%	44.8%	45.3%	45.8%	46.3%	46.9%	47.4%
Growth		*5.2%*	*5.0%*	*3.5%*	*2.8%*	*-2.6%*	*1.1%*	*1.3%*	*1.2%*	*1.2%*	*1.2%*	*1.2%*	*1.2%*	*1.2%*
Malaysia	12.6%	14.7%	16.7%	18.4%	20.3%	21.4%	22.4%	23.4%	24.1%	24.8%	25.4%	26.0%	26.4%	NA
Growth		*16.4%*	*13.5%*	*10.5%*	*10.3%*	*5.4%*	*4.7%*	*4.2%*	*3.1%*	*2.8%*	*2.5%*	*2.3%*	*1.8%*	*NA*
New Zealand	46.0%	47.5%	48.8%	50.2%	51.6%	52.9%	54.4%	56.0%	57.6%	59.3%	61.1%	63.0%	64.9%	66.8%
Growth		*3.2%*	*2.7%*	*2.8%*	*2.9%*	*2.5%*	*2.9%*	*2.9%*	*2.9%*	*3.0%*	*3.0%*	*3.0%*	*3.0%*	*3.1%*
Philippines	1.4%	1.6%	2.0%	2.7%	3.2%	3.5%	3.8%	4.3%	4.6%	5.0%	5.3%	5.7%	6.2%	6.6%
Growth		*14.3%*	*24.5%*	*36.8%*	*19.1%*	*9.5%*	*9.5%*	*12.4%*	*7.5%*	*7.5%*	*7.5%*	*7.5%*	*7.5%*	*7.5%*
Singapore	43.4%	45.5%	47.6%	51.5%	54.5%	57.0%	60.0%	63.0%	66.2%	69.6%	73.2%	76.9%	80.8%	85.0%
Growth		*4.7%*	*4.7%*	*8.1%*	*5.9%*	*4.6%*	*5.1%*	*5.1%*	*5.1%*	*5.1%*	*5.1%*	*5.1%*	*5.1%*	*5.1%*
Thailand	NA	NA	6.5%	7.8%	8.3%	8.3%	9.6%	10.0%	10.3%	10.6%	10.9%	10.7%	10.5%	10.4%
Growth		*NA*	*NA*	*20.0%*	*6.1%*	*0.5%*	*16.2%*	*3.4%*	*3.6%*	*2.9%*	*2.0%*	*-1.5%*	*-1.5%*	*-1.5%*
Japan	47.3%	47.9%	48.8%	49.5%	49.5%	49.2%	49.5%	49.8%	50.2%	50.6%	50.9%	51.3%	51.7%	52.1%
Growth		*1.3%*	*1.8%*	*1.4%*	*0.1%*	*-0.7%*	*0.6%*	*0.7%*	*0.7%*	*0.7%*	*0.7%*	*0.8%*	*0.8%*	*0.8%*

**International Telecommunication Union*
E = Morgan Stanley Dean Witter Equity Research Estimates

where privatization and strategic stake sales look increasingly likely.

The data boom *is* coming to Asia. Data and multimedia services have been engines of growth in the developed markets of Asia. In Hong Kong, these services now represent nearly 20% of total revenues — up from only 5% five years ago. A similar picture is playing out in Singapore, Australia, and New Zealand. While PC and telephone (wireline and wireless) penetration are pre-conditions for the occurrence of the data boom, we believe operators in developing countries must be ready to provide these services to their customers as soon as that penetration is available.

The networks of tomorrow should significantly decrease the value of existing networks. We believe that IP telephony (specifically international) provides a very real threat to international revenue streams that are already under fire. The question arises: What will Asia's incumbent operators do with their legacy networks? The likely answer is that they will be rendered obsolete by the high-bandwidth offerings of new competitors. As markets continue to open, Asia's operators have the potential to miss out entirely on the growth provided by these new networks. Large global competitors are currently capable of providing services that locals cannot yet replicate. If this situation does not change, Asian operators may miss out on the data boom.

Asia/Pacific Wireless: Consolidation Likely to Accelerate

Overview

Competition remains intense in most Asia-Pacific wireless markets. Nearly all Asian economies have three or more cellular operators, and several have five or six. Consolidation is likely to accelerate: We expect one or two operators to exit Hong Kong, Malaysia, and the Philippines, and new competition is less likely to emerge in Thailand, Indonesia, and India, though we do expect to see new operators in Australia, China, Singapore, and New Zealand.

Prices should stabilize as weaker players exit the field. The 10–20% annual declines in ARPUs among traditional customers seen in many countries from 1995–98 should decline to 3–7% over the next two years. Handset subsidies should also decline as ARPUs bottom and competition for new subscribers becomes more rational. On the bright side, price declines have brought new user groups to Asian wireless telephony, such as women and teens.

Despite the Asian crisis, demand has remained strong in the region's developed markets. We expect penetration rates to exceed 50% in Hong Kong, Singapore, Korea, Japan, and Australia by 2003. On the other hand, disconnects have increased in emerging Asian markets as a result of bad debts. In the Philippines and Indonesia, Thailand, and Malaysia, we do not expect subscriber addition rates to recover significantly until late 1999 or 2000.

Prepaid customers should comprise 20–30% of total wireless users in most Asia-Pacific markets by year-end 2000, according to our projections. Prepaid services are now available in the Philippines, Indonesia, India, Hong Kong, Malaysia, and New Zealand, and prepaid growth continues to accelerate, especially in the Philippines and India. In our view, prepaid has the potential to solve a number of cellular issues in the region, with the benefits of lower default risk and wider margins more than offsetting pressure on ARPUs. In addition, mobile data services should help to stabilize ARPUs and are expected to reach 15–20% of total telecom revenues by year-end 2000 from 5–10% currently.

In Asia's developed markets, our favorites are SmarTone and SK Telecom; in emerging markets, our top picks are China Telecom (HK) and Thailand's Advanced Info Service. All of these companies have strong or leading domestic market positions, and all benefit from strong balance sheets and brand names. SmarTone and AIS have the added advantage of strategic ownership by large foreign partners (British Telecom and Singapore Telecom, respectively).

Key Investment Themes

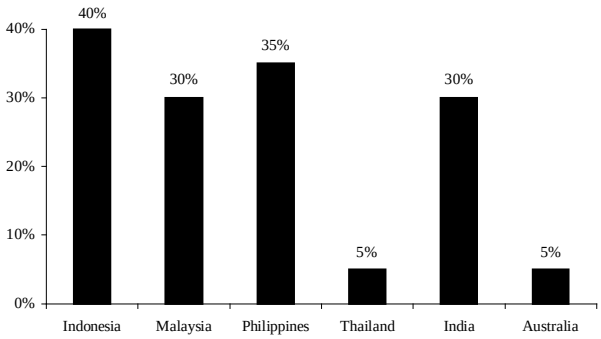
In Asia, competition and consolidation remain the key drivers of investment returns in most markets, in our view. We expect one or two operators to exit in Hong Kong's cellular arena, Malaysia, and the Philippines. Also, little new competition will likely surface in Thailand, Indonesia, and India. However, we expect new operators to enter gradually in Australia, China, Singapore, and New Zealand.

Digital conversion risk remains high for a number of carriers. Incumbent carriers in Thailand, Malaysia, the Philippines, Australia, and New Zealand maintain high proportions of their customers on analog networks. This poses a problem, we believe, as analog networks should all but disappear within the coming three or four years — at latest with the advent of W-CDMA technology.

Emerging market operators need to stabilize their subscriber bases. We believe investors should be wary of those companies that focus on average revenues per unit (ARPU) and margins. Bad debts and related subscriber disconnections need to come under better control before these companies become attractive, in our view. Likewise, we believe runaway up-front subsidies have to be controlled. In most cases, we believe prepaid will be able to solve a number of cellular's greatest concerns, with the benefits of lower default risks and margin enhancement outweighing reduced ARPU.

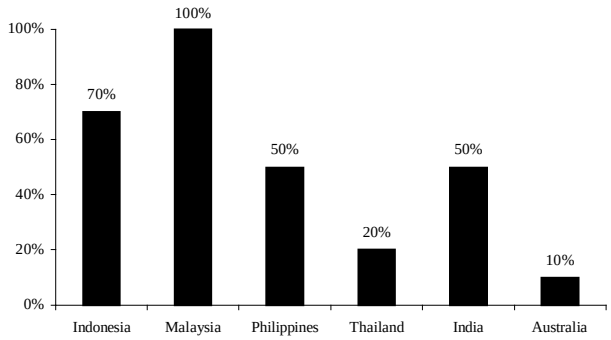
Within the developed Asian markets, we see strong positions at SmarTone and SK Telecom; in Asia's emerging markets, we favor China Telecom (HK) and Thailand's Advanced Info Service. All four of these operators maintain strong, if not leading, positions in their markets, and should be able to weather both existing as well as any new

Figure 1
Prepaid as a Percentage of Total Cellular Subscribers (1998E)



Sources: Company data and Morgan Stanley Dean Witter Equity Research

Figure 2
Prepaid as a Percentage of Total Net Additions (1998E)



Sources: Company data and Morgan Stanley Dean Witter Equity Research

competition. Our Asian cellular favorites all possess strong balance sheets and brand names and — in the case of SmarTone and AIS — strategic ownership by large foreign partners (British Telecom and Singapore Telecom, respectively).

Market Growth

In Asia-Pacific wireless, competition continues to drive prices down…and penetration up. Virtually every Asian economy currently has three or more cellular operators. Consolidation, while pending in a number of markets, is still in its early stages. Pricing, therefore, remains under pressure. Furthermore, operators consistently introduce new technologies (CDMA, GSM-1800) at discounts to the prevalent GSM-900 standard. Low prices tend to bring previously untapped user groups, especially females and teens, into the market.

Economic weakness has done little to impact demand in the developed Asia-Pacific markets. Since the end of 1997, Korea's penetration rate has grown from 15% to 30%, Hong Kong's from 34% to 45%, Japan's from 30% to 37%, and Singapore's from 27% to 35%. We expect over 50% penetration rates in Hong Kong, Singapore, Korea, Japan, and Australia by 2003.

The emerging Asian economies, however, have seen significant disconnects as a result of bad debts. In the Philippines and Indonesia, 20–25% of year-end 1996 subscribers voluntarily or involuntarily terminated their service over the last 24 months. In Thailand and Malaysia, net additions flattened in 1998. We believe subscriber addition rates are unlikely to recover significantly until late 1999 or 2000, once these economies stabilize.

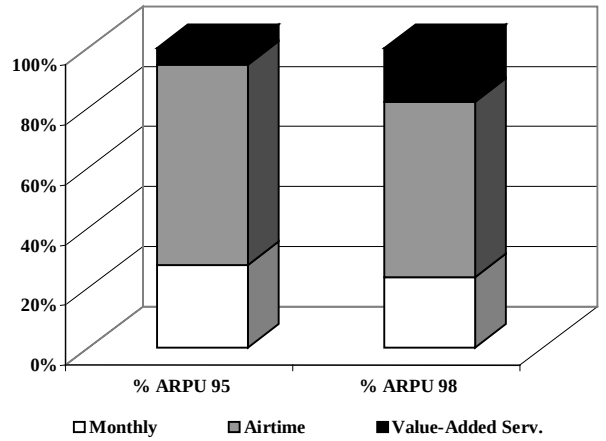
Prepaid services, the rage in Europe, are playing an ever-larger role across the region, especially in ASEAN countries. The number of countries/carriers offering prepaid calling plans is accelerating. Subscriber addition rates have already begun improving in the economically weakened Indonesian, Thai, and Philippine markets. In Indonesia and the Philippines, 60–75% of all net adds today are prepaid subscribers.

We estimate that prepaid customers could comprise 20–30% of total wireless users in most Asia-Pacific markets by year-end 2000.

Mobile data services should play a major role in stabilizing ARPUs among traditional users. More advanced carriers in developed markets have already introduced 9.6 Kbps wireless data services, with speeds up to 128 Kbps expected to be available by year-end 1999. SmarTone in Hong Kong has maintained higher-than-average unit revenues through its early introduction of data. In fact, data now comprise 5–10% of total revenues in the developed Asia-Pacific markets — this should rise to 15–20% by year-end 2000.

Figure 3

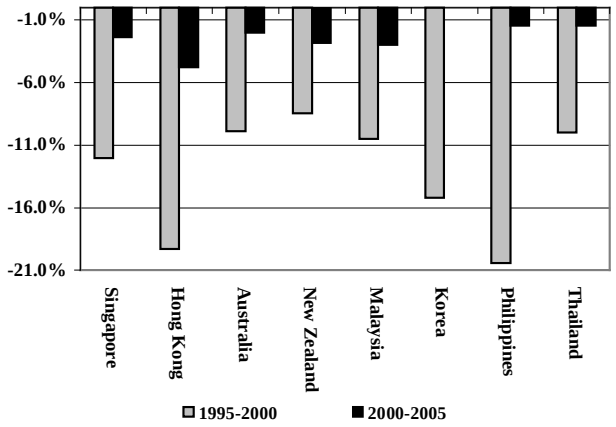
SmarTone ARPU Components: 1995 vs. 1998E



Sources: Company data and Morgan Stanley Dean Witter Equity Research

Figure 4

CAGR ARPU (US$) Declines



Sources: Company data and Morgan Stanley Dean Witter Equity Research

The Competitive Environment

Many Asia-Pacific cellular markets appear over-competitive and ripe for consolidation. For reasons of over-licensing (Philippines, Malaysia) or free market mentality (Hong Kong), several Asia-Pacific cellular markets are currently served by as many as five or six operators. Operating cash flow margins in the Asia-Pacific wireless sector therefore average 5–7 percentage points lower than those in the U.S. and Europe. *Returns* on equity also appear low — in some cases lower than companies' *costs* of equity.

The Asian economic crisis has hastened the consolidation process…though more is yet to come, in our view. Seven cellular carriers around the region have already been closed, sold, or have failed to initiate service. An additional 3–5 carriers remain in severe financial straits on the back of high dollar debts, limited cash flows, and minimal access to fresh capital.

As weak operators exit, pricing should begin to stabilize. The 10–20% annual ARPU declines among traditional customers posted in many countries from 1995–98 should decelerate to 3–7% over the coming two years. Handset subsidies should also decline as ARPUs bottom and frenzied competition for new subscribers begins to wane.

Trends and Developments

Fixed-mobile convergence should provide a marketer's dream… to those companies able to offer it. Telecom New Zealand's corporate customers can already combine fixed and mobile telephones within their PBX. Singapore Telecom should be able to offer comparable service within 12–18 months. Though technologically capable, Hongkong Telecom and Telstra face regulatory obstacles to bundling their fixed and mobile services.

Prepaid represents the next infant territory in most Asia-Pacific markets. Currently, prepaid plans are offered in the Philippines, Indonesia, India, Hong Kong, Malaysia, China, Singapore, and New Zealand. Prepaid take-up rates continue to accelerate, especially in the Philippines and India. By year-end 2000, prepaid subscribers could comprise 60–80% of new cellular additions.

Calling-party-pays already exists across most Asia-Pacific markets — though China in particular could benefit from its implementation. In China, Hong Kong, and Singapore — the main Asian markets *without* calling-party-pays — as many as 90% of cellular subscribers also use pagers to screen incoming calls onto their mobile phones — an opportunity cost to cellular operators. Among these three countries, China appears the closest to enacting calling-party-pays, a move that we believe could help penetration and usage rates beginning in 2000.

Digital conversion remains a significant issue in selected markets. Several Asia-Pacific operators — mainly incumbents — still maintain 25–100% of their customer bases on analog networks. In many of these countries, newer opera-

tors possess *only* digital systems. Over the coming 2–3 years, the largest analog providers should see higher marketing and promotional expenses as they strive to migrate analog users onto their own digital platforms. This has been the case for SK Telecom in Korea, which has migrated from 100% analog to nearly 90% digital within the last four years.

Mobile data services should increase subscriber utilization and revenue generation. Operators are offering new data services to maintain ARPUs in the face of competition on basic services. New technologies, such as Symbian and BlueTooth, will allow greater wireless transmission speeds and connectivity. UMTS (3G) technologies are expected to provide the platform for global data communications across an open network.

Third-generation wireless services, including "wideband CDMA," are still 2–3 years away, we believe. Japan — the key Asian proponent of W-CDMA — has scheduled its introduction for 2001. Korea's SK Telecom is also heavily involved with W-CDMA technology. However, the ubiquity and relatively low cost of existing GSM services versus existing CDMA networks in Asia suggest that the former standard will remain dominant over the near term. Ultimately, however, greater data demand should push users toward the higher bandwidth expected from W-CDMA.

Figure 5

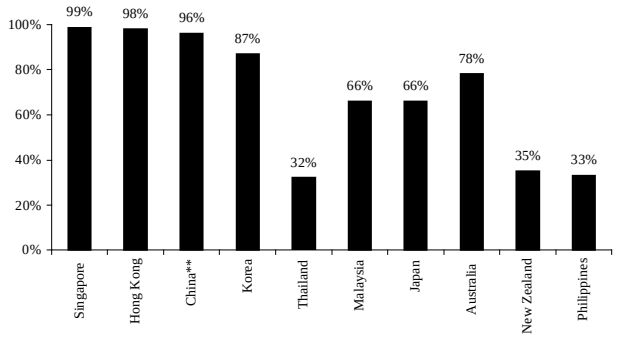
Availability of Calling-Party-Pays

Country	Availability of Calling Party Pays
Singapore	No
Hong Kong	No
Australia	Yes
New Zealand	Yes
Malaysia	Yes
Korea	Yes
Philippines	Yes
Thailand	Yes
China**	No
Japan	Yes

*** CHTK operating provinces only*
Sources: Company data and Morgan Stanley Dean Witter Equity Research

Figure 6

Percentage of Network Digitized



*** CHTK operating provinces only*
Sources: Company data and Morgan Stanley Dean Witter Equity Research

Table 1

Wireless Subscribers (Thousands): Asia/Pacific

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Australia	NA	1,220	2,305	3,815	4,893	5,698	6,614	7,455	8,314	9,192	9,891	10,604	11,333	11,873
Growth		*NA*	*88.9%*	*65.5%*	*28.3%*	*16.5%*	*16.1%*	*12.7%*	*11.5%*	*10.6%*	*7.6%*	*7.2%*	*6.9%*	*4.8%*
China*	NA	576	1,499	2,528	3,489	6,700	9,472	12,052	14,789	17,747	20,409	22,450	24,694	27,164
Growth		*NA*	*160.3%*	*68.6%*	*38.0%*	*92.0%*	*41.4%*	*27.2%*	*22.7%*	*20.0%*	*15.0%*	*10.0%*	*10.0%*	*10.0%*
Hong Kong	163	405	642	1,080	1,791	2,608	3,296	3,865	4,341	4,662	4,871	5,041	5,166	5,270
Growth		*148.7%*	*58.2%*	*68.3%*	*65.8%*	*45.6%*	*26.4%*	*17.3%*	*12.3%*	*7.4%*	*4.5%*	*3.5%*	*2.5%*	*2.0%*
India**	NA	NA	NA	328	881	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indonesia	NA	NA	NA	563	916	763	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*62.9%*	*-16.8%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Korea	472	960	1,641	3,181	6,833	13,988	17,065	19,454	21,205	22,477	23,601	24,781	26,020	27,321
Growth		*103.5%*	*70.9%*	*93.8%*	*114.8%*	*104.7%*	*22.0%*	*14.0%*	*9.0%*	*6.0%*	*5.0%*	*5.0%*	*5.0%*	*5.0%*
Malaysia	340	577	983	1,548	2,106	2,200	2,464	2,772	3,188	3,634	4,088	4,538	4,992	NA
Growth		*69.7%*	*70.4%*	*57.5%*	*36.0%*	*4.5%*	*12.0%*	*12.5%*	*15.0%*	*14.0%*	*12.5%*	*11.0%*	*10.0%*	*NA*
New Zealand	148	246	381	492	576	708	825	926	1,010	1,096	1,183	1,272	1,363	1,455
Growth		*66.2%*	*54.9%*	*29.0%*	*17.2%*	*22.9%*	*16.5%*	*12.2%*	*9.1%*	*8.5%*	*8.0%*	*7.5%*	*7.1%*	*6.8%*
Philippines	102	193	443	807	1,180	1,621	2,103	2,531	2,977	3,442	3,847	4,267	4,621	4,988
Growth		*90.2%*	*129.1%*	*82.0%*	*46.2%*	*37.3%*	*29.8%*	*20.3%*	*17.6%*	*15.6%*	*11.7%*	*10.9%*	*8.3%*	*7.9%*
Singapore	179	235	306	430	844	1,054	1,265	1,467	1,660	1,825	1,995	2,136	2,282	2,432
Growth		*31.3%*	*30.2%*	*40.5%*	*96.2%*	*24.9%*	*20.0%*	*16.0%*	*13.1%*	*9.9%*	*9.3%*	*7.1%*	*6.8%*	*6.6%*
Thailand	458	732	1,269	1,690	2,063	2,186	2,471	2,752	3,070	3,396	3,731	4,017	4,282	4,554
Growth		*59.8%*	*73.4%*	*33.2%*	*22.1%*	*5.9%*	*13.1%*	*11.4%*	*11.5%*	*10.6%*	*9.9%*	*7.7%*	*6.6%*	*6.4%*
Japan***	2,131	4,332	11,713	26,903	38,254	46,984	53,584	57,784	60,484	62,684	64,384	66,084	67,784	69,484
Growth		*103.3%*	*170.4%*	*129.7%*	*42.2%*	*22.8%*	*14.0%*	*7.8%*	*4.7%*	*3.6%*	*2.7%*	*2.6%*	*2.6%*	*2.5%*

**Only CTHK Operating Provinces*
***International Telecommunication Union*
****Including PHS*
E = Morgan Stanley Dean Witter Equity Research Estimates

Table 2
Wireless Penetration: Asia/Pacific

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Australia	NA	6.8%	12.8%	20.9%	26.5%	30.5%	35.0%	39.0%	43.0%	47.0%	50.0%	53.0%	56.0%	58.0%
Growth		*NA*	*86.7%*	*63.6%*	*26.8%*	*15.1%*	*14.8%*	*11.4%*	*10.3%*	*9.3%*	*6.4%*	*6.0%*	*5.7%*	*3.6%*
China*	NA	0.5%	1.3%	2.2%	3.1%	3.6%	5.0%	6.3%	7.7%	9.1%	10.4%	11.3%	12.3%	13.4%
Growth		*NA*	*155.5%*	*66.9%*	*36.6%*	*16.9%*	*40.1%*	*26.1%*	*21.5%*	*18.9%*	*13.9%*	*8.9%*	*8.9%*	*8.9%*
Hong Kong	5.5%	7.9%	12.7%	21.2%	33.6%	44.8%	53.3%	60.7%	66.1%	68.7%	70.7%	72.1%	72.9%	73.6%
Growth		*43.1%*	*60.5%*	*67.4%*	*58.3%*	*33.7%*	*18.8%*	*13.9%*	*8.9%*	*4.0%*	*3.0%*	*2.0%*	*1.0%*	*1.0%*
India**	NA	NA	NA	NA	0.1%	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indonesia	NA	NA	NA	0.3%	0.5%	0.4%	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*60.1%*	*-18.2%*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Korea	1.1%	2.2%	3.7%	7.0%	14.9%	30.0%	36.1%	40.7%	43.7%	45.8%	47.4%	49.1%	50.9%	52.8%
Growth		*101.7%*	*70.3%*	*90.4%*	*112.0%*	*102.0%*	*20.4%*	*12.5%*	*7.6%*	*4.6%*	*3.6%*	*3.6%*	*3.6%*	*3.6%*
Malaysia	1.8%	3.0%	4.9%	7.6%	10.0%	10.2%	11.2%	12.3%	13.8%	15.3%	16.8%	18.2%	19.5%	NA
Growth		*66.3%*	*66.2%*	*53.6%*	*32.7%*	*1.9%*	*9.3%*	*9.8%*	*12.2%*	*11.2%*	*9.8%*	*8.3%*	*7.3%*	*NA*
New Zealand	4.3%	7.0%	10.8%	13.8%	16.0%	19.5%	22.5%	25.0%	27.0%	29.0%	31.0%	33.0%	35.0%	37.0%
Growth		*64.9%*	*53.3%*	*27.8%*	*16.1%*	*21.6%*	*15.4%*	*11.1%*	*8.0%*	*7.4%*	*6.9%*	*6.5%*	*6.1%*	*5.7%*
Philippines	0.2%	0.3%	0.7%	1.2%	1.7%	2.2%	2.8%	3.3%	3.8%	4.3%	4.7%	5.1%	5.4%	5.7%
Growth		*89.0%*	*124.5%*	*77.5%*	*43.0%*	*34.2%*	*26.8%*	*17.6%*	*15.0%*	*13.0%*	*9.2%*	*8.4%*	*5.8%*	*5.5%*
Singapore	6.2%	8.0%	10.3%	14.2%	27.3%	33.5%	39.5%	45.0%	50.0%	54.0%	58.0%	61.0%	64.0%	67.0%
Growth		*28.6%*	*27.9%*	*38.0%*	*92.8%*	*22.7%*	*17.9%*	*13.9%*	*11.1%*	*8.0%*	*7.4%*	*5.2%*	*4.9%*	*4.7%*
Thailand	0.8%	1.3%	2.1%	2.8%	3.4%	3.5%	3.9%	4.3%	4.7%	5.2%	5.6%	5.9%	6.2%	6.5%
Growth		*57.5%*	*70.8%*	*31.2%*	*20.3%*	*4.4%*	*11.4%*	*9.7%*	*9.9%*	*9.0%*	*8.2%*	*6.1%*	*5.0%*	*4.8%*
Japan	1.7%	3.5%	9.3%	21.4%	30.3%	37.2%	42.3%	45.5%	47.6%	49.2%	50.5%	51.8%	53.1%	54.4%
Growth		*101.7%*	*169.2%*	*129.2%*	*41.9%*	*22.6%*	*13.8%*	*7.6%*	*4.5%*	*3.5%*	*2.6%*	*2.5%*	*2.5%*	*2.5%*

**Only CTHK Operating Provinces*
***International Telecommunication Union*
E = Morgan Stanley Dean Witter Equity Research Estimates

Table 3

Wireless Average Revenue Per User ($ US): Asia/Pacific

	1993	1994	1995	1996	1997	1998E	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E
Australia	NA	NA	$59.4	$53.1	$45.3	$39.6	$36.1	$35.3	$34.6	$33.9	$33.3	$32.6	$31.9	$31.3
Growth		*NA*	*NA*	*-10.6%*	*-14.8%*	*-12.5%*	*-9.0%*	*-2.0%*	*-2.0%*	*-2.0%*	*-2.0%*	*-2.0%*	*-2.0%*	*-2.0%*
China*	NA	$59.3	$50.5	$46.8	$45.6	$45.8	$37.5	$36.0	$34.2	$33.1	$32.2	$31.6	$31.2	$30.8
Growth		*NA*	*-14.9%*	*-7.2%*	*-2.7%*	*0.4%*	*-18.1%*	*-3.9%*	*-5.0%*	*-3.2%*	*-2.8%*	*-2.0%*	*-1.3%*	*-1.3%*
Hong Kong	NA	$130.3	$118.8	$111.0	$75.0	$58.7	$44.1	$40.6	$38.1	$36.4	$34.8	$33.2	$31.8	$31.5
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*-7.9%*	*-6.1%*	*-4.6%*	*-4.5%*	*-4.4%*	*-4.3%*	*-1.0%*
India	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Indonesia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Growth		*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Korea	$59.2	$66.0	$69.8	$63.6	$30.3	$26.5	$30.7	$30.6	$30.6	$30.6	$30.6	$30.6	$30.6	$30.6
Growth		*11.5%*	*5.8%*	*-9.0%*	*-52.3%*	*-12.6%*	*15.9%*	*-0.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Malaysia	$70.2	$68.4	$66.9	$66.0	$56.7	$40.8	$39.6	$38.4	$37.3	$36.2	$35.1	$34.0	$33.0	$32.0
Growth		*-2.6%*	*-2.1%*	*-1.4%*	*-14.0%*	*-28.0%*	*-3.0%*	*-3.0%*	*-3.0%*	*-3.0%*	*-3.0%*	*-3.0%*	*-3.0%*	*-3.0%*
New Zealand	$55.9	$61.4	$56.1	$44.5	$46.4	$38.2	$37.3	$36.1	$35.0	$34.0	$33.0	$32.1	$31.2	$30.4
Growth		*9.9%*	*-8.7%*	*-20.7%*	*4.3%*	*-17.6%*	*-2.6%*	*-3.1%*	*-3.1%*	*-2.9%*	*-2.8%*	*-2.8%*	*-2.7%*	*-2.6%*
Philippines	NA	$72.0	$60.4	$48.5	$32.0	$24.2	$21.8	$19.2	$19.0	$18.7	$18.4	$18.1	$17.9	$17.6
Growth		*NA*	*-16.0%*	*-19.7%*	*-34.0%*	*-24.4%*	*-10.3%*	*-11.5%*	*-1.5%*	*-1.5%*	*-1.5%*	*-1.5%*	*-1.5%*	*-1.5%*
Singapore	$79.2	$86.7	$85.9	$79.8	$55.7	$50.6	$47.9	$45.3	$44.2	$43.1	$42.1	$41.1	$40.2	$39.3
Growth		*9.4%*	*-0.9%*	*-7.1%*	*-30.2%*	*-9.2%*	*-5.3%*	*-5.5%*	*-2.4%*	*-2.4%*	*-2.3%*	*-2.3%*	*-2.3%*	*-2.2%*
Thailand	$58.0	$55.1	$51.5	$48.7	$24.7	$31.3	$31.1	$30.4	$29.8	$29.2	$28.7	$28.4	$28.2	$28.1
Growth		*-4.9%*	*-6.6%*	*-5.4%*	*-49.3%*	*26.9%*	*-0.8%*	*-2.2%*	*-2.0%*	*-1.9%*	*-1.9%*	*-1.0%*	*-0.5%*	*-0.5%*
Japan	NA	$164.3	$132.7	$104.7	$90.1	$77.3	$71.1	$68.3	$66.6	$65.8	$65.0	$65.1	$65.2	$65.4
Growth		*NA*	*-19.3%*	*-21.1%*	*-13.9%*	*-14.1%*	*-8.0%*	*-4.0%*	*-2.5%*	*-1.2%*	*-1.2%*	*0.2%*	*0.2%*	*0.2%*

**Only CTHK Operating Provinces*
E = Morgan Stanley Dean Witter Equity Research Estimates

Japanese Wireline: Deregulation Continues to Fuel Competition

Overview

All segments of the Japanese telecom market have become highly competitive, with the exception of local service. Consolidation is under way in the international and domestic long distance markets, which are merging into a "one-stop-shopping" integrated market as a result of deregulation. Global competitors AT&T and BT are highly visible in Japanese markets following their recently announced 30% stake in Japan Telecom.

The reorganization of NTT in 1999 promises to bring the most radical change in industry structure since liberalization in the mid-1980s. NTT will be divided into three core operating segments: Local East and West Japan and Long Distance. This structure results in two major changes: improvement in cost-allocation transparency, which should permit access-charge and local-tariff reforms; and the deregulation and rationalization of NTT's long distance unit, which has already occurred.

A weak economy has hurt wireline growth in Japan, while wireless telephony has increased its share. Correlating closely with GDP, growth in access lines and traffic minutes has been sluggish in the recessionary 1990s, with real GDP growth of 1.5% from 1991–97 driving average annual line growth of only 2.1%. Mobile telephony has taken market share in total traffic minutes, and mobile accounted for 12% of total domestic minutes in Japan in 1997, up from 7% a year earlier.

NTT's domination of the local loop, balance sheet strength, and potential upside from international expansion make it our top wireline pick in Japan. We also believe that Japan Telecom is well positioned, with nationwide and international fiber networks and access to the rights of way of its parent, JR Railway.

Key Investment Themes

We believe that financial, technological, and marketing strength define competitive advantage in the Japanese wireline market. These three factors will have an iterative relationship on the overall success of a telecom operator, in our view. While each is desirable, one cannot be sacrificed for another. We believe the synergy among these variables will bring above-average returns to the relatively strong, while weakening those that are deficient. This could become a vicious downward spiral given the capital intensity and rapid pace of technological change in the industry.

In concrete terms, we believe a bundled, full-service wireline product, with ample balance sheet, marketing, distribution, and brand strength, are the crucial attributes. NTT stands out as the most prominent carrier in Japan (if not Asia), possessing such strengths, in our opinion. DDI stands out as the weakest on the wireline side in terms of technology and financial strength. We believe KDD and Japan Telecom have yet to prove themselves savvy marketers, with price the key determinant of competitiveness.

The attractiveness of markets is heavily dependent upon the level of competition. While company-specific variables determining *relative* competitiveness are critical, perhaps the first step should be to determine the *absolute* attractiveness of the overall market.

The Japanese long distance market has the lowest barriers to entry, in addition to being the most competitive, as defined by the number of competitors. It should be no surprise that this market segment has seen the poorest operating and financial performance since deregulation. In our view, only a lift in traffic volumes and data demand could brighten the long distance market outlook. A GDP recovery should be the leading indicator of the return to strength of the long distance market.

The local wireline market provides NTT with a cushion of predictable revenues, while regulation gives the incumbent

Table 1
Japan Telecommunications: Defining Competitive Advantage

	Financial Strength	Technological Strength	Marketing Strength	**Overall Average**
NTT	1	1	1	**1.0**
Japan Telecom	2	2	2	**2.0**
KDD	2	2	3	**2.3**
DDI	3	3	2	**2.7**

1=above average 2=average 3=below average
Source: Morgan Stanley Dean Witter Research

Table 2
Japan Telecommunications: Levels of Competition — Number of Effective Operators by Segment

Mobile	Local*	Long-distance
4–5	1+	6+

** NTT has a de facto monopoly on local lines; however, local NCCs, with TTNet in particular in Tokyo, have begun to ramp up local leased-line services, as well as dial-around local-minute competitive services.*
Source: Morgan Stanley Dean Witter Research

several more years of benign competition to continue to rationalize, which should lift profitability and shareholder value in the process.

On the wireline side, we believe NTT is best positioned given its dominance of the local loop, its solid balance sheet, and the potential upside of international expansion. Additionally, we feel Japan Telecom is well positioned, with its nationwide and international fiber network and access to the rights of way of JR Railway, its parent company.

Market Growth

Wireline market growth in Japan has been less than stellar due to economic circumstances, as well as the growth of mobile telephony. Given the inherently high correlation with GDP, it's no surprise that wireline growth and traffic minute growth in Japan have been sluggish during the post-bubble, recessionary 1990s. Real GDP of only 1.5% (1991–97) has led to only 2.1% average annual line growth.

Additionally, mobile telephony has been gaining market share in terms of total traffic minutes. Almost nil in the early 1990s, mobile minutes amounted to 12% of total domestic minutes in Japan in 1997, up from 7% a year earlier.

Data-services demand growth is driving a shift from basic analog to digital ISDN lines and digital leased lines. This shift in demand from traditional voice circuits to digital bandwidth distorts reported "wirelines" and "wireline penetration," as the definition of a "line" needs to be revised for the changes in modern technology (for instance, basic ISDN has two-voice channels on one line), as well as standardized across countries for comparative purposes.

Increasing competition as a result of deregulation has hurt long distance growth. Through the World Trade Organization accord on telecommunications, deregulation has increased the level of competition in the market dramatically since 1997. Increased competition has unleashed strong pricing pressures, leaving no revenue growth and little room for profits for both domestic and international long-distance carriers.

Table 3
Japan Telecommunications: Estimated Price Elasticity, 1991–96

	Long Distance	Mobile	Fixed Line
Est. Annual Traffic, Subs Growth*	3.6%	81.2%	2.3%
Est. Annual Rate, ARPU Declines**	6.7%	20.1%	4.5%
Est. Price Elasticity* **	**0.54**	**4.04**	**0.51**

**Fixed-line volume measured in minutes: Mobile average annual ARPU estimates including cellular and PHS.*
***NTT fixed-line average per-minute declines: Mobile average annual ARPU estimate including cellular and PHS.*
****Approximation for discussion purposes. Ignores correlation with GDP and fixed-line growth.*
Source: Company data, MPT, MSDW

International carriers have begun providing domestic services, while domestic carriers have entered the international arena — historically two separate markets divided by regulation. However, with stalled minute volume growth because of the recession, pricing cuts have been largely *inelastic*, with the majority of lost revenues dropping directly to the bottom line. For instance, NTT in 1996 proclaimed a benchmark domestic long distance call to be ¥100 per three minutes by the year 2000. It was ¥140 at the time, is currently about ¥90, and is expected to drop to ¥70–80 by 2000. So goes the business plan. Another striking example is provided by KDD, whose benchmark price to the U.S. reached ¥450 per three minutes in 1997, only to fall to ¥240 in 1998, which remains above the competition.

Data demand appears to be the antidote to the secular decline in plain-vanilla voice prices. While data demand is rising, the large majority of market revenues are plain-vanilla voice service revenues. These voice revenues are under severe pricing pressure, and data demand growth is not yet sufficient to offset such declines.

A strong recovery in macroeconomic (GDP) growth would likely have a leveraged effect on a wireline profitability recovery. We believe there would be increases in line growth, traffic minutes per line, and demand for data ser-

Table 4
Japan Telecommunications: Balance Sheet Strength

1998 Consol.	Internal Cash Flow (¥Bil.)	Net Debt/ Capital	Avg. Cost of Debt
NTT	318.7	38.3%	3.1%
NTT DoCoMo	85.0	19.5%	2.7%
DDI	-159.6	78.9%	2.5%
JT	-19.8	31.3%	2.3%
KDD	-80.4	26.7%	2.3%

Source: Morgan Stanley Dean Witter Research

vices. Overall, we believe the telecom revenue pie should rebound strongly if an economic recovery unfolds.

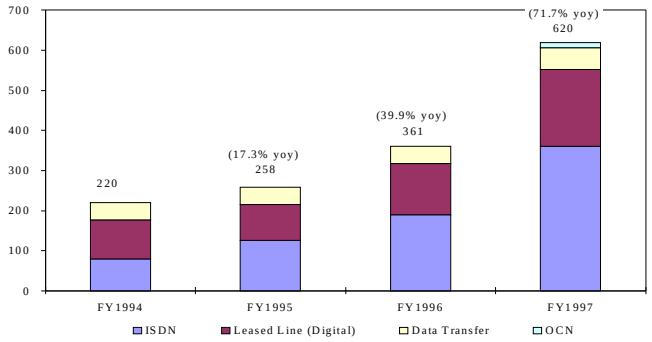
Balance sheet strength is critical to both weather the economic storm and maintain technological competitiveness, in our view. Competition has taken its toll on balance sheets, especially at DDI, which has an 80%-plus ratio of net debt to capital, negative free cash, and what we view as questionable long-term technological competitiveness. In our opinion, NTT, the 800-pound gorilla, clearly stands out as the operator with the soundest financials, given its solid balance sheet, low cost of capital, and dominance of the "annuity-like" local market.

Competitive Environment

Consolidation has begun as the international and domestic long distance markets, once separated by regulation, merge into a "one-stop-shopping" integrated market. All segments of the market are highly competitive, with the exception of NTT's local monopoly. Competition has led to consolidation in the Japanese market. Domestic long-distance operator Japan Telecom now owns ITJ, which was once the smallest of three international carriers. KDD belongs in part to the Toyota family since the 1998 merger with Teleway, which was once the smallest of four domestic operators.

In addition, foreign carriers such as AT&T and BT are in the limelight given their recently announced 30% stake in Japan Telecom. The only remaining stand-alone international carrier, IDC, has strong historical ties to NTT, which is in the process of reorganizing. Cable and Wireless (C&W), a 17% shareholder in IDC, has challenged NTT in acquiring IDC as C&W targets a more robust Japan strategy.

Figure 1
NTT: Data and Internet Related Revenue Growth



Source: Company Data

Given the social implications of layoffs in Japan, such consolidation has yet to provoke a decline in headcount. Both Japan Telecom and KDD now employ over 20% more labor than they did in their pre-merger states. This "merger indigestion" calls for Pepto-Bismol (both acquired firms were essentially in the red at the time of the merger, with price cutting further hitting the bottom line post-merger).

Trends and Developments

The 1999 reorganization of NTT is one of the most prominent changes in the industry structure since the liberalization of the market in the mid-1980s. NTT will be divided into three core operating units: Local East Japan (61,000 employees), Local West Japan (67,500 employees), and Long Distance (6,500 employees). Regulation of the local units will fall under the "NTT Law" regime, while the long distance company will be deemed deregulated.

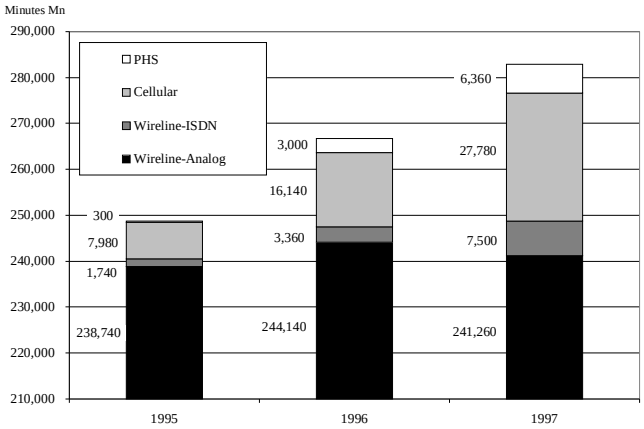
This structure brings two key changes to the industry: (1) Cost-allocation transparency will be raised, which will allow for access-charge and local-tariff reforms, and (2) the long distance unit has been deregulated and already rationalized to a competitive level.

The long distance unit will be allowed to fully enter the international long distance business (a previous restriction), while the local companies will have more time to rationalize under a regulatory regime, giving the business units a fairly benign competitive environment.

The access-charge regime is expected to undergo significant reform in 2000. The "long-run incremental cost"

Figure 2

Japan Telecommunications: Domestic Traffic Minutes



Source: MPT

(LRIC) access-charge calculation methodology is expected to be implemented in Japan by the Ministry of Posts & Telecommunications (MPT). This could lower access charges significantly from current levels — a plus for new common carriers (NCCs); a negative for NTT, the incumbent local service provider.

The access reform debate also includes local rate rebalancing (a plus for NTT plus), number portability (a minus for NTT, a plus for NCC), and pre-subscription discussions (a short-term plus and long-term minus for NTT; vice-versa for NCC).

The paradigm shift from voice to data and from fixed line to wireless has been and will be a key trend to monitor. So far, the demand for data services has not outpaced the deterioration in plain-vanilla voice pricing. A GDP recovery should allow for marked improvement in voice pricing.

There is currently a debate in Japan regarding the need for an extensive nationwide fiber-optic network versus satellite, CATV, and xDSL-based technologies. Fiber seems to be the focus for now, but the U.S. experience indicates that CATV lines and xDSL could be a substitute for the costly fiber rollout.

W-CDMA could become a wireless local loop (WLL) competitor to NTT's local monopoly. We believe the technology itself, as well as the economics, will be the deciding factors. Over the medium term, NTT DoCoMo should have the most extensive wideband network, given capital constraints at competing entities.

Lastly, mobile telephony is taking minute market share away from wireline. As mentioned above, mobile minutes totaled 12% of total domestic minutes in Japan, up from 7% a year earlier.

Japanese Wireless: Number Two in Subscribers

Overview

Rapid growth has made Japan the number two wireless market worldwide as measured by subscribers. Since deregulation in 1994, rates have fallen about 20% annually while annual knock-on subscriber growth has averaged 80%. With wireless penetration approaching 40%, this growth rate is likely to subside, but we forecast that penetration will exceed 50% over the next five years as prices continue to fall. With 47 million subscribers, Japan is second only to the U.S with 67 million and a penetration rate of about 25%. Mobile telephony's share of the telecom minute pie has risen to 12% from 3% over the last two years.

The industry's focus is shifting to profitability as subscriber growth slows. Subscriber acquisition costs, primarily handset incentives and subsidies, soared as companies concentrated on building their subscriber base. Churn rates, rising with improvements in technology, also pushed up acquisition costs. EBITDA margins at top-tier companies dropped from the mid-40s to the 20–30% range, and many second-tier firms are posting substantial losses. As efforts focus on subscriber retention, incentive costs have come down dramatically, and churn rates have eased as well.

With many carriers deeply in the red, consolidation appears inevitable. Wireless capital requirements remain high, and only three carriers will receive third-generation wideband licenses, according to a government mandate. NTT DoCoMo's combination of cellular and data transmission using the personal handy-phone system (PHS) also raises the bar for its competitors. We believe that NTT DoCoMo is the premier wireless carrier in Japan. DDI, although not a pure play, is well positioned in cellular, in our view, and Japan Telecom's earnings should accelerate as a result of its minority interest in J-Phone.

Investment Themes

Financial, technological, and marketing strength define competitive advantage. We believe these three factors will have an iterative relationship on the overall success of a telecom operator. In our opinion, while each strength is desirable, one cannot be sacrificed for another, as the synergy among these variables should bring above-average returns to the relatively strong, while weakening those that are deficient, given the capital intensity and rapid pace of technological change in the industry.

In concrete terms, we believe that the crucial attributes are (1) a bundled, full-service, state-of-the-art wireless service offering/technology platform, (2) a nationwide footprint, (3) strong handset development and procurement, and (4) ample balance sheet, marketing, distribution, and brand strength.

We believe NTT DoCoMo stands out as the most prominent carrier in Japan (if not Asia), holding such strengths. DDI, we believe, stands out as the weakest on the wireless side in terms of financial strength. We believe DDI and IDO have an above-average technological advantage in the short term with the planned 1999 CDMA rollout. However, we estimate that the threat of a technological leap-frog from W-CDMA is only two years away.

In our view, the remaining carriers could be considered second-tier operators, having less scale, regional footprints, financial issues, and mediocre marketing strength, with consolidation likely.

We believe NTT DoCoMo, the only pure play in the Japanese mobile market, is best positioned in the mobile market, given its nationwide footprint, strong brand name and distribution channels, solid balance sheet, and its leading role

Table 1
Japan Telecommunications: Defining Competitive Advantage

	Financial Strength	Technological Strength	Marketing Strength	**Overall Average**
NTT DoCoMo	1	1	1	**1.0**
DDI*	3	2	2	**2.3**
IDO*	2	2	3	**2.3**
J-Phone	3	2	2	**2.3**
Tu-ka	3	3	3	**3.0**
Digital-Tu-ka	3	3	3	**3.0**
Astel	3	3	3	**3.0**

1=above average 2=average 3=below average
** DDI and IDO have an above-average technological advantage in the short term with the 1999 CDMA rollout, in our view. However, we estimate that the threat of a technological leap-frog from W-CDMA is only two years away.*
Source: Morgan Stanley Dean Witter Research

Table 2
Variables that Drive Wireless Penetration

Variable	Japan
Country wealth:	High-End
Distribution of wealth:	Flat
Number of competitors:	Effective 4-5
Intensity of competition:	High
Years service available:	19
Price of handsets/service:	¥0-30,000
Spectrum availability:	Available
Quality/Availability of fixed-line:	High/Available

Source: Morgan Stanley Dean Witter Research

in next-generation wideband technology development. Although not a pure play, which has implications for the investment decision, DDI is well positioned in the cellular segment, in our opinion, given its new CdmaOne network and solid brand name. Additionally, Japan Telecom, with its minority interest in J-Phone, should witness a mobile-driven acceleration in earnings, as J-Phone has proved to be a savvy marketer.

Market Growth

In Japan, the wireless market has experienced explosive growth since handset deregulation in 1994. Prices (ARPU) have fallen about 20% per annum over the past five years, with knock-on subscriber growth averaging over 80% on an annual basis. We expect this highly elastic rate of growth to subside, since penetration is nearing 40%. However, our subscriber forecast calls for penetration to rise to well above 50% over the next five years as prices continue to come down.

In Table 2, we can see that Japan has nearly all the attributes we believe it takes to be a leader in the global game of *Who has the highest penetration rate?* Although Scandinavia currently takes the prize with penetration rates above 45%, we note that national subscribers typically total less than 5 million. Japan, with a penetration rate of about 37%, totals 47 million subs (a tenfold differential), second only to the U.S.'s 67 million subs and penetration rate of 25%.

Growth in mobile data service and per-subscriber minutes of use (MOU) should become increasingly important to sustain revenue growth and "terminal" ARPU levels as subscriber growth slows. Top data transmission speeds using PHS (personal handy-phone system, a low-mobility wireless technology) are currently 32 Kbps, with an upgrade to lift this to 64 Kbps this year. CdmaOne (DDI and IDO) will offer similar speeds (similar rollout time). This compares with PDC (NTT DoCoMo et al.) speeds of 9.6 Kbps (switched) and 14.4 (packet).

W-CDMA is expected to raise the ante to 384 Kbps in the spring of 2001, with fixed-wireless applications eventually reaching 2 MBPS, speeds similar to that of a T-1 digital leased line.

On the hardware side, Internet-ready handsets, built-in video handsets, and mobile PCs & Windows CE equipment are being developed. We think content (killer apps) will need further development as well to boost demand to significant levels.

Mobile telephony has been taking an increasing share of the overall telecom minute pie, rising from 3% to 12% over the past two years. However, per-subscriber MOU has been steadily declining, from 170 minutes per month in 1995 to 155 minutes in 1997, as over 80% of incremental net additions are "low-call" subscribers. Further pricing reductions and the increase in digital services should help revive MOU growth in the medium term.

The Competitive Environment

Japan's wireless market appears hypercompetitive, making consolidation all but inevitable to revive profitability for some carriers, in our opinion. Many carriers are hemorrhaging red ink or posting below-average profitability due to the rampant competition. Two forces should drive consolidation in the wireless industry: (1) Third-generation wideband licenses will be allocated to only three carriers as per MPT mandate (not to mention the capital requirements and restraints facing the industry), and (2) NTT DoCoMo has already set an industry precedent by combining cellular with PHS (while already being the leading paging operator).

The industry has shifted gears to a lower-cost (incentive), higher-margin strategy, which should support profit growth. During the period of high subscriber growth, the industry's leading strategy was one of low margin, high volume. This has changed with the slowing of subscriber growth. Subscriber acquisition costs (SACs), mainly handset incentives/subsidies, ballooned in the high-growth period to the ¥60,000+ range per subscriber. Meanwhile, massive technological improvements in handset function helped inflate churn rates to 4–5% per month on

cellular and 5–7% on PHS, which ultimately caused overall SACs to rise dramatically.

This sales-incentive burden can single-handedly explain the collapse of EBITDA margins from the mid-40s to the 20–30% range at top-tier NTT DoCoMo and DDI. It also causes the new start-up carriers to face a daunting SG&A bill on top of the already heavy capital expenditures required for network build-out.

As the fervor to take on new adds has shifted to more of a focus on maintaining current subscribers (and increasing per-subscriber profitability), incentives have fallen to the ¥30,000 area. In addition, industry churn rates have come down to the 2–3% range, which has driven EBITDA margins up some 200–400+ basis points from their trough in 1996.

Two anomalies are worth noting. First, NTT DoCoMo has taken 57% of the overall market, while maintaining 10–15% premium prices, an industry-low sub-2% churn (only 1% cancellation-related, the remaining handset-upgrade-related) and industry-low sales incentives (at a 20–30% discount to the industry average incentive).

DDI has placed a large bet on a new technology, CdmaOne, to revive its competitive advantage in the market. This new investment has cost the firm dearly on several fronts: (1) financial flexibility — debt surged to 80% of total capital, (2) churn — remains in the 3–4% range, (3) handset subsidies — still in the ¥40,000–50,000 range for CDMA handsets, and ultimately (4) falling cellular profitability as a result of overall depreciation and SACs ballooning despite increased profitability in the industry at large.

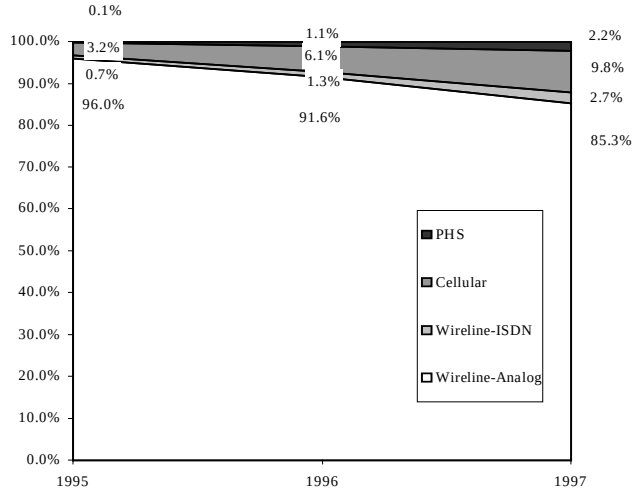
Trends and Developments

Fixed-mobile convergence has the potential to substantially alter the market. We expect that it will impact the industry from at least two angles: bundled-products/bundle discounts, and churn reduction. The more value-added the service, the less likely a customer is to switch to a competitor. Increased customer loyalty can translate into lower subscriber acquisition and retention costs, which can support bundle-discount strategies.

For NTT, regulatory hurdles relating to product bundling may arise, as could the question of monopoly and/or anti-competitive practices, given its dominant position in the market. DDI, in fact, has already raised the ante by accusing NTT DoCoMo of anticompetitive behavior and by seeking FTC intervention. This dispute is purely on the mobile side, DDI citing issues with the recently combined NTT DoCoMo cellular-PHS bundled service offering. We expect NTT Local to be off limits to DoCoMo; however, NTT Long-Distance may be able to bundle products with DoCoMo (although, we think the NCCs will likely question regulators about such marketing tactics as well).

Figure 1

Japan Telecommunications: Domestic Traffic Minute Market Share



Source: MPT

DDI's rollout of narrow-band CdmaOne will have to be closely monitored to see if the new digital service can pull share away from current PDC platforms. To date, despite what appears to be a strong incentive program, CdmaOne subscriber growth has been lackluster, given a regional piecemeal rollout. However, with the nationwide launch and the introduction of single-mode CDMA handsets scheduled for April 1999, a critical level of competitive advantage may be reached —the final question being, Do DDI and IDO have the financial firepower to market the new technology aggressively?

We believe that DDI is the only operator that stands a chance of making a go of the PHS business from a stand-alone perspective. In our view, NTT DoCoMo has increased the odds that a combined cellular-PHS mobile offering is the only way to turn a profit on PHS infrastructure. While DDI's relatively larger PHS subscriber base has led

the firm to the land of break-even, versus red ink in the rest of the PHS industry, high churn and an unabating (albeit slow) exodus to cellular continue to put the "ongoing concern" assumption into question. A merger *and* rationalization with the cellular unit would ease our trepidation.

Third-generation W-CDMA broadband services should have a dramatic impact on the competitive environment. We believe W-CDMA will have to be able to take market share from wireline, increase per-subscriber MOUs, support ARPU, and sustain strong revenue growth.

The up-front cost of capital expenditure for the 3G network remains a key variable to investors. While these are *potential* positives for the next-generation technology, short-term earnings could take a hit as accelerated depreciation schedules reflect the up-front charge to lay the network. If we assume a 50% penetration rate and eventual nationwide rollout, implied industry capex should be an estimated ¥4–5 trillion over the next five or so years.

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