

The Rural–Urban ‘Digital Divide’ in New Zealand: Fact or Fable?¹

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ABSTRACT *Much electronic commerce literature addresses the potential existence of digital divides between different classes of users. While many studies document users reported perceptions of disadvantage or cite infrastructure availability benchmarks, few studies quantify the extent of such divides in actual uptake and usage of electronic communications tools. This study seeks to quantify the extent of perceived rural–urban digital divides among businesses in New Zealand. Yellow Pages business register data are analysed to determine business uptake of e-mail and websites by location.*

The results challenge conventional perceptions of disadvantage on the basis of geography alone. Indeed, some provincial areas demonstrate higher uptake of business e-mail than their urban counterparts. Smaller and more remote provincial centre businesses are more likely to be using e-mail than their counterparts closer to the metropolitan centres. Those centres most remote from New Zealand’s traditional commercial centre demonstrate higher uptake than those closer. Explanations based upon disadvantages such as poor telephony infrastructure appear inadequate in accounting for these observations.

Rather, we contend that while infrastructure may play some part in the explanation for low rural hinterland uptake, the results of this study are consistent with economic determinations of the optimal time to invest in new technologies. Specifically, higher provincial and rural communication costs are a significant factor in encouraging higher and earlier levels of provincial and rural e-mail adoption, and the optimal time to invest in website adoption depends more upon firm size, local economic conditions and product than infrastructure quality and business location.

Keywords: digital divide, electronic commerce, New Zealand, rural–urban.

Introduction

The existence of a ‘digital divide’ between technology ‘haves’ and ‘have nots’ has dominated the ‘knowledge economy’ policy debate in recent times in most countries where electronic commerce is an increasingly more common method of transacting between firms and individuals. The extent of the debate is evident from the coverage given to it in the publications of international organisations such as

the OECD,² national policy bodies such as the US Department of Commerce³ and Australia's National Office for the Information Economy (NOIE),⁴ and in the academic literature.⁵

New Zealand is no exception in this debate, with two key themes of 'divide' having been posited:

- that a potential divide exists due to the differing socio-economic status of individuals creating an access barrier for some to the technology (computers and Internet access) required to participate in the knowledge economy; and
- that a potential divide between urban and rural New Zealanders is growing, driven by differing capacities and quality of the communications infrastructure servicing different locations.

These two themes recur in many local publications,⁶ and featured prominently at the Electronic Commerce Summit (Auckland, November 2000) where the nation's Electronic Commerce Policy⁷ was launched.

However, while it is generally recognised that both 'divides' may exist, and are driven by different causes, it is the rural–urban divide, fuelled by the recent Ministerial Review into Telecommunications,⁸ which has drawn most popular attention. The commonly held perception is that rural New Zealanders, hobbled by the relative disadvantages of an inadequate telecommunications infrastructure, are much less able to share in the benefits offered by the Internet and electronic commerce than their city-dwelling counterparts.⁹ Thus, a perceived 'telecommunications digital divide' may be prejudicing the ability of rural and provincial firms and individuals to access the Internet, and is hence contributing to a growing 'electronic commerce digital divide'.

Despite the debate and the rhetoric, however, few definitive studies that either verify the existence, or measure the extent, of this perceived rural–urban divide, in New Zealand or elsewhere, have been undertaken. Rather, speculation surrounding the extent of the 'divide' has been supported predominantly by surveys of respondents' perceptions of disadvantage¹⁰ rather than analyses of actual uptake and usage.

Nonetheless, some New Zealand empirical studies have been undertaken:

- the Ministry of Economic Development's (MED) annual analysis of the Information Technology sector in New Zealand;¹¹
- a study of rural telephony commissioned by the Ministry of Agriculture and Fisheries (MAF);¹² and
- the MED-commissioned BRC Marketing and Social Research analysis of business uses of the Internet.¹³

In addition, the Institute for the Study of Competition and Regulation (ISCR) has prepared a report on the state of electronic commerce in New Zealand, which examines the relative states of the infrastructure—electronic banking, telephony, and the Internet—that underpins electronic commerce.¹⁴

These studies reveal a far more equivocal picture of the extent of the rural–urban digital divide than popular debate depicts is the case. While the MED/BRC analysis shows a lower uptake of computer and Internet use by businesses in provincial and rural areas than main centres,¹⁵ the MAF study, despite reporting significant levels of user dissatisfaction with the standard and quality of rural

telephony services,¹⁶ when juxtaposed with figures from the MED statistics on information technology uptake in New Zealand and sources collated for the ISCR report, fails to support the contention that individual rural users are slower in the uptake of new technologies than the average New Zealander.¹⁷ Indeed, the MAF figures provide some substantiation for the ISCR conclusion that geographic isolation may provide a greater incentive for rural users to become connected to the Internet, while inadequate telephony infrastructure may be encouraging even earlier substitution by new technologies which bypass the telephony system, than is evident in the usage patterns of urban New Zealanders.¹⁸ Furthermore, the ISCR study shows that rural New Zealand does not appear to be disadvantaged relative to urban New Zealand with respect to access to other key elements of electronic commerce infrastructure such as Automatic Teller Machines (ATMs) and Electronic Funds Transfer at Point of Sale (EFTPOS) terminals. In addition, the growing availability of mobile EFTPOS terminals eliminates one more potential disadvantage for rural New Zealanders—if the infrastructure is not tied to a specific location, then location—either rural or urban—ceases to be a significant differentiator of accessibility.

So is there really a rural–urban ‘digital divide’ in New Zealand? Gaining a consistent and comparative impression from the above studies is problematical, given that each uses a different definition of ‘urban’ and ‘rural’.¹⁹ Furthermore, the entities surveyed differ between surveys: individuals (MAF), businesses (MED/BRC), or mixed business/family/individual units (MAF). This bears materially upon the inferences to be drawn when extrapolating from infrastructure accessibility measures into electronic commerce usage patterns, as the requirements for specific forms of infrastructure to support electronic commerce depend critically on the predominant uses to which digital media are put.²⁰

For example, the typical Internet data transfer requirements for individuals, families and many small businesses are predominantly consumption-related, requiring much greater downloading capacity than uploading. The requirements for other small, and medium to large businesses tend to be more symmetric (combining both production and consumption patterns equally, including electronic selling and purchasing), or even skewed towards production, and hence greater uploading (e.g. large amounts of advertising, or transmission of digital products to customers). What may appear to be a ‘digital divide’ due to unequal distribution of some forms of infrastructure on a geographical basis may thus not necessarily constitute an effective ‘usage divide’ if the usage patterns of the distinct physical locations differ significantly. If government policies and business strategies used to address a perceived ‘producer divide’ are used to also address what may or may not be an actual ‘consumer divide’, then not only is the wrong ‘divide’ being addressed, but usage and uptake patterns may also be distorted by inappropriate infrastructure and application investment, potentially worsening the divide that actually exists.

Specifically, nationwide investment in high capacity two-way telecommunication infrastructure on the basis that all users in all areas, both rural and urban, should be entitled to the same standard of access to the Internet may not be the most efficient investment decision if both the needs and user profiles of areas differ.²¹ Importantly, making such infrastructure available at prices which do not reflect the real cost may encourage users to customise development of applications based upon the available technology, rather than searching for alternatives which may offer a more cost-effective, and hence efficient, solution. Similarly, it would be

equally unwise to provide incentives, either implicit or explicit, to encourage specific means of trading (for instance, encouraging Web-based trading for all entities) without first giving consideration to the extent to which the business cases of the individual entities involved support such an investment. Ironically, both of these measures would 'close' some perceived 'divides', but at the expense of the wise use of the economy's scarce resources.

Thus, any determination or measurement of a potential 'rural-urban divide' based upon geographical criteria requires a detailed analysis not only of the availability of infrastructure but also of the extent of uptake, the types and sizes of entities which are using the infrastructure, and the uses to which the uptake is being put. To this end, it is concluded that the existing studies, while providing insight into some aspects of this analysis, are an insufficient basis from which to draw conclusions about any generalised rural-urban divide.

The Study

The purpose of this study is to provide additional data to increase understanding of any potential New Zealand geographical differences in business use of the Internet.

Data from the electronic Yellow Pages business directory, the predominant location-based register of businesses in New Zealand, are used to assemble counts of businesses advertising email and website addresses. The focus is thus on business use of the Internet. Using a secondary data source enables a positive analysis rather than the mixed positive and normative analyses which have been employed in survey-based studies. This approach is novel, as we can find no record of similar analyses in the international literature and thus we have no basis for international comparison for either our methodology or our results. However, we believe that this approach offers an opportunity to gain new insights on comparative regional behaviour of business Internet use in New Zealand.

The principal advantage of the Yellow Pages data is the ability to measure on a population basis (businesses listing in the Yellow Pages) by geographic area, rather than using the sample-based methodologies adopted by other studies. This removes the margin of sampling error, and overcomes the problem of insufficient numbers in small areas. Secondly, the data enable analysis based on tightly defined geographical areas (the level of a telephone exchange). This facilitates a relatively sophisticated level of comparison that has not been possible in other New Zealand analyses. Thirdly, the Yellow Pages data allow investigation of comparative usage of electronic addresses by businesses serving their own geographic area, and businesses with a national service focus facilitated by 0800/0900 and mobile telephone numbers.

The data do, however, have some limitations. While providing a population count, they necessarily present a significant under-representation of the numbers of businesses operating e-mail and websites, as not all businesses with websites and e-mail addresses choose to list these details in the Yellow Pages directory. While this results in a proportion of businesses registering websites and e-mail addresses significantly lower than those obtained from the MAF and MED/BRC studies, we are confident that, as the relative proportions between e-mail and websites closely resemble the MAF and MED/BRC proportions, that although the absolute percentages are not a true reflection, the comparative proportions can be relied upon. Furthermore, we can find no evidence to suggest that there are any significant

differences in the listing practices of different regions.²² Thus, we are confident that, while absolute percentages may be low, inter-regional comparisons are valid on the basis of the percentages we have derived. Further, the existence of a listing fee helps to ensure that those businesses choosing to list are indeed active electronic commerce participants, as there would be no incentive to pay a listing fee if the activities associated with the operation of the e-mail or website address were not a core part of regular trading practices. Thus, we have reasonable confidence that the comparative proportions between e-mail and website listings reported in this analysis will reflect actual differences in the use of each medium in practice.

Consistent with the definition of electronic commerce used in both the MED/BRC and ISCR studies, ‘business use of the Internet’ is defined to be any business use to which the Internet is put, thus including both transactions of information (e-mail, advertising, Web-based searches), and buying and selling (business to business and business to consumer) exchanges. To distinguish between the bases of urban and rural used in other studies, ‘metropolitan’ refers to the four main cities in New Zealand: Auckland, Wellington, Christchurch and Dunedin. ‘Provincial’ centres are the principal towns in each of the 14 districts defined in the Yellow Pages data excluding the ‘metropolitan’ centres, while ‘rural’ is defined as the rural hinterland surrounding each provincial centre in each of the regions.²³ Where ‘urban’ is used, this encompasses both metropolitan and provincial centre classifications.

We analyse these data in conjunction with the previous studies to gain further insight into the relative patterns of e-mail and website usage by businesses in metropolitan, provincial and rural New Zealand, and test our findings against three commonly held perceptual hypotheses of the ‘rural–urban digital divide’ in New Zealand:

- that there is a ‘rural–urban digital divide’ because metropolitan businesses use websites more than provincial and rural ones;
- that there is a ‘rural–urban digital divide’ because provincial and rural New Zealand businesses are slower to adopt new technologies; and
- that there is a ‘rural–urban digital divide’ in favour of the North Island, and particularly Auckland, businesses due to the greater population base and closeness to equipment and infrastructure suppliers.

Our analysis finds that there is little evidence to support any of these hypotheses. Rather, we find that a possible divide exists between some provincial centres and their rural hinterland in the use of websites and e-mail, though this is not necessarily a function of geography, as some rural regions outperform some metropolitan centres in the uptake of both websites and email. Furthermore, there is evidence to suggest that, for e-mail at least, the geographically isolated and sparsely populated South Island exhibits greater business uptake than the more populous North Island.

Next, we draw out some explanations for the patterns of behaviour we have determined from our analyses of all available sets of data. Principal among these are:

- that higher rural communication costs are a significant factor in encouraging earlier and higher levels of provincial and rural email adoption;
- that provincial and rural email adoption may be paralleling the demand-driven adoption of EFTPOS in New Zealand;

- that the optimal conditions for determining timing of website adoption depend more upon firm size and product than infrastructure and business location, and thus are not necessarily the same as those for e-mail adoption; and
- that there is some evidence of substitution of websites for e-mail as business communication tools.

We conclude our analysis with a brief summary identifying those remaining ‘rural–urban business digital divides’ which our analysis does indicate may be real, and recommendations of where the models for closing these gaps may be found.

The Data

Over the period from mid-September to early-October 2000, the Telecom Yellow Pages electronic directory listings for each of 18 geographical regions and the national 0800/0900 and mobile numbers were scanned to determine:

- the total number of businesses listed in each area by sub-regional exchanges;
- the total number of businesses listed under each category classification (allowing for the fact that some businesses list across multiple categories);
- the number of businesses listing an e-mail address by each category and sub-region; and
- the number of businesses listing a website address by each category and sub-region.

Table 1 summarises the data. Of the 18 identified regions, the percentage of listings with website addresses ranged between 0.8% (Gisborne) and 4.76% (Auckland

Table 1. Telecom Yellow Pages data summarised by region

Exchange	Count	Web	E-mail	Web%	E-mail%
Auckland dist totals	43,073	1465	2280	3.40%	5.29%
Auckland urban	41,503	1977	2630	4.76%	6.34%
Bay of Plenty	20,550	434	704	2.11%	3.43%
Canterbury totals	37,643	1370	2559	3.64%	6.80%
Gisborne	2621	21	75	0.80%	2.86%
Hawke’s Bay totals	10,132	179	437	1.77%	4.31%
Manawatu totals	10,110	322	564	3.18%	5.58%
Marlborough	3434	123	352	3.58%	10.25%
Nelson & Bays totals	7502	316	747	4.21%	9.96%
Northland totals	11,754	397	741	3.38%	6.30%
NZ 0800/025 totals	8926	740	916	8.29%	10.26%
Otago totals	12,684	604	1042	4.76%	8.22%
Southland totals	6471	147	449	2.27%	6.94%
Taranaki totals	7225	168	302	2.33%	4.18%
Timaru–Oamaru totals	4916	97	269	1.97%	5.47%
Wanganui totals	4059	111	252	2.73%	6.21%
Waikato totals	21,077	582	853	2.76%	4.05%
Wairarapa totals	3183	32	73	1.01%	2.29%
Wellington totals	31,104	1370	2126	4.40%	6.84%
West Coast totals	2103	61	130	2.90%	6.18%

Urban). The percentage of regional listings with email addresses ranged from 2.29% (Wairarapa) to 10.25% (Marlborough). A nineteenth classification, 0800/0900 and 021/025 numbers (hereafter 0800 ‘region’) which cannot be linked to one specific geographical location, makes up the balance of the data. These 0800 numbers exhibited by far the largest proportion of both website listings, with 8.29%, and e-mail, with 10.26%.

The Fables

Table 1: There is a ‘Digital Divide’ Because Urban Businesses ‘on the Net’ have Proportionally more Websites than Provincial and Rural Ones

As in the MED/BRC study, the number of firms using e-mail exceeds the number using websites for commercial activity. However, while the MED/BRC study shows around 80% of all firms using e-mail also have websites (main centres 85%, provincial and rural firms 74%), our analysis shows a significant regional variation, ranging from 35% in Marlborough to 81% for 0800 numbers. Not surprisingly, the highest ratios of websites to e-mail occur in the metropolitan areas while the lowest occur in rural areas. This replicates the MED/BRC finding and appears to reinforce the ‘digital divide’ perception that ‘urban businesses are ahead in e-commerce because they use websites proportionally more than their rural counterparts’.

However, more detailed analysis shows that the reason why urban businesses have proportionately more websites is not necessarily because they are more ‘enabled’ but because businesses in a number of provincial and rural regions are significantly greater users of email. While Table 1 shows the spread of website and e-mail listings, Figure 1 shows that provincial and rural regions have significantly higher proportions of e-mail addresses listed than their metropolitan counterparts. Indeed, the highest-ranking provincial region, Marlborough, has an e-mail listing rate 50% higher than its closest metropolitan rival, Wellington, which ranks only fifth highest.

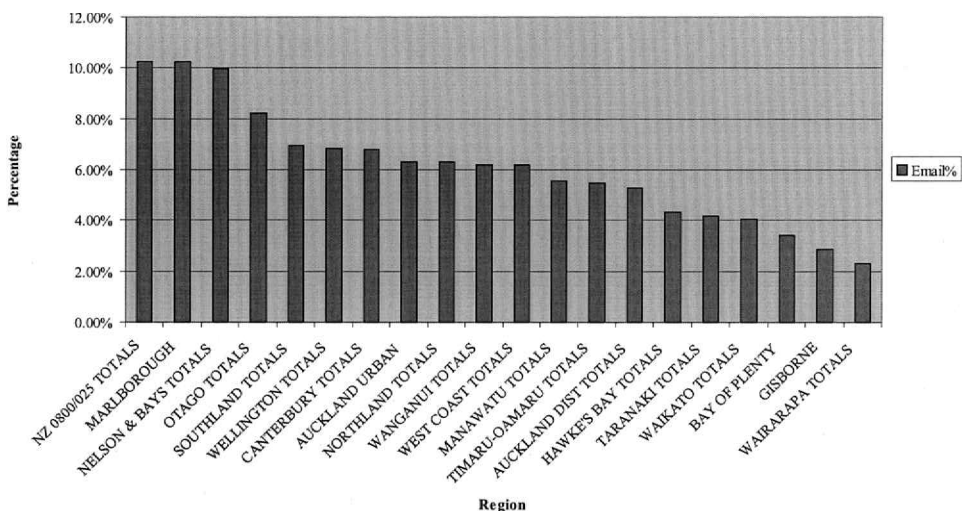


Figure 1. Yellow Pages e-mail as a percentage of listings

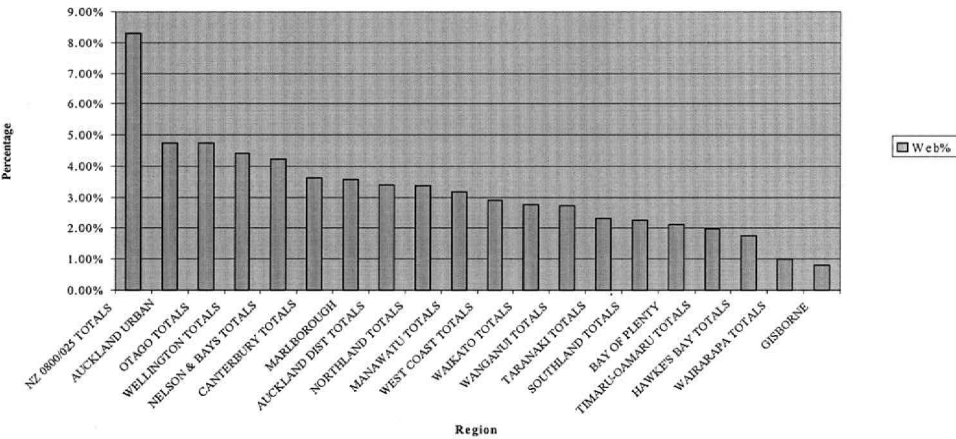


Figure 2. Yellow pages websites as a percentage of listings.

Furthermore, even the figures for website listings do not show a clear advantage for main centres over provincial and rural ones. As Figure 2 shows, although urban Auckland has the highest regional website listing percentage, with the capital city Wellington third, provincial regions Otago, Nelson and Bays, and Marlborough rate second, fourth and sixth, respectively.

These figures imply that e-mail is being used much more extensively as a business tool in some provincial and rural areas than urban ones, and that usage of websites in some provincial and rural areas is also significantly higher than some urban areas. Indeed, the data suggest that there may well be a divide ‘going the other way’—that provincial and rural business users of email in some areas are proportionately more ‘enabled’ than their metropolitan counterparts by a significant margin. This is partially supported by the MAF survey, which shows that over half of the respondents to the question on the future role of telecommunications believed that, despite living in rural areas or especially because they lived in rural areas, new telecommunications-based technologies had much to offer, and that they would be in a position to take advantage of them.²⁴

Table 2: Provincial New Zealand is Dragging the E-commerce Chain

Superficially, the finding of higher rural uptake of email appears to contradict the MED/BRC finding that provincial New Zealand businesses have a lower uptake of e-mail than their metropolitan counterparts. However, when aggregated into the classifications used in the MED/BRC study, these same data mirror the MED/BRC results. Main centres show higher proportions of both website and e-mail listings (provincial at 65% and 86% of main centres, respectively, compared with 74% and 85% in the MED/BRC study) (Table 2).

Yet these same data yield the significant provincial and rural e-mail advantage evidenced in ‘Table 1’. This apparent inconsistency can be explained by the relative sizes of the samples in each of the two analyses. The main centre versus provincial and rural analysis merges the well-performing provincial and rural areas of Otago, Marlborough, Nelson and Bays and Southland, which have small populations, with the poorly performing larger provincial areas of Wairarapa, Gisborne, Waikato, Bay of Plenty, Taranaki and Hawkes Bay. While both the MED/BRC findings and this

Table 2. Telecom Yellow Pages data aggregated by main centre and provincial area classification

Exchange	Web%	Email%	Total	Count	Web	Email
National	3.63%	6.03%	190,338	290,070	10,516	17,501
Main centres	4.21%	6.48%	100,939	153,386	6464	9943
Provincial areas	2.59%	5.20%	84,305	127,758	3312	6642
NZ0800/015 totals	8.29%	10.26%	5094	8926	740	916

analysis show an average national picture whereby provincial and rural New Zealand trails main centres, this averaging conceals the significantly better performance of a number of provincial areas. To assume a national perception of a ‘rural divide’ whereby all provincial and rural regions lag all main centres is thus both false and misleading. At least four provincial and rural centres outrank *all* main centres in business email usage on the basis of our data.

Thus we cannot support the grossly oversimplified hypothesis that rural New Zealand *per se* is dragging the e-commerce chain. Rather, we draw attention to the fact that some large provincial and rural areas fit this ‘rural–urban digital divide’ scenario, while others quite clearly do not. This finding leads us to question whether the rural–urban divide hypothesis may have some validity if we redefine what is meant by ‘urban’ and ‘rural’. By separating the data pertaining to the main provincial centre(s) from the rest of each region’s data, we can analyse on the basis of provincial centre and rural hinterland (Table 3).

This analysis reveals a clear dominance of urban and provincial centres over rural for website usage. All provincial centres except Gisborne City²⁵ rank higher than their corresponding hinterlands. This clearly supports the existence of a divide between urban centres and provincial towns, and their rural hinterlands. However, while the metropolitan centres appear high in the rankings for websites, they are not overwhelmingly dominant. Dunedin and Wellington are clear leaders, but Whangarei ranks above Auckland, and Nelson ranks above Christchurch. This indicates that website usage in some provincial centres is as high as that in metropolitan areas. Furthermore, Otago Rural ranks 11th, ahead of both Wellington Districts and Auckland Districts.

The results for e-mail listings are even more decisive in favour of provincial centres than the website figures. Provincial centres Blenheim and Nelson are clear leaders, with Dunedin the highest ranking metropolitan at fourth. Metropolitan Wellington and Christchurch sit at eighth and ninth, behind provincial centres Whangarei (sixth) and Invercargill (seventh). The same rural districts as in the website analysis comprise the least listed users of email. Further, while rural hinterlands represent 16% of all business listings, they comprise only 8% of the website listings and 10.6% of the e-mail listings. However, the rural hinterlands showing lowest uptake represent only 7% of the total listings, and of these Waikato represents 42.5%. This implies that rural hinterland divides, where they exist, are region-specific, and that the regions exhibiting significantly low actual and proportional performance can be readily identified. Further analysis is required to identify the real causes of the ‘divide’—which does not, on the face of this analysis, appear to be driven by population density or geographic location alone.

Table 3. Telecom Yellow Pages data separated by provincial centre and rural hinterland

Exchange	Count	Web	E-mail	Web%	E-mail%
Auckland dist totals	43,073	1465	2280	3.40%	5.29%
Auckland urban	41,503	1977	2630	4.76%	6.34%
Bay of Plenty—rural	5916	101	179	1.71%	3.03%
Bay of Plenty—Tauranga/Rotorua	14,634	333	525	2.28%	3.59%
Canterbury rural	9003	195	465	2.17%	5.16%
Canterbury—Christchurch	28,640	1175	2094	4.10%	7.31%
Gisborne rural	104	1	1	0.96%	0.96%
Gisborne city	2517	20	74	0.79%	2.94%
Hawke’s Bay rural	2126	15	56	0.71%	2.63%
Hawkes Bay Napier/Hastings	8006	164	381	2.05%	4.76%
Manawatu rural	2059	19	69	0.92%	3.35%
Manawatu—Palmerston North	8051	303	495	3.76%	6.15%
Marlborough rural	764	26	65	3.40%	8.51%
Marlborough—Blenheim	2670	97	287	3.63%	10.75%
Nelson & Bays rural	907	25	54	2.76%	5.95%
Nelson & Bays—Nelson	6595	291	693	4.41%	10.51%
Northland rural	5968	119	254	1.99%	4.26%
Northland—Whangarei	5786	278	487	4.80%	8.42%
NZ 0800/025 totals	8926	740	916	8.29%	10.26%
Otago rural	3618	127	229	3.51%	6.33%
Otago—Dunedin	9066	477	813	5.26%	8.97%
Southland rural	1677	17	58	1.01%	3.46%
Southland—Invercargill	4794	130	391	2.71%	8.16%
Taranaki rural	1835	18	45	0.98%	2.45%
Taranaki—New Plymouth	5390	150	257	2.78%	4.77%
Timaru—Oamaru rural	608	10	19	1.64%	3.13%
Timaru—Oamaru urban	4308	87	250	2.02%	5.80%
Wanganui rural	853	8	23	0.94%	2.70%
Wanganui urban	3206	103	229	3.21%	7.14%
Waikato rural	7533	101	204	1.34%	2.71%
Waikato—Hamilton	13,544	481	649	3.55%	4.79%
Wairarapa rural	996	3	11	0.30%	1.10%
Wairarapa—Masterton	2187	29	62	1.33%	2.83%
Wellington districts	14,011	489	800	3.49%	5.71%
Wellington city	17,093	881	1326	5.15%	7.76%
West Coast totals	2103	61	130	2.90%	6.18%

Table 3: New Zealand E-commerce Activity Begins and Ends in Auckland

A surprising outcome of the above analysis is that New Zealand’s largest city, Auckland, does not appear to be the leader in electronic commerce. Traditionally, a larger population and closeness to both suppliers and markets has given Auckland businesses a commercial advantage over those in other regions, and has been a significant factor in Auckland businesses being among the leaders in the uptake of other business processes and technologies (for example, just-in-time inventory management). However, this pattern of uptake does not appear to be replicated in website and e-mail listing behaviour. Auckland ranks only fifth in website listing and 11th in e-mail.

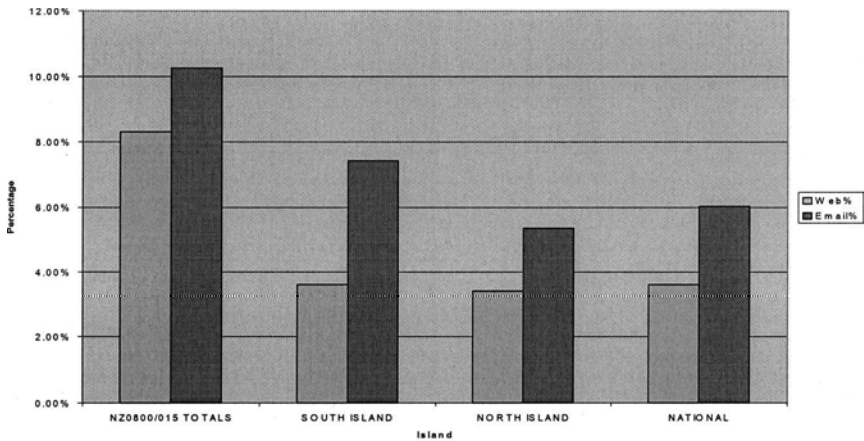


Figure 3. Yellow Pages websites and email listing percentages: North Island v South Island.

Rather, it is New Zealand's smallest metropolitan centre—Dunedin—which this analysis shows is the metropolitan leader. Furthermore, Dunedin's rural Otago hinterland also features highly among the rural leaders. This implies that some very different dynamics are driving the uptake of electronic commerce communications compared with those driving the uptake of traditional business practices.

Rearranging the data by north–south geography reveals that there are concentrations of like website and e-mail listing behaviour in specific adjacent geographic areas. For instance, Wellington/Marlborough/Nelson and Bays represents a cluster of high listing, along with Otago and Invercargill. A cluster of related low listing occurs in Bay of Plenty/Waikato/Taranaki/Gisborne/Hawkes Bay/Wairarapa. While these patterns are evident in urban geography they are even more obvious in rural geography.

The rural geography analysis reveals another trend—the South Island appears to have consistently higher listing percentages than the North Island, despite the population of listings in the North Island being much greater (71% North Island, 29% South Island). This is clearly evident in Figure 3. While there does not appear to be a very great north–south difference in website listing behaviour, there is a significant South Island advantage in the listing, and hence use, of e-mail as a business tool (71% North Island, 29% South Island—see Table 4)

This suggests that there may, in fact, be an *inverse* relationship occurring in the propensity of businesses to list and use e-mail. Rather than supporting the

Table 4. Telecom Yellow Pages data aggregated by North and South Islands

Exchange	Web%	E-mail%	Count	Web	E-mail
NZ0800/015 totals	8.29%	10.26%	8926	740	916
South Island	3.64%	7.42%	74,753	2718	5548
North Island	3.42%	5.35%	206,391	7058	11,037
National	3.63%	6.03%	290,070	10,516	17,501

hypothesis that Auckland as the predominant business and population centre would be the likely leader in this aspect of business uptake of electronic commerce, our analysis offers some evidence to suggest that the opposite is true. That is, areas most distant from the main commercial centre—those in the South Island—have proportionately greater e-mail uptake. Thus, not only can we refute the hypothesis that Auckland assumes electronic commerce uptake leadership as a function of its traditional business concentration and leadership, we can also suggest that a combination of both distance from Auckland, and lack of business concentration appears to be a significant factor in the significantly greater propensity for South Island businesses to adopt e-mail as an electronic commerce business tool.

Interpretations from the Data

While initially, the findings may appear contradictory, we believe there are logical and justifiable explanations for the results we have obtained. These lie in an analysis of the economics underpinning business uptake of new processes and technologies. Investigation of the marginal costs and benefits to businesses, the uses to which businesses appear to be putting the new technologies, the products that they are producing, and from this, analysis of the optimal time to invest, provide some plausible explanations for all of the phenomena observed in our data analysis.

Proposition 1: Earlier and Higher Provincial and Rural E-mail Adoption is Consistent with Higher Rural Communication Costs and Benefits

The principal use of e-mail in a business is for communication. E-mail can substitute for traditional postage, telephone, fax and face-to-face communication. Typically, businesses in more remote or less densely populated areas by necessity face higher costs of communication. This is particularly true of face-to-face communication, where travel costs are greater; but also for fax and telephone communication due to the need to make a long distance call charged on minutes of communication time at a rate dependent upon the physical distance between callers. If the message to be conveyed is long and complex, then the communication time will be longer, or face-to-face communication required, and is hence more costly.

With a smaller local network and greater probability of having to make a charged-for toll call, rural or provincial business would typically make more calls and incur higher per call charges than a comparable business in a metropolitan area. Physical distance from suppliers and customers also increases the cost of communication initiated by trading partners, which are typically passed on in the form of higher prices to the more costly customer. Thus, if communication costs (both explicit and implicit) are higher for a rural or provincial firm than a metropolitan one, then the 'break-even point' at which the benefits of a new technology such as e-mail begins to offer real savings will occur at an earlier stage for rural firms than metropolitan ones. As the marginal benefits for rural users begin accruing at a higher cost of e-mail technology, it is consistent that we observe proportionately higher levels of e-mail uptake in rural and provincial New Zealand than in metropolitan areas. We would expect businesses facing higher communication costs to be among the earliest adopters of substitute communications technologies. This is precisely the pattern of provincial and rural uptake revealed by our data.

Higher e-mail uptake observed in the South Island is also consistent with this analysis. The higher concentration of businesses in the North Island (71% of the businesses listed) combined with the much larger geographical area of the South Island means that it is more likely that trading partners of South Island businesses will be located at a greater distance than those of rural and provincial North Island businesses. Thus, the higher penetration of e-mail in the more geographically distant and remote areas of the South Island—Marlborough, Nelson and Bays and rural Otago—is entirely consistent with the much lower penetration in rural Waikato (comparatively close to Auckland) and rural Wairarapa (comparatively close to Wellington), where the costs of communication would be proportionately lower.

Extending this argument, we would expect to see even higher proportionate levels of uptake in the rural areas than in the provincial centres, but this clearly is not the case in our data, as all rural hinterlands²⁶ show lower e-mail uptake than their provincial centres. We contend that there are at least two plausible explanations for this observation—the costs and quality of telephony infrastructure in rural areas, and the types of businesses which are typically located in higher-utilising rural areas.

Infrastructure quality is clearly a factor governing the uptake of electronic commerce. While it is acknowledged that impediments to uptake arise from the interaction of a complex set of factors, of which the state of rural telecommunications is not alone, we find some evidence in New Zealand to suggest that the costs of rural telephony, both out-of-pocket and time and quality loss, are higher for rural businesses, and that this may be part of the explanation of lower and later uptake of both e-mail and websites in rural areas. The capacity of the local loop servicing 5% of rural customers is insufficient to satisfy the 14 kbps requirement for reliable fax and email transmission,²⁷ a significant barrier to adopting e-mail as it prevents participation entirely. Poor standards of line maintenance, line noise, exchange overloading and electric fence interference are cited as significant factors contributing to poor quality telephone service (24, 18 and 22%, respectively in the MAF survey), resulting in additional time and inconvenience costs to rural subscribers. Despite these higher costs, the MAF report indicates that the benefits of Internet connectivity are sufficiently large for some subscribers to invest in bypass technologies such as wireless and satellite, but the threshold for investment in these technologies is high, meaning that few businesses may have a valid business justification for uptake.

Businesses in rural areas thus face higher costs on average in substituting e-mail for other forms of communication than businesses in provincial centres, where these additional costs do not have to be borne. This pushes the costs of adoption much higher, requiring more benefits to justify adoption, effectively delaying the point of uptake.

However, the quality of infrastructure cannot be held solely responsible for lower rural Internet uptake. Failure to charge rural customers the real costs of existing telephony infrastructures is also potentially distorting the pattern of bypass technology investment and uptake in rural areas. The universal price enshrined in New Zealand's 'Kiwi Share' legislation means that rural customers are paying substantially less than the average cost of provision for their telephone service.²⁸ Consumer decisions to invest in bypass technology are based upon additional benefits and price of new technologies relative to existing ones. If the price the consumer pays for the existing technology is artificially low, then a higher level of

benefit will be required to justify uptake of the new technology than if the customer faced the actual cost of existing technology. If such high benefits are not achievable, then the customer will not buy the new technology and no market will exist. From the supply side perspective, investment will be prevented as there would be no return on the investment at the artificially low prices, even in the event of there being demand for the technology. The net effect is lower uptake, as evidenced in the Yellow Pages data.

Nonetheless, the data indicate that in some rural areas additional benefits outweigh the higher costs faced. We find that the rural areas where e-mail uptake is high are also those whose local economies are comparatively more buoyant (e.g. Marlborough, rural Otago). Furthermore, the types of industries which underpin these more buoyant economies (e.g. tourism in rural Otago, wine in Marlborough) require businesses to communicate regularly with trading partners who are located at a distance. The business case hence supports earlier adoption. In addition, if the products in which the business trades are digital, or can be supplemented by digital co-products,²⁹ the business case for the adoption of both e-mail and websites becomes viable much earlier.³⁰

Thus, we believe, the patterns of rural and provincial e-mail adoption and the bias in favour of higher uptake in the South Island that we have witnessed in the Yellow Pages data are entirely consistent with an adoption pattern driven by the distribution of the costs and benefits facing business users.

Proposition 2: The Patterns of E-mail Adoption We are Seeing in Provincial and Rural New Zealand Appear to Indicate Demand-Driven Adoption Similar to the EFTPOS Rollout

Boles de Boer, Evans and Howell present a case for New Zealand's almost ubiquitous utilisation of EFTPOS technologies being a consequence of the early accrual of tangible benefits to all parties concerned—banks, retailers and consumers. Particularly, consumer and retailer accrual of these benefits has been a significant factor in demand for new technologies, resulting in very early and world-leading levels of adoption of this technology.³¹

Similar patterns of adoption are evident in the use of e-mail, as the benefits (e.g. reduced time and cost of communicating, increased timeliness of message exchange) accrue to both the sender and the transmitter. Thus there are incentives for trading partners to adopt the new technology simultaneously to maximise benefit sooner. This should result in 'clusters' of uptake among businesses which are frequent communications exchangers. This demand-driven pattern may help to explain 'clusters' of higher e-mail uptake observed in some provincial towns (that is, localised network effects). In particular, the high uptake of both website and email use in Whangarei may be evidence of 'clustering' due to the emphasis given to Internet capability in that area's local government-sponsored business development initiative.³²

Proposition 3: The Optimal Time to Invest in Websites Depends more on Firm Size and Product than on Infrastructure and Geographic Business Location

The location-based explanations of propositions 1 and 2 above provide some cogent reasons for the observed patterns of e-mail uptake, but the patterns associated with website listing and uptake are less clear. While areas such as Marlborough have very high e-mail listing percentages, their rates of website

listing are not proportionately as high. However, Otago rates highly in both measures.

If it is assumed that the business case for e-mail adoption rests upon a trade-off between the costs and benefits of alternative communication technologies, then what costs and benefits should be traded off in the business case for developing and using a website? While user familiarity with Internet-based techniques will play a role in reducing costs such as staff training for keyboard skills, these comprise only a small component of the business case for developing and using a website. While connection to e-mail is a relatively cheap and easily implementable practice which easily substitutes in the business processes for existing communication practices, website development is more costly and complicated.³³ The investment required for development and operation of a website is significantly higher, both in capital cost, and the costs of redesigning existing processes to accommodate the website processes. Thus, greater benefits, in absolute terms, will be required to justify the business case. This implies that larger businesses with greater trading volumes should reach the point where the costs of website development and operation are exceeded by benefits sooner than smaller businesses. As larger businesses tend to be more concentrated in larger provincial towns and metropolitan centres, we would expect to see greater uptake of websites in these areas than in smaller provincial and rural centres; and indeed, this is the pattern that the data generally reveals. Four of the top six highest ranking website locations are metropolitans, with the lowest six rankings rural hinterlands.

Interestingly, though, the third and fifth website rankings in the Yellow Pages data are occupied by provincial centres—Whangarei and Nelson, respectively. In initial analysis, business size does not appear to be a sufficient explanation of why these comparatively small provincial towns should rank so highly. Further, it does not alone explain the ranking of Dunedin over Auckland.

This leads us to surmise that the nature of the product is significant. While all firms potentially can benefit from website advertising and the cost-related efficiencies of digital information and commercial exchange, there will be an increased incentive for firms trading in information products and related information-based co-products to adopt website trading due to the relative cost advantages of web-based production and distribution methods.³⁴ This additional avenue of cost reduction further advances the business case for website adoption over firms trading in traditional products.

Anecdotal evidence supports the contention that the products produced by some Dunedin businesses (e.g. the digital imaging cluster, research institutes attached to the University of Otago, tourism) may well be a factor that is beginning to be evidenced in the higher website uptake in this city. While it is highly speculative, there may also be some foundation to the suggestion that patterns of business associated with niche products, such as Whangarei's luxury boat-building industry (e.g. engineering design, interior fitting design, and even digital pre-sales publicity) may be a factor in higher website uptake. Further, rural Otago's reliance upon tourism would provide a more conducive base for electronic transacting than Gisborne's reliance upon traditional agricultural and horticultural products.

In addition, there is less justification for inadequate telecommunications infrastructure and higher costs of rural telecommunications as a potential inhibitor of rural website usage. Websites can be, and in many instances are, hosted on the computers of Internet Service Providers (ISP) and specialist web hosting services located in a completely different geographic area to the business they serve.³⁵ A

rural business may therefore have its website hosted on a computer in an urban area, bypassing problems posed by inadequate telecommunications infrastructures. Indeed, Yellow Pages offers a website hosting service for clients who don't even have a computer.³⁶ If the predominant pattern of website business usage is the transmission of reasonably static data to clients, with minimal communication from the website host computer to and from the business location, then website location can be wherever the best business case dictates. This may explain why the rate of website uptake is very little different for South Island and North Island business, despite the greater average costs of communications that would be expected in the more geographically remote South Island compared to the North.

Only if the amount of information required to be transmitted to and from the physical site of operation of the business is large does the capacity and quality of the telecommunications infrastructure become important. Clearly, the costs of the broadband technologies best suited to these large symmetric data transfers are significantly higher for rural users than urban ones, as there are fewer users among whom to share the fixed costs. Hence, costs do pose a barrier to rural website uptake, but only for businesses with large data transfer requirements.

However, we add a caveat to this analysis. While our postulations relate to the behaviour of businesses as producers and operators of websites we cannot necessarily use these arguments to rationalise the usage by businesses of other businesses' websites—that is, when businesses act as consumers of website products and services. Location and infrastructure quality may be a factor in the patterns of businesses accessing other businesses' websites. However, this will only be a barrier for the small percentage of rural businesses with less than 33kbps line capacity. Furthermore, business size does not necessarily imply any greater or lesser benefit to be gained from information discerned from website searching or reduction in costs from the availability of digital products and exchange processes. However, the patterns that are emerging from this are not able to be elicited from the Yellow Pages data. Further research will be required to refine knowledge about these aspects.

The parameters determining the optimal time for business investment in websites thus differ significantly from those determining investment in e-mail. These factors can also explain both the lower uptake of websites overall, and the differences in uptake between websites and e-mail within a specific area. Website adoption appears to be governed more by the size of the business and the types of products and processes the business trades in than by physical location or the state of infrastructure. Our data are consistent with the patterns of uptake one would expect based upon this rationale in the business case for website adoption.

Proposition 4: Websites can Substitute for Email in Some Business communications

To complete the analysis of our data, the patterns of uptake yielded by the non-geographically dependent 0800/0900 and 021/025 Yellow Pages listings were examined. Businesses listing these numbers tend to either have one location servicing the entire country, or maintain a national chain of proprietary or franchised operations. These numbers exist to facilitate information exchange or to accept orders. Thus, 0800 number usage replicates purposes of e-mail and websites. Hence, we would expect some supply side substitution effects between these technologies. Furthermore, as the same technologies also offer customers additional benefits, such as greater accessibility to information, and time savings by

being able to bypass human intervention in accessing that information, we would expect to see customers substituting electronic methods of interaction for telephone ones. The Yellow Pages data exhibit evidence of some of these effects. However, it appears as though, while websites may provide some ability to substitute for both e-mail and telephone, e-mail is a complementary technology.

0800 numbers have the highest proportion of website listings in the country (74% higher than the highest region). However, while e-mail listing is also high, it is proportionately only the same as the highest region. Hence, businesses operating 0800 numbers are significantly more likely to be operating websites than other businesses, but not necessarily more likely to be operating e-mail addresses.

It is unsurprising that national 0800 businesses would be more likely to be operating websites, as their business processes already support remote delivery. Introducing a new way of advertising or processing orders would incur fewer changes, and hence cost, than if these processes had to be redesigned. Thus, by the business case argument, an earlier accrual of net benefits could be anticipated. Furthermore, nationally based firms would be more likely to be larger, and hence earlier adopters of websites. Flexibility of location choice also reduces dependence upon local infrastructure quality.

However, given that one central location necessarily means distance from significant parts of the customers base, on cost basis earlier and higher e-mail adoption would be expected to be even more likely, especially given that businesses with 0800 numbers bear the costs of consumers communicating via traditional telephony. The incentives to 0800 businesses to adopt e-mail seem higher even than those in rural areas. Yet the Yellow Pages data do not support this. While e-mail adoption is high, it is not significantly higher than that in many regions. This apparent anomaly leads us to question whether there is some form of substitution occurring between websites and e-mail. Higher levels of website adoption may lead to a reduced need to communicate by e-mail.

Two possible scenarios emerge. If the purpose of the 0800 number is merely for communicating—e.g. connecting the customer with the local franchise—then there are significant human time and transaction cost savings available to the business by putting information on a website. Automating the human exchange into a Web page substitutes for a telephone call, reducing the business information exchange costs and shifting the costs of information acquisition onto the consumer. This cost incentive leads 0800 businesses to favour websites for communication in preference to developing either email or telephone interfaces.

Likewise, if the purpose of the 0800 number is to collect information for the processing of transactions, then once again a Web page provides the opportunity to reduce human processing costs and to shift communication costs onto consumers. While the adoption of website selling is more costly, requiring a ‘re-engineering’ of back office functions and a more complicated and expensive Web page design and operation (e.g. the need to use secure servers), if transaction volume is sufficient, then the business case may warrant development. If 0800 numbers enable the ‘pooling’ of national demand, thus generating economies of scale, then the critical mass of web-based purchases required to justify website selling would be expected to be reached earlier than if, for example, each local franchise collected and forwarded orders individually.

However, e-mail does not offer the same advantages. While websites structure the information exchange process, thus streamlining mass customer interaction, the ‘free form’ of both e-mail and telephone interaction requires human

intervention in every communication to interpret and act. In this environment, e-mail provides few if any advantages over a call centre. Indeed, it may cause increased costs due to loss of timeliness, as e-mails cannot replicate the interactive nature of a telephone conversation. While e-mail may complement the activities of a telephone or website service, it is unlikely to act as a substitute, as it lacks some of the key functionality of both the other services.

If some website substitution for e-mail is occurring, with significant cost advantages for 0800 business, then this would help explain higher website uptake but only comparable e-mail uptake in 0800 companies in the Yellow Pages data.

Conclusions

Our analysis of the Yellow Pages data leads us to conclude that, while there is evidence of some 'rural-urban digital divides' in New Zealand, it is by no means as simple as saying that all rural businesses are disadvantaged relative to all urban businesses.

Our analysis shows that it is necessary, when making an assessment of 'digital divides' to separate out the different forms of Internet-based technologies, as different patterns of uptake, and hence relative advantage and disadvantage are evident across different technologies. It is also necessary to establish the different uses to which the technologies are put, and whether there are any significant usage patterns which might require a different level of assessment to be made of the needs of different geographical areas. Furthermore, the products traded may also form a part of this analysis, along with the role each of these technologies may play as partial or complete substitutes and complements for each other. Unless there is a clear understanding of the role all of these factors play, it is difficult to determine whether any geographical region may be more or less advantaged than any other in terms of access to, or usage of, specific technologies.

Using this approach, we conclude:

1. There is no evidence in the Yellow Pages data to support the existence of a 'digital divide' with respect to business uptake of e-mail and website applications between metropolitan and provincial centres in New Zealand merely on the basis of geography.
2. The data suggest that there is a 'divide' which favours earlier adoption of e-mail in particular by businesses that are more remote from their trading partners over those whose partners are closer. This translates into a higher e-mail uptake in the South Island than in the North.
3. There is evidence to suggest lower levels of uptake of both e-mail and websites applications in all rural areas compared to the level of uptake in their provincial centres. This may be explained to some extent by a combination of the small scale of businesses reducing the incentives to invest in, particularly, websites, and higher costs (both of maintaining a service and the costs of bypass) facing rural telephony subscribers, which may be delaying uptake of e-mail. Furthermore, the artificial costs of telephony faced by businesses in rural areas may be distorting the decision making with respect to adopting bypass technologies.
4. However, there is evidence to suggest that some rural and provincial areas are at a greater disadvantage than others. This relative disadvantage may be due as much to economic and social conditions dictating a later uptake of new technologies, and the nature of the products and services businesses in these

areas create, as to the state of telephony infrastructure, population density and geographical location.

5. ‘Digital divides’ favouring earlier uptake of websites by urban and 0800 businesses may be as much a factor of the size of the business, the type of products bought and sold, and where the communication costs lie as of physical location.
6. In all instances, greater insights into the patterns of uptake of any of the Internet-based technologies are gained by analysing the business cases for adoption of the technology than merely focusing on location. Using this approach shows a ‘divide’ which, infrastructure disadvantages notwithstanding, favours rural and provincial businesses over metropolitan ones in the adoption of e-mail.

While we acknowledge the limitations of the Yellow Pages data, we suggest that as the findings of this analysis can be rationalised against recorded and reported business behaviours, this study represents the most comprehensive analysis available currently on regional uptake of Internet-based technologies in New Zealand. Further quantitative research is required to authenticate these findings. Nonetheless, these findings provide a useful foundation for informing the policy debate surrounding the development of national Electronic Commerce strategies.

Notes and References

1. This paper is based on a background report prepared for the New Zealand Ministry of Economic Development’s e-Commerce summit, November 2000. I wish to thank Damian Stewart for his work in assembling the data, and Frank March and Lewis Evans for comments on an earlier draft.
2. For example, OECD, *The Economic and Social Impacts of Electronic Commerce*, OECD, Paris, 2000.
3. For example, US Department of Commerce, *Digital Economy 2000*, Department of Commerce, Washington, DC, 2000.
4. For example, NOIE (National Office for the Information Economy), *National Bandwidth Inquiry: Final Report*, NOIE, Canberra, 1999.
5. For example, R. G. Lentz, ‘The E-volution of the digital divide in the US: a mayhem of competing metrics’, *Info*, 2, 4, 2000, pp. 355–77.
6. For example, Ministry of Economic Development, *Electronic Commerce: Strategic Importance, Key Issues and Way Forward*, Ministry of Economic Development, Wellington, 2000.
7. *Ibid.*
8. Ministerial Inquiry into Telecommunications, *Final Report*, Wellington, 2000. <http://www.teleinquiry.govt.nz>.
9. For example, D. Anderson, ‘No closing the gap in rural telecommunications’, *Rural News*, 4 September 2000.
10. For instance, Ministry of Economic Development states that, while information about access is limited, ‘what information we do have suggests that a digital divide is likely in . . . parts of rural New Zealand’ (*Electronic Government. Briefing to the Minister of State Services and Minister for Information Technology*, Wellington, 1999, para 16. http://www.ssc.govt.nz/Documents/Government_Information_and_Technology_Management.htm). This is reinforced in Information Technology Advisory Group, *The Knowledge Economy*, ITAG, Wellington, 1999, yet no substantiating data are provided. Indeed, it is noted that the MAF study, as well as collecting data regarding Internet usage, also collects significant quantities of perception data, see T. Atkins, *Telecommunications: Use, Constraints and Potential in Rural Areas*, Ministry of Agriculture

- and Fisheries, Wellington, 2000. These surveys of perception are also prominent in the Australian literature—for example, NOIE, *The Current State of Play*, NOIE, Canberra, 2000.
11. Ministry of Economic Development, *Statistics on Information Technology in New Zealand 2000*, Ministry of Economic Development, Wellington, 2000.
 12. Atkins, *op. cit.*
 13. Ministry of Economic Development, *Electronic Commerce in New Zealand: A Survey of Businesses on the Internet*, Information Technology Policy Group, Competition and Enterprise Branch, Wellington, 2000.
 14. D. Boles de Boer, L. Evans and B. Howell, *The State of E-New Zealand*, New Zealand Institute for the Study of Competition and Regulation Research Paper, 2000. <http://www.iscr.org.nz>.
 15. Five percent of main centre businesses do not use computers compared to 9% of provincial and rural businesses. Similarly, 17% of main centre businesses do not use the Internet, compared to 25% of provincial and rural.
 16. A large number of respondents to the MAF survey reported problems associated with telephony services. When the problems associated with slow Internet access speed were removed from the data, reported problems fell only 4% (from 58 to 54% of respondents). This implies that potentially slower Internet access speed is neither a significant problem for rural users, nor an impediment to the uptake of Internet services (Boles de Boer *et al.*, *op. cit.*, p. 49).
 17. Despite facing infrastructure disadvantages, rural users' telephone and mobile phone penetration rates (99 and 70%, respectively—MAF and MED) exceed the national averages (96 and 40%—ISCR). Furthermore, MAF-reported computer usage in rural areas (61%) matches if not exceeds national penetration (42.8% at 1998, approximately 50% in 2000 by current MED projections) with 76% of those computers being used for business purposes and 81% connected to the Internet (projected nationally at around 60%—MED). MAF figures are slightly lower than the corresponding MED/BRC provincial and rural computer penetration because MED/BRC figures include businesses in provincial towns not included in the MAF study.
 18. Seventeen percent of respondents to the MAF survey have a satellite dish for digital data downloading (both television signals and other data). The report documents significant interest in early adoption of wireless applications. MED figures show a national pay television penetration of only around 25–30%.
 19. The MED/BRC study defines 'urban' as Auckland, Wellington, Christchurch and Dunedin, while 'provincial' is the balance of New Zealand. The MAF sample was drawn from New Zealand Post's rural delivery locations. The MED/BRC figures also include towns and provincial centres, while MAF's respondents were almost exclusively non-town-dwellers.
 20. A. Barua, A. Whinston and F. Yin, *Not All Dot-coms are Created Equal: An Exploratory Investigation of the Productivity of Internet-based Companies*, Centre for Research in Electronic Commerce, University of Texas at Austin, Austin, Texas, 2000.
 21. Such an investment policy also ignores the role of anticipated technological change, whereby new and improved technologies become available.
 22. Inter-regional comparisons might be compromised if there were regional differences in the way in which listings were solicited. One way that such a difference might be detected would be if one area displayed a significantly greater number of multiple listings for businesses (for instance, as a result of a vigorous listing campaign by Yellow Pages salespeople). However, no such significant regional variation presents itself. Therefore we have no reason to assume that any one region has been more vigorous in soliciting email and website listings either.
 23. Where comparisons to other studies are made, the terminology used to define categories in those studies is used.
 24. Atkins, *op. cit.*, p. 31.
 25. Gisborne rural's higher ranking is a function of the small number of websites listed in a small population.
 26. Except Gisborne rural, due to small number problems.
 27. Atkins, *op. cit.*

28. See, for instance, L. Evans, ‘Telecom’s “Kiwi Share”: do consumers still need it?’, *ISRC Competition and Regulation Times*, 2, 2000.
29. See Barua *et al.*, *op. cit.*
30. See ‘The role of information content’, Boles de Boer *et al.*, *op. cit.*, pp. 52–54.
31. *Ibid.*, pp. 20–26.
32. Anecdotal report from Whangarei businesses.
33. Forty percent of respondents to the MED/BRC survey cited costs as a significant reason inhibiting uptake of electronic commerce.
34. See Barua *et al.*, *op. cit.*
35. Indeed, it may even be located in another country.
36. New Brighton Florist case study <http://www.yellowpages.co.nz/advertise/success-stories/florist.html>