Literature review of the economic impact of the Internet

for
InternetNZ

Prepared by
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1. **INTRODUCTION AND SUMMARY**

InternetNZ is interested in learning more about the potential contribution that the Internet has made to the New Zealand economy. This report presents a review of the literature with the aim of first distilling the conceptual ways that the Internet is likely to have influenced economic performance and second providing a critical review of the empirical evidence of the scale of this relationship.

The ubiquitous nature of the Internet makes this relationship an issue of great interest but also a very complex and difficult one to analyse. The underlying concept of the economic contribution of the Internet is actually quite simple. The Internet facilitates cheap and quick sharing of information. This results in an outward shift in the effective supply of information, which promotes the production of information-sharing dependent products and services. The resulting increase in the efficiency of production ultimately has the positive impact of increasing the consumer surplus; ie more people can receive what they desire at an affordable price.

However, quantifying the relative importance of the Internet is a more difficult task. This is because of a number of things:

- The consumer surplus is a conceptual phenomenon rather than a readily measurable one (it is about what one would have been prepared to pay for a product in excess of what one actually paid).
- The introduction of new technologies produce losers as well as winners (eg mainstreet retailers losing market share to virtual retailers)
- Many Internet products are intermediate in nature, meaning that it is often difficult to identify who the ultimate beneficiary of the product might be (eg information collected on the Internet might help a law firm win a civil case, which benefits both the firm and their client, as well as clients of the client).
- There can be a long gestation period between a development on the Internet and its economic consequences (eg to draw a long bow, many might argue that the Internet was highly influential to the “Arab Spring” events. If so, the Internet might ultimately contribute to a large increase in average incomes in many Arab countries. This in turn might eventually have benefits for New Zealand if their demand for New Zealand products increases.).
- The new nature of Internet business activities mean that existing statistical systems struggle to capture both the scale and location of economic activities influenced by the Internet.
- The development of the Internet has coincided with a host of other IT developments with complex inter-relationships with Internet developments.
- Finally the measurement issue is less one about defining the world with the Internet, that is readily observable, it is instead about
defining and measuring the counterfactual, a world without the Internet.

**Conceptual issues**

The Internet is hypothesised to enhance economic performance in two distinct ways:

- Increasing the efficiency of production by reducing the costs of finding and using shared information
- Enhancing the way the economy matches what is produced with the products and services desired by society

The second of these ways potentially has the more profound impacts on social wellbeing and on economic growth prospects. Unfortunately these subjective improvements in wellbeing are difficult to observe and measure. This has at least two implications for attempts at measuring the economic impact of the Internet:

- Estimates of the economic impact based on productivity improvements are likely to understate the full economic impact as they will not fully account for welfare enhancements resulting from changes in relative prices.
- The ultimate impact of the Internet could take a very long time to manifest itself on wellbeing. One plausible outcome of the advent of the Internet is to enhance the return in capital, which would result in capital deepening in affected economies, leading to an acceleration in the pace of economic growth. It might take many years, perhaps decades before the economic impact of the Internet fully manifests itself.

**Internet specific issues**

The Internet has exhibited characteristics to suggest that it is a general purpose technology. Ultimately general purpose technologies lead to an incremental jump in economic wellbeing and are likely to herald further related innovations. Like previous general purpose technologies, it appears that the Internet has been responsible for major stock market disruptions.

Part of the reason for the Internet-induced global stock market volatility experienced between 1997 and 2002 was the presence of network externalities which encouraged a "land rush" to secure Internet real estate in order to gain first-mover market position and other advantages.

Due to the presence of these network externalities, many Internet-based industries are dominated by individual businesses. In general, the benefits to consumers from network externalities outweigh the costs of having dominant firms. However, there can remain political economy issues associated with the concentration of gains resulting from the Internet.
We identify a number of areas where the advent of the Internet has
generated issues that will be perceived as problems by different groups:

- Persistent price dispersion of products sold on the Internet
- A potential erosion of the GST tax base
- An increase in the volume and sophistication of Internet crime
- A lack of evidence that the advent of the Internet has been as
  beneficial for less developed economies.
- Evidence that the Internet is more beneficial for more concentrated
  population centres, which in turn implies that the economic benefit for
  New Zealand from the Internet may be less marked than in other
  places around the world.
- The advent of the Internet undermines the legal protection of
  intellectual property.

None of these factors are sufficient to offset the net positive influence of
the Internet. Indeed in some cases the observed impact simply reflects
the interaction of the Internet with broader social and economic issues (eg
tax design and criminal behaviour). Others perhaps reflect transitory
effects (eg price dispersion and the impact of the Internet in less
developed economies). The last two points are perhaps more about the
allocation of the gains resulting from the Internet, than the overall net
impact. For example, even if the Internet does encourage a further
concentration of population and economic activity into major urban
centres, this does not preclude important benefits for rural based
activities. Also it is not clear from the evidence available whether this
erosion of intellectual property rights has negative economic
consequences.

**Economic impact estimates**

The studies of the economic impact of the Internet reported here, to
varying degrees, suffer from:

- Errors in measuring the extent of Internet activities
- Having a narrow study focus
- Employing simplistic estimation methods
- Insufficient time to analyse the full impacts.

Our assessment is that (Czernich, Falck, Kretschmer, & Woessmann,
2009) utilised the most robust analytical methods. Applying their result to
the (Manyika & Roxburgh, 2011) estimates of an average Internet
penetration in France, Germany, the US and the UK of 60% would suggest
that the Internet has already boosted economic activity in developed
economies by between 5 and 9%.

This potentially provides a rough estimate of the expansion in economic
activity resulting from productivity improvements (ie representing the
welfare gain resulting from the shift from $Y_{sq}$ to $Y_{sq}$ in Figure 6).
However, as our conceptual model has suggested, and a number of
analysts have also argued (eg (Litan & Rivlin, 2001)) much of the benefit
from the Internet is likely to show up in improved consumer convenience and expanded choices, rather than in higher productivity and lower prices.

The two studies incorporating estimates of the consumer surplus (Greenstein & McDevitt, Measuring the Broadband Bonus in Thirty OECD Countries, 2012) and (Manyika & Roxburgh, 2011) both suggested that the scale of consumer surplus is likely to be around 0.5% of GDP in developed economies. Adjusting these estimates for the quality of broadband can considerably expand these estimates, for example increasing the estimate for New Zealand from 0.5% to 3% of GDP.

However, these estimates of consumer surplus only attempt to account for the extent that cheaper broadband eases people’s budget constraints. It takes no account of how people’s lives have been improved by access to services available on the Internet.

The results of the investigation by (Penard & Suire, 2011) into the relationship between Internet use and subjective perceptions of well-being is indicative of a positive relationship between the Internet, particularly access, and people’s sense of well-being. This is consistent with the view posited in the Conceptual issues section that access to the Internet improves economic welfare by improving the match between what is produced and what people desire. But it does not confirm this supposition and it does not provide an estimate of the magnitude of its impact or its longer term impact.

Our theoretical discussion highlighted the potential relationship from better market place matching and the long term pace of growth; better matching is likely to increase the average return on capital, which will tend to increase people’s willingness to invest in their future. This suggests that there are three, potentially testable, hypotheses about the transmission of the development of the Internet onto economic prosperity. These are, after controlling for inherent differences between different sectors and in different time periods:

- Was the return on capital in Internet related investments higher than the return in other sectors?
- Has there since been a more broadly based increase in the return of capital?
- If so, has this increase in the return on capital resulted in a sustained relative shift between consumption and capital accumulation?

One could then calculate the growth impact of the capital accumulation attributable to the Internet to estimate the long run economic impact of the Internet.
2. **CONCEPTUAL ISSUES**

The underlying concept of the economic contribution of the Internet is actually quite simple. The Internet facilitates cheap and quick sharing of information. This results in an outward shift in the effective supply of information, which promotes the production of information-sharing dependent products and services. The resulting increase in the efficiency of production ultimately has the positive impact of increasing the consumer surplus; ie more people can receive what they desire at an affordable price.

This impact is illustrated schematically in Figure 1 and Figure 2. First we discuss the basic analytical tools: the supply and demand schedules. The latent demand for knowledge intensive goods are represented by the line marked Demand. The downward slope of the demand schedule reflects people’s price sensitivity; people will be willing to purchase more of a product if its unit price is lower. Conversely, the willingness of producers to supply the product is illustrated by the supply line. Supply schedules tend to slope upwards, ie more is supplied if the price is higher. Actual observed transactions reflect the interaction between supply and demand. In the example illustrated in Figure 1, the market equilibrium would see \( q_0 \) products produced and sold for a unit price of \( p_0 \). The financial value of the market activity would therefore be \( p_0 \cdot q_0 \).

![Figure 1](image-url)
However, Figure 1 also illustrates the win-win nature of market operations. Producers generally receive a price in excess of what they would have been prepared to supply the goods at. This producer surplus is represented by the area of the triangle that is above the supply schedule and below the actual market price, \( p_0 \). Consumers also receive a surplus, represented by the triangle above the market price but below the demand schedule. This consumer surplus reflects that many consumers are prepared to pay more for the product than they actually need to pay. Although this consumer surplus is not directly observable, this still represents a welfare benefit to consumers as their saving is available to be spent on other products.

In Figure 2 we extend the analysis to illustrate the implication of a technology advance such as the arrival of the Internet. The Internet creates value by vastly lowering the cost of transferring many types of information, on a one-to-one, one-to-many, or many-to-many basis. In cases where the product itself is information, the potential for value creation is enormous (Borenstein & Saloner, 2001). The main consequence of the increased reach is the improvement in matching of buyers and sellers, especially in previously very inefficient markets like that for used consumer durables.

If, at this stage, we assume that nothing changes people’s underlying demand, the impact of the Internet can be illustrated as an outward shift in the supply schedule for the production of information-sharing dependent products and services (ie from \( S_0 \) to \( S_1 \) in Figure 2). As illustrated, the impact of such a change is a fall in the average price from...
p₀ to p₁ and an increase in production from q₀ to q₁. This implies an unambiguous increase in consumer surplus, in our illustration equivalent to the area of the trapezoid, p₀e₀e₁p₁. The impact on the producer surplus is less clear cut, as there is a loss in producer surplus associated with the price decline as well as an increase associated with the increase in sales volumes. The magnitude of these two offsetting impacts is an empirical issue that depends on the slope of the demand schedule (ie consumers’ responsiveness to price changes) and the extent of the supply response to the technology change.

The supply and demand illustrative device is also not sufficient for illuminating the potential impact on overall economic activity. Supply and demand diagrams relate to just one market, and just focus on the pricing mechanism. Absent from Figure 2 is the impact of changes in this market for the markets for other goods and services. This impact will be influenced by both income effects (eg if a reduction in the producer surplus exceeds the increase in the consumer surplus this might imply a reduction in income available to spend on products in other markets) and competition for the nation’s productive resources. We therefore introduce a two product illustrative model, which provides clearer insights about economy wide impacts.¹

Figure 3 shows the production and consumption possibilities in the economy. The curved line PP represents the maximum amount of two goods (say food and machinery) that can be produced when the economy is operating at full capacity. It represents the resource and production limitations that are placed on the amount of goods and services available for consumption, or the income that can be earned to purchase the desired goods and services. Points on the frontier represent the different combinations of food and machinery that could be produced using all the available resources. Production beyond the frontier is physically impossible with the available resources. The curve’s concavity to the origin reflects the law of diminishing returns - eventually the shortage of one input will constrain production no matter how many other inputs are used (eg there are limits to the amount of wheat that one acre of land can yield, no matter how many workers, harvesters, or amounts of fertilisers used).

The CC lines are indifference curves. Along a line CxCx any combination of goods gives the consumer the same level of utility. The level of utility is higher the further away from the origin the curve. The curves are convex to the origin to illustrate that people put more value on scarce goods and therefore will require greater compensation in terms of the abundant good before foregoing a unit of the scarce good.

¹ A two-good model of course remains a gross over simplification of modern economies, but has the advantage of being able to illustrate in 2-dimensional diagrams on paper. The concepts illustrated typically can be generalised into to more complex situations.
The tangent of $PP$ and $C_1C_1$, point $a$, reflects the optimal levels of production and consumption as $C_1C_1$ is the highest level of utility, defined as combinations of consumption of the two types of goods, possible given the available resources in the economy. The slope of the line $R_1$ is the real exchange rate reflecting the relative price of the two goods; food and machinery. Reaching point $a$ is predicated on the assumptions of free, open and costless capital and labour movements, perfect information and no other distortions or externalities, due to government or otherwise.

In reality it is unlikely that the optimal point $a$ will ever be reached because markets will never be perfect in a theoretical sense. Market imperfections – market distortions and externalities – will conspire to prevent the most efficient allocation of resources possible. Therefore, the economy will produce either inside the production possibilities frontier (to the left of $PP$) or on the frontier to the left or right of point $a$. All these points are inferior to point $a$ in an economic welfare sense because they will be associated with lower consumption utilities.

Thus an economy as illustrated in Figure 4 is probably more representative of a real economy. To generalise across a wider combination of goods and services, but retaining the two dimensional illustrative device, we can describe goods by their relative use of key inputs capital ($K$) and labour ($L$). We present market distortions as a relative price line ($r_{sq}$) that differs from the one that would truly reflect social preferences\(^2\), but we assume full utilisation of resources so that production takes place on the production possibility frontier at point $E_{sq}$. However, although resources are fully employed welfare is suboptimal ($Y_{sq}<Y^*$).

\(^2\) The optimal price line would be steeper sloped so that the tangential point with the production frontier coincided with the tangential point of the optimal social welfare curve $Y^*$. 
The critical concept underpinning diagrams like Figure 4 is the difference between extra production and the welfare created by this production. Although more production will generally enhance welfare, often a far greater enhancement is available from shifting what is produced so that it better matches social preferences.

So what happens with the introduction of a productivity enhancing technology such as the Internet? Essentially this advance enhances the output produced by the available capital and labour. This implies an outward movement in the production possibility frontier, illustrated as a shift from $p_0$ to $p_I$ in Figure 5. With no change in relative prices (and assuming full employment of resources) this would imply an increase in output from $E_{sq}$ to $E_{sq}$. The associated enhancement in wellbeing is the outward movement in the welfare curve from $Y_{sq}$ to $Y_{sq}$. 
However, an increase in productivity is only part of the story. The Internet also generates benefits that are not easily measured, or even if they can be, are not easily expressed in monetary terms. These benefits are things like the added convenience, the ability to customize products and services, and the social benefits of new forms of interaction, communities, and expression that the Internet has made possible (Varian, Litan, Elder, & Shutter, 2002). In other words the Internet is a device that improves the matching between the types of goods and services that are produced and the true requirements and desires of society. We illustrate this property of the Internet in Figure 6 with a shift in the slope of the relative price line (from $r_{sq}$ to $r_I$) in the direction that better reflects the desires of society$^3$.

In Figure 6 we presume that the relative price line is closer to optimal than what prevailed previously, but that other distortions persist so that we are not presuming that the Internet solves all of society’s economic allocation problems. However, a point to note from Figure 6 is that the improvement in national welfare resulting from better matching can perhaps be more significant than that provided by the improvement in productive efficiency$^4$. That is, from a welfare perspective, what is

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$^3$ The optimal position would be the slope that is tangential to the production possibility frontier at the same point that the welfare curve furthest from the origin intersects with the production possibility frontier, ie equivalent to $R_1$ in Figure 3.

$^4$ Note this is not necessarily the case with the Internet, the larger welfare gain obtained from better matching in Figure 6 (ie $Y_I - Y_{sq} > Y_{sq} - Y_{sq}$) is simply the result of the somewhat
produced can be as important as how efficient the production methods used are.

From a dynamic perspective, the Internet’s ability to encourage production that better matches production with consumer desires is likely to have the more profound long term welfare benefit. We attempt to illustrate this point in Figure 7, which is essentially the same as Figure 6, but removes the lines associated with a pre-Internet world.

All the diagrams we have used in this section only attempt to illustrate comparisons between discrete points in time (ie comparative static analysis). They are silent on the transition path between different points in time and they say nothing about future prospects. We will return to issues about transition paths and issues about winners and losers in the next section, but will discuss here some of the conceptual implication for growth prospects from the Internet.

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arbitrary way that the curves were drawn. Our point is not that better matching is more important than better productivity, but that it *can be.*
If we presume that the deep desires of a society are relatively constant over time\(^5\), but that innovations will generally result in outward movements in the production possibility frontier over time, then the future economic and welfare prospects resulting from these productivity improvements will be largely determined by the mix of relative prices. This is because relative prices will create incentive about what is produced. In Figure 7 the line \(g_{sq}\) represents the growth path that results from ongoing growth resulting from the pre-Internet relative prices and \(g_I\) represents the growth path with relative prices influenced by the advent of the Internet.

Both of these growth paths presume full employment of resources, but which growth path is likely to be faster? Our view is that the closer matching of production with society preferences generated by the Internet is likely to produce a growth dividend. The reason is that the higher income effect of better matching will generate higher returns on capital \((Y_I/k_I > Y_{sq}/k_{sq})\), which in turn will induce a higher general appetite for investing and deferring consumption. The resulting higher pace of capital accumulation (including intangible investment in research and development) will thus induce a faster sustainable pace of economic growth.

\(^5\) By “deep desires” we do not mean that the demand for specific products will not shift over time, but that desires for what the products deliver us (e.g., shelter, warmth, sustenance, entertainment, social contact etc) evolve very slowly.
Summary of implications of conceptual issues

The Internet is hypothesised to enhance economic performance in two distinct ways:

- Increasing the efficiency of production by reducing the costs of finding and using shared information
- Enhancing the way the economy matches what is produced with the products and services desired by society

The second of these ways potentially has the more profound impacts on social wellbeing and on economic growth prospects. Unfortunately these subjective improvements in wellbeing are difficult to observe and measure. This has at least two implications for attempts at measuring the economic impact of the Internet:

- Estimates of the economic impact based on productivity improvements are likely to understate the full economic impact as they will not fully account for welfare enhancements resulting from changes in relative prices.
- The ultimate impact of the Internet could take a very long time to manifest itself on wellbeing. One plausible outcome of the advent of the Internet is to enhance the return in capital, which would result in capital deepening in affected economies, leading to an acceleration in the pace of economic growth. It might take many years, perhaps decades before the economic impact of the Internet fully manifests itself.
3. **INTERNET SPECIFIC ISSUES**

In this section, we discuss Internet-specific factors about how the presence of the Internet is likely to have impacted on economic behaviour and decision making. That is, what is the way that using the Internet transmits through to economic consequences? For example, in the previous section, we classified two dimensions of technology impacts on economic activity and wellbeing; via productivity improvements and enhancing the match between production and consumption. In practice, the Internet has achieved these gains in various ways such as the Internet's role as a:

- communications mechanism.
- market medium
- host for brand new products (e.g., social media)
- source of information
- mechanism for collaboration
- and so on

**History**

The Internet was conceived during the 1960s by military research with the goal of guaranteeing stable communication in the event that parts of the communication system were destroyed. The United States Ministry of Defence developed a decentralised computer network based on "store-and-forward" software. Messages could be broken down into smaller components, with each individual package receiving the electronic address of the recipient. Such information packages could then be processed by the system and routed to the final destination through any of the channels of the network, and software on the receiving computer would reassemble the packages into one message (Gilroy, 1999).

In itself, this technical development would eventually have profound impacts on the telecommunications industry, but it was the development of the user-friendly World Wide Web (WWW), created at the Swiss physics laboratory CERN in 1989 that provided the springboard for the major expansion in the use of the Internet. The main advantage of WWW was that it enabled users without requiring far-reaching computer knowledge to explore the Internet through connections called hypertext links, i.e., a taxonomy applicable to the entire Internet. Every web page on the Internet has its individual address: the Uniform Resource Location (URL). The Hyper Text Transfer Protocol (HTTP) then accommodates the actions

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6 For example (Madden & Coble-Neal, 2002) contend that Internet technology is having a fundamental impact on telecommunications markets. The telecommunications industry is being transformed from circuit to packet switching technology and has enabled carriers to extract substantial efficiency gains. In the process, the aggressive pursuit of scale economies has destroyed former national monopoly settlement arrangements, forcing incumbents to engage in large interlocking corporate alliances, conduct bandwidth trading and scrap now obsolete physical networks. The resulting plunge in telecommunications costs and the explosion in bandwidth capacity have accelerated the adoption of e-commerce. In turn, e-commerce is generating efficiency gains through market expansion, reduced barriers to entry and transaction costs.
necessary for integrating publishing, computing, and broadcasting on the Internet. Public use of the WWW was applied to the Internet in 1993 as an interactive system for the dissemination and retrieval of information and multimedia sources such as audio and video sequence files within a document through web pages (Gilroy, 1999).

**Benefits of the Internet**

The Internet creates value by vastly lowering the cost of transferring many types of information, on a one-to-one, one-to-many, or many-to-many basis. In cases where the product itself is information, the potential for value creation is enormous. The main consequence of the increased reach is the improvement in matching of buyers and sellers, especially in previously very inefficient markets like that for used consumer durables (Borenstein & Saloner, 2001).

Advantages of Internet information dissemination include:

- Low cost of providing very detailed content
- The delivery of information when the customer/client/investor desires
- The Internet offers flexibility, client interaction, and sophisticated search capabilities.

Looking specifically at business to business transactions, (Lucking-Reiley & Spulber, 2001) identify four areas where the Internet offers potential productivity gains for businesses:

- efficiencies from automation of transactions,
- economic advantages of new market intermediaries,
- consolidation of demand and supply through organized exchanges, and
- changes in the extent of vertical integration of companies.

The cost savings that came from automating transaction processes are likely to have been substantial. Processing a purchase order manually involved paperwork, data entry, phone calls, faxes, and approving requests. On-line transactions reduce these types of costs by a factor of ten or more. (Borenstein & Saloner, 2001) quote an estimated cost to businesses of manual ordering processes of $US50 per transaction. (Lucking-Reiley & Spulber, 2001) quote an estimate of banking transactions in the US in 2000 of $1.27 for a teller, $0.27 for an ATM, and $0.01 for on-line transactions.

(Benghozi & Paris, 2008) note that allowing consumers to compare products directly without having to rely on supposedly knowledgeable experts, the Internet changed the traditional role of the intermediary. The Internet no longer functions as just a distributor or expert consultant but also regulates transactions, promoting and prescribing goods and services. As such the Internet has removed the role of some intermediaries (and so reduced distribution costs), but it has also introduced or expanded the role of other intermediaries, for example the role of search engines, web browsers. (Lucking-Reiley & Spulber, 2001) also note that the Internet
has also encouraged outsourcing to replace some transactions that were previously internal to the firm.

(Borenstein & Saloner, 2001) note that despite the relative inefficiency of delivering goods directly to the home, there are many sources of cost savings, including a reduction of handling (unpacking, stocking and maintaining shelves, and such), theft (which can account for 3% of the sales of a retailer), rent (low-cost distribution centres replace expensive urban or suburban real estate), and selling costs (automated sales replace relatively expensive in-store salespeople).

As discussed in the conceptual issues section, customers also receive a wide range of benefits from the Internet. Specific benefits include:

- Better matching and access to existing goods and services, via on-line catalogues, reviews, and samples; also by modelling past search and purchase behaviour.
- Centralised stockholding means that firms can more readily meet the specific requirements of individual customers.

**General purpose technology**

The Internet is now considered by many to be a General Purpose Technology. There does not appear to be a robust definition of a general purpose technology, but perhaps a useful definition is that they are deep new ideas or techniques that have the potential for important impacts on many sectors of an economy. They potentially have three key characteristics:

- pervasiveness,
- technological dynamism, and
- "innovational complementarities" with other forms of advancement. (Wright, 2000)

Historical examples include writing and printing; bronze and made-to-order materials; the waterwheel, steam, electricity, and the internal combustion engine; railways and motor vehicles.

It has been argued that the impact of Internet and telegraph technology diffusion have been similar in character (Madden & Coble-Neal, 2002). That is, they gained rapid global adoption, generated informal communications channels, redefined business practice and provided challenges to regulatory regimes. Further, both technologies were first adopted by service sectors. The status of telegraph as a general-purpose technology is primarily based on how it directly motivated the invention of the telephone. Telegraph also stimulated electrical transmission technology and provided an early commercial application of electricity, permitting the proliferation of electrical transmission networks. Such observations suggest the Internet has the potential to radically impact on industrial organisation, with significant implications for microeconomic and competition policy. While developments relating to the telegraph are clear in hindsight, it remains difficult to anticipate exactly the form Internet-
motivated invention and innovation might take. However, its similarity to the telegraph suggests substantial innovation is likely to follow.

**Stock market impacts**

Although the introduction of general purpose technologies typically heralds a quantum shift in economic wellbeing, analysis of periods of dramatic technological change find:

- Financial market volatility is not unusual at the start of technical diffusion.
- Private value from such changes often rests in the hands of a small number of firms for long periods before dissipating.
- Modern entrants obtain value (and displace incumbents) more quickly than comparable historical episodes. (Greenstein, Review of Technology and the New Economy by Bai Chong-En; Chi-Wa Yuen, 2004)

Financial market volatility appears to be a marker of general purpose technologies, representing what appears to be a necessary disruptive impact of major technology changes. For example (Hobijn & Jovanovic, 2001) argue that the commercial release of the microprocessor “4004 computer chip” by Intel in 1971 heralded both the invention of the personal computer and a major obsolescence of physical capital as typically non-corporate early adopters displaced incumbent traditional businesses. The net result was that a lot of capital value is destroyed by making machines, workers, and managers obsolete. Product-market entry of new firms and new capital takes time, and their stock-market entry takes even longer. In the meantime, the stock market declines. (Hobijn & Jovanovic, 2001) further argue that aggregate valuation can fall below the present value of dividends because capital may “disappear” right after a major technological shift, as new capital forms in small, private companies. Later, these companies are “IPO’d”, and only then does their value become a part of stock-market capitalization.

On the other side of the decline in market value of traditional businesses technological revolutions also appear to produce “bubbles” in stock prices of innovative firms. (Pastor & Veronesi, 2009) argue that new technologies are characterised by high uncertainty about their future productivity, and that the time-varying nature of this uncertainty can produce the observed stock price patterns. The nature of the risk associated with new technologies changes over time. Initially, this risk is mostly idiosyncratic (i.e., specific to individual firms and innovations) due to the small scale of production and a low probability of a large-scale adoption. The risk remains idiosyncratic for those technologies that are never adopted on a large scale. For the technologies that are ultimately adopted, however, the risk must gradually change from idiosyncratic to systemic risk. As the probability of adoption increases, the new technology becomes more likely to affect the old economy and with it the

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representative agent's wealth. As a result, systemic risk in the economy gradually increases during technological revolutions.

(Pastor & Veronesi, 2009) identify the following characteristics of technology revolutions:

- a bubble in stock prices which is much stronger in the new economy than in the old economy;
- stock prices in both economies reach the bottom at the end of the revolution;
- the new economy's beta rises sharply before the end of the revolution (i.e., movements in new economy stock prices become less idiosyncratic and more likely to co-move with general stock market prices);
- the new economy's stock price volatility will also rise sharply and exceed the old economy's volatility before the end of the revolution;
- the old economy's volatility also rises but less than the new economy's volatility;
- the new economy's beta and both volatilities all peak at the end of the revolution; and
- the old economy's productivity begins to rise at the end of the revolution.

All of these characteristics are observed for the recent internet revolution, with the revolution's impact on the US stock market timed to have taken place between 1997 and 2002 (Pastor & Veronesi, 2009). This is the period between the first quantum of Internet related IPOs and the point where the probability of large scale adoption of the Internet technology reached one (i.e., became an accepted fact).

**First-mover advantages**

One of the drivers of the “dot com” stock market bubble was the identification of first mover advantages in the Internet market. (Borenstein & Saloner, 2001) characterised the bubble as a "land rush" to secure Internet real estate in order to gain first-mover market position and other advantages. Many firms pursued strategies that could be interpreted as the payment of one-time, largely sunk entry costs.

First-mover advantages are particularly important for Internet based businesses and industries due to the presence of network externalities. The ultimate source of this externality is a simple product of the complete interconnection nature of networks; members of a network are connected to all other members. This means that there is a quadratic relationship between the size of a network and its potential benefit to individual members. In a network of N subscribers, the addition of one new subscriber allows for 2N additional types of connections (from the new subscriber to all old subscribers and vice versa). This leads to Metcalfe’s Law: if there are N individuals on a network, then the total value of the network is represented by the number of potential pairings, i.e., N(N-1) (Cave & Mason, 2001). Thus a network with ten members has a potential reach of 90 connections, but a network of 20 has 380 potential connections and a network of 100 has 9,900 potential connections.
The implication is that there are considerably more advantages for new entrants to join large established networks. These direct network externalities are bolstered by indirect benefits; the more members, the more likely that new services will be offered over it. The increasing returns to scale also mean that these complementary services can be supplied at lower costs as the networks grow.

The result of these network externalities is a prevalence of dominant firms in Internet industries. These are often first mover companies, eg Amazon, eBay. However, the acquired dominance of Google demonstrates that innovation can displace an apparently dominant firm (Yahoo) (for a discussion of this displacement see (Varian H. R., 2006)).

The presence of firm dominance in Internet industries raises issues of overall market efficiency and the distribution of gains from the Internet revolution. The issue about the distribution of gains is perhaps of more relevance than market efficiency issues. This is illustrated in Figure 8 (adapted from Figure 2 from (Gilroy, 1999)).

The industry demand curve is $D$ in the left hand panel. If there were just minor firms the market equilibrium would be at $a$. But a dominant firm, with cost and revenue represented by the right hand panel of Figure 8, would profit maximise by producing at the point where marginal revenue equals marginal cost\(^8\) (ie $MR_d = MC_d$), with output of $Q^*$ and a selling price of $p^*$. The minor firms are effectively competitively restricted to also charging $p^*$, and so supplying $Q_m$ product to the market. In this situation the dominant firm makes super-normal profits (shaded area in the right hand panel of Figure 8). But consumers are also better off, they obtain an additional consumer surplus equivalent to the trapezoid $p_apbp^*$ in the left hand panel.

\(^8\) The cost of additional production from this point would exceed expected revenue, thus reducing the overall profitability of the firm's activities.
In the short run, this appears a stable solution, as “the new entrants settle under the lee of the giant, making a tidy living, but ensuring that their hefty rivals do too” (Gilroy, 1999). If profit opportunities exist, new entrants will be attracted, driving prices towards costs. New entrants may also be sources of new marketing ideas and new technologies, again Google provides an example where a new entrant can displace the incumbent dominant firm.

Although the political issue of the distribution of the benefits from the Internet persists, these need to be balanced against the benefits that the Internet delivers in terms of efficiency gains and enhancements to consumer surplus. The advantages to dominant Internet industry firms also need to be balanced against the enhanced efficiency and competitiveness that the Internet has introduced into the traditional communications sector (see footnote 6 on page 16).

**Potential problems emanating from the Internet**

With new opportunities and welfare gains that the Internet has brought there have also a number of real and imagined potential problems.

**Price dispersion**

One of the initial conundrums produced by the Internet has been the evidence, against all expectations, of increases in price dispersion as a result of the Internet. The Internet was expected to produce a more frictionless and well informed market that was expected to result in more people paying a similar price for similar goods and services. However, studies have typically found substantial and persistent dispersion in prices on the Internet [(Smith, Bailey, & Brynjolfsson, 2000), (Coiera, 2000), (Levin, 2011)]

A number of reasons for this observation of price dispersion have been posited:

- Differences in Internet literacy between users
- Differences in the subjective costs individuals put on the time it takes to search for better deals
- The price that individuals place on reliability of service (ie paying a potentially higher price for greater certainty of product quality and delivery)
- The increased capability for Internet providers to price discriminate (ie to match the price offered on products with customers’ true willingness to pay)
- Associated with price discrimination is an ability to offer targeted loss leaders⁹
- The greater potential for customisation of products to individuals provided by Internet-based providers means that delivered products might be more different than simple descriptions might suggest

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⁹ Using loss leaders is an old idea, for example (Gilroy, 1999) notes the example of Rockefeller distributing kerosene lamps free of charge to the Chinese in the 19th century, thereby creating an enormous demand for their complementary input, kerosene produced by Rockefeller’s refineries.
• There may be differences between the quoted price and the overall cost to the customer, for example prices might be more similar after accounting for sales taxes and delivery costs.

Some of these reasons suggested above are perhaps a product of early stage issues with the Internet (eg dispersion in Internet literacy would have been greater initially; also developments in search engine design will be reducing search costs). Others suggest that the true scale of price dispersion might be overstated due to mismeasurement.

**Fiscal issues**

Internet sales can potentially undermine the tax base in many countries. For example, (Goolsbee, 2001) noted that, partly as the result of historical circumstance, most people in the United States are not paying sales taxes on their purchases over the Internet. As a result, many state and local officials became quite agitated that the rise of the Internet was severely eroding the state and local tax base.

There is potentially an issue in New Zealand related to the national boundary on New Zealand’s tax system. In particular, the “destination” design of our GST means that, in principle, all imports should be subject to GST. In practice many items purchased internationally using the Internet escape GST as it is not practical for Customs to police small personal transactions.

Changing the underlying design of the New Zealand’s GST system from its current “destination” basis to an “origin” basis would be a simple and effective means of addressing the risk of the Internet undermining the tax base. This adjustment would also address a number of other inherent problems with New Zealand’s tax system (eg the inequity of the tax treatment on the export of services). However, inertia in the policy environment means that this is not something that is likely to be ever addressed by the New Zealand government. Instead there is more likely to be a series of ad hoc “fixes” that will simply act to reduce economic efficiency and intrude on individual freedoms.

**Internet crime**

Online crime has taken off as a serious industry since about 2004 (Moore, Clayton, & Anderson, 2009). Until then much of the nuisance came from amateur hackers who defaced websites and wrote malicious software in pursuit of bragging rights.

In the old days, electronic fraud was largely a cottage industry, local and inefficient: a typical card fraudster ran a vertically-integrated mall business. For example, he might buy a card-encoding machine, get a job in a shop where he could copy customers' cards, and then go out at night to steal cash from automatic teller machines (ATMs). Similarly, electronic fraud might have involved a call-centre employee collecting password data for use by an accomplice.

According to (Moore, Clayton, & Anderson, 2009) online crime has many similarities with the economics of conventional crime. But there are some
interesting differences, many of them driven by the global scale of online crime. A useful historical analogy relates to when criminals started using cars. Suddenly a burglar could break into several houses in a town where the police didn't know him and be home in time for breakfast. It took the police a generation to catch up, using national police networks and fingerprint databases. Online crime, like vehicle-assisted crime, will force big changes, both because it is transnational and also because it consists of a high volume of low-value offenses. Existing mechanisms for international police cooperation are designed for rare serious crimes, such as murder and terrorism, while online crime is petty crime committed on a global and industrial scale. Another difference is that conventional crime is generally committed by marginal members of society, especially by young men suffering multiple deprivation or abusing drugs or alcohol. In contrast, people with comparative advantage at online crime tend to be educated and capable, but they live in societies with poor job prospects and ineffective policing.

**Internet and economic development**

The foregoing discussion about Internet crime suggests that the development of poor economies is perhaps the ultimate means of addressing the source of Internet crime. A cynic might also contend that Internet crime is potentially providing a mechanism for economic development opportunities in those “societies with poor job prospects and ineffective policing”.

How else might the Internet contribute to economic development? (Singh, 2004) notes that given the high transaction cost nature of developing economies, anything that reduces these transaction costs (whether through policy or technology) anywhere in the economy can play a role in stimulating development. In addition to reducing transaction costs, (Singh, 2004) notes that IT can promote economic development through improvements in the efficiency of education delivery, by speeding up the diffusion of innovations through better communications.

Early papers by development economists have typically been pessimistic about the role that the Internet can play in the advancement of less developed economies. For example (Kenny, 2002) notes that past experience with new technology suggests potentially negative implications for the impact of the Internet on developing countries. (Kenny, 2002) noted that low Internet usage rates prevailed even where access is available in developing countries. The barrier according to Kenny is less about the physical costs of the prerequisite equipment, but a lack of human capital. General education, specific technical and language skills and the broader institutional environment are all factors that might explain low usage rates (Kenny, 2002).

The foregoing discussion is perhaps rapidly being made redundant by the experience of India and other Asian economies. In addition the technology shift towards phone access to the Internet is removing some of the fixed asset barriers to Internet access in less developed countries. (Dean, Sebastian DiGrande, & Zwillenberg, 2012) note that the Internet is rapidly changing; moving from fixed access to ubiquitous access, and from
being dominated by the developed nations to one dominated by emerging
nations.

The economic consequences for poorer nations could be substantial. For
example (Whiteford, 2011) notes that the potential economic benefit from
an Internet/mobile approach to remitting funds could enrich Pacific island
economies by more than 1% of GDP.

Location issues

The Internet has also potentially had profound impacts on the location of
economic activity and the distribution of the population. An initial
perspective was that the introduction of the Internet was going to weaken
the forces for economic and population concentration. However, Internet
usage is typically concentrated in urban areas and the prevailing
perspective of economic geographers is that agglomeration forces and
population density is likely to intensify in upcoming decades. This partly
reflects the higher cost of delivering Internet infrastructure in less densely
populated areas. For example, (Stenberg, et al., 2009) found that rural
communities in the US have less broadband Internet use than metro
communities, with differing degrees of broadband availability across rural
communities.

However, (Forman, Goldfarb, & Greenstein, 2004) noted that basic
internet technology is widely dispersed among both urban and rural
locations. Moreover, although advanced internet technology was adopted
most rapidly in large urban areas, the research finds that much (but not
all) of the apparent “digital divide” in internet use can be explained by the
heavy concentration of internet-intensive industries in large urban areas.
Essentially the mix of industries with the highest enhancement adoption
rates tends to be in the biggest cities. These industries include
management of companies and enterprises, media, telecommunications
and data processing, utilities, finance and insurance, professional,
scientific and technical services, and wholesale trade.

(Kolko, 2001) demonstrates that the concentration of industry clusters is
an interaction between the technology aspect of the Internet which, all
other things being equal, reduces the need for industry concentration.
However, high internet use industries tend to have a strong demand for
skilled workers. Higher skilled industries tend to benefit from
concentrated location because firms can benefit from knowledge spillovers
(learning from nearby collaborators and competitors) and access to a
larger pool of suitably skilled workers. The analysis of (Kolko, 2001)
indicates that, at least for now, the skill requirements dominate,
encouraging geographical concentration of high Internet-use businesses.

(McCann, 2009) applies economic geography analysis to draw out
implications for the New Zealand economy. With the Internet favouring
the performance of high skilled industries, economic development has
been favouring the concentration of economic activity and penalising
the performance of isolated and dispersedly populated economies like New
Zealand’s.
The implication is that although the Internet has added to the efficiency of economic production and welfare in New Zealand, it may not have done so to the same degree that it has helped other more concentrated population centres. Thus it has perhaps harmed the relative economic performance of New Zealand.

Although New Zealand economic activity may not benefit from the Internet as much as more densely populated nations, the Internet is still likely to be a positive influence. To begin with New Zealand consumers will still benefit from the resulting improvements in choice and availability. In this sense the welfare gains (as distinct from production gains) are potentially greatest for thinly populated countries like New Zealand. Also in terms of agriculture, the Internet may actually be quite favourable given the high skill nature of New Zealand agriculture production. US studies show that rural regions that have greater access to the Internet have had better economic performance (see for example (Stenberg, et al., 2009). Thus although the Internet may in general foster the expansion of urban centres, rural communities will also benefit, and by promoting the exchange of ideas, the Internet may enable New Zealand’s high skilled agriculture industry to further enhance their global competitive advantage.

**Internet and property rights**

The introduction of the Internet has undermined the market power of industries that have profited from the legal protections to intellectual property particularly copyrighted quasi-public goods\(^{10}\) like music, books and film. The combination of digital translation of these products, plus the cheap transportation of digital products on the Internet has increased the ability of individuals to free ride, ie consume the good without paying for it. From a purely legal perspective, the free acquisition of copyrighted material constitutes theft. However, from an economic perspective the issue is less black and white, at least from an ex ante perspective. From a national economic perspective one is interested in the institutional arrangement that will generate the most efficient sustainable outcome. In terms of intellectual property the sustainability issue relates to providing the incentives for the ongoing production of new music, films and books.

Historically copyrights have been the institution that has provided this incentive. With the advent of the Internet has come a medium that has the potential to completely undermine copyright protection. However, the Internet also provides intellectual property owners with very large network externalities; information sharing and sampling across the internet extends the potential reach of many of these products far beyond what was available from traditional marketing mediums. The issue from an economic perspective is empirical, is the loss of revenue from a fall in unit price associated with information sharing, greater or less than the revenue gain from an increase in the size of the market, ie is the area of rectangle A in Figure 9 bigger or smaller than the area of rectangle B. If the area of B is larger than A, it implies that the market is highly price sensitive, and the net outcome is a win-win situation where there is both an expansion in

\(^{10}\) Quasi-public in the sense that once the good is provided to some consumers, it is very difficult to preclude other consumers from consuming it.
the consumer surplus and a gain in industry revenue. In terms of music, the results of (Gopal, Bhattacharjee, & Sanders, 2006) was that contrary to conventional wisdom, lowering the cost of sampling music would propel more consumers to purchase music on-line as the total cost of evaluation and acquisition decreases, i.e., they found B > A.

![Diagram of supply and demand](image)

**Figure 9**

**Summary of Internet specific issues**

The Internet has exhibited characteristics to suggest that it is a general purpose technology. Ultimately general purpose technologies lead to an incremental jump in economic wellbeing and are likely to herald further related innovations. Like previous general purpose technologies, it appears that the Internet has been responsible for major stock market disruptions.

Part of the reason for the Internet-induced global stock market volatility experienced between 1997 and 2002 was the presence of network externalities which encouraged a “land rush” to secure Internet real estate in order to gain first-mover market position and other advantages.

Due to the presence of these network externalities, many Internet-based industries are dominated by individual businesses. In general, the benefits to consumers from network externalities outweigh the costs of having dominant firms. However, there can remain political economy issues associated with the concentration of gains resulting from the Internet.

We identify a number of areas where the advent of the Internet has generated issues that will be perceived as problems by different groups:
- Persistent price dispersion of products sold on the Internet
- A potential erosion of the GST tax base
- An increase in the volume and sophistication of Internet crime
- A lack of evidence that the advent of the Internet has been as beneficial for less developed economies.
- Evidence that the Internet is more beneficial for more concentrated population centres, which in turn implies that the economic benefit for New Zealand from the Internet may be less marked than in other places around the world.
- The advent of the Internet undermines the legal protection of intellectual property.

None of these factors are sufficient to offset the net positive influence of the Internet. Indeed in some cases the observed impact simply reflects the interaction of the Internet with broader social and economic issues (eg tax design and criminal behaviour). Others perhaps reflect transitory effects (eg price dispersion and the impact of the Internet in less developed economies). The last two points are perhaps more about the allocation of the gains resulting from the Internet, than the overall net impact. For example, even if the Internet does encourage a further concentration of population and economic activity into major urban centres, this does not preclude important benefits for rural based activities. Also it is not clear from the evidence available whether this erosion of intellectual property rights has negative economic consequences.
4. **ESTIMATES OF ECONOMIC IMPACT**

In this section we review international studies that have attempted to measure the economic impact of the Internet

**Measurement issues**

As (Fraumeni, 2001) notes, the Internet exacerbates pre-existing old economy measurement problems. A number of Internet-intensive sectors are in difficult-to-measure sectors such as banking, insurance, brokerage services, education, and medical care. In addition the new nature of Internet business activities mean that existing statistical systems struggle to capture both the scale and location of economic activities influenced by the Internet. Further problems with measuring the economic impact of the Internet include:

- Many Internet products are intermediate in nature, meaning that it is often difficult to identify who the ultimate beneficiary of the product might be (eg information collected on the Internet might help a law firm win a civil case, which benefits both the firm and their client, as well as clients of the client).
- There can be a long gestation period between a development on the Internet and its economic consequences.
- The development of the Internet has coincided with a host of other IT developments with complex inter-relationships with Internet developments.
- The introduction of new technologies produce losers as well as winners (eg mainstreet retailers losing market share to virtual retailers)

In addition to these practical measurement issues that are likely to hamper the practical measurement of economic impacts there are also difficulties in comparing results between different studies as measurements can differ due to differences in the:

- Concept being analysed (eg e-commerce, Internet, broadband roll-out)
- Time period analysed
- Economic concept being influenced (eg productivity, employment, GDP growth, consumer surplus)
- Breadth of the analysis (individuals, firms, regions, countries).

Also like all studies analysing economic and social data there is a great difficulty in isolating the impact of the issue of interest (eg the Internet) from other concurrent events. Even if this isolation is achieved it can be difficult to establish a causal relationship. For example a correlation between Internet use and economic activity might represent the Internet stimulating economic activity, economic activity stimulating Internet activity, a simple coincidence, or a combination of all three.
The combination of different research aims and different methods employed means that one needs to be cautious about the extent one can make any generalisation from the findings of the studies reported here.

**Studies providing estimates of economic impact**

**Citation:** (Altig & Rupert, 1999)

**Aim:** estimate the impact of Internet connectivity on economic growth

**Coverage:** Cross country analysis

**Period:** 1974-1999

**Key findings:** estimate a growth model that implies that 100% Internet usage would have been associated with a 4 percentage point increase in economic growth in the 25 year period from 1974-1999.

**Caveats:** Authors conceded that their approach was simplistic, had a high risk of omitted variable bias, and felt that their estimate was implausibly high.

**Citation:** (Litan & Rivlin, 2001)

**Aim:** estimate the cost savings for firms from the Internet

**Coverage:** US

**Period:** 1995-2000

**Key findings:** estimate a total cost saving will be about 1-2%, which over five years translates into an annual contribution to productivity growth of 0.2-0.4%.

**Caveats:** Focus is purely on business cost savings; analysis can only be considered to be of savings resulting from initial Internet adoption; no analysis of causal direction or allowance for impact of contemporaneous technologies.

**Citation:** (Freund & Weinhold, 2002)

**Aim:** estimate the impact of Internet penetration and growth in the international trade of services

**Coverage:** US

**Period:** 1995-1999

**Key findings:** After controlling for GDP and exchange-rate movements, find that a 10-percent increase in Internet penetration in a foreign country is associated with about a 1.7-percentage-point increase in service exports and a 1.1-percentage-point increase in service imports.
Caveats: Narrow focus; no analysis of causality.

Citation: (Varian, Litan, Elder, & Shutter, 2002)

Aim: estimate the productivity impact of Internet business solutions

Coverage: US, UK, France, Germany

Period: 1996-2000

Key findings: estimate that Internet business solutions increased US annual productivity growth by 0.17 percentage points. The equivalent improvement in the combined economies of UK, France and Germany was 0.017 percentage points.

Caveats: The analysis focused purely on direct productivity impacts, ignoring spillover impacts and potential consumer surplus welfare gains. No obvious analysis of causality.

Citation: (Gillett, Lehr, Osorio, & Sirbu, 2006)

Aim: estimate the impact on different economic indicators of broadband access in different zip code areas of the US

Coverage: US

Period: 1998-2002

Key findings: Broadband access estimated to increase employment by 1.0-1.4% (1998-2002); the number of business establishments by 0.5-1.2% (1998-2002); housing rents by 6%; shifted industry mix towards IT intensive industries. They found no evidence of an impact on wages.

Caveats: Not clear that the study adequately accounted for causality issues, hence it might be that better performing areas (in terms of jobs, new businesses, higher rent) are more likely to have broadband access.

Citation: (Grimes, Ren, & Stevens, 2009)

Aim: estimate the impact of Internet connectivity on firm productivity

Coverage: Panel data of 6,051 individual firms in New Zealand

Period: 2001-2006

Key findings: find a (levels) productivity effect of broadband relative to no broadband of approximately 10% across all firms. All of these productivity gains are attributed to the adoption of slow relative to no broadband, as no discernible additional effect arising from a shift from slow to fast broadband was found.
**Caveats:** The analysis focused on direct firm specific productivity, ignoring potential indirect spillover impacts. Authors note that the lack of impact of fast broadband should be interpreted with care due to a risk that the split between fast and slow broadband could have been poorly distinguished and that there may not have been adequate time for firms to extract a benefit from high speed broadband.

**Citation:** (Choi & Yi, 2009)

**Aim:** estimate the impact of Internet connectivity on economic growth

**Coverage:** Cross country analysis (207 countries)

**Period:** 1991-2000

**Key findings:** estimate a growth model that implies that 100% Internet usage would have been associated with a 5-6 percentage point increase in economic growth in the 10 year period from 1991-2000.

**Caveats:** It is unclear why the data analysis ended in 2000. The model is likely to suffer from omitted variable bias, and lacks any causality analysis.

**Citation:** (Czernich, Falck, Kretschmer, & Woessmann, 2009)

**Aim:** the economic growth consequences of broadband infrastructure

**Coverage:** a panel of 20 OECD countries

**Period:** 1996-2007

**Key findings:** find that a 10 percentage-point increase in broadband penetration raises per-capita GDP by 0.9-1.5 percentage points. Results are deemed to be robust to country and year fixed effects, controlling for linear second-stage effects of instruments. They verify that the instruments predict broadband penetration independent of the diffusion of contemporaneous technologies like mobile telephony and computers.

**Caveats:** the authors identify two key limitations 1) their measure of broadband is a rough one insofar as it considers any bandwidth over 256 kbit/s to be broadband; 2) their results represent medium term rather than long run impacts

**Citation:** (Manyika & Roxburgh, 2011)

**Key findings:** The method underpinning this McKinsey Global Institute report is not clear. However they contend that the Internet constituted 2.9% of global GDP in 2009 and 3.4% of GDP in large and developed economies. Further they contend that the Internet accounted for 21% of the GDP growth in mature economies in the 5 years to 2010. Interestingly they also provide estimates of the consumer surplus accruing
to users of the Internet; ranging from an annual surplus of $216 per user in Germany to $336 per user in the United Kingdom.

**Caveats:** A lack of explanation of the methods used make it difficult to assess the veracity of the McKinsey assertions.

**Citation:** (Greenstein & McDevitt, Measuring the Broadband Bonus in Thirty OECD Countries, 2012)

**Key findings:** Attempts to measure the economic value created by broadband Internet using measures of new gross domestic product and consumer surplus in 30 OECD countries. The median bonus (revenue growth and consumer surplus) delivered by broadband in the 30 OECD countries was equivalent to 0.5% of GDP in 2010, a rate consistent with the finding of (Manyika & Roxburgh, 2011). However, adjusting for broadband quality raised the median estimated bonus to 1% of GDP per capita in 2010. The result specific to New Zealand was equivalent to the international median of 0.5% of GDP in 2010. However, the quality adjusted calculations indicated a broadband bonus in New Zealand equivalent to 3% of GDP, the fifth highest result of the 30 countries.

**Caveats:** The calculation of consumer surplus is based purely on willingness to pay for broadband services and does not account for any indirect benefits such as improvements in industrial productivity or from a better match between production and consumer desires. The research focus was also on the transition to broadband rather than the Internet as a whole.

**Comment**

The studies of the economic impact of the Internet reported here, to varying degrees, suffer from:

- Errors in measuring the extent of Internet activities
- Having a narrow study focus
- Employing simplistic estimation methods
- Insufficient time to analyse the full impacts.

Our assessment is that (Czernich, Falck, Kretschmer, & Woessmann, 2009) utilised the most robust analytical methods. Applying their result to the (Manyika & Roxburgh, 2011) estimates of an average Internet penetration in France, Germany, the US and the UK of 60% would suggest that the Internet has already boosted economic activity in developed economies by between 5 and 9%.

This potentially provides a rough estimate of the expansion in economic activity resulting from productivity improvements (ie representing the welfare gain resulting from the shift from $Y_{sq}$ to $Y'_{sq}$ in Figure 6). However, as our conceptual model has suggested, and a number of analysts have also argued (eg (Litan & Rivlin, 2001)) much of the benefit from the Internet is likely to show up in improved consumer convenience and expanded choices, rather than in higher productivity and lower prices.
The two studies incorporating estimates of the consumer surplus (Greenstein & McDevitt, Measuring the Broadband Bonus in Thirty OECD Countries, 2012) and (Manyika & Roxburgh, 2011) both suggested that the scale of consumer surplus is likely to be around 0.5% of GDP in developed economies. Adjusting these estimates for the quality of broadband can considerably expand these estimates, for example increasing the estimate for New Zealand from 0.5% to 3% of GDP.

However, these estimates of consumer surplus only attempt to account for the extent that cheaper broadband eases people’s budget constraints. It takes no account of how people’s lives have been improved by access to services available on the Internet.

The results of the investigation by (Penard & Suire, 2011) into the relationship between Internet use and subjective perceptions of well-being is indicative of a positive relationship between the Internet, particularly access, and people’s sense of well-being. This is consistent with the view posited in the The studies of the economic impact of the Internet reported here, to varying degrees, suffer from:

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of well-being. This is consistent with the view posited in the *Conceptual issues* section that access to the Internet improves economic welfare by improving the match between what is produced and what people desire. But it does not confirm this supposition and it does not provide an estimate of the magnitude of its impact or its longer term impact.

Our theoretical discussion highlighted the potential relationship from better market place matching and the long term pace of growth; better matching is likely to increase the average return on capital, which will tend to increase people’s willingness to invest in their future. This suggests that there are three, potentially testable, hypotheses about the transmission of the development of the Internet onto economic prosperity. These are, after controlling for inherent differences between different sectors and in different time periods:

- Was the return on capital in Internet related investments higher than the return in other sectors?
- Has there since been a more broadly based increase in the return of capital?
- If so, has this increase in the return on capital resulted in a sustained relative shift between consumption and capital accumulation?

One could then calculate the growth impact of the capital accumulation attributable to the Internet to estimate the long run economic impact of the Internet.

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References


