

**The Costs of the
ITC Downstream Exclusion Order
to the U.S. Economy**

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SUMMARY OF ANALYSIS

This paper¹ analyzes the economic effects of the Order issued by the U.S. International Trade Commission (ITC) banning the importation of all new wireless broadband handset models that contain Qualcomm chipsets found to infringe Broadcom’s “sleep mode” patent.² We conclude that there are compelling economic policy justifications for disapproving the ITC Order.

In conducting our analysis, we employ conventional economic techniques to estimate the effect of the ITC Order on (1) “consumer surplus” (*i.e.*, lost economic welfare to consumers), and (2) “producer surplus,” including the lost profits of wireless carriers, handset manufacturers, network infrastructure suppliers, and providers of content, applications, and peripherals. In addition, we analyze the “spillover effects” of the Order on productivity across the broader U.S. economy as well as its impact on U.S. international competitiveness. We also estimate the lost revenue for the U.S. Treasury in connection with the upcoming 700 MHz spectrum auction and discuss more generally how the Order threatens to diminish federal spectrum revenue in the future.

Our calculations utilize published data sources from the U.S. Government, independent financial institutions, and industry analysts.³ In order to ensure the integrity of our results, we have not used any individual companies’ proprietary data or market forecasts.

We express no opinion on the merits of the ITC’s infringement finding and offer no conclusions about whether non-infringing solutions—*i.e.*, new EV-DO and HSDPA handset models—will become available to U.S. consumers in substantial volumes prior to the expiry of the Broadcom patent on June 8, 2010. The technical and legal uncertainties surrounding this question are substantial, and we are not in a position to answer this critical question. Our economic model therefore identifies three distinct scenarios whereby “non-infringing handset solutions” would become widely available to consumers after either 1, 2, or 3 years, respectively. Based on the foregoing, we estimate:

	“Non-Infringing Handset Solution” After 1 Year	“Non-Infringing Handset Solution” After 2 Years	“Non-Infringing Handset Solution” After 3 Years (<i>i.e.</i> , Upon Expiry of Patent)
Lost Consumer Surplus	\$3.2 – 6.5 billion	\$5.9 – 11.8 billion	\$8.8 – 17.7 billion
Lost Producer Surplus	\$1.1 – 1.8 billion	\$1.6 – 2.7 billion	\$2.0 – 3.4 billion
Total Lost Surplus	\$4.3 – 8.3 billion	\$7.5 – 14.5 billion	\$10.8 – 21.1 billion

¹ Prepared at the request of Qualcomm Incorporated.

² *In the Matter of: Certain Baseband Processor Chips And Chipsets, Transmitter And Receiver (Radio) Chips, Power Control Chips, And Products Containing Same, Including Cellular Telephone Handsets*, Investigation No. 337-TA-543 (Int’l Trade Comm’n), June 7, 2007.

³ Sources include Gartner, The Yankee Group, Ovum, Strategy Analytics, CIBC, HSBC, the Federal Communications Commission, the Bureau of Labor Statistics, the Bureau of Economic Analysis, and the Securities and Exchange Commission.

As this chart indicates, the direct economic harm to consumers and producers attributable to the Order ranges from **\$4.3 to \$21.1 billion**.

- **Harm to Consumers:** Consumers will be denied access to valuable new products and services, and the prices paid for existing products and services will be higher than otherwise would be the case. We estimate that the total damage to consumer welfare from the loss of access to new products and services ranges from **\$3.2 to \$ 17.7 billion**.
 - Consumer surplus is the single most important measure of consumer welfare used by economists and policy makers. It is commonly used to measure the benefits of new product introductions, services, and technologies.
- **Harm to Producers:** A broad array of firms across the wireless broadband industry—including carriers, handset manufacturers, network infrastructure suppliers, and providers of content, accessories, and peripherals—will suffer lost profits as a direct result of the Order. We estimate that these producers will experience lost profits ranging from **\$1.1 to \$3.4 billion**. This is distinct from lost revenue to producers.
 - The ITC Order represents a particular setback for the wireless carriers, who have undertaken extraordinary investments—roughly \$30 billion in 2006 alone—to be prepared to offer new broadband services.

In addition, our report analyzes the following points:

- **Spillover Effects and Harm to U.S. Productivity:** Productivity gains from the telecommunications sector are expected to contribute approximately \$17 billion to the U.S. economy in 2007, and the wireless communications industry accounts for more than a quarter of the total sector sales. Although harm to U.S. productivity is difficult to quantify with precision, it is clear that the effects of the ITC Order will spill over into the broader U.S. economy, resulting in at least **several billion dollars** in additional GNP losses.
- **Harm to Domestic Competition:** Another effect of the Order is to create distortions in the competitive environment by picking “winners and losers” among handset makers and carriers in the multibillion dollar wireless broadband industry.
- **Harm to the President’s Broadband Initiative and U.S. International Competitiveness:** The Order will retard progress toward the President’s stated goal of expanding access to wireless broadband services for U.S. consumers. The ITC Order will also stifle evolution within the wireless industry by preventing the purchase of new 3G handsets as well as updated versions of existing handsets. Moreover, the Order will place the United States at a comparative disadvantage in broadband technology by limiting consumer choices, slowing the decline in prices for older wireless technology, and curtailing the ability of American businesses to improve their productivity.

- **Lost Spectrum Revenue for the Federal Treasury:** We estimate that the ITC Order will result in **up to \$1.4 billion** in lost revenue for the U.S. Treasury in connection with the upcoming 700 MHz spectrum auction. We also conclude that the application of the Order will diminish future auction revenues due to the increased risk that future infringement involving one of the thousands of other patents contained in wireless broadband handsets will lead to future downstream exclusion orders.

In evaluating the policy implications of the Order, it should be clear that extraordinary and widespread economic harms will be borne by both consumers and producers across the U.S. economy. Significantly, we note that a downstream remedy in the ITC is discretionary and all of these collateral economic harms can be avoided by a decision to disapprove the downstream remedy and by means of a monetary damages award in federal court. In economic terms, that would be the most “efficient” patent remedy under the particular circumstances of this case. For all these reasons, we conclude that there are compelling economic policy justifications for disapproving the ITC Order.

I. INTRODUCTION

This paper analyzes the economic effects of the Order issued by the U.S. International Trade Commission (ITC) banning the importation of all new wireless broadband handset models that contain Qualcomm chipsets found to infringe Broadcom's "sleep mode" patent.⁴ We find that the direct economic harm to consumers and producers attributable to the Order is between \$4.3 and \$21.1 billion, depending on a number of factors. In addition, the Order will have significant negative effects on domestic productivity as well as U.S. international competitiveness. Finally, the exclusion⁵ would frustrate the President's stated goal of universal broadband access, undermine the federal spectrum auction designed to further those goals, and inadvertently select winners and losers in the multibillion dollar wireless broadband industry. In considering the policy consequences of the Order, it should be clear that extraordinary and widespread economic harms would be born by both consumers and producers across the U.S. economy, and that these harms can be avoided if the Administration disapproves the ITC Order.

The magnitude of our estimated harm is a function of the market conditions that prevail in the U.S. mobile wireless sector: the size of the market, the rapid pace of technological change, and the spillovers of this industry to the rest of the economy, have the combined effect of generating large negative results.

As a threshold matter, the sheer scale and critical role of this sector make large and widespread effects from the ITC Order highly likely. As of the end of 2006, there were 233 million active cellular lines in the United States, or an average of more than 2 mobile phones for each American household.⁶ The average minutes of use on mobile lines has been growing at a rate of 21.6% per year, climbing to over 800 minutes per month per line; that exceeds the average usage of landlines, which has been *falling* at an annual rate of 5.3%.⁷ The number of broadband mobile lines recently surpassed 30 million and has been growing at a staggering rate of 375% per year.⁸ By 2010, 106 million additional U.S. subscribers are expected to adopt either EV-DO or WCDMA/HSDPA technology.⁹ Because mobile wireless is pervasive, the technology is now deeply integrated into the daily lives of Americans and has become an indispensable tool of the nation's business.

⁴ *In the Matter of: Certain Baseband Processor Chips And Chipsets, Transmitter And Receiver (Radio) Chips, Power Control Chips, And Products Containing Same, Including Cellular Telephone Handsets*, Investigation No. 337-TA-543 (Int'l Trade Comm'n), June 7, 2007.

⁵ References to "exclusion" in this paper refer to the downstream exclusion of handsets.

⁶ CTIA – The Wireless Association, Feb. 2007.

⁷ *In the Matter of: Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, WT Docket No.06-17 (Federal Communications Commission), *FCC Eleventh Annual Report*, Sep. 26, 2006.

⁸ Yankee Group 2007 Mobile Forecast.

⁹ Ovum, December 2006. EV-DO was originally expected to grow at an annual rate of 32.6% and WCDMA/HSDPA was expected to grow at an annual rate of 97.5%. See *Deutsche Bank: At the Starting Line – The Race to Mobile Broadband* at 10-11 (Feb. 2, 2007).

The economic harm caused by the ITC Order is further amplified by the fast pace of technical change in the mobile wireless sector. A constant stream of new technologies, standards, products, services, and applications fuels the fierce competition in these markets. Mobile carriers, handset makers, and other firms use technology to gain a competitive edge over their rivals. The virtuous cycle that exists between technological advancement and market competition is confirmed by steady declines in consumer prices¹⁰ and the rapid rollout of new products and services with ever greater capabilities and features.¹¹ A “freeze” imposed by the ITC Order on the leading edge of mobile wireless technology applies the brakes to this dynamic process that will likely cause lasting harm beyond the time when the Order is no longer in effect.

Finally, the production and consumption of mobile wireless products and services create enormous value for the American economy. Households and businesses derive convenience and utility from cellular communications, as confirmed by the extraordinary popularity of the service. Firms throughout the wireless mobile supply chain create wealth for their shareholders and for their employees. Productivity is enhanced as cost declines, accessibility increases, and applications and content expand. The ITC Order will reduce U.S. productivity growth beyond the wireless industry and, in turn, undermine U.S. competitiveness.

In conducting our analysis, we accept the industry consensus that Qualcomm currently supplies all chipsets for EV-DO handsets sold in the U.S. market. AT&T—the only HSDPA carrier currently operating in the United States—similarly confirms that Qualcomm supplies chipsets for nearly all HSDPA handsets currently sold in the United States.¹² Because all handsets are imported, the ITC Order’s immediate effect is to impose a virtual ban on the sale of all new models of wireless broadband handsets in the U.S. market, including all cell phone, smart phone, and PDA models with new or improved functions or features.

Further, given the technical and legal uncertainties surrounding the future availability of commercial quantities of non-infringing handset models, we conduct our analysis using 1, 2, and 3 year scenarios. We adopt this approach recognizing that industry experts cannot reliably predict when “non-infringing handset solutions”—*i.e.*, new EV-DO and HSDPA handset models—will become available to U.S. consumers, and note that the Broadcom patent expires on June 8, 2010.

Our calculations utilize published data sources from the U.S. Government, independent financial institutions, and industry analysts, including *Gartner*, *The Yankee Group*, *Ovum*, *Strategy Analytics*, *CIBC*, *HSBC*, the *Federal Communications Commission*, the *Bureau of*

¹⁰ See Cellular Telephone Service component of the Consumer Price Index, U.S. Department of Labor, Bureau of Economic Analysis, Washington, DC.

¹¹ In recent years, consumers have accelerated their replacement of wireless handsets and devices, and carriers have sped up the deployment of successive generations of wireless technology and the introduction of new handset models. The average data download speed experienced on U.S. mobile networks increased at an estimated annual rate of 37.5% between 1995 and 2005. *Future Mobile Broadband: HSPA, EV-DO, WiMAX & LTE*, Informa UK, Ltd: London, June 2006.

¹² *Public Statement of AT&T Mobility In Response to the Proposal for an ITC Order Order Limited to WCDMA Handsets*, USITC Inv. No. 337-TA-543, at 13 (May 18, 2007) (“non-Qualcomm 3G products are largely unavailable, not fully tested and qualified, not proven to meet market volume demand, and contain inferior features”).

Labor Statistics, the Bureau of Economic Analysis, and the Securities and Exchange Commission. In order to ensure the integrity of our results, we have not used any individual companies' proprietary data or market forecasts.

The remainder of this report is divided into five sections. In **Section II**, we measure the economic damage to consumers—*i.e.*, lost “consumer surplus”—resulting from the ITC Order. In **Section III**, we measure the negative effect of the ITC Order on “producer surplus”—*i.e.*, the lost profits of wireless carriers, handset manufacturers, network infrastructure suppliers, and providers of content, applications, and peripherals. We also explain why the Order would inadvertently distort the mobile broadband market, disadvantage companies with respect to their rivals, and handicap technologies without regard to their economic merit. In **Section IV**, we analyze the negative “spillover effects” of the Order on U.S. productivity and international competitiveness. In **Section V**, we analyze how the ITC Order will result in lost revenue for the U.S. Treasury in connection with the upcoming 700 MHz spectrum auction and diminish future auction revenues. Finally, in **Section VI**, we explain why, to the extent Broadcom suffers economic harm, the most economically efficient solution, on top of the remedy already directed at Qualcomm, would be a monetary damages award in federal court that affords a remedy to Broadcom and causes no collateral economic damage to U.S. consumers, third-party producers in the wireless industry, U.S. economic productivity, or the U.S. Treasury.

II. HARM TO U.S. CONSUMERS

The Order will harm consumers by denying them access to new products and services and by raising the prices they would otherwise pay for existing products and services.¹³ To measure this harm, we estimate the loss of consumer surplus associated with new product and service offerings in three market segments: handsets, voice and data services, and third party content and peripherals. Consumer surplus is measured as the difference between what a consumer is willing to pay for a good or service (the consumer's derived value or reservation price) and the actual price paid. It is the consumer equivalent of producer profit. Consumer surplus is the single most important measure of consumer welfare used by economists and policy makers. Its use is ubiquitous in the antitrust, merger, and trade policy contexts, and it is commonly used to measure the benefits of new product introductions, services, and technologies. In fact, federal statutes and regulations often require that policies be evaluated in terms of net economic welfare, of which consumer surplus is a key component.

Our basic approach is to forecast key trends in the mobile wireless market under two scenarios—no Order (the baseline scenario) and ITC Order.

A. BASELINE SCENARIO (NO ITC EXCLUSION ORDER)

Our baseline scenario (no ITC Exclusion Order) reflects independent analysts' expectations of the evolution of wireless telecommunications in the United States, which cover the period from the second quarter of 2007 and extends past mid-2010. Specifically, we use

¹³ More broadly, the ITC Order could impede deployment of public and quasi-public services that would benefit the health and well-being of U.S. citizens. These include the use of mobile wireless for the delivery of telemedicine (*e.g.*, remote monitoring of diabetes), public safety applications such as rapid emergency response enabled by the transmission of medical records and images, and provision of distance learning and training to remote students and the disabled.

forecasts of total and 3G subscriber lines, total and 3G handset sales, and average revenue per user (ARPU) of the carrier network. In broad terms, analysts expect modest growth in wireless subscribers as wireless service approaches saturation in the United States. However, they forecast rapid growth in 3G subscribers and handset sales both in absolute terms and as a percentage of total wireless subscribers, with a corresponding (and accelerating) loss of 2G subscribers and handset sales. By 2011, 2G is expected to account for only a small fraction of total wireless subscribers. Carrier ARPU is forecasted to remain level for the next few years with the continued decline in revenue from voice services to be offset by an increase in data services accompanying the greater utilization of these services by 3G subscribers.¹⁴

B. INCREMENTAL EFFECT OF THE ITC EXCLUSION ORDER

We expect that the Order will alter the evolution of the wireless industry by preventing the purchase of new 3G handsets as well as updated versions of grandfathered handsets. At the margin, this restriction will cause some 2G subscribers who otherwise would have purchased a 3G handset and service, to remain 2G subscribers. For these consumers, their expenditure on data services will be reduced on average because 3G service users spend more than non-3G users on such services. Finally, although there is no reason to believe the Order will slow the overall growth in the number of wireless subscribers, it will alter the mix of 3G and 2G subscribers by slowing the rate of increase in the former.

C. LOST CONSUMER SURPLUS

Equipped with the difference in subscriptions, handset sales, and service purchases, we estimate the monetary harm to consumers, measured in lost consumer surplus, caused by the Order. The lost consumer surplus is measured as the amount consumers would be willing to pay for the goods and services denied by the Order in relation to what they would pay for those goods and services absent the Order. We can measure the lost consumer surplus with two pieces of information: the lost revenues associated with goods and services and a concept known to economists as the “elasticity of demand,” *i.e.*, how sensitive consumers are to changes in price. The results of our analysis, presented in Table 1, show a total loss of consumer surplus in the billions of dollars.

Table 1: Estimate of Lost Consumer Surplus from the ITC Order

	“Non-Infringing Handset Solution” After 1 Year	“Non-Infringing Handset Solution” After 2 Years	“Non-Infringing Handset Solution” After 3 Years (<i>i.e.</i> , Upon Expiry of Patent)
Lost Surplus (Service)	\$0.4 – 0.9 billion	\$1.2 – 2.4 billion	\$2.3 – 4.6 billion
Lost Surplus (Handsets)	\$2.7 – 5.4 billion	\$4.5 – 9.0 billion	\$6.2 – 12.3 billion
Lost Surplus (Content and Apps)	\$0.1 – 0.1 billion	\$0.2 – 0.4 billion	\$0.4 – 0.8 billion
Total Lost Consumer Surplus	\$3.2 – 6.5 billion	\$5.9 – 11.8 billion	\$8.8 – 17.7 billion

¹⁴ The increase coming from two sources: the increasing 3G subscriber base and increased utilization within the 3G customer base, see discussion in HSBC “Data Accelerator Mobile Data Ripples Across the Pond” May 7, 2007, p. 12.

III. LOSS OF PRODUCER SURPLUS

The harm to producers—carriers, handset and device manufacturers, suppliers of network infrastructure, and suppliers of accessories and peripherals—flows directly from their inability to provide new products and services under the ITC Order. This harm is measured as profits lost to producers—what economists refer to as lost “producer surplus.” Producers in the wireless industry stand to lose significant sums in the form of forgone profits from sales of new 3G handsets and services, and from forgone cost savings made possible by cheaper network equipment and more efficient network maintenance and operation. Over the longer run, the return to their massive investments on 3G infrastructure and spectrum would be at risk until alternative handset supplies become available or the Broadcom patent expires. Precluded from importing the infringing products, mobile carriers, handset makers, and other firms will re-direct their efforts and resources. The harm caused by the Order includes forgone profits from the diversion to these less lucrative pursuits. The profits lost as a consequence can be estimated by applying a reasonable profit margin to the difference in gross revenues forecasted with and without the Order.

As with our measure of lost consumer surplus, our basic approach is to forecast key trends in the mobile wireless market under two scenarios—no Order (the baseline scenario) and ITC Order.

We quantify the impact on these firms by measuring the difference in their profit streams by first estimating the change in gross revenues that can be expected, and then applying an appropriate profit margin to those revenues. The margins are selected to closely approximate the profitability rates on incremental sales. These rates are currently much greater than a firm’s typical gross profit margin because so much of the expense associated with incremental supply had already been sunk at the time the ITC Order was issued on June 7, 2007. Further into the future, much of the firm’s costs are recoverable, so the incremental margin grows and approaches the firm’s operating margin.

A. HARM TO WIRELESS CARRIERS

A large portion of the effect of the Order will be realized by mobile service providers, in part because they act as intermediaries between retail customers and suppliers of other products, such as handsets and mobile content. The carriers derive the bulk of their retail revenue from: (1) monthly voice and data subscriptions, (2) vertical services sold on a piecemeal basis (*e.g.*, roaming, text and picture messaging) or by subscription (*e.g.*, mobile games, handset insurance), and (3) handset sales.¹⁵

We assume that, had existing 2G subscribers been permitted to buy the excluded handsets, some proportion of them would have upgraded to 3G service. These subscribers would have increased their expenditures on all three categories. The loss of these profits is particularly damaging given the extraordinary investments undertaken by the mobile carriers to provide these new services. As a threshold matter, the four major carriers—Verizon, AT&T/Cingular, Sprint Nextel, and T-Mobile—have invested nearly \$30 billion on infrastructure in 2006 to provide 3G

¹⁵ Carriers also derive wholesale revenues in the form of inter-carrier compensation (*e.g.*, call termination).

services.¹⁶ These investments include retrofits of cell towers and transmission equipment but also outlays on rights for radio spectrum needed for the new services. Mobile carriers recently spent \$13.9 billion on spectrum rights at U.S. government auctions under the assumption that they could recoup their investment by providing the very 3G services that this Order curtails.¹⁷ At a minimum, the ITC Order would lower each carrier's return on assets and return on investment.

Furthermore, the Order will distort competition among mobile wireless product and service suppliers, rendering some winners and others losers. For example, T-Mobile would be disproportionately harmed by the Order since its initial 3G rollout is planned for the end of 2007,¹⁸ and it has no grandfathered 3G handset devices, thereby greatly diminishing the value of its \$2.7 billion in infrastructure investments and \$4.2 billion in spectrum investments made in the recent auction for AWS licenses.¹⁹ Similarly, the Order catches Sprint-Nextel in the midst of the planned migration of former Nextel subscribers from the iDEN network to their new EV-DO network. Other carriers have a limited number of grandfathered handsets and were planning to launch dozens of new models before the holiday season.²⁰ Verizon, for example, had planned to introduce several new models, some with new features and others at lower price points, both to encourage adoption of 3G and to increase subscribership to finance its massive investments.²¹ The impact of such distributional effects are substantial because the turnover rate for handsets is high and has been accelerating in recent years²² as consumers demand devices with new features and better operability, and such turnover is a significant driver behind shifts in market share.²³

B. HARM TO HANDSET MANUFACTURERS

Handset makers are impacted in terms of lost sales of handsets as a result of the Order. While we assume that the aggregate number of mobile subscribers will be the same regardless of the Order,²⁴ the mix of the handsets will be affected since certain planned handset models are excluded, and so too will the rate of replacement of 3G handsets of all kinds. Under our

¹⁶ AT&T 2006 Annual Report, Deutsche Telekom 2006 Annual Report, Verizon 2006 Annual Report, Sprint-Nextel 10-K Report, for the fiscal year ending Dec 31, 2006.

¹⁷ http://wireless.fcc.gov/auctions/66/charts/66press_3.pdf

¹⁸ T-Mobile Press Release, Nov. 30, 2006. T-Mobile USA Secures Rights from FCC for Auctioned Spectrum.

¹⁹ David Janazzo, et al., "T-Mobile USA Read Across: Towers and Roamers," Merrill Lynch, Nov. 9, 2006.

²⁰ <http://www.phonearena.com>

²¹ <http://www.phonearena.com>

²² *Global Wireless Handset Market: Emerging Markets Drive Unit Growth*, PiperJaffray Investment Research, February 2007.

²³ *Global Wireless Handset Market: Emerging Markets Drive Unit Growth*, PiperJaffray Investment Research, February 2007.

²⁴ This assumption makes the follow-on calculations conservative. It is very possible that overall wireless mobile subscription growth will fall off when the Order reduces the capabilities of available handsets and services, and the related impairment of competition raises the average cost of mobile services.

assumptions as to how the number of handsets sold in each category is affected by the Order, we can create the two associated revenue streams, and measure the difference between them.

We then calculate our estimate of lost profits to device makers by applying a margin to the difference in handset expenditures. As with the carriers' profit margins, the margins for the handset makers are chosen to reflect the profitability of the incremental sale or marginal (lost) sale. Our estimate of lost profits to device makers can be derived by multiplying forgone sales (either lost 3G handset sale or the differential between a 2G and 3G handset) by a profit margin for such devices. Note that our lost profits figure is offset by any increase in profits from the sale of non-infringing devices.

C. HARM TO NETWORK INFRASTRUCTURE PROVIDERS

We assess the impact of the Order on suppliers of the network equipment deployed by carriers to provide 3G services on the 3G handsets. As carriers freeze their programs to deploy 3G services, they will naturally cut back on capital expenditures needed to roll out those services. The reduction in equipment purchases by the carriers will be felt by network vendors. As before, their lost profits can be estimated by applying the appropriate margin to those lost sales. Following our assumptions about consumer behavior under the Order, consumers will shift their purchases intended for 3G toward 2G handsets and services. We do not foresee, however, a significant offsetting impact on carriers' purchases of the older type of network equipment as a result, given that the spectrum, towers, backhaul and switching facilities enabling 2G products and services are already in place, and are likely to have sufficient capacity to accommodate the growth.

D. HARM TO PROVIDERS OF CONTENT, APPLICATIONS AND PERIPHERALS

Finally, providers of 3G content, applications, and peripherals will also be harmed by lower sales and profits when they are unable to launch products they have developed for new or improved features of the excluded devices. The profile of the companies in these industries is much different than those of the carriers and device manufactures. Unlike those giant corporations, many application providers are small and medium size businesses without significant capital resources. These providers have made considerable investments in product development for 3G applications and are heavily dependent on the availability of new devices that will be excluded under the ITC Order. Typically, subscribers purchase new applications soon after purchasing a new device with advanced features and the income from legacy applications diminishes rapidly.²⁵ Literally hundreds of applications developers are dependent on the introduction of 3G devices.

To summarize, our estimates of lost producer surplus resulting from the ITC Order are provided in the table below:

²⁵ <http://brew.qualcomm.com/brew/en/developer/directory.html>

Table 2: Estimate of Lost Producer Surplus from the ITC Order

	“Non-Infringing Handset Solution” After 1 Year	“Non-Infringing Handset Solution” After 2 Years	“Non-Infringing Handset Solution” After 3 Years (i.e., Upon Expiry of Patent)
Lost Surplus (Service)	\$0.1 – 0.2 billion	\$0.2 – 0.4 billion	\$0.3 – 0.5 billion
Lost Surplus (Handsets)	\$0.6 – 1.2 billion	\$0.8 – 1.7 billion	\$1.0 – 2.0 billion
Lost Surplus (Content and Apps)	\$0.0 – 0.1 billion	\$0.1 – 0.1 billion	\$0.1 – 0.2 billion
Lost Surplus (Network Equipment)	\$0.4 – 0.4 billion	\$0.5 – 0.5 billion	\$0.6 – 0.6 billion
Total Lost Producer Surplus	\$1.1 – 1.8 billion	\$1.6 – 2.7 billion	\$2.0 – 3.4 billion

E. DISTORTION TO THE COMPETITIVE PROCESS IN MOBILE WIRELESS MARKETS

Federal and state telecommunications regulators and lawmakers have refrained from direct regulation of the cellular industry since the mid-1990s—with the exception of allocating radio spectrum.²⁶ This deliberate hands-off policy was grounded in a belief that the cellular industry is naturally competitive and that consumers would benefit from lower prices, increased coverage, and technological choices. Nearly 25 years after its inception, their faith has been affirmed by the creation of an industry that generates over \$118 billion in annual revenues and has a combined market capitalization of nearly one trillion dollars.²⁷ The ITC’s Order departs from the competitive tradition by intervening at a fundamental technical level that will inevitably distort the competitive process that has worked so well for over two decades. In essence, the Order can be equated to a new industrial policy where the government—inadvertently and without prior consideration—picks winners and losers among the carriers, handset manufacturers, and content, applications and peripheral providers.

The distortions to competition caused by the Order will crop up at all stages of the mobile wireless supply chain. In each case, the principal source of the differential effects stems from the need for durable investments well in advance of production that are very costly to reverse. Even users make capital outlays on handsets that are specific to a wireless technology or to their company’s internal network, and face high costs to switching in response to relative price changes. The additional churn that will occur as the industry adjusts to the new conditions will impose further costs on carriers as they must spend more to retain their current customers and to acquire new ones.

All of these investments were prudently undertaken at the time, with due consideration given to the technical and economic merits of the alternatives, and with expectation of competitive returns. The investment conditions will be fundamentally changed by the Order.

²⁶ See Peter Huber, John Thorne, and Michael Kellogg, *Federal Telecommunications Law*, Aspen Publishers, 2nd edition, 1999.

²⁷ Ovum (2005), op. cit. and Yahoo! Finance. The industry market value of \$982 billion is an underestimate since the two largest mobile carriers, Verizon Wireless and AT&T, are excluded because they are classified elsewhere.

Mobile carriers will not be treated equally under the Order because the prospects for the two principal wireless standards will now change, and the carriers were compelled long ago to adopt a single standard when they designed and built their networks. Handset makers and network equipment vendors are in a similar situation, though they have more options to diversify across standards. In any event, newer, smaller entrants into the handset and network equipment industries will be less able to cope with the Order if it disfavors the wireless technology they decided to pursue.

It is not our contention that the ITC sought to tilt the playing field in this industry when it issued its Order, but the Administration should be aware that firms and technologies will necessarily receive unequal treatment as a result of the ITC Order. In a sense, the Order amounts to accidental industrial policy being practiced in one of the country's most critical high-tech industries.

IV. HARM TO U.S. PRODUCTIVITY AND INTERNATIONAL COMPETITIVENESS

In addition to the direct negative impacts on mobile wireless consumers and producers, the Order is likely to harm domestic productivity and U.S. international competitiveness. It would do this by slowing national broadband penetration.

A broad consensus has emerged among economists and policy makers—and affirmed by the Administration—that broadband uptake confers significant benefits throughout the economy. The President views rapid progress toward widespread broadband access and services to be a national priority.²⁸ Progress toward this goal will be hampered by the Order through two channels. First, the Order will likely retard the expansion of these services throughout the economy. Second, the Order undercuts the benefits of competition among broadband providers.

The growth of wireless broadband, and the mobile wireless segment in particular, has made a large contribution to the growth of broadband penetration overall in the United States. During 2006, the FCC reported that mobile wireless broadband lines grew from 379,536 to 11,015,968, a 29-fold increase.²⁹ In that same year, mobile wireless went from less than 1 percent of the country's broadband lines up to 17 percent.³⁰ That growth is put at risk by the Order.

Not only will the Order limit individuals' options for mobile broadband service, but it will also slow the pace of broadband adoption by impairing competition among broadband

²⁸ On March 26, 2004, President Bush stated: "This country needs a national goal for...the spread of broadband technology. We ought to have ... universal, affordable access for broadband technology by the year 2007, and then we ought to make sure as soon as possible thereafter, consumers have got plenty of choices when it comes to [their] broadband carrier." See http://www.whitehouse.gov/infocus/technology/economic_policy200404/chap4.html

²⁹ Federal Communications Commission, "High-speed services for internet access: status as of June 30, 2006," January 2007, p.1 and Table 1.

³⁰ Using a more demanding definition of broadband—transmission speeds exceeding 200 kbps in both directions—the FCC also reported that "advanced service lines" attributable to mobile wireless grew from 21,079 to 1,913,904 in 2006, a 90-fold increase. FCC (2007), op. cit., Table 2. The vast majority of the added wireless broadband lines occurred among business users, attesting to its use as a productivity tool.

providers. A pillar of U.S. broadband policy has been the FCC's promotion of "platform competition." By favoring facilities-based competition over service-based competition, the FCC has promoted the ongoing race between DSL and cable modem service. Wireless broadband is the third, and latest, contestant to enter the U.S. broadband race.

A vibrant 3G mobile industry will exert competitive pressure on other broadband access providers, including not only the two fixed-line platforms, but also the new fixed wireless WiFi and WiMAX services. Empirical research confirms that viable competitive threats from alternative platforms accelerate the deployment of broadband infrastructure and services.³¹ The competition that has been sustained in the U.S. broadband market has resulted in falling prices, faster speeds, and more compelling services. These trends will likely weaken as a result of diminished competition from 3G wireless services. Indeed, the incentives for build out of advanced networks that carry mobile video services, while they will not evaporate, will diminish relative to a world in which broadband customers have widespread access to mobile broadband alternatives

By freezing diffusion of the most advanced technologies of mobile broadband, the ITC's Order will impair the ability of the mobile carriers to apply competitive pressure on fixed wireless and fixed line broadband providers. As competition in broadband provision cools off, we would expect the recent declines in broadband prices and improvements in transmission speeds to slow down, with a corresponding slow down in the spread of broadband access.³² This may be particularly felt in rural and remote regions of the country where wireless broadband has been relatively more prevalent than fixed-line technology, as compared to their urban residential counterparts.³³

A. HARM TO U.S. ECONOMIC GROWTH THROUGH REDUCED PRODUCTIVITY GROWTH

Mobile wireless technologies comprise one of the fastest growing segments of a sector that is well known for making significant contributions to the overall economy. The reason telecommunications plays such a large role stems principally from its pervasive use in the production and distribution of goods and services. Voice communications and data networking lower the costs of creating, transmitting and processing information, and eliminate considerable time and cost spent on transporting people and goods. They also have spawned new services such as location-specific marketing, mobile music and television, and cellular payments systems that will add to our Gross National Product in years to come.

Cellular mobile systems—including handheld devices, radio spectrum and network infrastructure—constitute a production *platform* that serve as a host for new services and applications. A distinctive property of a production platform is its ability to enable services that

³¹ For evidence on the success of platform competition in European broadband markets, see Walter Distaso, Paolo Lupi, and Fabio Manenti, "Platform Competition and Broadband Uptake: Theory and Empirical Evidence from the European Union," *Information Economics & Policy*, 18:1, March 2006, 87-106.

³² It can be shown that handicapping one of the broadband contestants will slow down the deployment pace of the other. See Glenn Woroch, "Open Access Rules and Equilibrium Broadband Deployment," in *Frontiers of Broadband, Electronic and Mobile Commerce*, edited by Gary Madden and Russel Cooper, Physica-Verlag, 2004.

³³ See *A Nation Online: Entering the Broadband Age*, U.S. Department of Commerce, Sept. 2004, Table 3.

could not have been envisioned when it was first built. The rail system offers an old economy example. The rails are largely indifferent to what they carry—passengers, freight of all kinds, and more recently, shipping containers. The ability of the mobile communications infrastructure in general, and the 3G deployments in particular, to carry all kinds of transmissions—voice, images, video, data, instant messaging—lies at the heart of its ability to promote innovation. The ITC Order threatens to stall this creative process for the next two to three years—an eon in Internet time.

Several studies have established a positive relationship between a country's investment in telecommunications infrastructure and its growth of GNP. One frequently cited, cross-national study attributed nearly 17% of the cumulative annual growth of U.S. GNP over the 1971-1990 period to telecommunications infrastructure investment.³⁴ Mobile wireless infrastructure investments are also inputs to all types of production, but especially the fast-growing service sector, and 3G has been singled out for its potential to make fundamental changes in how these businesses are run. An example would be real-time video conferencing of dispersed sales teams, service technicians, or medical personnel.

Mobile wireless contributes to the macro-economy through its effect on business productivity, and it is difficult to overemphasize the importance of productivity growth for the U.S. economy. When labor productivity grows, the U.S. economy can generate more goods and services for the same amount of labor time.³⁵ Total Factor Productivity (TFP) is a broader measure of productivity that takes into account other factors of production besides labor, including capital plant and equipment, energy and information technology. Over the period 1959-1998, labor productivity grew at an average annual rate of 2.042%. In the 5-year period 1995-1999, however, it jumped up to 2.58%.³⁶ Similarly, TFP grew during 1959-1998 at an average annual rate of 0.625% rate and subsequently rose to 0.99% during 1995-1999.³⁷ As testament to its importance to the economy, it has been estimated that the communications sector alone is responsible for about 4% of the growth in TFP during the latter half of the 1990s.³⁸

The mechanism by which telecommunications investment raises productivity is plain. Like so many high-tech products, communications equipment tends to follow Moore's Law, registering steady improvements in performance achieved through scale economies and learning by doing.³⁹ Responding to the steep fall in the performance-adjusted prices of these products,

³⁴ Lars-Hendrik Roller and Leonard Waverman, "Telecommunications infrastructure and economic development: a simultaneous approach," *American Economic Review*, 91:4, September 2001, 909-923.

³⁵ Labor productivity, the most common productivity measure, is the dollar value of goods and services produced in a given year per U.S. worker.

³⁶ See Dale Jorgenson and Kevin Stiroh "Raising the speed limit: U.S. economic growth in the information age," *Brookings Papers on Economic Activity*, 2000, 125-211.

³⁷ *Ibid.*, Table 2.

³⁸ *Ibid.*, Table 4.

³⁹ Between December 2001 and December 2006, the government's index of the mobile communications equipment fell at an annual average rate of 7.3%. Between December 1997 and December 2006, the government's index of the mobile communications service fell at an annual average rate of 4.7%. See BLS, series IDs CUUR0000SEED03 and PCU33422033422012 for producer price index series.

American businesses have spent vast sums on communications technology. As firms substitute away from more costly and less efficient factors of production, American business and American workers become more productive.

A simple calculation suggests how the ITC Order would impact GNP. Several studies have quantified the portion of U.S. GNP growth attributable to investment in communications products and services.⁴⁰ We take an average of those estimates equal to 0.13 percentage points.⁴¹ Making the conservative assumption that the recent contribution of the communications sector (defined to include radio and television broadcasting) to GNP growth will continue for the near future, the sector will add \$17.2 billion to GNP over the course of 2007, or \$54.70 per capita in 2006 dollars. At present, wireless communications accounts for 27% of the communications sector, and has been growing.⁴² It is not known how much the ITC's Order will reduce business investment in mobile wireless, but it is clear that, if the Order has the effect of freezing its contribution for even a single year, then several billion dollars in GNP will be lost.

The size of this macroeconomic effect is plausible when one looks at mobile wireless as a "general purpose technology," akin to electric power and the internal combustion engine.⁴³ General purpose technologies are known to contribute significantly to economic growth.⁴⁴ Consider the immense wealth created by such network industries as the rail network, the highway system, the electricity grid, and more recently, the Internet. Besides delivering greater bandwidth along with mobility, 3G technologies will enable a quantum leap in data and signal processing, allowing enterprises to expand and enhance the offerings to their customers, at the same time they lower their costs of doing business.

B. IMPAIRMENT OF U.S. INTERNATIONAL COMPETITIVENESS

The evidence is overwhelming that domestic deployment and diffusion of communications technology promote economic growth and international competitiveness, and that poor telecommunication infrastructure and services are impediments to economic development. While studies analyzing the cross-country effects of 3G deployment are not yet available, the more general findings of the economic literature provide a guide to the benefits that are likely to accrue from this technology.

⁴⁰ Jorgenson and Stiroh (2000), *op. cit.*, as well as Stephen Oliner and Daniel Sichel, "Information Technology and Productivity: Where Are We Now and Where Are We Going?" *Journal of Policy Modeling*, July 2003; 25(5): 477-503.

⁴¹ Jorgenson and Stiroh (2000) find it to be an increase of 0.109 points over the 1995-1999 period, while Oliner and Sichel (2003) estimate the increase to be 0.15 percentage points for the 1996-1999 period. Note that both studies estimate the effect of investment in communications equipment and services on the GNP, and not the direct contribution of communications final goods and services to the GNP.

⁴² Roger Entner and David Lewin, *The Impact of the US Wireless Telecom Industry on the US Economy*, Ovum: Boston, September 2005.

⁴³ See Paul David and Gavin Wright, "General purpose technologies and surges in productivity: historical reflections on the future of the ICT revolution," Economics Working Paper, Stanford University, 2004.

⁴⁴ See Timothy Bresnahan and Manuel Trajtenberg, "General Purpose Technologies: 'Engines of growth'?" *Journal of Econometrics*, 65, January 1995, 83-108.

As discussed above, broadband penetration is a critical measure by which to appraise the state of a country's telecommunications progress. U.S. broadband penetration has grown significantly since the FCC began tracking high-speed lines in December 1999. By the end of 2006, the FCC reported that the number of broadband lines of all kinds in the United States had reached 64.4 million, a 12-month increase of 20.2 million or 51.2% for the year.⁴⁵ As impressive as this growth may be, the United States still lags far behind our European and Asian counterparts. While the US has been making progress towards achieving the President's goal of ubiquitous broadband availability, the ITC order undermines the progress that has been made in this area.

The weight given to telecommunications investment and usage on U.S. productivity is confirmed by international cross-country studies. When isolating the drivers of total factor productivity growth across countries, information and communications technology emerges as a significant factor.⁴⁶ A key element in the adoption of these technologies is a competitive environment that drives down product prices. In an international context, the U.S. has benefited from this advantage in many information and communications technologies. Clearly, the Order would place the United States at a comparative disadvantage in 3G technology by limiting choices and would slow the decline in prices for older 2G and 2.5G wireless.

U.S. businesses have been shown to be particularly effective at adopting new technology to increase productivity relative to their international rivals.⁴⁷ This strength may be accounted for by the lack of government and institutional barriers to adopting new technologies and to implementing systems that contribute to their effective use. Whatever the reason, the Order would likely have a comparatively larger effect on U.S. firms and the U.S. economy than most of our OECD counterparts.

Finally, the fact that many information and communication technologies require learning by doing, and that the pace of change in 3G wireless is so rapid, exacerbates the effect of the Order. Wireless technology will continue to advance while the American economy is denied the benefits of 3G. In the meantime, our foreign counterparts will have the opportunity not only to catch up, but to pull ahead. Thus, while we are unable to quantify the economic effects of the Order on U.S. international competitiveness, the dynamics of this industry point to the conclusion that a downstream exclusion order will have significant negative effects for the United States.

⁴⁵ Federal Communications Commission, "High-speed services for internet access: status as of June 30, 2006," January 2007, p.1 and Table 1.

⁴⁶ Andrea Bassanini, Stefano Scarpetta and Ignazio Visco "Knowledge, technology and economic growth: recent evidence from OECD countries." OECD Economics Department Working Papers, No. 259.

⁴⁷ Austan Goolsbee, "How the U.S. has kept the productivity playing field tilted to its advantage." The New York Times, June 21, 2007. Others have also noted slower pace at which new technology enhances productivity in the European Union. See Edmund S. Phelps, "Understanding the Great Changes in the World: Gaining Ground and Losing Ground since World War II." *Capitalism and Society*, 1:2, 2006.

V. LOST SPECTRUM REVENUE TO THE U.S. TREASURY

By excluding handsets and services destined to use the 700 MHz spectrum band, the ITC's Order will directly impact the outcome of the upcoming FCC auctions of those frequencies. In the 1990s, the FCC and Congress decided to re-allocate the 700 MHz band from television broadcasting to non-broadcast uses. A portion of the 700 MHz band will be licensed to private entities to supply advanced wireless communications,⁴⁸ including services that would be delivered using the downstream products excluded by the Order. Those frequencies will become fully available after the transition to digital television broadcasting is complete—currently scheduled for February 2009. With the auction required to start no later than January 28, 2008, the new licensees will be able to start service as soon as the analog broadcasts cease.⁴⁹ The 700 MHz band is one of the last highly desirable portions of spectrum to be re-allocated for the foreseeable future, and the Congressional Budget Office (CBO) estimates the revenues to the U.S. Treasury from that auction to be as much as \$14 billion.⁵⁰

Firms that bid on these frequencies will necessarily take account of how the ITC Order will alter their plans to deploy advanced wireless services. Inevitably, a good portion of the planned services will likely be delayed with the ITC Order, causing the carriers to put off the launch date of services in this band. As a logical consequence, the carriers will reduce their bids to reflect the delay in the stream of expected profits derived from this spectrum.⁵¹

By January 2008, the statutory deadline for the start of the auction, the ITC Order will have the effect of adding substantial uncertainty to the industry's analysis of when handsets that could operate in the 700 MHz band will be made available. Any risk that handsets will remain substantially unavailable until 2010 will factor into their analysis. For example, using the CBO estimate of auction receipts and a hurdle rate of 10 percent, a delay in availability of handsets until 2010 results in a potential reduction in proceeds from the auction of about \$1.4 billion.

Indirect effects of the exclusion order on future auction receipts could be much higher than the direct effects. The wireless networks that will utilize the chips at issue here require massive sunk investments. Increased uncertainty about future cash flows can have a significant impact on the valuation of sunk investments.⁵² Broadcom's success in leveraging a power

⁴⁸ Of the 84 MHz of the 700 MHz band allocated to private uses, 60 MHz is scheduled to be put up for auction in early 2008.

⁴⁹ T-Mobile was the largest purchaser of licenses in the recent AWS spectrum license auction. It plans to begin offering its 3G service in the fall of 2007, approximately one year after the AWS auction ended.

⁵⁰ Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008 to 2017*, pp. 64-65. Private sector estimates of the value of this band vary widely and are evolving as the Federal Communications Commission codifies the rules for the auction and use of this band. The CBO estimate is widely viewed as conservative.

⁵¹ A potentially more significant direct effect of the exclusion Order on the 700 MHz auction would be if the order caused bidders to forgo participation in the auction. The absence of any large bidder would mean significantly less money was showing up at the auction. In a well working auction, the prices paid by the auction winners are set by the valuation of the penultimate bidder. Removing one or more high value bidder from an auction allows the bidder(s) with the next lower valuations to win licenses and the prices paid will be set by bidders with even lower valuations.

⁵² Avinash Dixit and Robert Pindyck, *Investment Under Uncertainty*, Princeton University Press (Princeton, New Jersey, 1994).

management patent to derail advances in the mobile handset market will increase the uncertainty of the value of all mobile wireless investments, which in turn will reduce the willingness to pay for those investments. We cannot say exactly how much of a shadow Broadcom's success will cast on the stability of investments in the technology sector generally and the mobile wireless sector in particular, but the effect could have a significant impact on the multi-billion dollar investments needed to deploy modern communications networks. Whatever reduction in willingness to pay actually materializes, it will be expressed in terms of lower auction receipts for the U.S. Treasury.

VI. A REMEDY DIRECTED AGAINST QUALCOMM, AND AN AWARD OF MONETARY DAMAGES, PROVIDE THE MOST ECONOMICALLY EFFICIENT SOLUTION IN THIS CASE

Principles of dynamic efficiency counsel that patent infringement should be remedied by imposing squarely on the infringer the cost of fairly compensating patent holders. Imposing costs on third party producers and consumers is inherently inefficient because this reduces the incentives for firms to avoid infringing behavior. Such costs are a deadweight loss for the economy, and destroy economic efficiency. The analysis and calculations set out in this report have led us to conclude that this particular ITC Order would cause substantial and disproportionate economic harm to third parties.

To more fully understand why the unique circumstances of this case and this industry render the ITC's downstream exclusion remedy economically inefficient, consider that:

- Broadband handset alternatives are not generally available to consumers during the patent period;
- Broadband chipsets are technologically inextricable from the downstream handsets; and
- Third parties have already sunk substantial investments into valuable new technologies that will be stranded.

We understand that Broadcom has already obtained an exclusion order and a cease and desist order against Qualcomm at the ITC, and that it also has the ability to obtain a monetary damages award in an ongoing federal court litigation involving the identical patent claim. The collateral economic damage identified in our analysis can therefore be avoided, and a remedy can be afforded to Broadcom, through such alternative remedies. In this way, an economically efficient result can be achieved.

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In conclusion, conditions that prevail in mobile wireless industry make it highly probable that this particular ITC Order will create a gross imbalance with economic harms to third parties that far outweigh any social benefits derived from application of a downstream remedy. We therefore conclude that there are compelling economic policy justifications for disapproving the ITC Order.