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THE ECONOMIC IMPACT OF BROADBAND IN THE PHILIPPINES

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The economic impact of broadband in the Philippines

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It is part of a new series of ITU reports on broadband that are available online and free of charge at the Broadband Commission website: http://www.broadbandcommission.org/ and at the ITU Universe of Broadband portal: www.itu.int/broadband.

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Preface

The past twenty years have been an extraordinary time for the development of information and communication technologies (ICTs) – with the 'mobile miracle' we have brought the benefits of ICTs within reach of virtually all the world's people. Through its technical standardization and spectrum management work, ITU has been at the forefront of technological change and is today committed to continue to drive positive change in the ICT sector and beyond. It is now time to make the next step, and to ensure that everyone – wherever they live, and whatever their circumstances – has access to the benefits of broadband. This is not just about delivering connectivity for connectivity's sake, or even about giving people access to the undoubted benefits of social communications. It is about leveraging the power of broadband technologies, and especially mobile technologies, to make the world a better place.

In 2010, ITU, in conjunction with UNESCO, launched the Broadband Commission for Digital Development to boost the importance of broadband on the international policy agenda and believes that expanding broadband access in every country is key to accelerating progress towards these goals by the target date of 2015. The Commission is co-chaired by President Paul Kagame of Rwanda and Carlos Slim Helú, President of the Carlos Slim Foundation. Some 60 Broadband Commissioners representing governments, industry, academia and international agencies contribute the benefit of their insights and experience to the Commission's work. At the *Broadband Leadership Summit* held in October 2011 in Geneva, the Broadband Commission recognized broadband as a critical modern infrastructure contributing to economic growth and set four clear, new targets for making broadband policy universal and for boosting affordability and broadband uptake. Innovative new models that promote competition, innovation and market growth are now needed to make the broadband opportunity reachable for all world citizens.

At ITU, the United Nations specialized agency for ICTs and telecommunications, we are committed to playing a leading role in the development of the digital economy through extending the benefits of advances in broadband and embracing the opportunities it unleashes. The three ITU sectors – Radiocommunication, Standardization and Development – are working together to meet these challenges and our collective success will be a key factor in ensuring the provision of equitable broadband access throughout the world. The ITU Broadband Reports represent one tangible contribution towards this commitment.

Dr Hamadoun I. Touré

Secretary-General, ITU

Foreword

Broadband has become a key priority of the 21st Century, and I believe its transformative power as an enabler for economic and social growth makes it an essential tool for empowering people, creating an environment that nurtures the technological and service innovation, and triggering positive change in business processes as well as in society as a whole. Increased adoption and use of broadband in the next decade and beyond will be driven by the extent to which broadband-supported services and applications are not only made available to, but are also relevant and affordable for consumers. And while the benefits of broadband-enabled future are manifest, the broadband revolution has raised up new issues and challenges.

In light of these developments, ITU has launched a new series of ITU Broadband Reports. The first reports in the series, launched in 2012, focus on cutting-edge policy, regulatory and economic aspects of broadband. Other related areas and themes will be covered by subsequent reports, including market analysis, broadband infrastructure and implementation and broadband-enabled applications. In addition, a series of case studies will complement the resources already made available by ITU to all its many different types of readers, but especially to ICT regulators and policy-makers.

This new series of reports is important for a number of reasons. First of all, the reports focus on topical issues of special interest for developed and developing countries alike. Secondly, the various reports build on ITU's recognized expertise in the area augmented by regular feedback from its Membership. Lastly, but not least, this series is important because it provides a meaningful contribution to the work of the Broadband Commission for Digital Development. The findings of the ITU Broadband Reports trace paths towards the timely achievement of the ambitious but achievable goals set recently by the Commission, as well as provide concrete guidelines. Since broadband is a field that is growing very fast, we need to constantly build knowledge for our economies and societies to thrive and evolve into the future.

For these reasons, I am proud to inaugurate this first series of the ITU Broadband Reports and look forward to furthering ITU's work on the dynamic and exciting broadband ecosystem.

Brahima Sanou

Director, ITU Telecommunication Development Bureau

Executive Summary

This study assesses the economic impact of broadband in the Philippines. Drawing from the wealth of research literature on economic effects generated on the basis of cross-sectional analyses (e.g. for OECD, Latin American and Arab States), it applies econometric tools and techniques to measure the impact of broadband on a single nation.

The Philippines telecommunication sector plays a critical role in contributing directly to the country's economy. Telecommunication revenues account for 2.5% (or US$ 5.3 billion) of the country's Gross Domestic Product (GDP), contributing some $267 million annually to economic growth and generating 1.0% of total tax collections. Furthermore, the sector employs 525,000 skilled workers and professionals.

Beyond the direct economic impact of telecommunications, the indirect contribution of broadband through spill-over effects over the rest of the economy is estimated by constructing a structural econometric model for the period 2000-2010 specified for the fixed and mobile broadband sectors. While the model estimates that the fixed broadband market in the Philippines is not yet sufficiently mature for it to contribute significantly to the wider economy, mobile broadband adoption was found to contribute **an annual 0.32% of GDP**. This represents **6.9% of all GDP growth** for the economy during the past decade, given that GDP in Philippines grew at a compound annual average rate of 4.6%. In addition, given the acceleration of mobile broadband penetration since 2005, **the impact of the technology has almost doubled, reaching 0.61% of GDP** and representing **7.3% of all economic growth in the country**. This result further reinforces the increasing returns to scale hypothesis for network infrastructures.

The challenge for the Philippines telecommunication sector remains in applying the lessons from mobile broadband, and integrating mobile with fixed to accelerate fixed broadband adoption and expand fixed network access and coverage. In parallel, the development of applications in the areas of education, public health, media and entertainment and government services, will act as incentives to further increase broadband adoption.

1. Introduction

Since the mid-1970s, social scientists and policy-makers have been researching the contribution of information and communication technologies (ICTs) to economic development[1]. In fact, ever since the first studies conducted by researchers of the World Bank and development agencies, social scientists have been developing tools and techniques to measure the impact of telecommunications on GDP growth, employment creation and productivity, among other metrics.

Until recently, the primary statistical approach to test the economic contribution of ICT has been based on the study of cross-sectional samples of countries. Due to limitations on data availability, the primary emphasis has been on OECD countries (facilitated by the extensive Eurostat data sets) or worldwide analysis (based on ITU statistical indicators). While this approach is continuing to be pursued[2], researchers are starting to focus their assessments on specific country studies. For example, aiming to understand the economic impact of broadband, in the past three years we have conducted studies for Germany (Katz et al., 2010a), the United States (Katz and Suter, 2009a; Katz et al, 2011a), Costa Rica (Katz, 2011e), Chile (Katz, 2010c), Colombia (Katz, 2011e), Peru (Katz, 2011d) and Senegal (Katz and Koutroumpis, 2012).

The following study focuses on assessing the economic impact of broadband in the Philippines. It analyses the relative impact of fixed and mobile wireline and wireless broadband communications. The measurable economic impact of ICT infrastructure depends heavily on the timing of introduction, existing adoption conditions and market maturity. As studies of the lagged impact of ICT have demonstrated (Hardy, 1980; Jorgenson et al., 2006; Karner and Onyeji, 2007), the significant economic impact of ICT does not materialize immediately after the introduction of a new technology.

Broadband services represent a market that has contributed to the evolution of the Philippine economy during the last decade. To measure this contribution, a structural model, relying on four simultaneous equations that model the market operation was constructed for each of the two countries. The equations addressed:

- Endogenous growth from existing capital and labor together with broadband penetration metrics;
- Demand for broadband services depending on the price and adoption patterns;
- Supply and competition of broadband taking into account the regulatory and infrastructural investments in ICT; and
- Revenues and output of the broadband market as a proxy for the 'health' and sustainability of the sector.

This study begins by providing a brief review of the research literature regarding the impact of broadband on the economy (Section 2). The review of the literature provides a context for the development of the approach utilized in the case study. In section 3, a view of the primary features of the Philippines economy is presented and then the key dynamics of the local telecommunications market are explained

[1] See, for example, Madden, G. and Savage, S.J. (1998), Marsch, D. (1976), Norton, S.W. (1992), and Schapiro, P. (1976).

[2] See Koutroumpis (2009), Waverman (2009) and Katz (2009d).

(Section 4). The results of the econometric model are presented and discussed in Section 5. The implications from a public policy standpoint are drawn in Section 6.

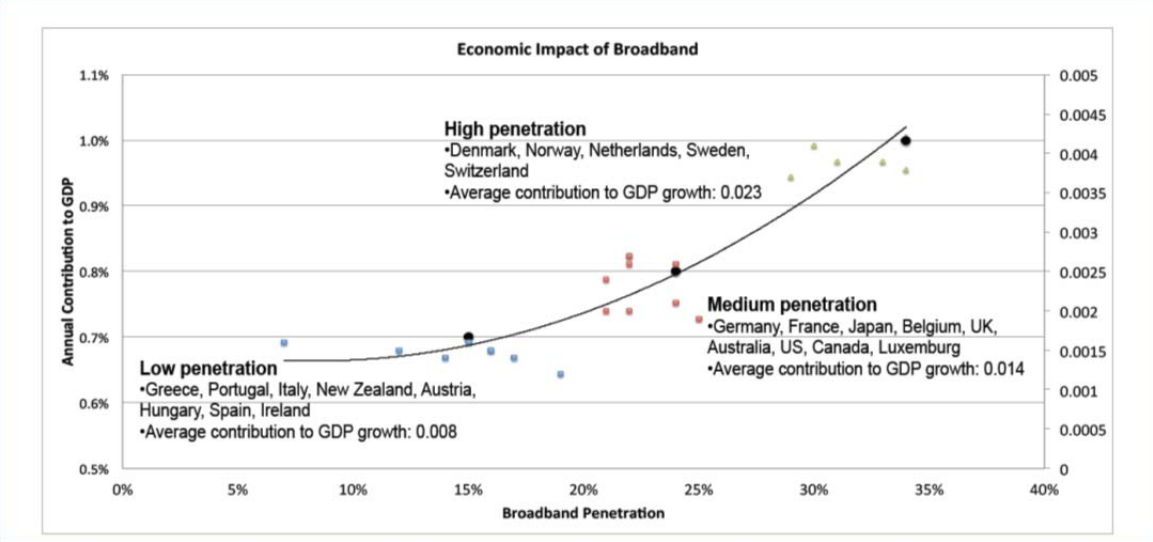
2. The Impact of Broadband on the Economy, Jobs and Welfare

Broadband contributes to economic growth initially by producing a series of effects similar to those generated by infrastructure deployment. Beyond the benefits for GDP growth, it also has significant economic impact on consumer surplus. Some of these effects — such as the impact of investment on infrastructure — have been estimated quantitatively through input-output analyses. Others, such as the impact on productivity growth and the elasticity of supply, as well as multipliers of household income, have not yet been studied in detail. However, beyond this chain of causality, research in developed countries has begun to generate evidence of causality between broadband and growth, as well as the microeconomic effects broadband can have on business productivity.

Beyond the benefits for GDP growth, broadband connectivity also has significant economic impact on consumer surplus. Some of these effects —such as the impact of investment on infrastructure— have been estimated quantitatively through input-output analyses. Others, such as the impact on productivity growth and the elasticity of supply, as well as the multipliers of household income, have not yet been studied in detail. However, beyond this chain of causality, research in developed countries has begun to generate evidence of causality between broadband and growth, as well as the microeconomic effects it can have on business productivity.

Using data from OECD countries, two studies have evaluated the impact of broadband on GDP growth. The first analyzed this impact in 25 OECD countries between 1996 and 2007 (Czernich et al., 2009). The authors determined that the adoption of broadband was statistically significant in regard to the rise in per capita GDP, with a ratio of 1.9% to 2.5%. Koutroumpis (2009) tried to solve the underlying problem of endogeneity between variables by constructing a structural model with simultaneous equations (Figure 1). His analysis focused on 22 OECD countries over the period 2002-2007. Again, the results indicated that there is a statistically significant relationship. The author also determined that broadband's contribution to GDP growth increases with its diffusion due to network effects: in countries with low penetration rates (less than 20%), a 10 percentage point increase leads to a 0.7% GDP growth; in countries with an average degree of penetration (between 20% and 30%), the effect is 0.8%; while in countries with high penetration rates (over 30%), the impact on GDP growth rate is almost 1%. A list of similar studies is presented in Table 1.

Figure 1: Broadband contribution to growth in developed countries



Source: adapted from Koutroumpis (2009).

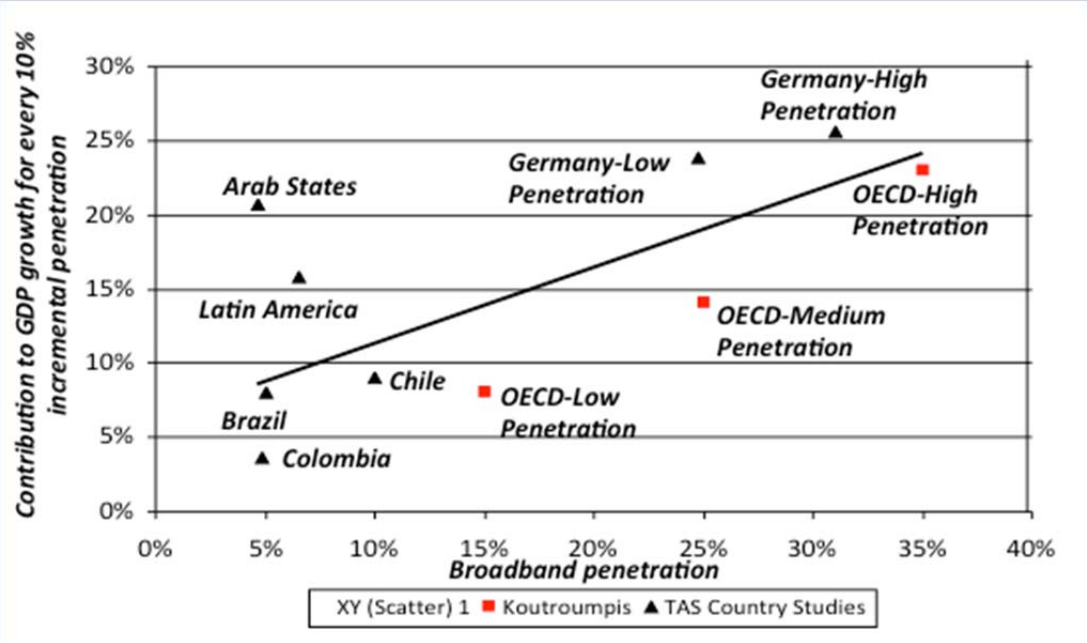
Table 1: Research results regarding the impact of broadband on growth

Country/Region	Study	Data	Impact
United States	Crandall et al. (2007)	48 states in the United States, 2003-2005	No statistically significant impact on GDP growth
	Thompson et al. (2008)	46 states in the United States, 2001-2005	A 10% increase in broadband penetration was linked to a 3.6% increase in efficiency
OECD	Czernich et al. (2009)	25 OECD countries, 1996-2007	Broadband adoption elevated per capita GDP by between 1.9 % and 2.5%
	Koutroumpis (2009)	22 OECD countries, 2002-2007	A 10 percentage point increase in broadband penetration produced between 0.7% and 1% increase in GDP growth
Germany	Katz et al. (2010a)	424 counties in Germany, 2000-2006	A 10% increase in broadband penetration produced a 0.255% increase in GDP growth
Developed countries	Qiang et al. (2009)	Developed counties from a sampling of 120 countries, 1980-2002	A 10% increase in broadband penetration produced a 1.21% increase in GDP growth
Low- and middle-income countries	Qiang et al. (2009)	Remaining countries (low- and middle-income developing economies) from a sampling of 120 countries, 1980-2002	A 10% increase in broadband penetration contributed 1.38% to economic growth

Source: Compiled by the author.

The incremental impact of broadband penetration is increasingly validated by a recent study published by one of these authors (Katz, 2011), where countries with lower broadband penetration tend to exhibit a lesser contribution of broadband to economic growth.

Figure 2: Broadband contribution to growth versus broadband penetration



Note: In the study, Katz et al. did for Germany; the country was split in two: landkreisse (counties) with high broadband penetration (average 31%) and landkreisse with low broadband penetration (average 24%).

Source: Katz (2011).

Beyond the impact on economic growth, researchers have also studied the subsequent effects of network externalities on employment variously categorized as "innovation", or "network effects"[3]. The study of network externalities resulting from greater broadband penetration has led to the identification of numerous effects:

- Introduction of new and innovative applications and services, such as telemedicine, Internet search, e-commerce, online education and social networking[4]
- New forms of commerce and financial intermediation[5]
- Mass customization of products[6]
- Reduction of excess inventories and optimization of supply chains[7]

[3] See Atkinson *et al.*, 2009.

[4] Op. cit.

[5] Op. cit.

[6] Op. cit.

[7] Op. cit.

- Business revenue growth[8]
- Growth in service industries[9]

Most of the research regarding the impact of broadband externalities on employment has been conducted using US data, although we have begun to develop studies for emerging countries.

Among the econometric studies of employment impact, are Gillett *et al.* (2006), Crandall *et al.* (2007), Shideler *et al.* (2007), Katz (2012) and Thompson and Garbacz (2008). Like the relationship between broadband and GDP growth, the contribution of broadband to employment is also conditioned by a number of special effects. Studies have particularly focused on two specific questions:

- Does the impact of broadband on employment differ according to industry sector?
- Is there a decreasing return in employment generation linked to broadband penetration?

As with GDP, the spillover employment effects of broadband are not uniform across sectors. According to Crandall *et al.* (2007), the job creation impact of broadband tends to be concentrated in service industries, (e.g., financial services, education, health care, etc.) although the authors also identified a positive effect in manufacturing. In another study, Shideler *et al.* (2007) found that, for the state of Kentucky, county employment was positively related to broadband adoption in the following sectors. The only sector where a negative relationship was found with the deployment of broadband (0.34% – 39.68%) was the accommodations and food services industry. This may result from a particularly strong capital/labor substitution process taking place, whereby productivity gains from broadband adoption yields reduced employment. Similarly, Thompson and Garbacz (2008) conclude that, for certain industries, "there may be a substitution effect between broadband and employment"[10]. It should therefore be considered that the productivity impact of broadband can cause capital-labor substitution and may result in a net reduction in employment.

This particular effect has been analyzed by Katz et al. (2010) in the case of rural economies of the United States. In particular, it was found that, within rural counties, broadband penetration contributes to job creation in financial services, wholesale trade and health sectors. This is the result of enterprise relocation enabled by broadband, which benefits primarily urban communities in the periphery of metropolitan areas (Katz et al. 2010d). In fact, research is starting to pinpoint different employment effects by industry sector. Broadband may simultaneously cause labor creation triggered by innovation in services and a productivity effect in labor-intensive sectors. Nevertheless, we still lack a robust explanation of the precise effects by sector and the specific drivers in each case. However, given that the sectoral composition varies by regional economies, the deployment of broadband should not have a uniform impact across a national territory.

With regard to decreasing impact on employment, some researchers have found a decreasing impact of broadband on employment. While Gillett *et al.* (2006) observed that the magnitude of impact of broadband on employment increases over time, they also found that the positive impact of broadband on employment tends to diminish as penetration increases. This finding may support the existence of a

8 See Varian *et al.*, 2002; Gillett *et al.*, 2006.

9 See Crandall *et al.* (2007).

10 This effect was also mentioned by Gillett *et al.* (2006).

saturation effect. Coincidentally, Shideler *et al.* (2007) also found a negative statistically significant relationship between broadband saturation and employment generation. This would indicate that at a certain point of broadband deployment, the capability of the technology to have a positive contribution to job creation starts to diminish.

In summary, a review of the research on the economic impact of broadband indicates multiple effects. Firstly and foremost, the evidence is fairly conclusive about the contribution of broadband to GDP growth. While the size of this contribution varies, discrepancies can be related to different datasets as well as model specifications. In addition, research has been successful in identifying the existence of a critical mass effect, indicating the existence of increasing economic returns of broadband penetration.

Secondly, broadband contributes to employment growth with spillover impacts on the rest of the economy. While deployment programs are, as expected, concentrated in the construction and telecommunications sectors, the impact of externalities is greater in sectors with high transaction costs (financial services, education and healthcare).

3. The Philippine Economy

The Philippines is a south-east Asian country gradually transforming from an agricultural nation to a newly industrialized one. The Philippine economy is currently the 33th largest in the world[11] and is forecast to become 14th largest by 2050[12]. Largely due to a booming outsourcing services industry that generates more than half of total GDP and a competitive industrial sector, the Philippines has experienced a decade of uninterrupted high growth rates. At the end of 2010, the Philippines overtook India as the world leader in business support functions[13]. Business Process Outsourcing alone is a USD10 billion industry (2011) with more than 600 thousand employees; it is expected to reach USD25 billion by 2016[14].

The country's main exports include semiconductors and electronic products, transport equipment, garments, petroleum and copper products, coconut oil and fruits. Some of the largest technology equipment vendors have a long-standing presence in Philippines. The mining industry is also quite strong with gold, nickel, chromite and copper deposits and significant reserves of silver, coal, gypsum and sulfur. Geothermal energy sources account for more than a quarter of the Philippines' electricity production[15], second only to the US in absolute output.

The 2008-2009 global recession had a limited impact on the Philippine economy compared to its regional peers, mainly due to sparse exposure on foreign securities, domestic demand and large remittances from millions of overseas Filipino workers. However, the economy still suffers from low private and public investment, unemployment and poor infrastructure.

Compared to its regional counterparts, investment as a proportion of GDP in the Philippines fell to 16%

[11] Source: CIA Fact book, US State Department

[12] Goldman Sachs 'Next Eleven' countries forecast a 5.2% average GDP growth for 2015-2050

[13] IBM Global Business Services (2010)

[14] Market Intelligence, Business Processing Association of the Philippines (EXL)

[15] Geothermal Energy Systems - Philosophical transactions. Series A, Mathematical, physical, and engineering sciences (2007)

during the last decade. The IMF suggests that these levels are relatively low, and can be partly attributed to the variation in economic structures across countries. For example, the services industry is less capital-intensive than the industrial sector. Malaysia, India, Indonesia and Vietnam experienced higher than 20% investment to output ratios in the same period[16].

Low public investment stemming from an inefficient tax collection mechanism has resulted in budgetary slippages and a lagging business environment, relative to the country's direct competitors. Streamlining business procedures and improving governance by tackling corruption and strengthening the legal system would be helpful to raise both private and public investment[17].

This investment deficiency has generated financing inertia of critical public infrastructures. Telecommunication and energy networks are among those most affected. In terms of comparative metrics, the Philippines experience among the lowest scores in their region in kWh per capita of electricity and fixed phones per capita, together with India and Vietnam[18]. In light of these financial circumstances, the country seems in a position to exploit the potential of ICT networks to the maximum in order to help transform its economy and overcome major shortcomings.

[16] International Monetary Fund – Selected papers for Philippines (2011)

[17] Doing Business, World Bank (2010)

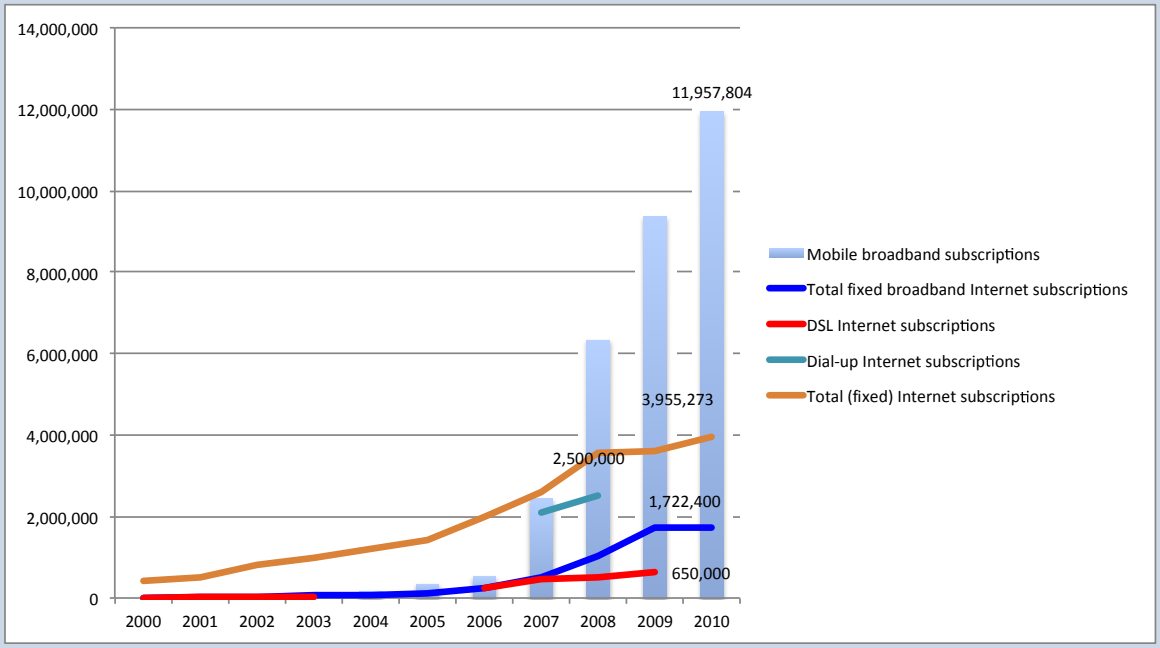
[18] World Development Indicators (2011)

4. The Telecommunication industry in the Philippines

4.1 Telecommunications and broadband demand

The Philippines' telecommunication sector has grown rapidly during the last ten years, primarily driven by the adoption of mobile telephony (Figure 3). The widespread adoption of wireless telephones had a critical impact on the subsequent adoption of mobile broadband exceeding 10 million subscribers in 2010.

Figure 3: Mobile broadband and Fixed Broadband (by technology) in Philippines

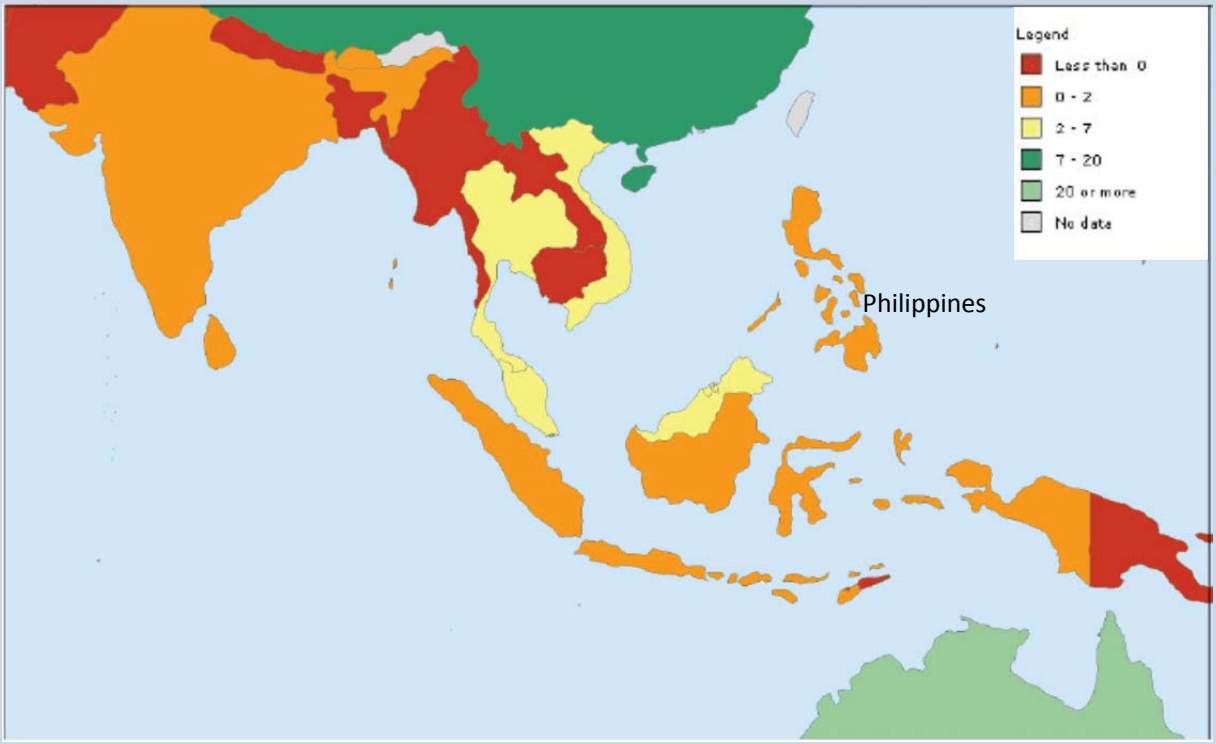


Source: ITU (2011), Wireless Intelligence (2012).

Fixed Internet subscriptions, including dial-up and DSL access, have remained fairly stable during the last decade, reaching 3.3% of Internet penetration in 2009. Fixed broadband is even lower, at 1.87% in 2009. There is only a limited substitution effect between dial-up and DSL, suggesting that there is yet much to be done in this segment. Prices have been following a decreasing trend, especially after 2005. However, there is only a very limited fixed access network, reaching 7.37% in 2009, thus capping the maximum fixed Internet adoption at comparatively low levels.

This phenomenon of mobile broadband growth and marginal subscription in fixed broadband appears to reflect the market needs for openness and connectivity. Almost half of all fixed line connections have some form of Internet connectivity, suggesting a lethargic expansion of legacy infrastructures. To the contrary, mobiles have surpassed all expectations and continue to do so, earning the country a predominant wireless wireless broadband adoption position among its counterparts.

Figure 4: The Philippines belong to the least advanced cluster for fixed broadband penetration in South-East Asia



Source: World Bank (2012).

4.2. Telecommunications and broadband supply

In terms of the supply side, the incumbent Philippines Long Distance Telephone Company (PLDT) controls 68% of the wireline sector after acquiring Digitel (with 2,200,000 subscribers in 2011), with the remaining part shared among Globe (14%), Bayantel (10%) and other smaller competitors. Total fixed line subscribers exceeded 3,200,000 in 2011. The annual revenue of the fixed line network was $1,061.73 million in 2011. The tax contribution of this part of the sector reached $53.07 million in 2011.

Table 2: Fixed line Sector Market Share in 2011

Company	Market Share
PLDT	68%
Digitel	14%
Bayantel	10%
Others	8%

Source: PLDT.

The mobile sector in Philippines accounts for almost 80% of total telecommunication revenue. In 2011, mobile revenues reached $3,913 million, while total telecommunication revenues amounted to $5,353

million. PLDT controls 68% of mobile market share in terms of subscriptions (with 63,700,000 subscribers), while Globe controls a little less than a third of mobile subscriptions. The national tax contribution of the mobile sector reached USD195.65 million in 2011 with an Average Revenue Per User (ARPU) of both operators of around USD3.48. Mobile broadband subscriptions exceeded 10 million in 2010, representing the most dynamic part of the sector.

Table 3: Mobile Sector Market Share in 2011

Company	Market Share
Smart Communications (PLDT subsidiary)	68%
Globe	32%

Source: PLDT.

The fixed broadband market is primarily shared between PLDT (58%) and Globe (28%). Other competitors control the remaining 14%. The tax contribution of the broadband sector reached USD18.92 million in 2011[19].

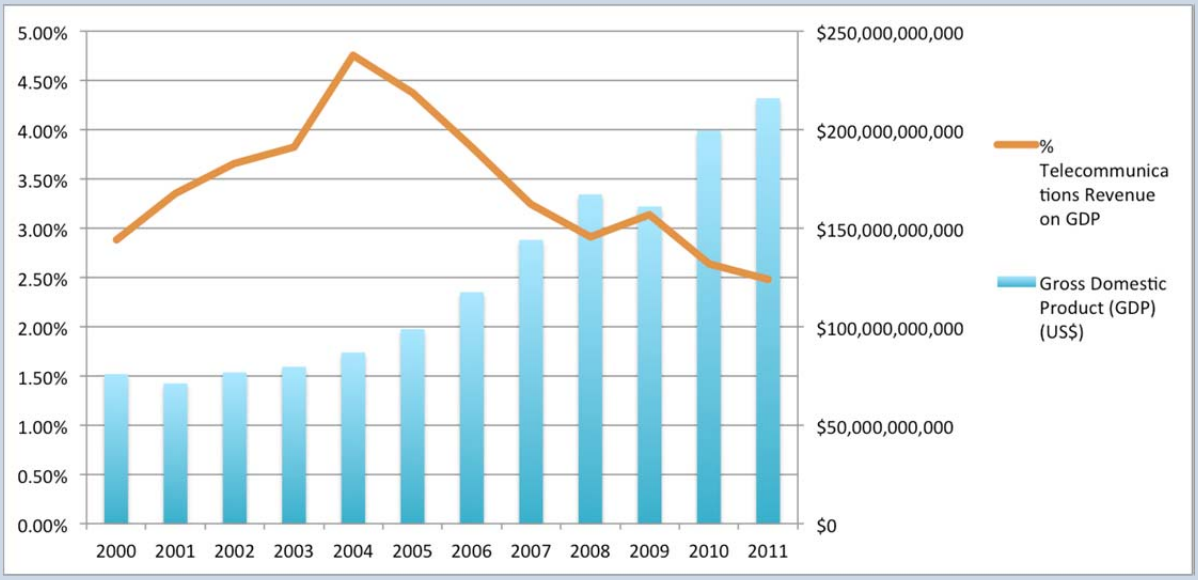
Table 4: Fixed Broadband Sector Market Share in 2011

Company	Market Share
PLDT	58%
Globe	28%
Others	14%

Source: PLDT.

[19] This was calculated by adding taxes paid by Globe and PLDT (Source: Annual Reports) and grossing that amount up for the remainder of the market (by relying on the 14%)

Figure 5: GDP and Telecommunication Revenue in Philippines



Source: PLDT.

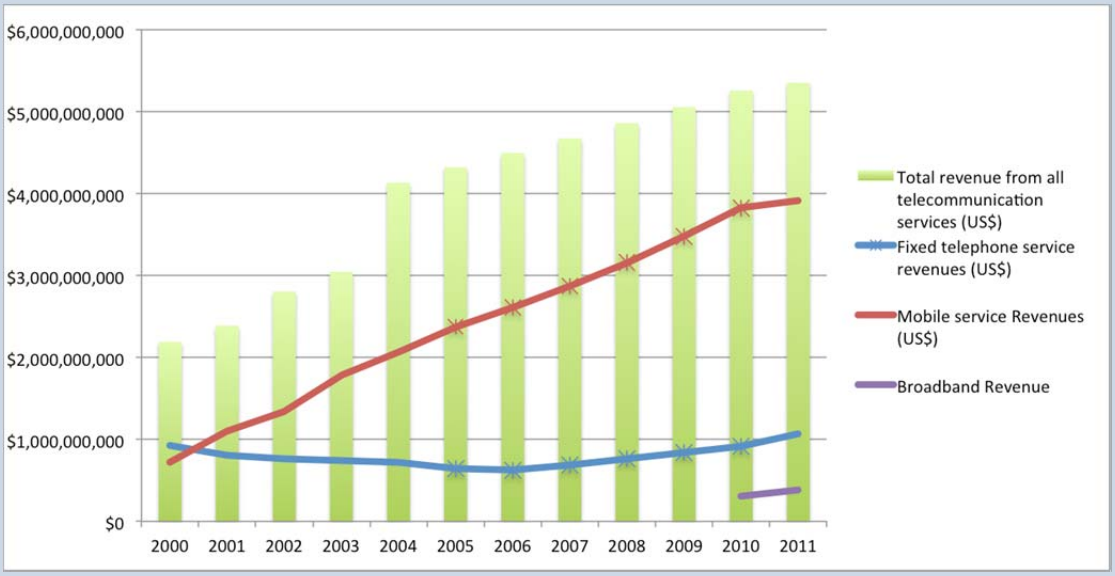
5. The economic impact of telecommunications and broadband in the Philippines

There are two distinct ways to assess the economic impact of telecommunications and broadband on the Philippines economy. The first is the sector's direct impact, resulting from its significance in and contribubtion to GDP (Figure 6), as well as the employment generated by its operators and their local suppliers. Additionally, the sector also contributes to the economy by means of taxes, such as corporate levies, value-added tax, and other fees. Besides, broadband communications as a general purpose technology, have an impact resulting from the network effects and spillovers to other productive sectors as was reviewed in Section 2. This section will asses the direct and indirect contribution that telecommunications has made so far to economic development in Philippines.

5.1 Direct economic contribution of telecommunications

The total revenues of the Philippenese telecommunication industry represented $5.3 billion (2.5% of the national GDP) in 2011. Mobile accounts for most of this revenue, making the total ICT sector contribution (including the IT sector) revenues rise to $8.9 billion in 2010. Some 28.5% of all foreign direct investment (FDI) was placed in the ICT sector, highlighting its importance to the national economy.

Figure 6: Percentage of GDP



Sources: ITU,PLDT (2010)[20]

The direct contribution of the telecommunication sector to the Philippines' economy has been growing since the beginning of 2000, largely due to a booming mobile sector. Between 2005 and 2008, the economy grew at an annual rate of 5.3% thus reducing the relative impact of telecommunications on national GDP to close to the 3.0%. This trend was reversed in 2009, when the economy grew only marginally (1.1%) and returned to this downward trend after 2010 that marked a record GDP growth for the country (7.6%). The saturation of mobile services, coupled with limited fixed broadband revenues, has resulted in this situation. In 2011, the total tax contribution of the telecommunication sector accounted for 1.0% of all tax collection in the country reaching $267.7m.

In parallel to its direct economic contribution, the telecommunication industry has had an important impact in the creation of direct jobs (i.e. telecommunication employment). The total number of direct jobs in telecommunications reached 525,000. The total direct and indirect employment figure represents 1.3% of total employment in Philippines, and 4.6% of the service sector. Finally, the Philippines telecommunication sector contributes 1.0% to the public treasury in terms of taxes being paid.

5.2 Indirect economic contribution of broadband

As shown in the literature reviewed above, beyond the direct economic contribution, telecommunications can have a positive contribution to economic growth. This section assesses the positive externalities of broadband in the Philippines. As anticipated in the introduction, given the different penetration rates exhibited by mobile telephony and broadband, the analysis of economic impact of both technologies will be conducted through two distinct econometric models.

[20] Asterisks denote authors' estimates in missing data.

Regional and country-level statistical studies of ICT impact in emerging economies usually suffer from the lack of microdata as the institutions and technical committees do not always collect information in a relatively frequent and consistent manner. More information on data availability as well as the specific resources utilized in the study can be found in the Appendix.[21]

5.2.1 Fixed broadband economic impact

In this study, a structural econometric model has been used, which was initially developed by Roller and Waverman (2001) for fixed line telephony and later adapted by Koutroumpis (2009) for broadband and Gruber and Koutroumpis (2011) for wireless. In particular, the model consists of four equations: an aggregate production function modeling the operation of the economy and subsequently three distinct demand, supply and output functions. The last three functions model the fixed broadband market operation and, controlling for their reverse effects, the actual impact of the infrastructures is estimated. In the production function, GDP is linked to the fixed stock of capital, excluding ICT infrastructure and labor and the broadband infrastructure, which is proxied by fixed broadband penetration.

The demand function links broadband penetration to the average consumption propensity of individuals proxied by GDP per capita and the cost of a basic broadband service. Subscribers are largely dependent on the entry-level prices of technology services that attract the majority of the operators' target audience.

The supply function links aggregate broadband revenue to the corresponding price levels, the GDP per capita and the degree of urbanization in the country. As fixed broadband services benefit from higher population concentration, the data reflected migration to urban areas affecting the supply of such services. Both parameters affect potential and existing operators, as well as the dynamics of the supply side of the market.

The infrastructure equation links annual change in broadband penetration to broadband revenues, used as a proxy of the capital invested in a country during one year[22]. The specification of the model, as well as its results, is included in detail in the Appendix.

Fixed broadband infrastructure has been found to have **no significant effect** on the Philippinese economy over the last ten years (2000-2010). This is partly related to the fact that fixed broadband subscribers had not yet reached 2% of the population in 2010 (Figure 7), suggesting a minimal effect on the broader community (see Table 7, Appendix).[23]

[21] This situation introduces a degree of complexity in the data mining phase. Data for this analysis come from the ITU, the Wireless Intelligence and the regional operators (Banyan and BLDT). Adoption metrics (fixed line, mobile broadband) have been fairly consistent since the fourth quarter of 2000 up until 2010. Telecommunications' costs are provided by the operators. Other macroeconmic metrics (GDP, fixed capital formation, education, labor force, etc) are available from the corresponding sector ministries. Market performance metrics (capex, revenues etc) are also available from local operators.

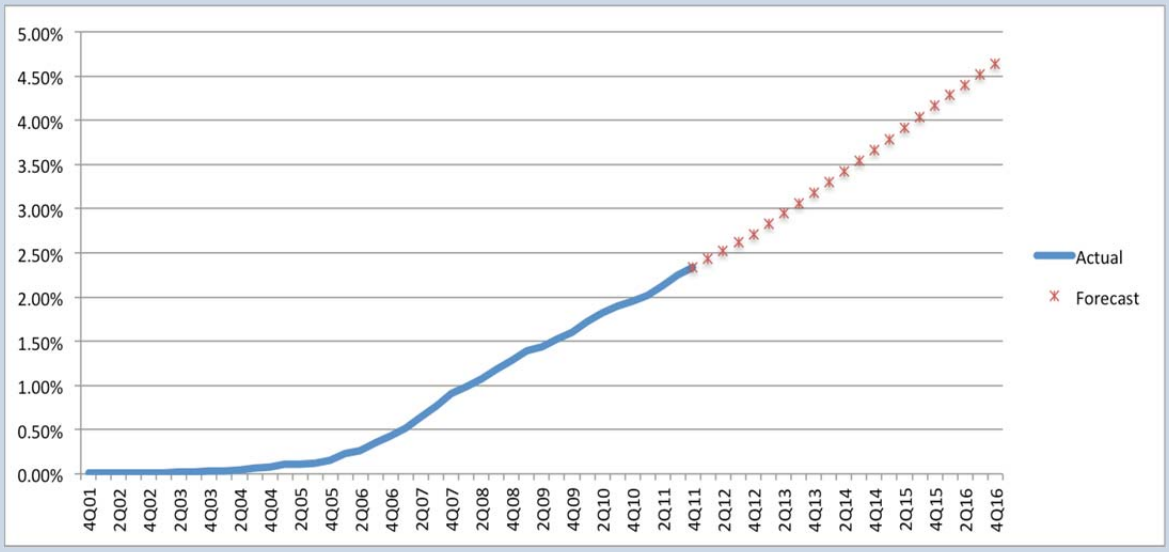
[22] This assumes a stable and constant link between income and investment, which in some cases might not be the case. Unfortunately, fixed gross capital formation for telecoms, which would be the more appropriate variable, was not available.

[23] This finding is further supported by the distortion in the demand function, where fixed broadband prices have an insignificant effect on adoption, thus implying that consumers are indifferent on product prices. What

This finding does not imply that broadband is not having an impact on the local services and outsourcing industry. It simply ascertains that at the aggregate level, this impact cannot be measured. In fact, research on the microeconomic impact of telecommunications consistently points out to the impact that broadband has both on export of services, particularly outsourcing (Abramovsky et al., 2006).

The future of broadband in Philippines is not linked with fixed access only. Frequently, countries with limited fixed access networks experience displacement (rather than substitution) towards rapid adoption of mobile broadband services. Current adoption of mobile broadband can be split into mobile phones with access to the Internet and dedicated mobile broadband services. Mobile phones with Internet access account for almost 23.5% of population (Q4 2011)[24] penetration, while mobile broadband services account for more than 13%. Mobile broadband connections are forecast to be used by 60.6% of the Philippenese population by 2016[25]. Given the insignificant impact of fixed broadband, it is expected that mobile broadband will contribute to the growth of the economy. Additionally, the mobility attributes of 3G and LTE connections can help serve the rural and remote parts of the country reducing social exclusion, increasing digital literacy and connecting those areas to the rest of the world. For this purpose, a further analysis of the mobile broadband market follows.

Figure 7: Fixed broadband penetration forecast in Philippines



Source: Wireless Intelligence, 2012.

is clear is that the rising GDPC in the local economy has helped adoption, but it remains unclear whether this part of the population would have adopted even without signiicant price or income changes.

[24] Source: Wireless Intelligence (2012)
[25] Source: Wireless Intelligence (2012)

5.2.2 Mobile broadband economic impact

In this section, we have replicated the structural econometric model used for fixed broadband, along the lines of Gruber and Koutroumpis (2011) for wireless voice services. Again, the model consists of four equations: an aggregate production function modeling the operation of the economy and three demand, supply and output functions. The last three functions model the mobile broadband market operation and, controlling for the reverse effects, the actual impact of the infrastructures is estimated. In the production function, GDP is linked to the fixed stock of capital, excluding ICT infrastructure and labor and the mobile infrastructure proxied by mobile broadband penetration.

The demand function links mobile broadband penetration to the average consumption propensity of individuals proxied by GDP per capita and the cost of mobile broadband access. The supply function links the aggregate mobile revenue to the GDP per capita and the degree of urbanization. As in the case of fixed access, demography often plays a key role in the access dynamics of mobile broadband infrastructure. The infrastructure equation links annual change in mobile broadband penetration to its revenues, used as a proxy of the capital invested in a country during one year[26].

The econometric specification of the model is also found in the Appendix, together with detailed presentation of the results.

Based on these models, mobile broadband was found to have significantly affected the Philippenese economy during the previous decade (2000-2010) (see Table 8 in Appendix).

This result is very important, given the relatively small fraction of the population that initially adopted the technology. In practice, less than 0.5% of the population used mobile phones before 2005 and this might include multiple SIM-card ownership[27]. The interpretation of this outcome requires a better understanding of the location specific parameters. In terms of actual and measurable growth contribution of the technology[28], the Compound Annual Growth Rate (CAGR) of mobile infrastructure was estimated. [29]

The CAGR for Philippines for the period 2000-2010, i.e. the annual contribution on GDP form mobile phones is approximately 0.32% of GDP. **This translates into an economic boost to the economy every year during the past decade of 0.32% due only to the spillover effects of mobile broadband usage.**

[26] This assumes a stable and constant link between income and investment, which in some cases might not be the case. Better proxies of telecoms investment like the direct telecoms investment or the fixed gross capital formation for telecoms were not available.

[27] It is commonly found in similar studies, that a variable percentage of the users own more than one subscription. This might lead to an overestimation of actual users and is directly related to the cost barriers of new SIM card acquisition. Stronger regulation of phone ownership can radically reduce this phenomenon.

[28] We follow the analysis in Koutroumpis (2009).

[29] Based on the following formula (10), we estimate the compound aggregate growth rate for Philippines:

$$CAGR = \left[\left(\frac{\frac{MobBBPen_{2010}}{100-MobBBPen_{2010}} - \frac{MobBBPen_{2000}}{100-MobBBPen_{2000}}}{\frac{MobBBPen_{2010}}{100-MobBBPen_{2010}}} \right) * \hat{a}_3 + 1 \right]^{1/10} \quad (10)$$

Given that the economy grew – on average – at 4.6% during this period, this figure suggests that mobiles alone were responsible for 6.9% of all economic growth in Philippines.

Looking at these figures in a shorter time-frame, we estimate the compound annual growth rates for the period 2005-2010. The impact of mobile broadband during that time **almost doubled reaching 0.61% of annual GDP growth**. As this explosion in mobile broadband coincided with a higher economic growth period (8.4% for 2005-2010), the relative impact of this technology is slightly higher, accounting for 7.3% of all economic growth in Philippines.

The structural model provides estimates for other important parameters of the economy. Fixed capital formation in the country is a critical growth catalyst, suggesting that 1% increase in fixed capital induces a 0.86% growth effect on GDP.

In terms of demand for mobile services, income is the single most important parameter affecting mobile broadband use. A mere increase of 1% in GDP will have a more than threefold effect (based on the coefficient of change in GDP in the demand function in Table 8, approximately 3.006 times) on the adoption of mobile broadband. Prices are also a key enabler for adoption of the technology. Decreasing prices by 1% would yield an additional 0.84% increase in subscriber penetration in mobile broadband networks (based on the coefficient of mobile broadband price in Table 8). It is evident that these results reflect the actual interest of the local population in Internet access, which is severely limited through fixed broadband offerings.

Supply dynamics suggest that income levels affect the revenues and investments of operators. The consumption propensity for broadband services seems to have a siginificant impact on increasing the supply of digital offerings. Increasing the disposable income (proxied by change in GDP) attracts 0.3% more supply (based on the coefficient of change in GDP in the supply equation in Table 8). Urbanization enters the regression as insignificant, perhaps suggesting that micro-demographic effects (rather than macro) have an impact on the supply of mobile broadband services.

Finally, revenues are found to have a significant impact on the performance of the industry, implying a reinvestment of the output to the productive basis of the economy[30]. This is an additional angle supporting the increasing returns to scale of ICT infrastructure.

[30] This is particularly relevant for markets undergoing high growth, while it not be the case with saturated markets.

6. Conclusions

The Philippines, a south-east Asian economy with impressive growth potential and an average $4,100 in purchasing power[31] per capita, has been studied for the impact of fixed and mobile broadband adoption on its economy. During 2000-2010, the fixed broadband market in Philippines was relatively thin and was not found to affect the wider economy. Nevertheless, the more dynamic and popular sector of mobile broadband was estimated to contribute **an annual 0.32% to GDP during the past decade**. This represents **6.9% of all GDP growth** for the economy, given that GDP grew annually at 4.6%. **Since 2005, this impact almost doubled reaching 0.61% of GDP,** thus accounting for **7.3% of all economic growth in the country**.

The policy implications of these results are self-evident. The private telecommunication sector has been able to address the country's rudimentary fixed line infrastructure through wireless price reductions and wide coverage. This has resulted in a fast adoption process. Future challenges focus on applying the lessons from wireless and combining mobile with fixed infrastructure in an optimal way to accelerate fixed broadband adoption. In parallel, the development of applications in education, public health, media and entertainment and government services, would act as incentives to further increase broadband adoption.

Across different regional and socio-economic contexts, the direct and indirect economic impact of network infrastructures is found to be persistently strong. First, mobile networks can be deployed quickly providing basic voice communications to a population often uncovered by fixed networks. In developing economies the attribute of mobility is enhanced by widespread network availability and more demanding lifestyle characteristics. Subsequently, mobile or fixed broadband networks take shape and allow users to access more sophisticated services – shopping, doing business, receiving health and e-government services, socializing and much more. Network effects seem to become stronger as more people decide to subscribe giving support to the increasing returns to scale hypothesis: more access to the networks multiplies their effect on the economy.

[31] CIA Factbook, 2011

Bibliography

Abramovsky, L., Griffith, R. (2006). Outsourcing *and off shoring of business services: how important is ICT?* Advanced Institute for Management Research London. Working paper 1744-009.

Atkinson (2009). *The digital road to recovery: a stimulus plan to create jobs, boost productivity and revitalize America*. The Information Technology and Innovation Foundation, Washington, DC.

Crandall, (2007). The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data. *Issues in Economic Policy*, *6*.

Czernich, N., Falck, O., Kretschmer T., & Woessman, L. (2009, December). Broadband infrastructure and economic growth (CESifo Working Paper No. 2861). Retrieved from www.ifo.de/DocCIDL/cesifo1_wp2861.pdf

Gillett, S., Lehr, W., and Osorio, C., & Sirbu, M. A. (2006). *Measuring Broadband's Economic Impact.* Technical Report 99-07-13829, National Technical Assistance, Training, Research, and Evaluation Project.

Gruber and Koutroumpis, P. (2011) "Mobile Telecommunications and the impact on Economic Development". Economic Policy, Vol. 67, 1-41, July 2011

Hardy, (1980). "The role of the telephone in Economic Development", *Telecommunications Policy*, 4 (4), pp.278-286.

Jorgenson, D., Ho, M, Samuels, J., Stiroh, K. (2007). *Productivity growth in the new millennium and its industry origins*. Paper presented at Sloan Industry Studies Conference, Boston.

Karner, J and Onyeji, R. (2007). Telecom Private Investment and Economic Growth: the case of African and Central & East European Countries. Jonkoping International Business School

Katz, R. and Suter, S. (2009a). *Estimating the economic impact of the broadband stimulus plan*. Columbia Institute for Tele-Information Working Paper. Retrieved from www.elinoam.com/raulkatz/Dr_Raul_Katz_-_BB_Stimulus_Working_Paper.pdf

Katz, R., Vaterlaus, S., Zenhäusern, P. & Suter, S. (2010a). The Impact of Broadband on Jobs and the German Economy. Intereconomics, 45 (1), 26-34.

Katz, R. (2010b). The contribution of broadband to economic development, Jordan, V., Galperin, H., Peres, W. *Fast-Tracking the digital revolution: Broadband for Latin America and the Caribbean*, Santiago, Chile: UN Economic Commission for Latin America

Katz, R., Avila, J., Meille, G. (2011a). *The impact of wireless broadband in rural America*. Washington, D.C.: Rural Cellular Association.

Katz, R. (2011b). *Evaluacion del Impacto Económico y Social de una Modificación del Marco Tributario de las Computadoras Personales en Perú*. Telecom Advisory Services, LLC, Stanfordville, NY.

Katz, R. (2011c). "Impacto económico de la Estrategia Nacional de Banda Ancha", Gobierno de Costa Rica. Rectoría de telecomunicaciones. *Estrategia Nacional de Banda Ancha*, San Jose, Costa Rica.

Katz, R. (2011d). "The impact of broadband on the economy: research to date and policy issues"*, Trends in Telecommunication reform 2010-11*. Geneva: International Telecommunication Union.

Katz, R. and Callorda, F. (2011e). *Medición de Impacto del Plan Vive Digital en Colombia y de la Masificación de Internet en la Estrategia de Gobierno en Línea*. Cintel: Bogota, Colombia, Diciembre 2.

Katz, R. (2012). *The Impact of Broadband on the Economy: Research to date and Policy Issues*. International telecommunication Union, The impact of Broadband on the Economy Broadband Series, Geneva, Switzerland.

Katz, R. and Koutroumpis, P. (2012). *The economic impact of Telecommunications in Senegal*. Working paper

Koutroumpis, P. (2009). "The Economic Impact of Broadband on Growth: A Simultaneous Approach". *Telecommunications Policy*, 33, 471-485.

Madden, G. and Savage, S.J. (1998). CEE Telecommunication investment and economic growth, *Information Economics and Policy* 10, pp. 173-95.

Marsch, D. (1976). "Telecommunications as a factor in the Economic Development of a Country", *IEEE Transactions on Communications* 24, July.

Norton, S.W. (1992). "Transaction costs, Telecommunications and the Microeconomics of Macroeconomic Growth", *Economic Development and Cultural Change*, 41 (1), pp. `175-96.

Qiang, C. Z., & Rossotto, C. M. (2009). Economic Impacts of Broadband. In *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, 35–50.Washington, DC: World Bank.

Roller, L-H. and Waverman, L. (2001). "Telecommunications Infrastructure and Economic development: A simultaneous approach*", American Economic Review*, 91(4), pp. 909-23.

Schapiro, P. (1976). "Telecommunications and industrial development," *IEEE Transactions on Communications* 24 (March).

Shideler, D., Badasyan, N., & Taylor, L. (2007, September 28-30). The economic impact of broadband deployment in Kentucky. *Telecommunication Policy Research Conference*, Washington D.C.

Thompson, H., & Garbacz, C. (2008). Broadband Impacts on State GDP: Direct and Indirect Impacts. Paper presented at the International Telecommunications Society 17th Biennial Conference, Canada.

Varian (2002) Varian, H., Litan, R., Elder, A. & Shutter, J. (2002). *The net impact study: the projected economic benefits of the Internet in the United States, United Kingdom, France and Germany*, Available from: www.cisco.com, also available at www.itu.int/wsis/stocktaking/docs/activities/1288617396/NetImpact_Study_Report_Brookings.pdf

Waverman, L., Meschi, M., Fuss, M. (2005). "The impact of telecoms on economic growth in developing countries", *The Vodafone Policy paper Series* (2), pp. 10-23.

Waverman, L. (2009). *Economic Impact of Broadband: An Empirical Study.* London: LECG, February 29.

APPENDIX

Data sources for the Philippines analysis:

Table 6: Data sources for Philippines

Variable	Explanation	Source
GDP	Gross Domestic Product in constant USD (2000)	World Bank
GDPC	Gross Domestic Product per capita in constant USD (2000)	World Bank
K	Gross fixed capital formation in constant USD (2000)	World Bank
L	Labor force with secondary education	World Bank
BB_Pen	Fixed broadband penetration (in 100 people)	World Bank
BB_Pr	Fixed broadband price per month	Local Operators (Banyan & PLDT)
Mob_BBPen	Mobile broadband penetration (in 100 people)	World Bank
Mob_Pr	Mobile broadband price per month	Wirelss Intelligence
BB_Rev	Fixed Broadband Telecommunications revenue	ITU
Mob_Rev	Mobile Broadband Telecommunications revenue	ITU
Urb	Urbanization	World Bank

Source: Compiled by the author.

Structural model for the impact of fixed broadband on the Philippines economy:

Aggregate Production function:

$$GDP_{it} = a_1 K_{it} + a_2 L_{it} + a_3 BB\_Pen_{it} + \varepsilon_{1it} \quad (1)$$

Demand function:

$$BB\_Pen_{it} = b_1 BBPr_{it} + b_2 GDPC_{it} + \varepsilon_{2it} \quad (2)$$

Supply function:

$$BB\_Rev_{it} = c_1 GDPC_{it} + c_2 Urb_{it} + \varepsilon_{3it} \quad (3)$$

Output function:

$$\Delta BB\_Pen_{it} = d_1 BB\_Rev_{it} + \varepsilon_{4it} \quad (4)$$

Results for the impact of fixed broadband on the Philippines economy:

Table 7. Results of Broadband Infrastructure Model

Variables	Fixed Broadband Model
Growth (GDP_{it})	
Labour force (L_{it})	1.007
Fixed Capital Stock (K_{it})	0.978***
BB Penetration (BB_Pen_{it})	0.002
Constant	-
Demand (BB_Pen_{it})	
BB. Price ($BBPr_{it}$)	- 0.104
GDPC ($GDPC_{it}$)	6.113***
Constant	- 45.048***
Supply (Mob_Rev_{it})	
GDPC ($GDPC_{it}$)	0.813***
Urbanization (Urb_{it})	0.721***
Constant	13.346***
Output (ΔBB_Penit)	
BB Revenue (BB_Revit)	5.192***
Constant	-118.347***
Year Effects	YES
Obs	36
R^2	(1)
Growth	0.99
Demand	0.86
Supply	0.74
Output	0.77

Source: Authors.

Structural model for the impact of mobile broadband on the Philippines economy:

Aggregate Production function:

$$GDP_{it} = a_1 K_{it} + a_2 L_{it} + a_3 MobBB\_Pen_{it} + \varepsilon_{1it} \quad (6)$$

Demand function:

$$MobBB\_Pen_{it} = b_1 MobBBPr_{it} + b_2 GDPC_{it} + \varepsilon_{2it} \quad (7)$$

Supply function:

$$Mob\_Rev_{it} = c_1 GDPC_{it} + c_2 Urb_{it} + \varepsilon_{3it} \quad (8)$$

Output function:

$$\Delta MobBB\_Pen_{it} = d_1 Mob\_Rev_{it} + \varepsilon_{4it} \quad (9)$$

Results for the impact of mobile broadband on the Philippines economy:

Table 8. Results of Mobile Broadband Infrastructure Model

Variables	Mobile Broadband Model
Growth (GDP_{it})	
Labour force (L_{it})	-0.248
Fixed Capital Stock (K_{it})	0.859***
Mob BB Penetration ($MobBB\_Pen_{it}$)	0.036***
Constant	-
Demand ($MobBB\_Pen_{it}$)	
Mobile BB. Price ($MobBBPr_{it}$)	-0.841***
GDPC ($GDPC_{it}$)	3.006***
Constant	-19.117***
Supply (Mob_Rev_{it})	
GDPC ($GDPC_{it}$)	0.307***
Urbanization (Urb_{it})	0.084
Constant	19.673***
Output ($\Delta MobBB\_Pen_{it}$)	
Mob Revenue (Mob_Rev_{it})	16.642***
Constant	-371.841***
Year Effects	YES
Obs	25
R^2	(1)
Growth	0.99
Demand	0.99
Supply	0.96
Output	0.76

Source: Authors.

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