Study on the Expected Effects on Fixed Internet Consumption in Different Fiscal Scenarios in Costa Rica

MINISTERIO DE CIENCIA, TECNOLOGÍA Y TELECOMUNICACIONES

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326
E82e Costa Rica. Ministry of Science, Technology and Telecommunications (MICITT).
Study on the Expected Effects on Fixed Internet Consumption in Different Fiscal Scenarios in Costa Rica.
-- San José, C.R.: MICITT, 2018.
40 p.

ISBN: 978-9968-732-61-1

1. BROADBAND 2. INTERNET 3. TAXES 4. TELECOMMUNICATIONS

Summary

Broadband (BB) Internet has become an important driver of the economy, boosting economic growth and employment generation. Therefore, studying the mechanisms for its promotion, and among them, consumption taxes, has acquired great relevance in recent years.

This study seeks to highlight the importance of assessing the potential impact of modifying the tax burden in the Broadband Internet service. The analysis is conducted through three General Sales Tax (GST) scenarios, observing only the potential impact on the penetration of the service and tax revenue. This study allows to identify situations in which a lower GST rate could be associated with a greater penetration of fixed BB Internet as well as an increase in tax revenue. It should be an aid to exemplify the complexities to be considered when adding distortions into the market of this important service and not as a forecast of potential tax revenue.

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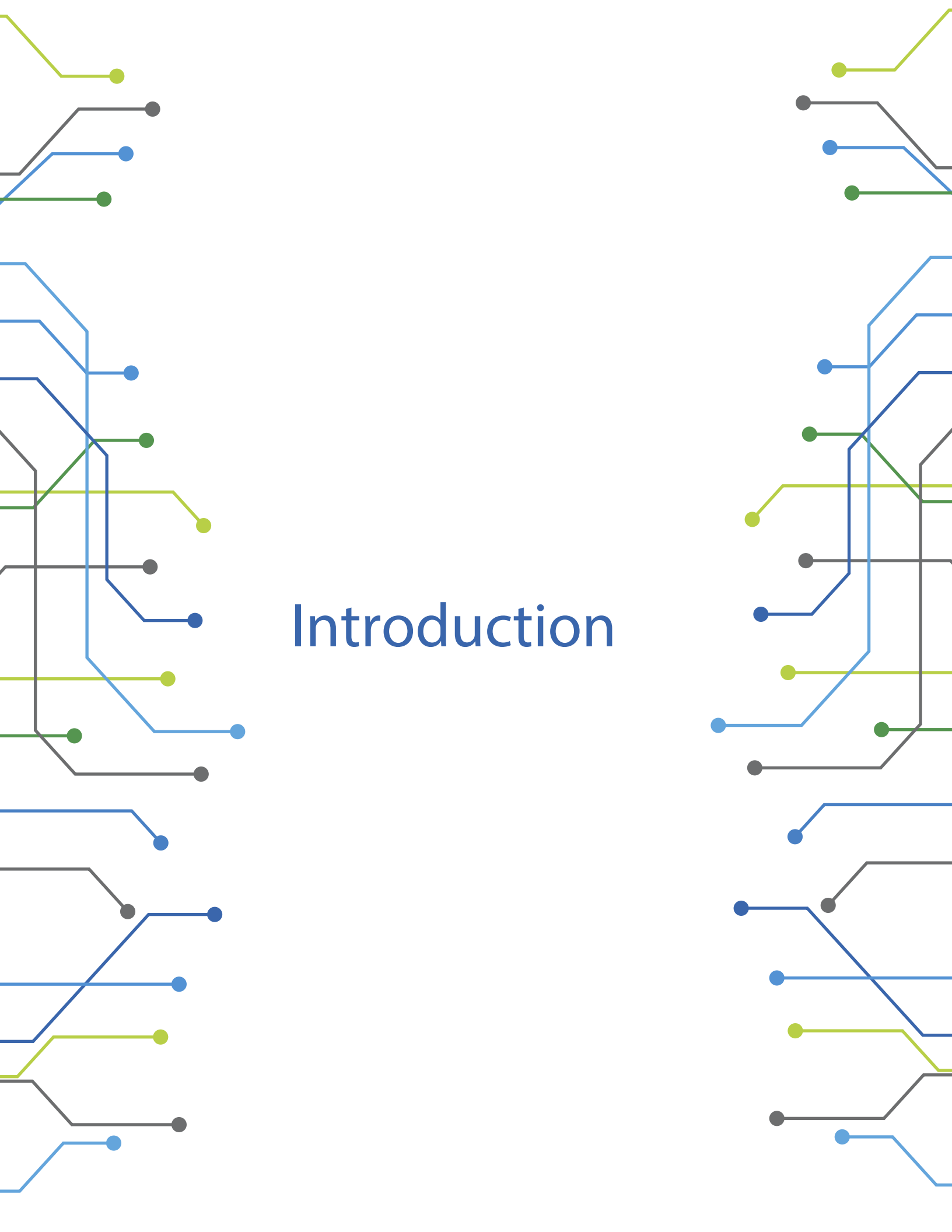


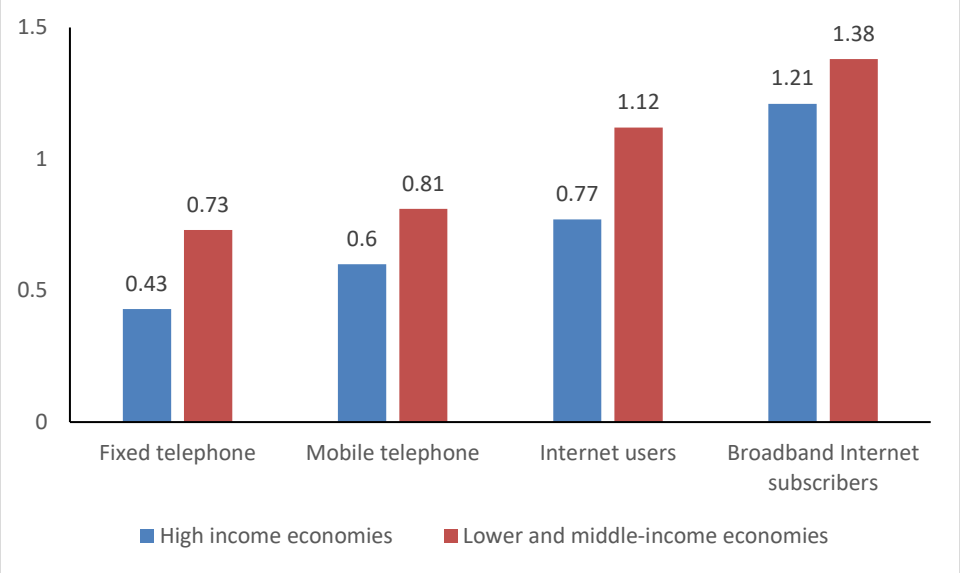
Introduction

Telecommunications have taken on a leading role in the economic and social development of nations, especially in an economy increasingly oriented to the service sector, which in 2014 accounted for 59% of the world Gross Domestic Product-GDP (World Bank, 2016).

Broadband (BB) Internet has revolutionized telecommunications, improving service efficiency as a result of a greater data transfer capacity (UN, 2013). Nowadays, *"[…] broadband has become critical infrastructure determining countries' national competitiveness in the global digital economy"* (ITU, 2013:1), being its role as trade facilitator and promoter of economic growth of particular relevance.

Numerous studies have demonstrated its benefits on the main macroeconomic indicators. As shown in the figure below, a 10% increase in the penetration of BB would cause a 1.38% GDP rise in lower and middle-income countries, significantly higher than the expected in relation with other technologies (Qiang, Rossotto and Kimura, 2009).[1] Furthermore, in Chile's particular case, it was discovered that a 10% increment in the penetration of BB is associated with a 0.018% employment rate increase (Katz, 2010).

Figure 1. GDP growth in percentage points after a 10% increase in different ICT (percentage points, 2009)



Source: Compiled by authors based on Qiang, Rossotto and Kimura (2009: 45).

Along with the benefits associated with broadband deployment, its penetration has shown a significant increase over the last few years[2] (Internet Society, 2015). One of the factors that has enabled the rise in the dissemination of broadband is the reduction of its price.[3] Thus, worldwide attention has been paid to the impact of the tax burden on the penetration of this technology.[4]

In Costa Rica, this service, like many other, has been at the center of discussions

[1] Other studies along the same lines are those conducted by Katz, and Callorda (2013) and Kayzer, Klarsfeld and Brossard (2014).
[2] According to the World Bank (2015), from 2005 to 2014, the penetration of fixed broadband increased by 74% worldwide.
[3] Haucap, Heimeshoff and Mirjam (2014) found a strong inverse relationship between the price of fixed broadband and its penetration.
[4] Deloitte (2011), Kayzer, Klarsfeld and Brossard (2014) and Miller and Atkinson (2014) are some of the authors who have studied the subject.

around a fiscal reform. According to international agencies, risk rating agencies, and the Government itself, a fiscal reform cannot be postponed.

As the Government highlights in its Value Added Tax (VAT) and Income Tax draft bills[5]: "[…] *the country faces a deteriorating fiscal situation which responds to structural problems in public finances* [adding that] *a significant amount of the fiscal deficit responds to the stagnation of the tax burden, which has remained slightly over 13% of its GDP*." (Strengthening of Public Finances Draft Bill, 2017: 2). Based on this argument, the Government proposes a fiscal reform which contemplates amendments to VAT[6] and Income Tax as priorities. Telecommunication services, and among them, broadband Internet, are affected by a reform with such characteristics.

Therefore, the country must focus on the pursuit of a fiscal design to boost telecommunications and particularly broadband access as a driving force of economic and social development, while covering its revenue needs in the face of a high fiscal deficit.

Under these circumstances, this research also aims to highlight the importance of assessing the potential impact of modifying the taxes that burden Broadband Internet service. To that end, the authors performed a comparative analysis of the implications on the demand for fixed BB Internet and the fiscal revenue derived from the consumption of this service under potential tax treatments in Costa Rica within the 2014-2021 period.

It is important to mention that this study carries out an illustrative exercise of the complexities associated with modifying the tax burden. The results must not be considered as a forecast of future behavior. In particular, it must be considered that this research is limited to observing the possible variations in the collection of tax revenue originating from sales tax and income tax. It does not include the analysis of other taxes (social security contributions, fees, among others), nor a study of fiscal incidence or the effect of shifting from a sales tax to a value added tax. Thus, it is stressed that the results must be construed as an alert on the possible interactions that could arise from an amendment to the tax burden and its potential impact on the conditions under which users access broadband Internet.

This study is structured as follows. In the first chapter, Costa Rica is analyzed in the international context, in relation with the penetration of fixed broadband, prices associated with the service, and tax burden. Then, the study delves into the evolution of the telecommunications market in the country, placing special emphasis on the fixed broadband service in the penetration, prices, income and fiscal aspects thereof. The third chapter contains an analysis of the implications on the demand for and tax revenue of the fixed broadband service under potential tax treatments. The final chapter contains the considerations derived from this study.

[5] Value Added Tax and Income Tax Draft Bill (N° 19678 and 19679 for VAT and Income tax, respectively).

[6] Under the Costa Rican tax legislation in force it is known as General Sales Tax, which is proposed to be migrated into the Value Added Tax.

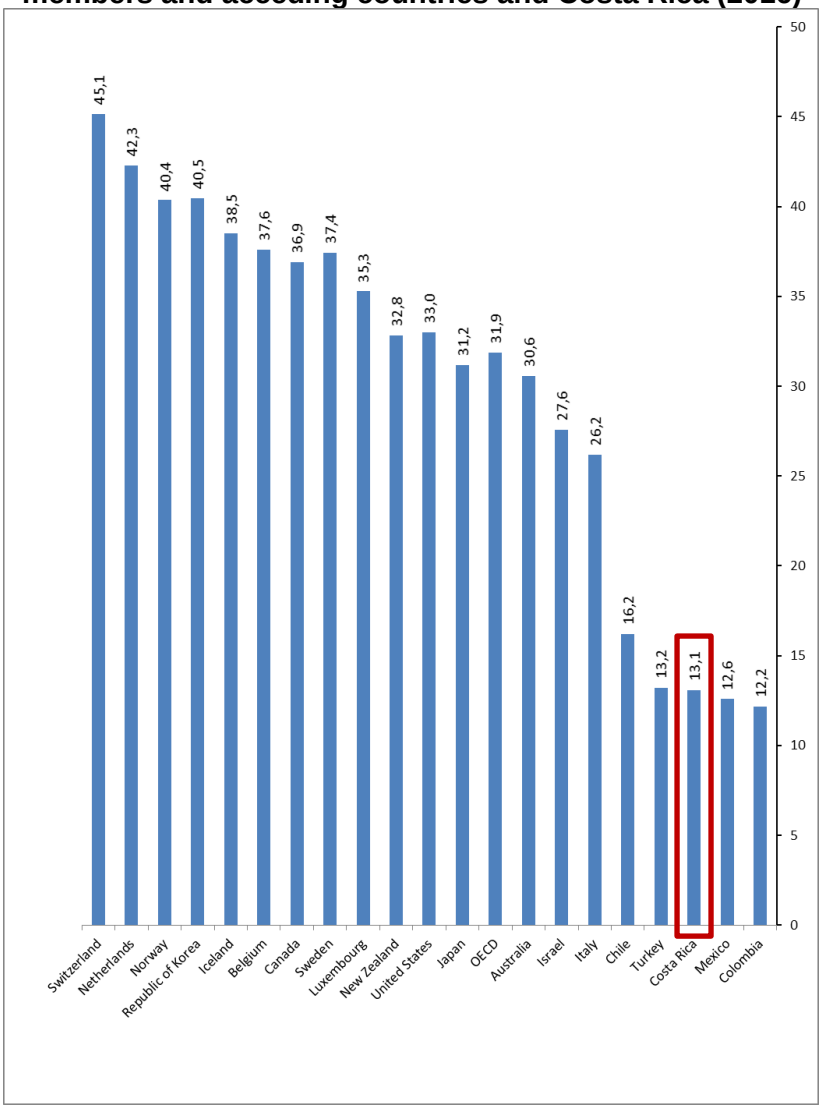
Costa Rica in the international context

When analyzing the implications of potential tax treatments on the demand for and revenue of the BB Internet service in the country, it is essential to consider the international context. For this study, the authors performed a comparative analysis between Costa Rica and OECD member countries and countries in the process of accession to the OECD (hereinafter called "OECD members and acceding countries"), in terms of fixed broadband penetration, price of the service, and consumption taxes.

As shown in Figure 2, Costa Rica holds the 35th place among the 37 countries analyzed for fixed broad band penetration, only outdoing Mexico and Colombia, which stand in the two bottom positions, respectively. Furthermore, one must emphasize that the average number of subscribers per 100 inhabitants of OECD member countries (31.9) is almost three times as many as in Costa Rica (13.1).

Finally, it is noticeable that a large gap (13.7 percentage points) exists between the 17 countries with a penetration greater than the Organization's mean, which have an average of 38 subscribers per 100 inhabitants, and the 20 countries below the mean, which have an average of 24 users per 100 inhabitants.

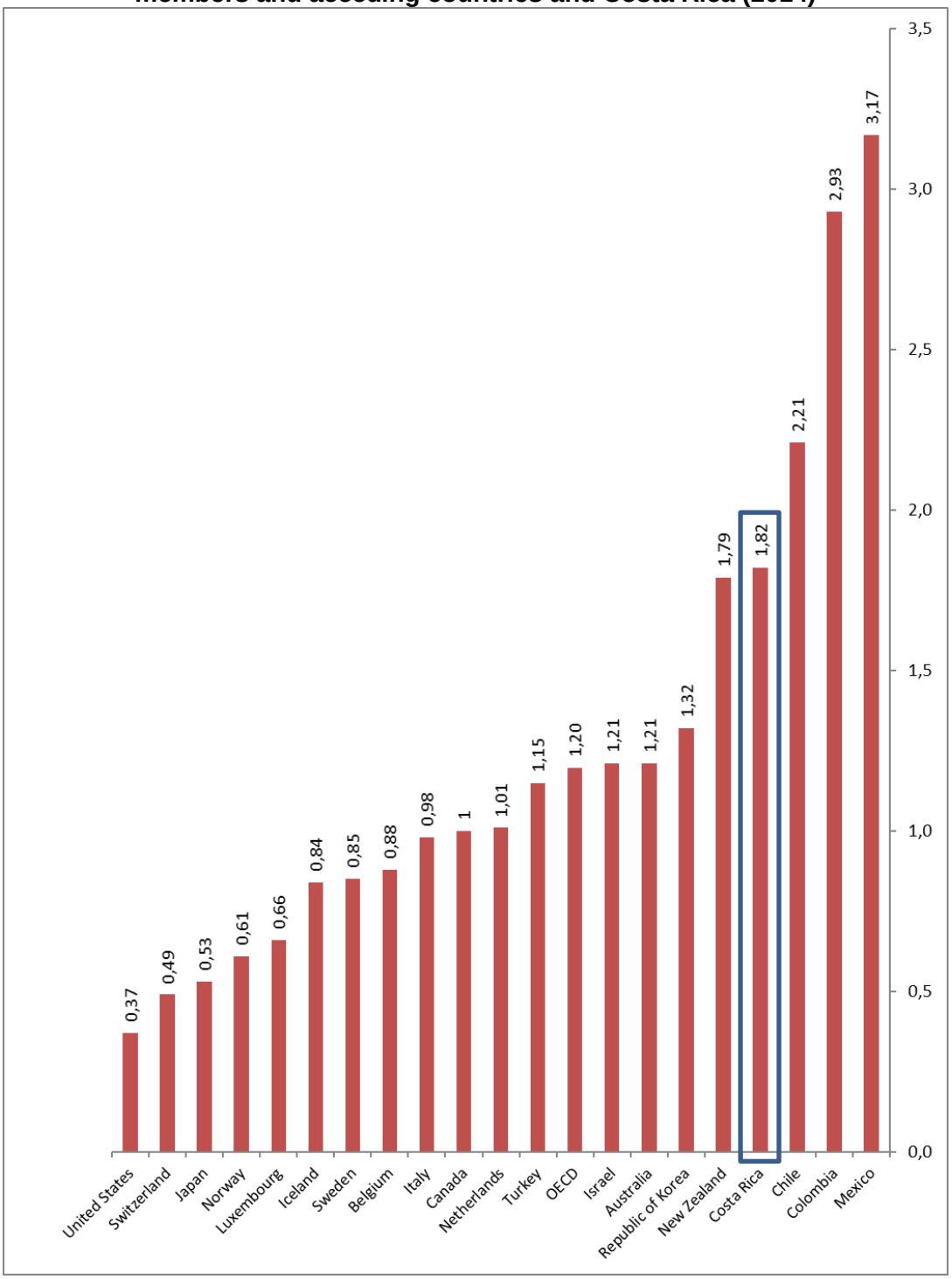
Figure 2. Subscribers to the fixed broadband service per 100 inhabitants in OECD members and acceding countries and Costa Rica (2016)



Source: Compiled by authors with data from ITU (2017).

In terms of fixed BB price, the country holds the 33rd position among the 37 countries analyzed (Figure 3), a very similar position to the one held in service penetration. Internet prices in the Costa Rican market, adjusted to GDP per capita (1.82), are much higher than the OECD mean (1.20). Another matter to be noted is the asymmetry of prices as they go from 0.37 in the United States to 3.17 in Mexico, showing significant variability when compared to the 0.60 mean.

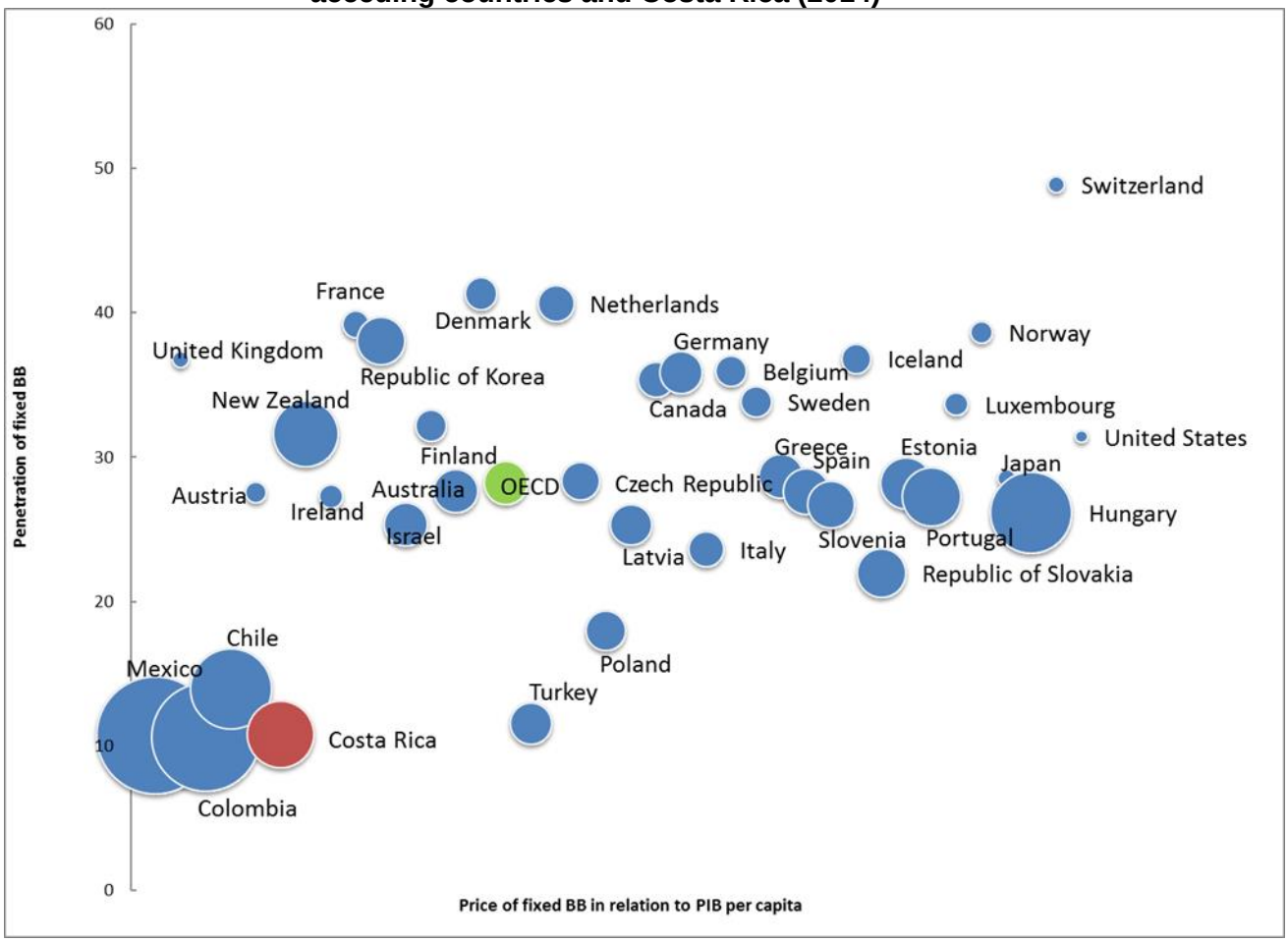
Figure 3. Price of the fixed broadband service in relation to GDP per capita in OECD members and acceding countries and Costa Rica (2014)



Source: Compiled by authors with data from the OECD (2015) and Sutel (2015).

The following figure shows the relationship between the price of fixed BB and its penetration. The left axis represents the penetration level, while the size of the circles reflects the price of the service in relation to GDP per capita. As evidenced below, in countries with higher penetration levels like Switzerland, the United Kingdom and Norway, the cost of fixed BB adjusted by GDP per capita is low.

Figure 4. Relationship between subscribers to the fixed broadband service per 100 inhabitants and the price of the fixed broadband service in OECD members and acceding countries and Costa Rica (2014)



Source: Compiled by authors with data from the OECD (2015) and Sutel (2015).

As stated above, another variable of interest are consumption taxes. Contextualizing the case of Costa Rica both at a general level and in terms of the service under study. Table 1 shows that differential rates are imposed on Broadband Internet in relation to other countries.

Table 1. Global value added taxes and value added taxes applicable to the fixed BB service in OECD members and acceding countries and Costa Rica (2014)

Country	Value Added Tax	Value Added Tax to Broadband
Australia	10%	10%
Belgium	21%	0%
Canada	10%	10%
Chile	19%	19%
Colombia	16%	16%
United States	1%	1%
Iceland	26%	26%
Israel	18%	18%
Italy	18%	18%
Japan	5%	5%
Luxembourg	5%	5%
Mexico	16%	16%
Norway	25%	25%
New Zealand	15%	15%
OECD	25%	25%
Netherlands	13%	34%
Republic of Korea	10%	10%
Sweden	25%	25%
Switzerland	8%	8%
Turkey	23%	38%

Source: Compiled by authors with data from the OECD (2015) and the Ministry of Finance (2015).

The table above shows that in almost every one of the 19 countries the tax burden in terms of consumption taxes in the economy coincides with the fact that it is imposed on the fixed BB service.

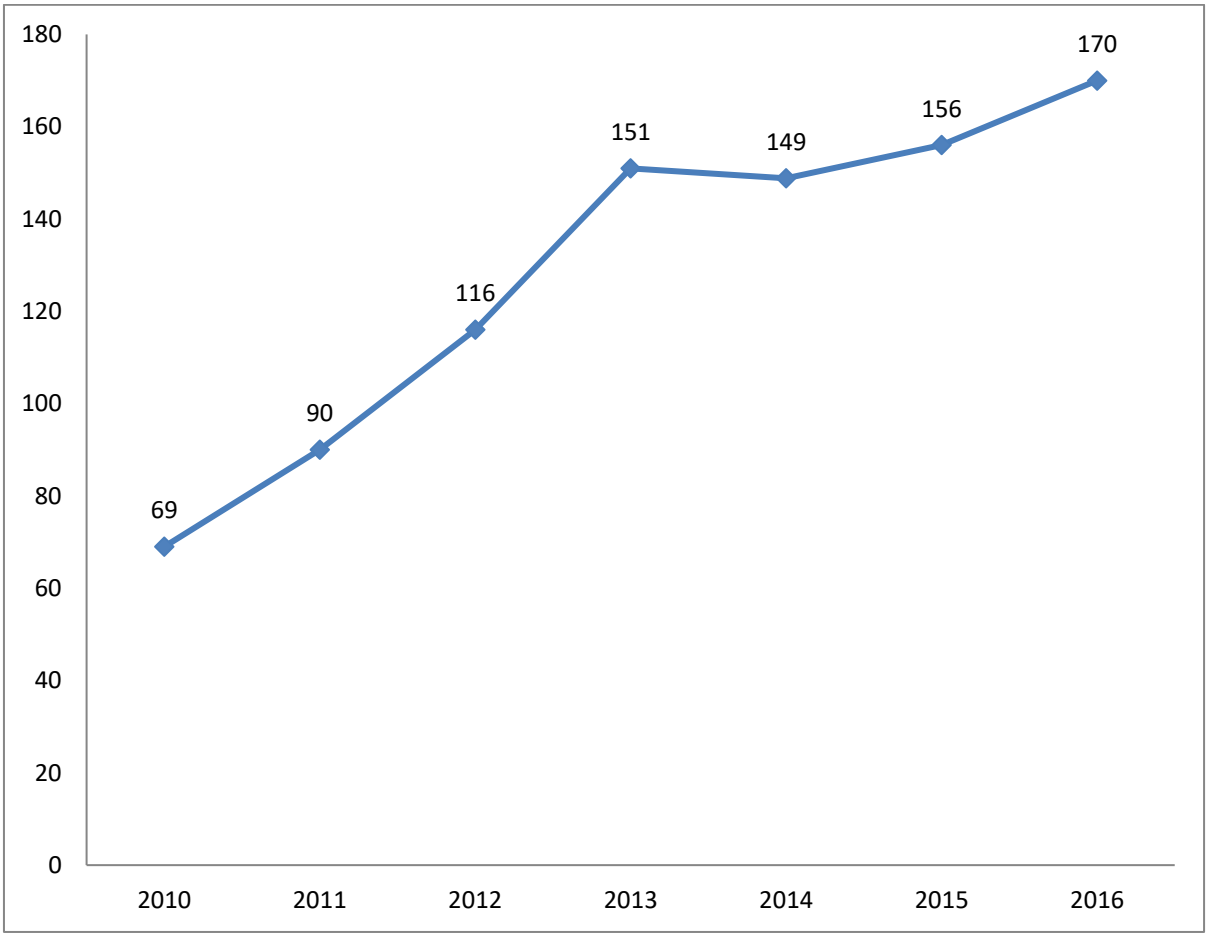
United States is an exceptional case where, with the passing of the Internet Tax Freedom Act, a moratorium is established to prevent states and local governments from taxing Internet access, thus being the country with the lowest consumption tax burden for the BB Internet service.

The Costa Rican context

This section provides an overview of the evolution of the Costa Rican telecommunications sector, emphasizing the fixed broadband Internet service with regard to penetration, price, income and revenue generated by its consumption.

With the opening of the telecommunications market in the year 2008, the sector has undergone significant growth that is reflected in statistics. The first evidence of its evolution is the increase in the penetration of mobile telephony. The country went from having 69 subscribers per 100 inhabitants in 2010 to 170 in 2016, representing a 146% increase during that period (Figure 5).

Figure 5. Mobile telephony subscriptions per 100 inhabitants in Costa Rica (2010-2016)

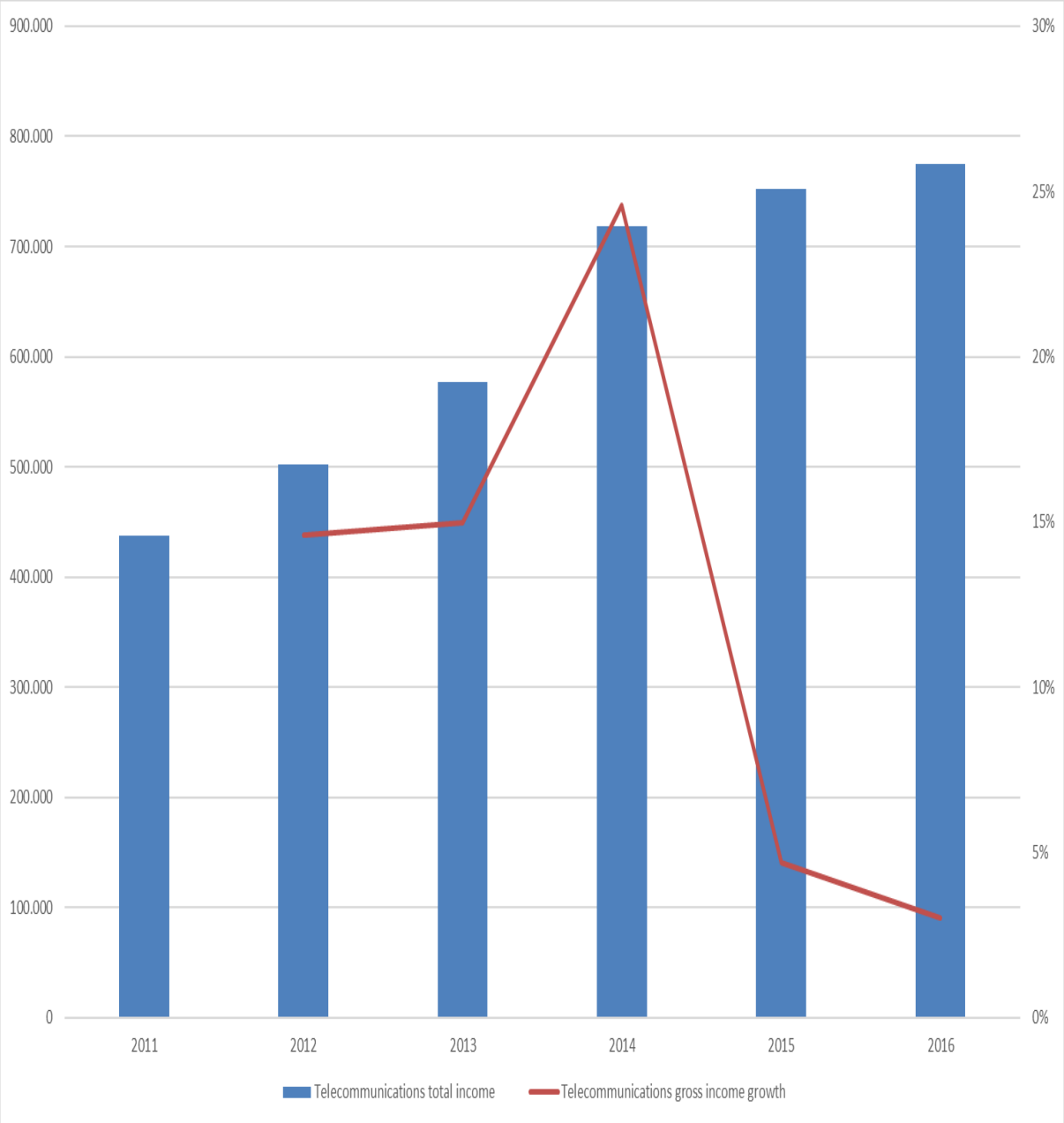


Source: Compiled by authors with data from Sutel (several years).

The growth undergone by the sector has been reflected in its total income, which, between 2011 and 2016, experienced a 77% increase. Even when the pace of growth slowed down in 2015 and 2016, it continued its consolidation, representing 3.02% of the national production in the year 2016.

This result has led to recognizing the sector as one of the most dynamic ones in the economy, because of its accomplishments, its productive linkages, and growth expectations (Chaverri, 2014), as well as its ability to drive both direct and indirect employment (Sánchez, 2014).

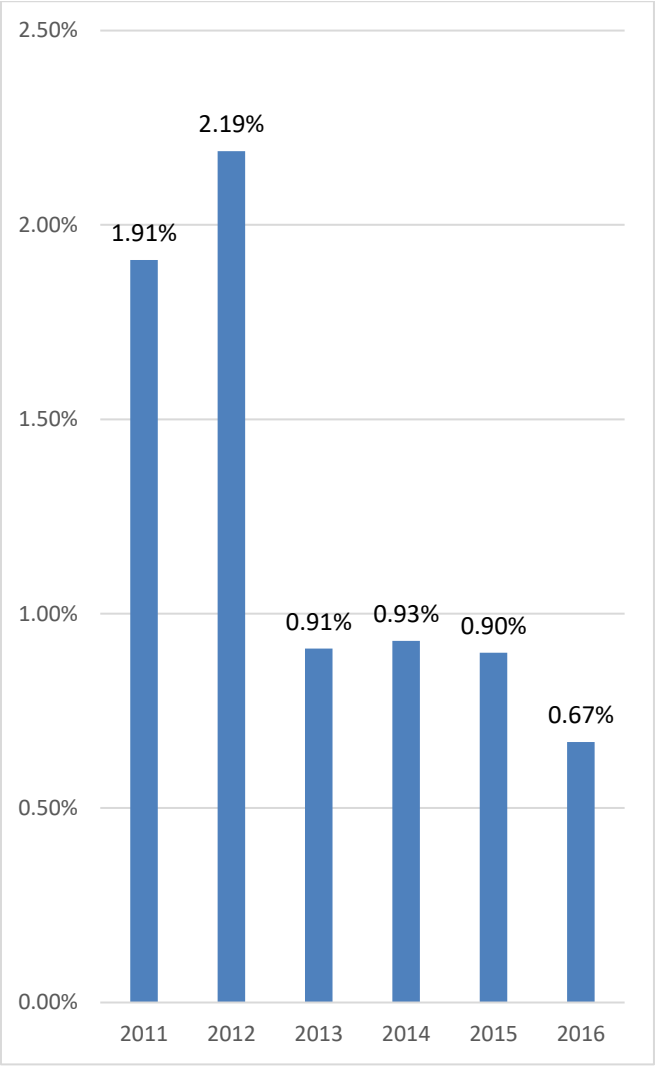
Figure 6. Telecommunications sector total income (millions of colones, 2011-2016)



Source: Compiled by authors with data from Sutel (several years).

Furthermore, the sector's average annual investment in relation to GDP between 2011 and 2016 was 1.25%. Investment levels in the years 2011 and 2012 (1.9% and 2.2% respectively) stand out as a result of mobile operators accessing the market. However, this indicator has high growth potential, as there is a recognized need for greater investment in infrastructure to achieve a broader coverage and better quality of telecommunications services in the country, with special emphasis on the Broadband Internet service.

Figure 7. Telecommunications sector investment in relation to GDP in Costa Rica (percentage, 2011-2016)



Source: Compiled by authors with data from Sutel (several years).

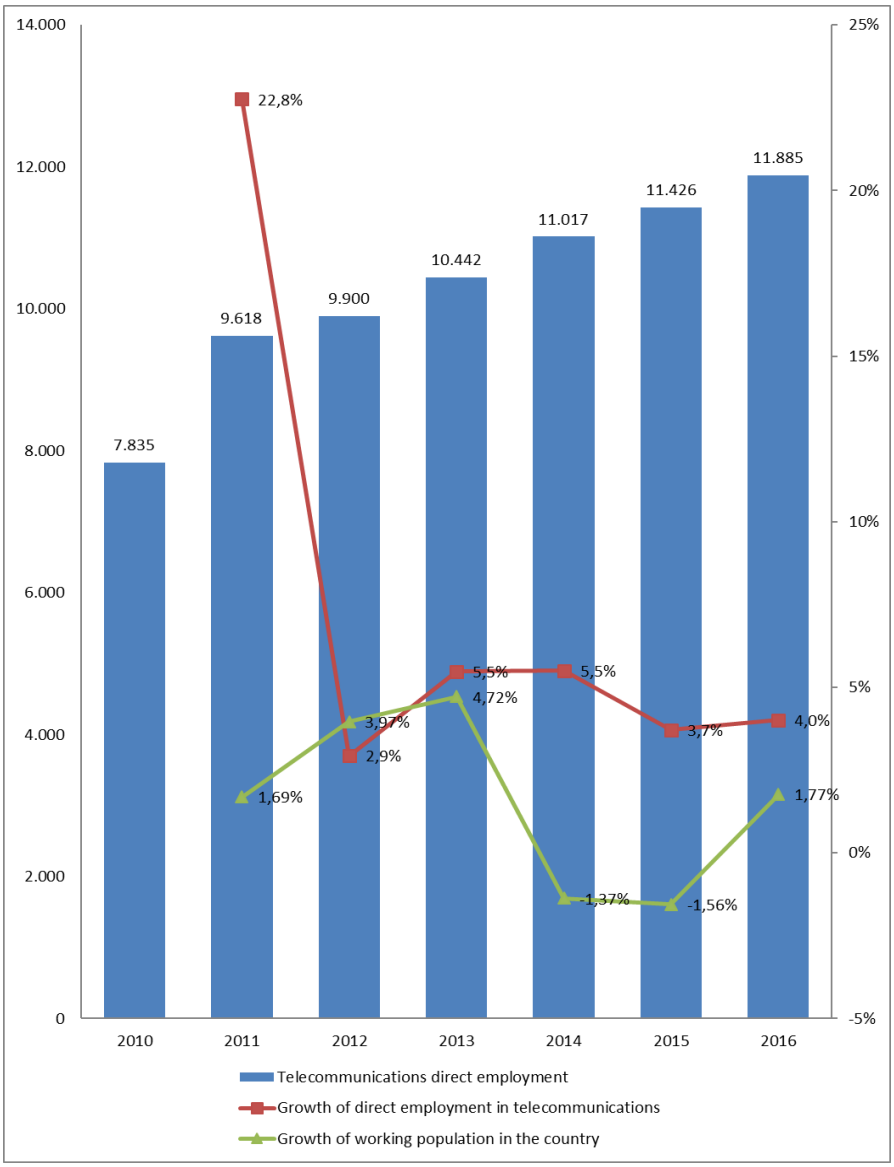
An example of the expected investment in terms of infrastructure is the use of the National Telecommunications Fund (Fonatel) resources. According to data from Sutel[7], by the first semester of 2017, this fund held 169,127 million colones.[8]

[7]Sutel (several years).

[8] The name of Costa Rica´s currency is “colones”. The Exchange rate as of 2018/8/14 is 570.22 colones per US dollar.

With regard to employment generation, the sector went from employing 7,835 workers in 2010 to 11,885 in 2016, as shown in the figure below. Only between 2010 and 2011, the labor force employed in Telecommunications increased by 22.8%. Since then, interannual growth has been 4.5%. It is worth comparing this result with the local situation in the country, where according to data from the Continuous Employment Survey (ECE)[9], the growth of the working population has been barely 0.85% between 2010 and 2016, even decreasing in the years 2013 to 2014 and 2014 to 2015 by -1.4% and -1.6% respectively, while the sector experienced a 5.5% and 3.7% increase, respectively.

Figure 8. Direct employment generated by the telecommunications sector, working population interannual growth rate, and direct employment generated by the telecommunications sector growth rate (number of workers and percentages, 2010-2016)

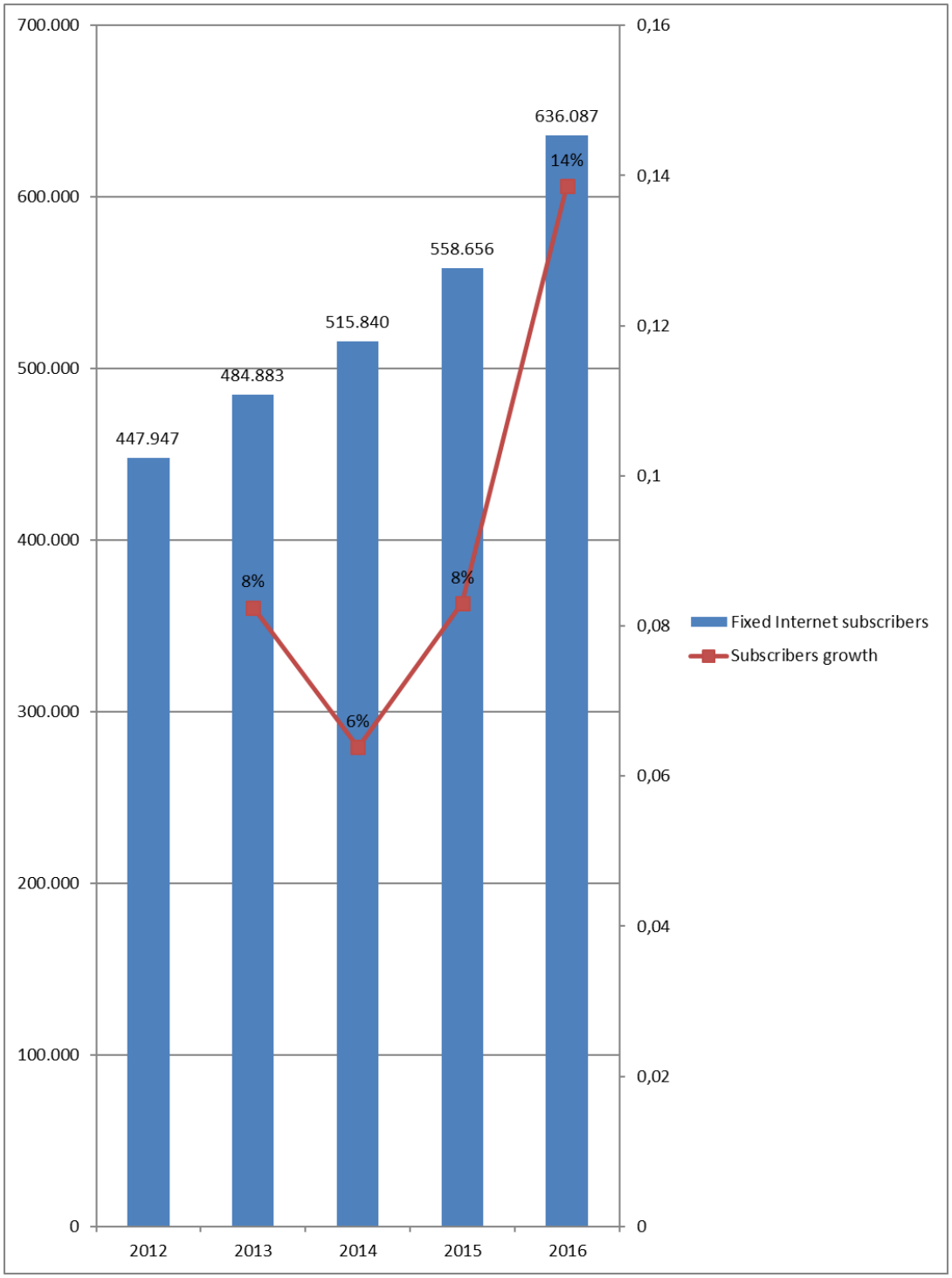


Source: Compiled by authors with data from Sutel (several years) and BCCR (2017).

[9] INEC (2015).

In terms of fixed Internet, in the year 2012, Costa Rica had 447,947 service subscribers, representing a penetration of 9.6 subscriptions per 100 inhabitants. By 2016, the number of service subscribers amounted to 636,087 (penetration of 13 subscriptions per 100 inhabitants). Thus, the average interannual growth in that period was 9%.

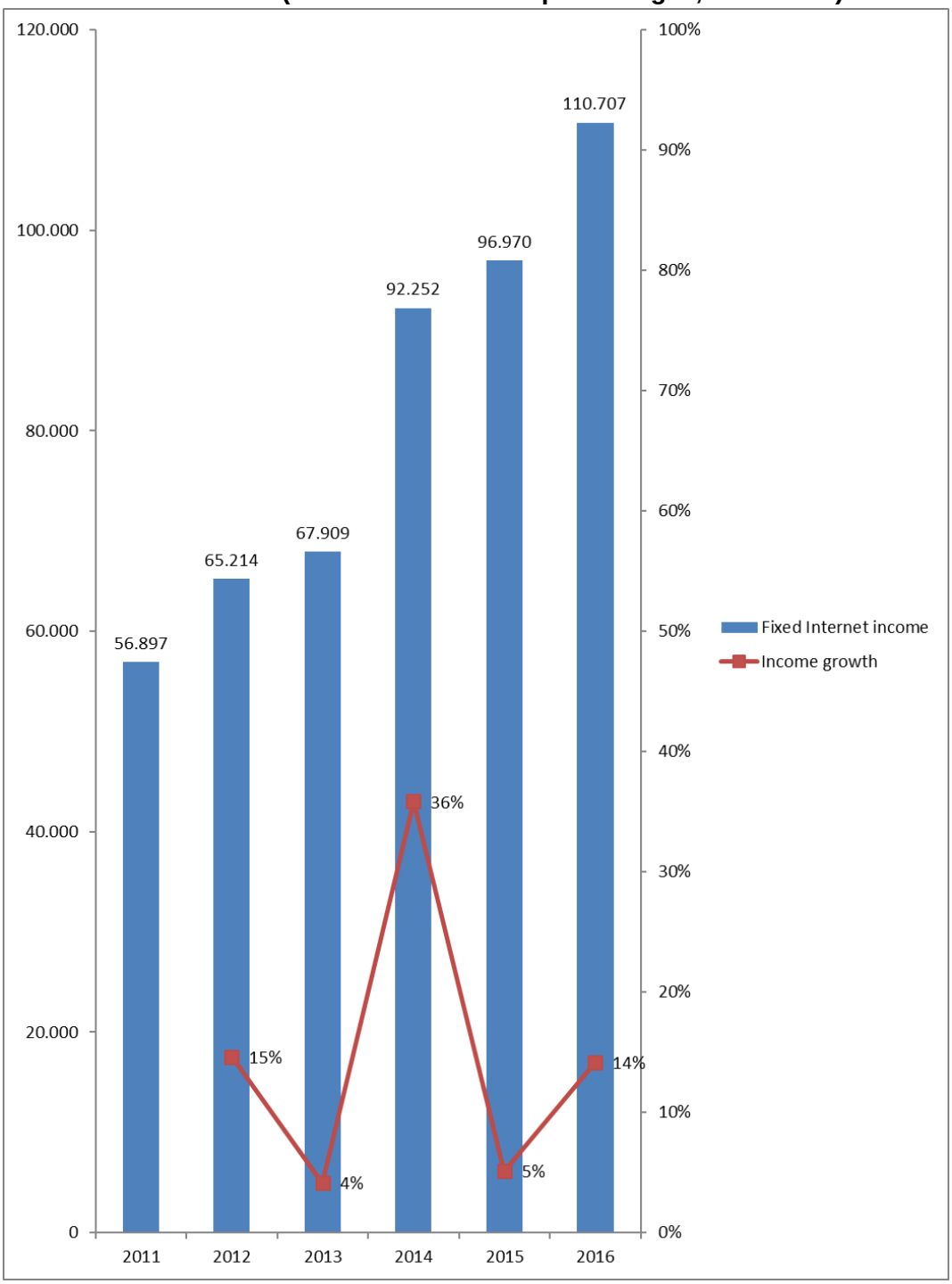
Figure 9. Total and interannual growth rate of fixed Internet subscribers in Costa Rica (number of subscribers and percentage, 2010-2016)



Source: Compiled by authors with data from Sutel (several years).

The income generated by fixed Internet consumption reached 56,897 million colones in 2011, while in 2016 it nearly doubled to 101,107 million colones (95% growth), as shown in Figure 10. This increase caused the service income to amount to around 14% of the total income of the telecommunications sector in 2016.

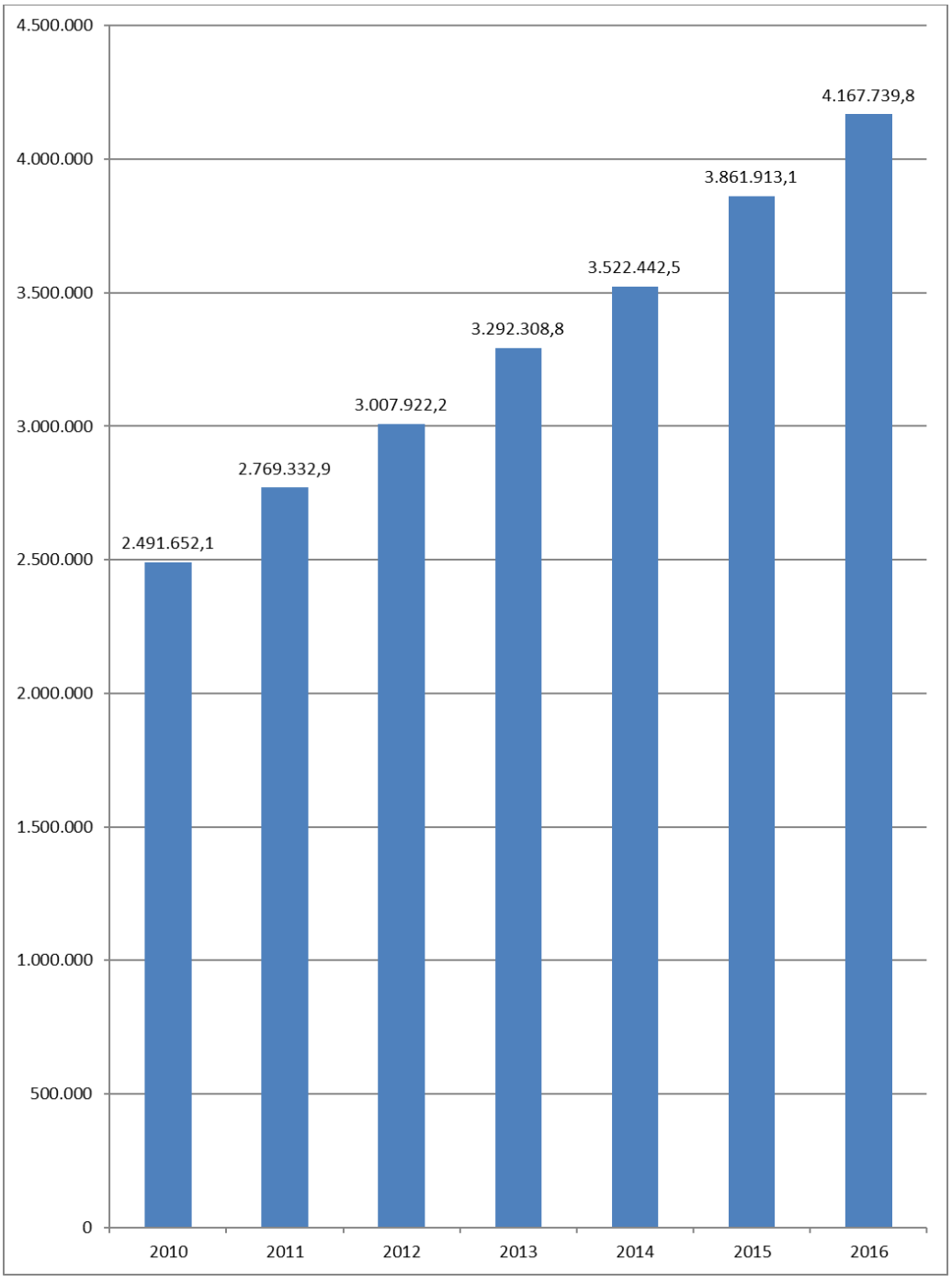
Figure 10. Total and growth rate of the income generated by the fixed Internet service in Costa Rica (million colones and percentages, 2011-2016)



Note:The data for 2011 and 2012 are estimates based on the assumption that the tax corresponds to 13% of the total income of the telecommunications sector.
Source: Compiled by authors with data from Sutel (several years).

One variable that is strictly linked to income is tax revenue. According to data obtained from the Ministry of Finance, in 2016 the two taxes representing a bigger contribution to tax revenue were the sales tax and the income and profit tax[10], both by 35%.[11]

Figure 11. Total tax revenue in Costa Rica (million colones, 2010-2016)



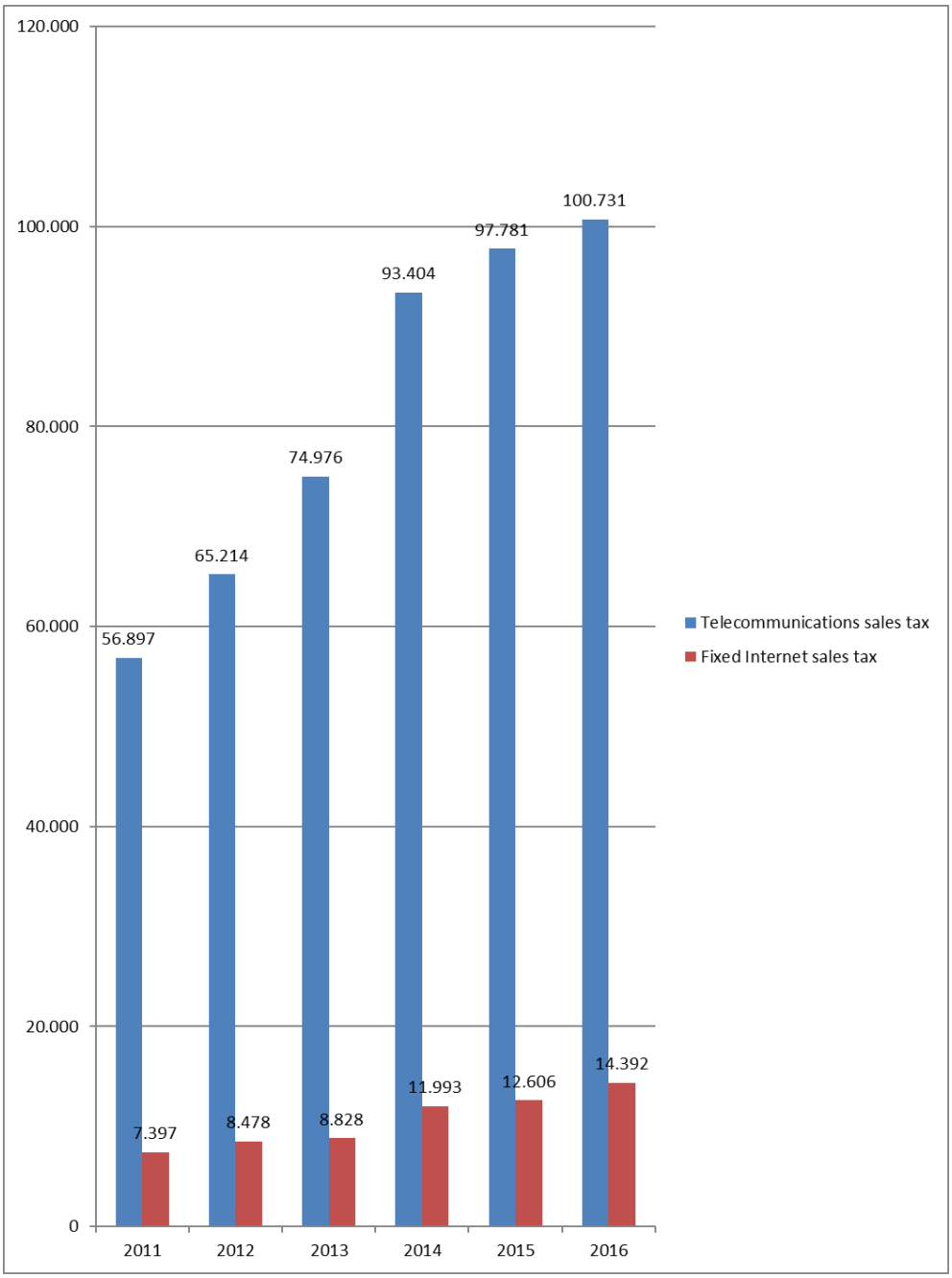
Note: Accumulated tax revenue as of December.
Source: Compiled by authors with data from the Ministry of Finance (2017).

[10] The terms income and profit tax and income tax are used with the same meaning indistinctly.

[11] Source: Ministry of Finance (2017).

According to an estimation based on the gross revenue of the telecommunications sector, Figure 12 shows tax revenues from sales taxes in telecommunication services and, particularly, in the fixed Internet service.

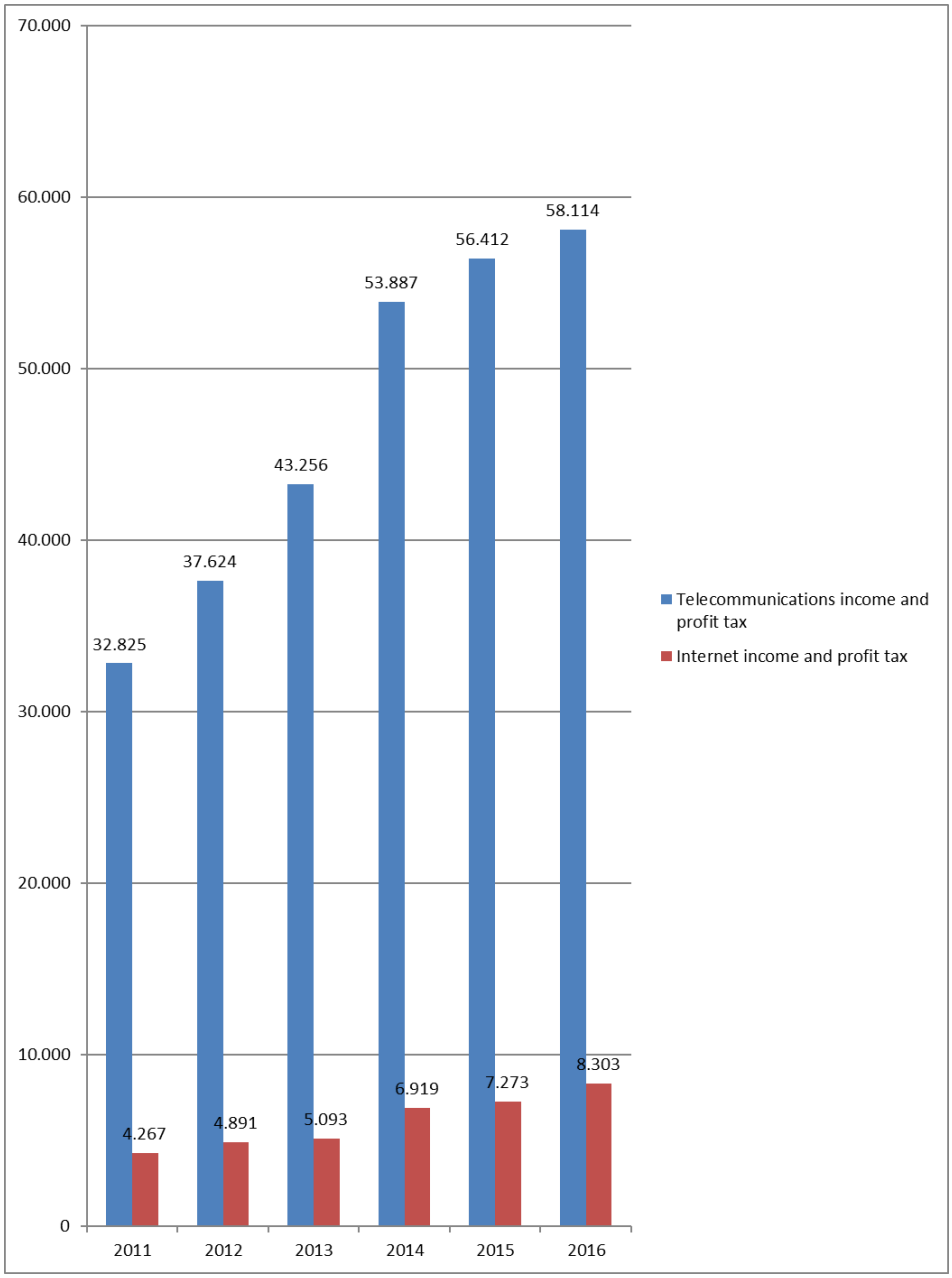
Figure 12. Total tax revenue from sales tax generated by the telecommunications sector and the fixed Internet service (million colones, 2011-2016)



Note: The sales tax is an approximation based on gross income.
Source: Compiled by authors with data from the Ministry of Finance (2017) and Sutel (several years).

As shown in Figure 13, the tax revenue generated by sales in the telecommunications sector has increased significantly, with an average interannual growth of 15% from 2011 to 2016; 2014 stands out due to its 33% increase. The same situation can be observed in the BB Internet service, which presents the same growth rates. Similarly, income tax revenue doubled during the period under study, being 2014 the year that presented the most significant growth.[12]

Figure 13. Total income and profit tax in the telecommunications sector and the Internet service in Costa Rica (million colones, 2011-2016)



Note: A net income of 25% of the gross income and an income and profit tax of 7.5% are assumed.
Source: Compiled by authors with data from the Ministry of Finance (2015) and Sutel (several years).

[12] It is assumed that the taxable net income is 25% of the gross income, obtaining the same revenue ratio both for the sector and for the fixed Internet service.

Results

On the basis of the information collected in the previous chapters, this section presents an analysis of the demand and revenue in fixed Broadband Internet service under three possible fiscal scenarios for 2014 and 2017:[13]

- Base scenario: Maintain the present general sales tax (GST) at 13%.
- Scenario 1: Raise the general sales tax (GST) to 15%.[14]
- Scenario 2: Exempt the service from general sales tax.[15]

Furthermore, two estimates of the possible change in the demand are made, based on the price elasticities proposed by Galperin and Rozier (2011).

- Estimate 1: The behavior of fixed Internet demand is similar to the broadband demand in Latin American countries, which have a price elasticity demand of -1.88.
- Estimate 2: The behavior of fixed Internet demand is similar to broadband demand in OECD countries, which have a price elasticity of demand of -0.53.

[13] The methodology used for the calculation is described in the annex.

[14] This scenario is defined in accordance with the fiscal reform proposed by the Government of Costa Rica, which proposes the transformation of the GST into VAT. However, for comparison purposes, the analysis is performed in relation to GST.

[15] The second scenario stands on the grounds of international initiatives such as the Internet Tax Freedom Act of the United States as well as on national discussions on the matter, where it is proposed to exempt the Internet service from sales tax.

Demand Analysis

Due to the lack of necessary data to calculate the impact of a variation in the GST on the demand for the service, the study uses international estimates which show the impact of a change in the penetration of 2Mb fixed Internet when the price change.

The results show how raising Internet consumption taxes may be linked to a decrease in the number of subscribers with broadband access. The following table shows that the resulting change could range from around 6,000 to more than 21,000 subscribers, in connection with a reduction in the contracting of fixed Internet services within a range from -0.1 to -0.4 percentage points.

Table 2. Change in the number of subscribers under the defined scenarios (2016)

	Scenario 1 (15% GST)		Base Scenario (13% GST)		Scenario 2 (0% GST)	
	Total change	Percentage change	Total change	Percentage change	Total change	Percentage change
Estimate 1 (LATAM)	-21,165	-3%	-	-	137,575	22%
Estimate 2 (OECD)	-5,967	-1%	-	-	38,784	6%

Source: Compiled by authors.

Contrary to the above, a reduction in the tax rate of the service could be associated with an increase in the number of subscribers with Internet access. Under these assumptions, the total exemption of fixed BB from GST could expect an approximate 39,000 to 137,000 subscribers to access the service; an increase in subscribers that would range between 0.7 and 2.1 percentage points.

Based on 2016 data, a prospective analysis estimating the possible implications of these fiscal scenarios on the demand for the service as at 2021 was conducted. For that purpose, in accordance with international trends and the evolution evidenced by the price of the Internet in Costa Rica in recent years, the assumption is that the price of BB will undergo a 5% reduction, which could generate an increase in the demand for the service.

Table 3. Estimation of the change in the number of subscribers under the defined scenarios by 2021 in relation to 2016

	Scenario 1 (15% GST)		Base Scenario (13% GST)		Scenario 2 (0% GST)	
	Total change	Percentage change	Total change	Percentage change	Total change	Percentage change
Estimate 1 (LATAM)	39,331	6%	59,792	9%	227,122	36%
Estimate 2 (OECD)	10,945	2%	16,856	3%	58,006	9%

Note: For the base scenario a 5% decrease is assumed in the price in relation to 2016.
Source: Compiled by authors.

As shown above, the exercise assumes a 5% reduction in the price of the service between 2016 and 2021, which would lead to an increase in the number of subscribers with Internet access that would range from 3% to 9% under the base scenario (between 17,000 and 60,000 subscribers).

Modifying the GST to a 15% rate could result in a smaller increase in the number of subscribers with Internet access, by 10,000 to 40,000 subscribers. This result represents an increase in comparison with 2016 in a range from 2% to 6% in the number of subscribers with the service. On the other end, the results of the exercise show how a sales tax exemption for broadband would result in approximately 59,000 to 227,000 additional subscribers being able to access BB Internet compared with 2016, which relates to a possible increase in the number of subscribers with the service ranging between 9% and 36%.

Although the purpose sought with the proposed scenarios is to portray the impact caused by a modification in the tax burden on the penetration of the Internet service, other effects should be considered when proposing a modification to the taxes charged on the service.

Tax Revenue Analysis

Once estimate broadband Internet consumption based on GST scenarios, some implications are proposed for their consideration regarding tax revenues. The analysis is carried out solely on the basis of the income and profit tax and the general sales tax, which together accounted for 68% of Costa Rican tax revenues in the year 2016 (Ministry of Finance, 2017).

To that end, it must be noted that they both have direct and indirect effects on tax revenue. As a result of a higher consumption in the service, tax revenues increase. In terms of the indirect effect, empirical evidence shows that an increased broadband penetration is associated with GDP growth, which consequently results in increased revenue. Due to the lack of certain data that would allow to estimate the change in GDP when modifying the GST applied to the service, the study uses of international estimations for its calculation. Thus, under the assumption that the relationship between national revenues originating from both taxes in relation to GDP remains the same, the implications on tax revenues under the different proposed scenarios may be estimated. According to data from the Ministry of Finance, in 2017 the tax revenue generated from sales tax in relation to GDP was 4.45%, in contrast with the 4.78% generated by income and profit tax.

To estimate the results, the study employs data from Qiang, Rossotto and Kimura (2009), who estimate the impact of a change in the penetration of Broadband Internet on economic growth. The authors estimate that, in lower-income countries, a 10% increase in Broadband Internet penetration is associated with a 1.38% increase in the GDP growth rate.

Table 4. Total estimated revenue from general sales tax and income and profit tax and revenues under the defined scenarios (million colones, 2016)

	Scenario 1 (15% GST)	Base Scenario (13% GST)	Scenario 2 (0% GST)
Estimate 1 (LATAM)	2,744,148	2,588,472	2,745,308
Estimate 2 (OECD)	2,744,259	2,588,472	2,744,586

Source: Compiled by authors.

The results show how an increase in the GST is not necessarily associated with an increased tax collection. Under the defined assumptions in this study, modifying the GST rate from 13% to 15% would result in a lower total revenue than a total exemption of the service (Table 4).

Under the Broadband Internet sales tax exemption scenario there is an increase in the income and sales tax collection by the Government. This finding is consistent with empirical evidence showing that a higher BB penetration is associated with an increase in production, which in this case is observed as an increase in the tax base and, therefore, in their collection.

Based on the results for 2016, a calculation is made to estimate the 2021 revenue, arriving at the same conclusions. In other words, an inverse relationship is observed between the Internet service GST rate and the fiscal revenue derived from income and

sales taxes. The results are shown in the following table:

Table 5. Total tax revenue from sales tax and income and profit tax and estimated revenues under the defined scenarios (million colones, 2021)

	Scenario 1 (15% GST)	Base Scenario (13% GST)	Scenario 2 (0% GST)
Estimate 1 (LATAM)	3,583,148	3,583,344	3,584,946
Estimate 2 (OECD)	3,582,876	3,582,933	3,583,326

Source: Compiled by authors.

As evidenced in Table 5, increasing the Internet consumption tax rate cause a slight decrease in revenues. If the service is completely exonerated, tax revenues from income and sales could increment.

In the exercise carried out, an inverse relationship can be observed between increasing the tax burden on the fixed Internet service and its revenue. This result is based on the role of the Broadband Internet service as a driving force of the economy.

Conclusion

Numerous studies have proven the relevance of broadband as a catalyst for development, with positive impact on economic growth and employment generation.

However, when compared with OECD members and acceding countries, Costa Rica has one of the lowest levels of fixed BB penetration, which could be because it is one of the countries with the most expensive service within the group.

The Costa Rican telecommunications sector has experienced great dynamism in recent years; presently certain services show a high growth potential.

Fixed BB stands out, with vast opportunities to improve its penetration level. The resources of the National Telecommunications Fund (FONATEL) seek to improve access for people in vulnerability conditions by investing in infrastructure.

Consequently, there is a recognized need for mechanisms that allow to promote Internet access among Costa Ricans as well as to identify actions hampering its progress. Several authors have pointed out that consumption taxes discourage broadband penetration by increasing the price of the service, identifying an inverse relationship between both variables.

This study evidences how raising the General Sales Tax on the Internet service in Costa Rica could cause a decrease in the penetration of fixed BB. Additionally, different scenarios are presented which show the reduction in sales tax could result in an increase in tax revenues relating to income and sales taxes in Costa Rica, mostly due to the potential indirect impact of BB penetration on the economy.

When analyzing a modification in the country that directly impacts individual consumption decisions, like imposing consumption taxes on broadband Internet, the potential direct and indirect impacts that the reform could have on the economy must be taken into consideration.

In terms of direct impact, it is important to consider who will bear most of the burden of the new taxes, the sensitivity of market participants with regard to the new scenario, and the possible changes in the penetration of the service in order to have a better assessment of the possible impact on tax revenue.

While in terms of indirect impact, it is important to consider the possible impact on the production and employment level which, in turn, may impact tax revenues for the government in other sectors.

National and international agencies have stressed the need to adopt measures to overcome fiscal deficit and improve public finances. Recently, OECD has emphasized the importance of eliminating tax exemptions and increasing the tax base.

This study agrees with the need to improve the fiscal situation in Costa Rica and does not seek to discourage any measures along those lines. Likewise, it does not intend to make any recommendations on the fiscal treatment that the service under analysis shall have in the end. The study merely highlights the importance of protecting people's right to access information, and to ensure the affordability of the service to all citizens, regardless of their income.

To sum up, it is important to note that the fourth industrial revolution is supported on the fundamental axis of access to

information, being Broadband Internet access the main means to achieve this. In this context, public policies must strengthen their commitment with the adoption of measures that allow the democratization of the access and usage of this service among citizens, regardless of their economic situation.

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Annex

Estimation Methodology

The estimation of the results presented in this study are based on the concept of price elasticity of the demand for the good *i* (ε_i), which is defined as the percentage change in the demanded amount of the good *i* ($\Delta\%Q_i$) in view of a percentage change in the price of that good ($\Delta\%P_i$). Thus:

$$\varepsilon_i = \frac{\Delta\%Q_i}{\Delta\%P_i} = \frac{\frac{Q_{2i}-Q_{1i}}{Q_{1i}}}{\frac{P_{2i}-P_{1i}}{P_{1i}}} \qquad (1)$$

First, it is worth noting that the authors do not have access to the necessary information or resources to estimate the price elasticity of demand for broadband Internet in Costa Rica. Therefore, they have used the results presented by Galperin and Rozier (2011), from which the following estimates are calculated:

- Estimate 1: The behavior of fixed Internet demand is similar to the broadband demand in Latin American countries, which have a price elasticity demand of -1.88.
- Estimate 2: The behavior of fixed Internet demand is similar to broadband demand in OECD countries, which have a price elasticity demand of -0.53.

Seeing that the study seeks to assess the potential impact of a fiscal reform, some fiscal reform projects previously presented and discussed in the Legislative Assembly in recent years have been used as references, resulting in the following scenarios:

- Base scenario: Maintain GST at 13%.
- Scenario 1: Raise GST to 15%.
- Scenario 2: Exempt the service from GST to 0%.

Based on the definition of price elasticity of demand, represented in equation (1), an exercise is conducted to identify the channels where the potential impact on total revenue could occur by modifying the GST on the fixed Internet service.

The study only discusses two ways in which the sector contributes to the public tax administration: the general sales tax and the income and profits tax.[16] It is assumed that the collection of these taxes in the sector behaves in accordance with the following equations:

$$R_{it}^{v} = Q_{it}(P_{it}(1 + t_{it}^{v})) \qquad (2)$$

$$R_{it}^{R} = U_{it}t_{it}^{r} \qquad (3)$$

Where Q_{it} and P_{it} are the quantity consumed and the selling price of good *i* at the time *t*, respectively, U_{it} is the net profit generated by industry *i* at the time *t*; t_{it}^{v} and t_{it}^{r} are the tax rates on sales and on income and profits, in good *i* industry at the time *t*. Therefore, R_{it}^{v} is the fiscal revenue generated by the application of the tax on the sales of good *i* at time *t*, while R_{it}^{R} is the revenue generated by applying an income and profit tax to the producers of good *i* at time *t*.

[16] No fees, social security contributions, parafiscal contributions, among others, are considered.

Considering the scenarios above, the price change is assumed to be due solely to a change in the GST, i.e. $\Delta P_{it} = \Delta t_{it}^{v}$.

On the basis of equation (1) and taking into account the results of Galperin and Rozier (2011), the estimations of the change in the demand for the service are calculated as per the following equation:

$$\Delta\%Q_i = \varepsilon_i * \Delta\%P_i \qquad (4)$$

Based on the above, ΔQ_i is estimated to represent the change in the penetration of the fixed Internet service.

The impact on total revenue

Based on the results obtained from equation (4), the authors apply the estimations by Qiang, Rossoto and Kimura (2009), who state that a 10% change in the penetration of the Internet service modifies the Gross Domestic Product (GDP) by 1.38% in lower and middle-income economies, as defined below:

$$\Delta\%PIB = \theta_i * \Delta\%Q_i \qquad (5)$$

Where θ_i is the impact on growth caused by a change in the penetration of service *i*.

To define the change in the country's total revenue, it is assumed that the relationship between the revenue generated by each tax and the GDP is maintained under the three proposed scenarios. Furthermore, it is assumed that the same proportion is kept by 2021.[17]

According to the data of the Technical Secretariat of the Budget Authority of the Ministry of Finance, in 2017 the total revenue collected through GST amounted to 4.45% of GDP, while the total revenue relating to income and profit tax was 4.78% (Ministry of Finance, 2017).

Therefore, the change in the estimated total revenue is calculated as follows:

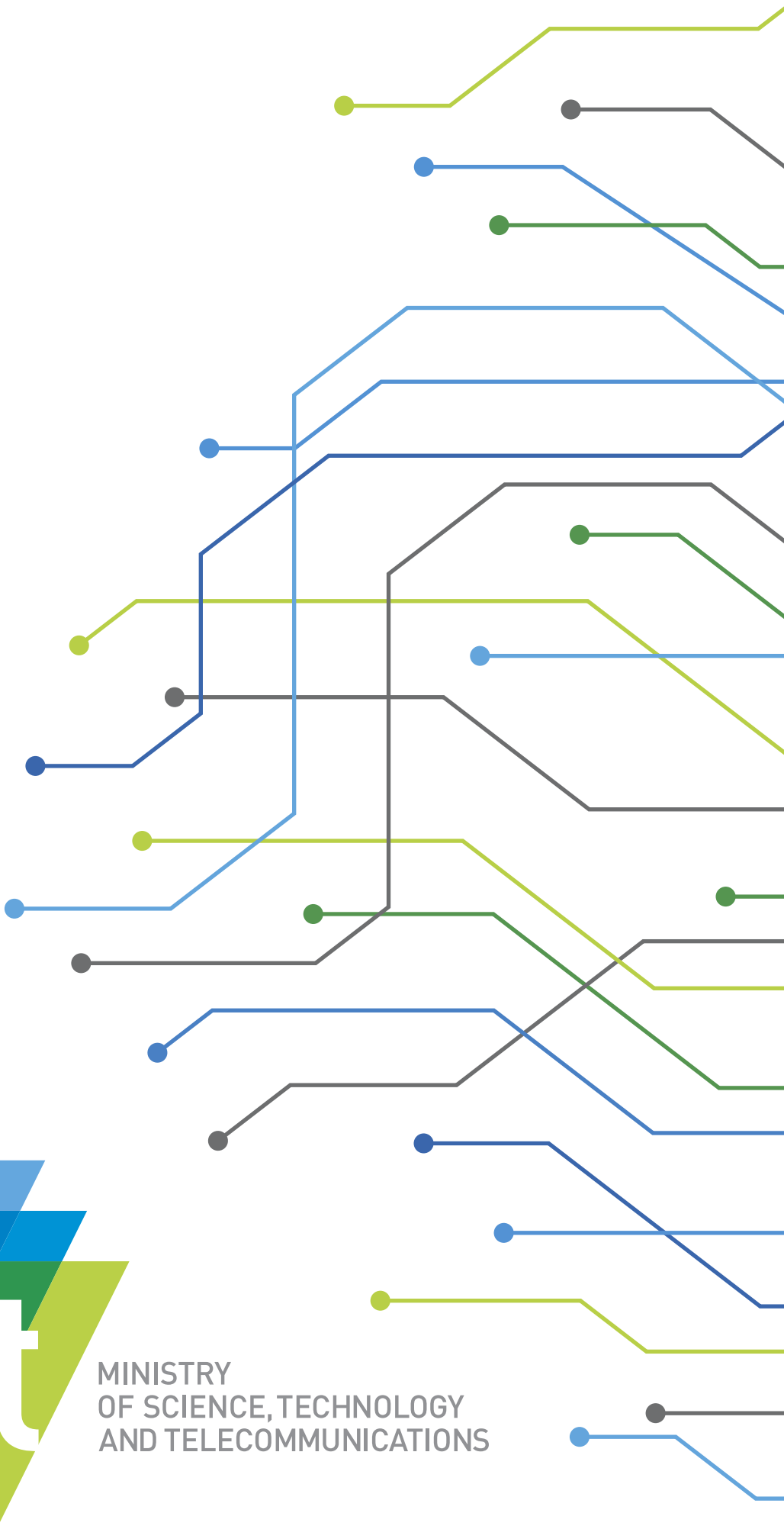
$$\Delta R_T^{v} = \left(\frac{RT_t^{v}}{PIB_t}\right)\Delta PIB \qquad (6)$$

$$\Delta R_T^{R} = \left(\frac{RT_t^{R}}{PIB_t}\right)\Delta PIB \qquad (7)$$

$$\Delta RT_t = \Delta R_T^{v} + \Delta R_T^{R} \qquad (8)$$

The change in total revenue (ΔRT_t) is calculated by adding the total revenue changes relating to GST at the time *t* (ΔR_T^{v}) and on the revenue from the income and profit tax at the time *t* (ΔR_T^{v}).

[17] The estimation was made using the average proportion of the last ten years without showing significant differences in the results.



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