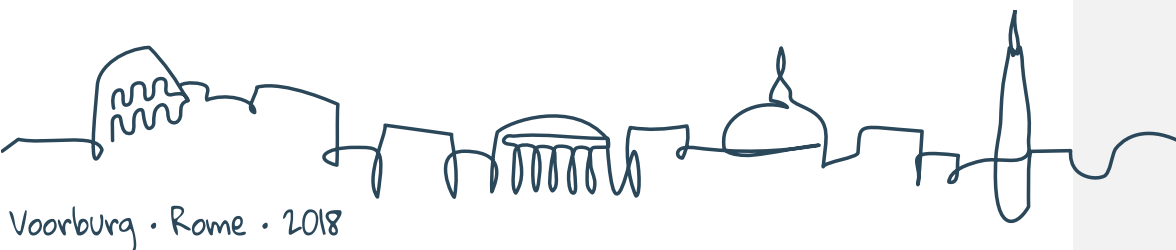


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Revisited sector paper Telecommunication ISIC J 61

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Introduction

The telecommunication service branch has been the subject of Voorburg Group meetings with mini presentations in 2008 and a resulting sector paper for the 2009 meeting in Oslo written by Benjamin Camus from INSEE. In 2012, an updated sector paper was presented by Aspasia Papa and Liam Murray from the Office of National Statistics (UK) in order to show changes in this rapidly changing service industry.

According to the revision of the Content Development Framework (CDF), accepted at the 2016 meeting in Zagreb, a new and extended CDF has been developed in order to provide additional information in the VBG papers to generate a much more comprehensive general reference document for all those who are interested in this statistical area.

This revisited sector paper is conjointly produced by the US, Germany, Hungary and Austria and serves several needs. First, it rearranges the above mentioned updated sector paper to accommodate the sections of the new CDF, which is the basis for this revisited sector paper. Because the paragraphs of the rearranged updated sector paper of 2012 have remained unchanged as long as the information is still valid and up to date, Aspasia and Liam will remain co-authors. Secondly, this revisited sector paper highlights changes and new developments in the telecommunication service branch, putting special emphasis on the mobile sector in order to sensitize statisticians to consider whether their statistics are still reflecting the rapidly changing characteristics of the branch.

1. Descriptions and characteristics of the industry

1.1 Definition of the Industry

Definition of the service

The definitions of the services in the telecommunication service branch are subject to constant changes over time due to technological progression and user needs. On the one hand, the services are theoretically well defined in the various classification systems which will be explained in the following classification chapter.

On the other hand, looking at various homepages of telecommunication service providers, one can find a wide variety of stand-alone services which could also be ordered in various combinations as bundled services as well. Besides the various plans consisting of rather normal services and bundled services of fixed/mobile line communication and internet services, more and more new services like cable tv, online tv, video on demand (VOD), music streaming, IT services (security as well as infrastructure) and cloud services (sometimes including office software) are offered by the providers.

The introduction and the continuous variation of such new services may make everyday life a little bit more comfortable for most of us, but not for statisticians that have to survey this rapidly changing services branch.

The classic definitions of the services provided can be found in the following chapter and in Annex 3 in a more detailed structure.

Classification issues

As a result of a lengthy harmonization process spanning several years, there is a great degree of consistency across the four main international industrial classifications ISIC (Rev.4), NACE (Rev. 2), NAICS (v. 2017) and ANZSIC (v.2006, Rev.1). However, unlike the industry classification comparison, product classifications are not harmonised to the same degree. Industry and products classifications are discussed in more detail in the sections below.

Industry classification

The most broadly used classifications are the International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4 and NACE Rev. 2. These classification systems used by EU countries for division 61 are identical. Under section "J" (Information and communication) in the hierarchy, the division 61 "Telecommunications" includes the activities of providing telecommunications and related service activities, i.e. transmitting voice, data, text, sound and video. The transmission facilities that carry out these activities may be based on a single technology or a combination of technologies. The commonality of activities classified in this division is the transmission of content, without being involved in its creation. The breakdown in this division is based on the type of infrastructure operated. In the case of transmission of television signals, this may include the bundling of complete programming

channels (produced in division 60) into programme packages for distribution.

As the networks of mobile and wired telecommunication are converging more and more, the owners of transmission facilities and infrastructure normally operate in several activity areas. They are classified according to the emphasis of their economic activity although “secondary” activities might be nearly as important as their “primary” activities.

According to the 2017 North American Industrial Classification System (NAICS) classification, the description of the 517 “Telecommunications” class is identical. The first two industry groups (wired and/or wireless or satellite) are comprised of establishments that operate transmission facilities and infrastructure that they own and/or lease, and provide telecommunication services using those facilities. The distinction among these industry groups is the type of infrastructure operated (i.e. wired/ wireless or satellite). The third industry group is comprised of establishments that provide support activities, telecommunications reselling services, or many of the same services provided by establishments in the first two industry groups, but do not operate as telecommunications carriers. Nevertheless, the classification of entities providing wired and wireless telecommunication services without operating the infrastructure is not quite clear. Establishments that resell the service without operating transmission facilities and infrastructure are classified in the third class. On the other hand, the classes of wired and wireless telecommunication activities both include operating and/or providing access to transmission facilities and infrastructure that they own and/or lease from owners and operators of networks and providing telecommunications services using this capacity to businesses and households. This implies that the statistician needs to distinguish between the activity of providing access and the activity of reselling.

Establishments primarily engaged as independent contractors in providing these services may be classified in other sectors (e.g. construction, administrative and support services, food service and drinking places) depending on the primary activity. NACE Rev 2 is the same as ISIC Rev.4 and NAICS (2017); however ANZSIC does not separate out satellite telecommunication activities from other telecommunication activities.

This table below provides a synopsis of the four main industrial classifications for Telecommunication services.

Table 1: Main industrial classifications for Telecommunication services

ISIC (Rev. 4)	NACE (Rev. 2)	NAICS (v. 2017)	ANZSIC (v. 2006/Rev. 1)	Class (Group)
6110	6110	5173	5801	Wired telecommunication activities
6120	6120	5173	5802	Wireless telecommunication activities
6130	6130	5174		Satellite telecommunication activities



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6190	6190	5179	5809	Other telecommunication activities
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Product Classification

Unlike the industry classification comparison, product classifications are not harmonised to the same degree. The Central Product Classification (CPC Rev. 2) is the main product classification system applicable for this industry and the relevant categories are namely:

- 841 "Telephony and other telecommunications services"
- 842 "Internet communication services"
- 8463 "Broadcasting, programming and programme distribution services"

Other groups in this division include on-line content, news agency services and library and archive services but they fall out of scope for the purpose of this paper. There are also 15 different subclasses for the telecommunications services with a breakdown according to technical criteria.

Another classification commonly used is the European Statistical Classification of Products by Activity (CPA 2008). There is a direct link between this classification of products and the NACE industry classification (the coding rules for the first four digits are the same as those for the NACE Rev. 2); and there are 24 CPA 2008 items for telecommunication services. The CPC Rev. 2 and the CPA 2008 are comparable, but CPA is more detailed. The 2007 North American Product Classification System (NAPCS) is complimentary to NAICS including more than 50 sub-items; however some of the items, such as installation of services for telecommunication networks and maintenance and repair services for telecommunication equipments, fall out of scope of this paper. Please see Appendix 3 for a more in-depth overview of product classification.

1.2 Market conditions and constraints

Importance of the industry

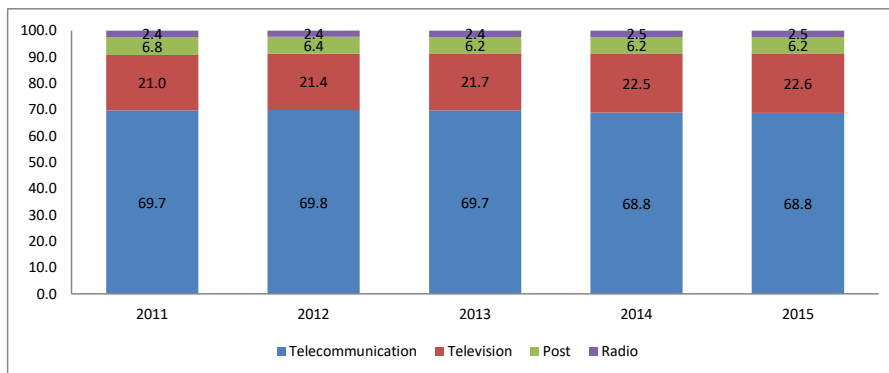
A strong case can be made that the telecommunication sector has been a major contributor to national economies. The Office for Communication (OfCom) reports that the revenue generated from telecommunication services continue to grow across 17 countries¹. Indeed, the revenue from telecommunication services stood at £864bn over the 17 countries involved in 2010 (*the latest year for which revenue data have been available for the updated sector paper in 2012*) and was 13.5% higher than the £762bn reported in the previous report in 2006. This section considers recent industry trends and market developments in the Telecommunication sector.

The telecommunications industries in the United States produce a significant amount of revenue. In 2015, wired telecommunications accounted for over \$300 billion USD and represented slightly over 1.1% of total gross output according to the national accounts. Wireless telecommunications accounted for over \$250 billion dollars and accounted for slightly under 1% of gross output for the United States in 2015.

At the same time, the telecommunication sector has experienced fast-paced changes both in terms of the volume of users as well as the technologies employed. According to the United Nations' International Telecommunication Union (2011), around 30% of the world's population (over 2 billion people) were internet users by the end of 2010, compared to just 6% at the end of 2000, and around 1.2 billion of these accessed the internet via mobile networks, using technologies which were barely nascent ten years previously.

Recent data in the respective Ofcom report (International Communications Market Report 2016) for the year 2016, with data from 2015, show a continuation of the trends that have been highlighted in the 2012 paper. According to the Ofcom report, the following graph shows telecommunication had the highest share of turnover generated in the communications sector in the last years.

Figure 1 : Share on turnover in the communication market

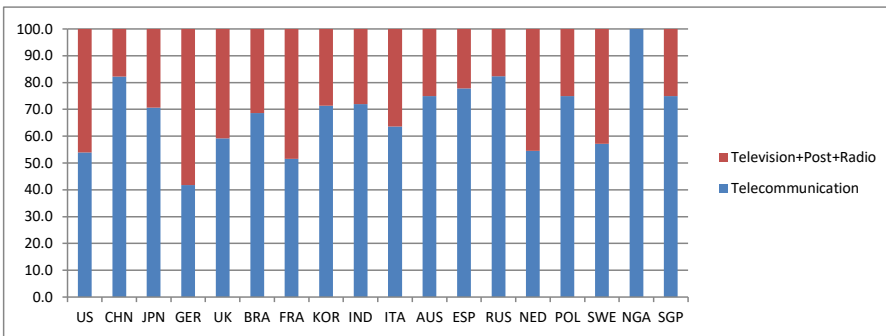


Source: Ofcom Report 2016

Regarding the investigated countries¹ and the respective communication market revenues, the study shows that, with the exception of Germany (only 42%), in each country the revenues from telecommunication exceed 50% of the total communication market revenues.

¹ FRA, GER, ITA, USA, JAP, AUS, ESP, SWE, NED, POL, SGP, KOR, BRA, RUS, IND, CHN, NGA

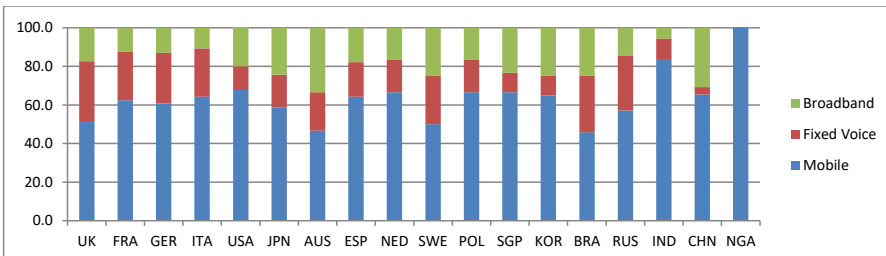
Figure 2 : Telecommunication share of turnover per country



Source: Ofcom Report 2016

Using the revenue shares of the main segments of the telecommunication market from the Ofcom report, the following picture can be drawn.

Figure 3: Turnover share per subsector

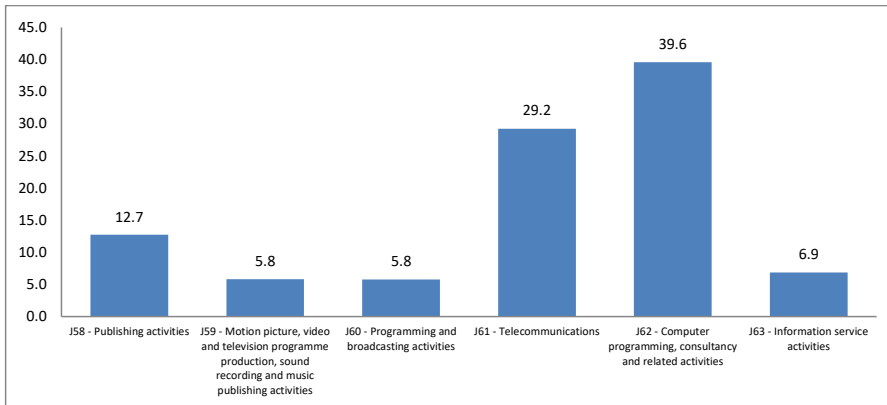


Source: Ofcom Report 2016

Besides Australia, Brasilia and the US in each other country mobile telecommunications generates 50% and more of the revenues in the telecommunication sector.

According to the Eurostat SBS database information for the EU-28 member countries, which contains turnover information for 2015, ISIC J61 and J62 are predominant in ISIC J- Information and communication. Data for ISIC J58 Publishing is not available in the database and has, therefore, been estimated by subtracting all other 2digit codes from the aggregate ISIC J - Information and communication. Data are not available to estimate predominance for previous years.

Figure 4: Turnover share on ISIC J Information and communication (EU-28) in 2015



Source: Eurostat Database

According to the Eurostat database, from 2011 to 2015, telecommunication represents a slightly decreasing share of sector J "Information and communication". The share of turnover and number of enterprises is continuously decreasing whereas, after a decreasing period, there was an upward trend regarding the number of persons employed in 2015.

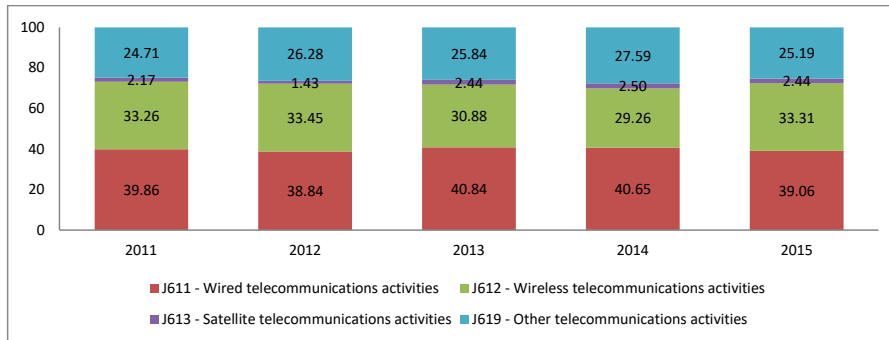
Table 2: Structural Development of J61 – Telecommunication (EU-28)

Share on ISIC J in %	2011	2012	2013	2014	2015
Number of enterprises	4,51	4,50	4,46	4,16	n.a
Turnover	35,58	33,83	32,29	30,18	29,24
Number of persons employed	18,64	16,77	16,66	15,83	16,32

Source: Eurostat database

Taking a more detailed look at the ISIC classification structure and Eurostat data regarding the telecommunication sector for the EU 28 member countries, the following graph shows the development of turnover shares of the respective 3 digit ISIC codes of ISIC J61 Telecommunications.

Figure 5: Share on Turnover by ISIC 4-digit code (EU-28)



Source: Eurostat Database

Compared to the results of the Ofcom report, the situation regarding the EU-28 countries revenue shares in the telecom service branch look slightly different. During the last several years, the wired telecommunications services generate the highest share of turnover followed by ISIC 612 Wireless telecommunication services. In all these years, an almost negligible amount of branch turnover is produced by satellite telecommunication activities.

Public regulations affecting the market situation

Traditionally, due to strict regulation coupled with high start-up costs and increased level of investment in R&D, the market structure for telecommunications service providers tended to be close to a natural monopoly or oligopoly market. However, increasing government deregulation over recent years in tandem with further regulation of existing suppliers and lower entry requirements have stimulated strong competition amongst business telecommunication service providers, with an increasing trend amongst suppliers to offer better and different services to the user community. As a result, the telecommunication industry landscape has been susceptible to rapid changes associated with:

- Regulation, such as the EU Electronic Communication Framework which aims to ensure effective competition and consumer protection as well as constituting the basis for a consistent regulatory environment across the communications markets of all Member States.
- Different telecommunications regulations in the United States that cover wired telephony networks and other telecommunications services. Incumbent local carriers of telephony are regulated under a different set of standards than wired cable networks or wireless telecommunications networks. This tends to result in differentiation based on network operations.
- Technology, including fiber optic cables and the introduction of next-generation core networks (NGNs).

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- Consumer's movement to new services, such as the substitution away from fixed broadband to mobile broadband.

Another noteworthy development in the industry is the wide expansion of social networking and the fact that until recently, social networking sites have mainly been accessed via a computer (laptop/desktop PC). With the growth of smartphones and the introduction of other devices such as tablet computers, consumers can now access social networking sites in a variety of ways and in more places than ever before.

Net neutrality on European level

In 2015, after a long period of negotiations, rules regarding net neutrality on European level have been legislated for the providers. Net neutrality should ensure that all data on the internet should be treated equal and passed e.g. with equal speed through the net of a provider regardless the type, origin and destination. On the one hand, internet services like Netflix or Spotify are therefore not allowed to buy a kind of prioritized data transfer, and on the other hand, providers are not allowed to offer such prioritized lines as well. This ensures that users do not have to pay an extra fee for the service in the case that it needs a faster internet speed to provide the service. Providers are not allowed to monitor and evaluate the data traffic regarding e.g. the importance of provided services in their net. Providers are allowed to intervene only in the case of tremendous shortages. This net neutrality is of utmost importance for the free competition between online service providers, for innovations, and the fundamental right to freedom of expression on the internet.

After a transition period of several years where roaming costs have been reduced little by little, on June 15th 2017 roaming costs have finally been repealed. From this day on, EU citizens can use their mobile telephones in EU countries up to a certain fair use limit similar to their use in their home country, without generating extra costs for roaming like in previous years.

But no light without darkness. Already at this early stage, providers are starting to further diversify their tariff structures. New and a little bit cheaper cell phone plans have been introduced that are similar to the former tariffs in all their details (minutes, SMS, data) but do not include a basic roaming option. For those who do not leave their countries in a lifetime this seems to be a good option. But in the case that you are travelling in the EU and use such a plan, it is not possible to activate the roaming option, even if you want to. Formerly, the user had the freedom of choice to deactivate roaming on their cellphones or to use their telephone and to roam at extra costs. Now your plan decides whether you can generally use your mobile in another country. This could lead to very unexpected situations as it makes the cellphone worthless in its core function in a foreign country. As a perfect example for the rapid developments and changes (even during the writing process of this paper) in this service branch, the Austrian regulatory authority has decided that the fact that this provider sells tariffs which are identical to the cheaper ones at a higher price because they do include the roaming option is contrary to the terms of the aforementioned roaming regulation as surcharges for roaming are forbidden by law. Customers can now reclaim the difference in the price they paid as compared to the cheaper tariff. That makes the new plans without the roaming option uncommon overall, because the same amount of money should not be paid for a worse plan.



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In former times, before we arrived in the area of the “internet of things” (IoT), the internet was intrinsically tied to the usage of a classical computer whereas other technical “things” (e.g. refrigerator, TV, printer) had only a power button and limited, but for the time being sufficient, functions. Now the number of “things” in daily life that could/should share data over the internet are continuously growing at a fast pace as people make their whole life connected. Examples of those “things” are the smart homes with their heating, lighting or security systems. Cars are connected as they receive navigation data over the internet or protect the drivers with emergency systems. Even our clothes or watches became “smart” as more and more wearables enter the consumer market. This process is still in its early phase and the amount of data usage will increase with its further future development.

Degree of concentration within the industry

In many European countries, the industry structure is characterized by a few dominating units. Because of the high concentration, the top few companies cover almost 90 % of the total turnover, which comes from the sales of **primary** as well as of **secondary products** generated by companies classified into the telecommunication industry. This circumstance also raises questions about sample selection. Companies operating in this area, because of the nature of the industry (continuous innovation, bundled services, cross-border trade in services), may rapidly change the structure and the content of services provided, accommodating partner’s needs. This may also cause difficulties in the classification of activities, particularly in determining the primary activity at the class level.

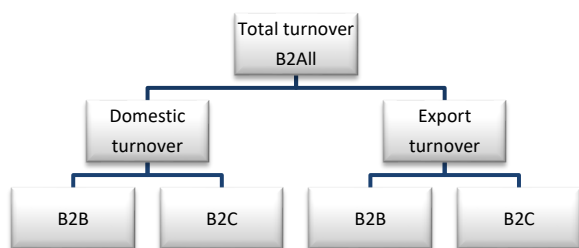
The wireless telecommunications industry *in the United States* is dominated by a few major players. Secondary resellers generally operate on one of the four main wireless networks in the US. The US has both major GSM and CDMA based wireless carriers. In the NAICS system, telecommunications resellers who do not operate their own network are classified in a separate industry. Based on 2015 revenue estimates, all telecommunications resellers accounted for about 3.2% of total wired and wireless telecommunications revenue in 2015.

In Germany the three network operators of mobile telecommunication networks generated more than 80% of total turnover in this market in 2016. The landline market is also dominated by very few providers, most of which operate their own networks. The operators of mobile telecommunication networks are also active in the landline market and are among the five market leaders. The five largest landline providers have a share of more than 90 % of the circuit points/connections in the branch of wired telecommunications. The very large intersection of fixed network providers and mobile operators and the rather “random” allocation of companies to one of the two sectors make the collection, calculation and interpretation of industry-specific indices difficult. For these reasons, the ISIC classes 6110 and 6120 in the German producer price indices are not considered separately, but as a single industry with the main products mobile telecommunications and landline / internet.

Type of consumer of the services

Most of the services provided by the resident producers can be purchased by all kinds of customers: businesses (B2B) or end consumers: households (B2C) and other (B2Other: capital investment, government, nonprofit organizations and export). For this reason the total turnover/output of companies may include a relevant share accounted from the B2B, B2C or B2Other transactions. However, due to the simplification, B2Others – because of the nature of transactions – could be taken into account as B2B trade. It should be noted, that only the final transaction in the sales/purchase chain is a true B2C relationship.

Figure 6 : Turnover share on Type of consumer of the services



In the case of wired and wireless telecommunication activities (6110 and 6120), the shares of business and private transactions in Hungary is split about 40-60, however, the satellite subindustry (6130) is dominated by B2C transactions and the B2B transactions are neglected. In contrast, the operations of other telecommunication services are determined by B2B sales.

Telecommunications providers in the US sell to all types of carriers. There are often price differences for business and household consumers. For example, specifically for wired telecommunications carriers, the revenue is split 15 percent to business and 85 percent to residential customers.

The issue of what can be considered as **export** (non-domestic) service is not straight forward. International telecommunications services are basically provided by a host service provider in the external country, however payments are made directly to the home service provider. For example, if a U.K. customer of a U.K. telecommunications service provider travels to France, any service used in France will be provided by a French service provider. Nevertheless, the U.K. customer pays for this service via the U.K. telecommunications provider, who has a contractual relationship with the French partner to reimburse the customer's service fees. In this case, UK imports, and France exports the services. (SPPI Guide, Eurostat-OECD).

Horizontal/vertical integration



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When a company wants to grow, it has two options: expand its current business or go into business with other companies through acquisition or merger. Naturally, each technique has advantages and disadvantages.

In the vertical integration business model, companies expand by gaining control of their entire supply chain that is, the IoT device, the gateway and the cloud-based service are all provided and controlled by the same company, which usually translates to better cost and quality control. However, the drawback to this control is a loss of flexibility. This type of integration can move forward toward the end consumer, or backwards toward the infrastructure or other production conditions. Many large telecommunications carriers already have vertical integration (fixed line+ wireless) - but they are monolithic.

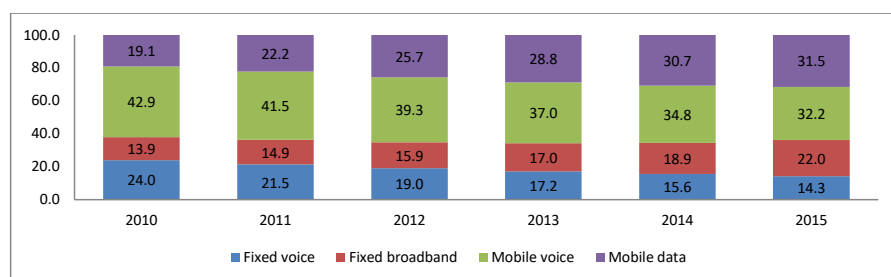
In case of a horizontally integration, the company acquires or merges with other companies that are active in the same area with the aim to create a company with stronger market positions, or to eliminate direct competition. Wireless buys wireless, fixed-line buys fixed-line, because by working on a common framework, those devices and services can more easily share information and resources. At a certain market size, the cost of increased business operations grows at a much lower rate than the profit from those activities. To foster this horizontal model, many companies are starting to roll out cloud platforms and gateway hardware that allow multiple users. (by Rich Quinnell, Editor in Chief, IoT World).

To summarize, business telecommunication services change rapidly in their specifications with frequent migrations of corporate usage. The most evident development in the industry is the market convergence which brings together information technology, telecommunication, and media, formerly operating in separate markets. This convergence has led to the blurring of traditional boundaries. It is projected that this trend towards horizontal integration of markets and services could lead to strengthening of market power, as there may be relatively few companies in a country that can provide a combined video, voice and data offering (OECD, 2008).

Industry trends

Fixed voice communication and text messages (SMS) are declining and are getting replaced by Apps and social networks. The findings of the Ofcom report below demonstrate very clearly that fixed voice and mobile voice telecommunication are declining in regard to retail revenues by sector whereas the shares of fixed broadband and mobile data are rising over the years.

Figure 7: Share on retail telecommunication revenues by subsector in % (Ofcom 17 countries)



Source Ofcom Report 2016

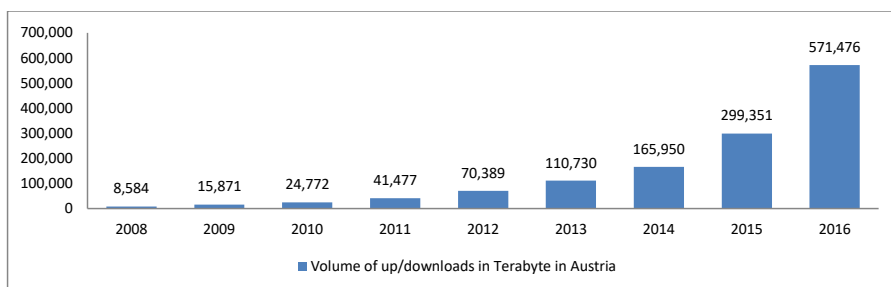
According to information gathered by the national regulatory authority (RTR) in Austria for example, the number of minutes for voice telecommunication services and the number of SMS is declining since 2012 as well. Compared to the year 2015, 650 Mio. Fewer SMS were sent in 2016, and the number of minutes of voice telephony decreased by 250 Mio. minutes. This could be attributed to the increasing distribution of mobile applications like social networks, messenger services and voice over IP services. This was favored by the area wide coverage of the internet availability. According to the Ofcom report 2016, in 15 countries 99% of the population are covered by 2G and 14 countries have a 4G mobile network coverage of 80% or greater.

Data volume and data speed have increased tremendously in the last few years. This was facilitated by the area wide coverage of the internet. For example, in Austria 8.600 terabytes have been up- and downloaded in the year 2008, whereas it had been 571.000 terabytes in 2016.

Figure 8 : Development of data volume in Austria in Terabyte



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Source: RTR Report 2016

According to the rising use of on demand streaming services in the field of television and music, the internet of things and the increasing net coverage, it is expected that the amount of data volume will increase in the future as well.

Primary and secondary products - structure

In Hungary, the proportion of the primary activity has been slightly over of 80% of the total turnover of companies classified to the division CPA 61 in recent years. The main areas of secondary activities of these companies are 35, 52, 59, 62, 63 and 68. On the other hand mainly companies with the primary activity 35, 49, 60, 62, 68 and 92 also provide services classified to the division telecommunication activities.

In the US, according to the 2012 Economic Census, 93.7 percent of revenue in the Telecommunications subsector (NAICS 517) was classified as primary activity.

1.3 Specific characteristics of the industry

Nature of selling

Bundling of services is a common “nature of selling” within this industry. Bundling refers to the sale of a number of services combined in a single price package, usually excluding the possibility that customers can obtain a single service without taking or paying for the other services in the bundle. Bundling of services can help generate economies for the supplier through, for example, reduction in service marketing charges, customer acquisition costs, billing charges, etc. For the client, bundling often has the advantage in that prices are lower compared to having to subscribe to each service individually, however customers may not want all the services offered in a bundle (OECD, 2008). The greatest savings, compared to purchasing standalone services, were available in France, where a ‘quad-play’ bundle including voice, broadband, TV and phone offered the lowest prices for a basket of services typical of a family (Ofcom, 2011).



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In addition, tariff complexity (e.g. benefits associated with specific tariffs are available only to certain types of consumers, for example some operators are offering business-specific roaming tariffs that are considerably cheaper than consumer offerings) make the pricing of telecommunication services difficult to measure. Adding to this complexity is the variation in installation and hardware costs which might be embedded in the ultimate price of the telecommunications services (OfCom, 2011).

In the United States, there is a strong trend for bundling of services in wired telecommunications. Wired bundles of services typically include telephony, video, and internet access services. Many of the contracts also include rental of various equipment such as modems, routers, DVRs, etc. In many countries, wireless providers also provide a bundle of services typically including voice service (telephony), SMS text services, and data access. Plans can include fixed or unlimited access and are priced accordingly. The trend of including a “free” mobile device with a two year contract is declining but phones are still offered on a payment plan (typically one or two years) that is included as a separate line in the bill.

Bundling is a common practice for both wired and wireless providers. Wired telecommunications carriers provide bundles that include voice, video, and Internet access at considerable discounts. Wireless carriers provide a wide range of plans from a set number of voice minutes or texts, to plans with unlimited voice, data and text. Many programs also allow unused data or minutes to be rolled over from one month to the next.

2. Measurement of turnover/output

2.1 General framework

A key user in all countries is for the calculation of the National Account. Annual output is used as a component for the annual national account. The short term measurement of the variable (monthly/quarterly) is also used by the national account, as an input for analysis of the business cycle. Data is used by external actors also for analyzing the business cycle and as an input to investigate historical structural changes in the industry.

Eurostat is of course a main user as well, as turnover is to be delivered both within the current STS and SBS regulation. The implementation of FRIBS will not change this.

National accounts are mainly interested in data at LKAU level, which in most (all ?) countries is not the Legal entity, responsible for the annual account. This causes quality issues on the LKAU (establishment) level, but is not a special issue for ISIC 61 as it occurs in many other industries as well.

The telecommunications industries are typically measured in gross terms for services provided in the United States. Care should be taken to differentiate provision of access to resellers from provision of services directly to consumers although both are measured in gross terms. In Norway gross revenues are measured as well.

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As with other industries there are challenges in the definition of turnover. In principle, the value of invoiced sales of goods and services supplied to third parties during the reference period should be collected. Therefore, particular care needs to be taken when using administrative data. For example, when using tax declaration for tax purposes, any revenues generated from non-turnover producing activities, such as sales of fixed assets should be excluded. In addition, when selecting a sample for a turnover survey it is important to ensure that turnover is broken down by primary and other activities as there could be substantial over/under coverage in the frame and estimates.

2.2 Measurement issues

Measuring output on the product level is especially important within industries undergoing rapid changes like ISIC 61. Data is valuable both for the National Account and external interessents in order to analyze the development of the industry. Anyway, collection of CPC data is very limited, based on the feedback from Vooorburg Group delegates. It should be added that the collection of product data for ISIC 61 is not compulsory for the European countries through the EU-regulation (and that will not change when FRIBS is implemented in 2020/2021)

Datasources used for collecting turnover data at the industry level is to a high degree administrative and therefore reduces response burden. Turnover, collected for short-term purposes is often available from the tax authorities, while annual turnover may be collected from the available annual accounts. In many service industries (besides from ISIC 45-47), turnover is approximately the same as output, as intermediation in services transactions is limited. However, not collecting information on product level, may raise the challenge that activities belonging to retail trade, which sometimes occur, might be included in the turnover for ISIC 61, if a separate enterprise/establishment is not registered. This could lead, to an overestimated output for ISIC 61 (and underestimated output for ISIC 46-47).

At the moment there are no alternative data sources, but some countries are looking into the possibility of using transaction data, both for collection on industry level, but perhaps also on product level.

As the industry has some degree of secondary production (e.g. ISIC 46-47), especially within the large enterprises with several establishments, a pps design is important in order to collect information concerning this production on an establishment level. A census for Multi Establishments Enterprises, combined with a sample survey amongst all other units in ISIC 61, has been used in Norway for many years.

The Telecommunication sector consists of n general, this increases the risk for measuring output which is produced in another economical national territory. The size of the enterprise groups also increases the challenge of measuring output, which is not produced for the market but for internal consumption. This could be reflected in national accounts Supply and Use tables, as production (supply) not used and will be visible as stock on the use side. In general, national accounts in many countries face increasing challenges with this imbalance within the service sector.

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2.3 Description of methods for measurement

Frequency of collection of data will vary with its purpose. Monthly collection could, for example, be for the purpose of a monthly output/turnover index or primarily for use in production of a monthly volume index or both. Quarterly collection serves the same purpose but just for another measurement period. Annual data are collected for the Structural Business Statistics and serve also as input for the final annual National Account.

For both the quarterly and annual data, administrative data are available for many countries (VAT, annual accounts). Monthly data is less accessible through administrative data

It is also possible to calculate monthly production, if you have a suitable volume indicator and a price index. The national account in Norway published for the first time in September 2018 monthly national account, where the volume calculations are based on employment statistics. Statistics Norway will further look into the possibility of using these data, in combination with a price index for ISIC 61 to calculate a turnover index, perhaps on a monthly basis.

3. Measurement of SPPI

3.1 General framework

There can be several objectives for key users. SPPI is used as a deflator for the national accounts in many countries and also as a reindexation of long term contracts within some industries. It is also a component which can be used to deflate a monthly volume index.

3.2 Measurement issues

Measuring SPPIs at the product level is especially important within industries undergoing rapid changes, like ISIC 61. But there are two other issues – or special characteristics within ISIC 61 that are important to be aware of when measuring the price development, namely bundling and quality adjustment. In addition, the scope of the index has to be decided as it also influences the measurement issues.

Bundling

When measuring the price of a bundle of services, two main alternatives are available to the price index compiler:

- 1) break down the bundle into separate services and price them separately or
- 2) price bundled services together as a group.

Under the first option, it is important to specify and price each component separately but also to measure the financial or other benefits provided to customers who subscribe to bundled services. Financial benefits are relatively easy to be reflected in pricing bundled services; however, pricing the other benefits is complicated. In addition, breaking down the bundles and pricing each sub-component separately will



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translate into a heavy calculation and response burden. One suggestion to minimize the burden could be to let respondents choose the service bundles that are most representative of their business in terms of revenues and then price the sub-components of these bundles separately.

For the second option, only the prices of the bundled services and their corresponding service specifications are required. Since the underlying services are not priced under this approach, the response and calculation burden is reduced. Keeping the bundles constant over time is a significant concern and two solutions to deal with this issue are apparent:

- 1) quality adjustment;
- 2) update the selected bundled services regularly. It should be noted that quality adjustment is also required when pricing the service components of the bundle separately (option 1).

Quality adjustment

Given that the telecommunication industry is constantly changing, one of the most challenging aspects is to ensure constant quality is maintained for the price data collected. It is therefore imperative that a statistical agency takes the necessary steps to ensure that the initial price specification is as detailed as possible so that price determining characteristics are identified and fixed and any change in quality is both identified and treated appropriately. Therefore, the statistical agency could ask the respondent a question on the price questionnaire to identify if there has been any change in the service specification since the previous questionnaire.

Alternatively the statistical agency could choose to assess movements in price and use this as a potential indicator of changes in service specification. Changes in the price should be further validated with the respondent, to capture the new specification and identify the change in price which is attributable to the change in service. This information can then be used to make an appropriate quality adjustment to the price data. A statistical agency should therefore monitor 'too stable' prices (that is, service prices which have not shown any price change for a number of periods) to ensure that the specification is still representative and the respondent is providing accurate and meaningful price information each period.

Scope-B2B/B2All

One important question in terms of the scope of the SPPI is whether to calculate Business to Business (B2B) or Business to All (B2All) price indices. Across countries, turnover share generated from services provided to households is higher than that generated from businesses although it varies largely from country to country. In France and Norway, two thirds of the market is due to households, while in Spain approximately half of the market of households represents the turnover (ITU, 2011). According to the European STS Regulation for SPPIs, B2B type of indices were specified. However for deflation of total output, especially for national accounts B2All indices are required. For this reason Eurostat introduced transmission of both SPPI indicators. As a result, a number of countries compile both B2B and B2All index while others produce a B2C (Business to Consumer) index. In other OECD countries, the B2All approach is most common to meet national accounts requirements and international recommendations. The choice of



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one or the other practice depends on the service activities, the pricing methods used and on the availability of data in business accounts.

The situation, in the European countries, will change regarding the new SPPI requirements introduced by the implementation of the upcoming Framework Regulation of Integrating Business Statistics (FRIBS). So far only SPPIs for B2B have to be calculated, but with FRIBS B2All indices will be mandatory. In order to ensure meaningful overall B2ALL indices, countries will have to calculate B2B and B2C indices, which will then be aggregated to B2ALL indices per service branch.

Besides the enhancement from B2B indices to aggregated B2All indices, the coverage of service branches will be massively extended in order to close all the gaps of the non-surveyed service branches of the current STS regulation. Instead of various 2-, 3-, and 4-digit NACE codes, with FRIBS complete NACE sections, as well as divisions and aggregates of sections H, I, J, L, M and N have to be calculated. In Austria, compared to the current coverage and disregarding the effect that additional B2C indices have to be developed besides the already existing B2B indices, this enhancement represents an increase in current coverage of 40% and 60% of CPA 6-digit codes that have to be covered by SPPIs in the near future.

The US approaches this issue by disaggregating between business and residential consumers which enables detailed cell index calculation by customer type as well as generating an aggregate index. Additionally, this breakout enables the use of appropriate indexes in the calculation of intermediate and final demand indexes separately. With this in mind the statistical agency may decide to make use of additional data such as the Consumer Price Index (CPI) or Harmonized Index of Consumer Prices (CPIH) as proxies of the business-to-consumer component of a business to all index. A suitable weighting structure could then be applied to weight together both the SPPI and CPI components to produce a business-to-all index. It should be noted that taxes, such as VAT, are included in the prices collected for a CPI. *Thus, the CPI-component needs to be adjusted to an index at constant taxes.* The statistical agency will need to balance the conceptual requirements of the 'ideal survey' against the cost and burden of collecting the data before accepting such concessions.

Use of CPI in calculation of B2All

Some possible areas with significant demand from households, as well as the possible use of CPI's (HICP-CT) as proxies could be selected by consideration of the following information:

- The content of the related classifications;
- Expansion of the data collection(s) on turnover/turnover structure;
- Weights from the National Accounts;
- Information received from the trade associations or market leader companies;
- Information received from the state authorities,
- Use of special administrative data sources (if any).

For use of existing CPIs as proxies, a more detailed analysis is needed (almost at 6 digit level). Because of heterogeneity of CPA categories (services can be used either for technical/industrial purposes or be

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used by households), the composition of consumption should be taken into account. In addition, it is important to analyze the weighting structure with the aim of having a weight split that is as accurate as possible when calculating a mixed B2All deflator.

Sample design

In terms of sampling design, the ideal survey for telecommunications would use the Probability Proportional to Size (PPS) method. Options for stratified sampling, using turnover as the stratification criterion, may also be applied to improve efficiency of the sample through reducing variance. If telecommunications is recognized as being led by a small number of dominant suppliers, a mixture of purposive and random sampling may also be considered. This could ensure that the largest companies are always included in the sample, with the remaining companies sampled randomly. Due to the rapid rate of technological development in this industry, the frequency of sample update may be more periodic than for other industries. It may be necessary to update the sample on an annual basis to ensure the survey remains representative of the technological changes which are taking place. However, some countries may choose to re-sample on a less frequent basis (such as every five years) or to carry out continuous or ad-hoc maintenance of the telecommunications sample.

The main challenge of sampling within telecommunication services is to choose submarkets and representative services to observe. Both the business and the household share is high and price movement seems to be significantly different regarding this two subgroups, first off because of discounts offered for business clients. It is important to get specific data as well as weights for every specific submarket.

Sampling and weighting – Hungarian example

To handle the challenge mentioned above, the Hungarian sample includes basically enterprises classified to the division 61 (the sample is chosen at class level), but it has been expanded by companies classified elsewhere, when they have a relevant share of telecommunication turnover as secondary activity, taking into account the product approach. It is worth noting that a market leader company in wireless telecommunication (6120), is also a market leader in wired telecommunication activities (6110). All representative items observed are classified under 6 digit level subcategories, from which primarily product-based SPPIs are computed. For European countries product-based turnover data at subcategory level are also available from the SBS statistics (Annex VIII.). They can be used for weighting to obtain product-based SPPIs at class level, which could be used as elements of higher level aggregations or industry-based SPPIs.

Because the business-telecommunication industry structure and market share is rapidly changing, it is recommended that the product and industry weights are rebased annually to allow these changes to be incorporated with new product services being added and old services removed.

For weighting purposes, Hungary uses two sources for aggregation of SPPIs. For class level indices product-based turnover data 1 year prior to the actual year (collected by the SPPI survey) are used. The



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higher level weights are industry-based (SBS) turnover data from 2 years prior to the actual year. Weights are updated annually.

Taking into account the type of the observation unit, or homogeneity of the total turnover by products (primary activity, secondary activities), you may want to consider the following alternatives for calculation of a deflator to obtain volume indicators:

- The total industry output/turnover is basically homogeneous, i.e. an appropriate product-based SPPI produced for the division 61 could be used as deflator (industry-based SPPI could be estimated by product-based SPPI).
- The total output includes significant share of secondary activities (services other than telecommunication activities). For the total industry output an industry-based deflator would be needed (e.g. a weighted average of product-based SPPI produced for 61 combined with useable deflators for relevant secondary activities – applying appropriate turnover share of elements).

For weighting together the business and consumer price indices relative turnover shares should be used.

Table 3 provides a simple fictive example how such a combination of deflators might be done. The turnover shares for the different sub-industries of telecommunication (CPA 61) for all transactions (B2All) are taken from structural business statistics. At the 4-digit (class) level the shares of B2B and B2C trade are estimated.

It is assumed that satellite telecommunication is dominated by B2C transactions, therefore a consumer price index (HICP.CT) is used for deflation. Other telecommunication is exclusively B2B and thus an SPPI should be used as deflator.

For wired and wireless telecommunication the situation is slightly more complex. The shares of business and private transactions is split e.g. 40-60 and 50-50 respectively. Here a combination of SPPIs and consumer prices (HICP-CT) is used. Ultimately, a split of the industry into 48.5% B2B transactions and 51.5% B2C transactions results ($B2B = 40.0\% * 40\% + 45.0\% * 50\% + 5.0\% * 0\% + 10.0\% * 100\%$)

Table 3: Weighting together B2B SPPIs and HICP - simplified example

		Turnover shares (%)		
		B2All	B2B	B2C
61	Telecommunication activities	100.0	48.5	51.5
61.10	Wired telecommunication activities	40.00	40.0	60.0
61.20	Wireless telecommunication activities	45.0	50.0	50.0
61.30	Satellite telecommunication activities	5.0	0.0	100.0
61.90	Other telecommunication activities	10.0	100.0	0.0



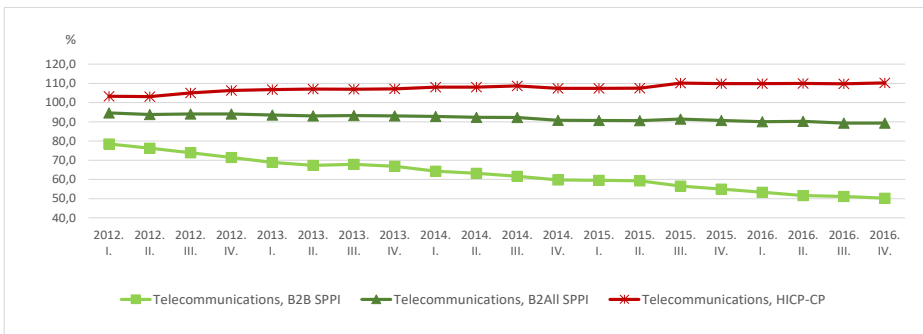
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The proposed selection criteria for identifying B2B and B2C markets may depend on the information system of the particular data supplier. In many cases, a generally used code of the legal form of the enterprise, tax code from contracts, the type of the bill/receipt or the form of the payment e.g. (corporate or retail account, cash) is available. On the other hand, companies may have other special registers, analytical records for selecting their customers.

In Hungary, information on the turnover proportion of submarkets is based on two data collections, by CPA 2.0: SPPI questionnaire, yearly B2B turnover data (at 4 and 6 digit level, 1 year prior to the reference year) are received from companies once a year and Structural Business Survey (SBS/ Annex VIII), which has been extended for this purpose by data on the turnover share of households (at 4 and 6 digit level).

The long-term decrease in Hungarian telecommunications services charges was caused by the effects of former investments and by an EU regulation owing to market and technical changes and in the short term by a fall in mobile internet and roaming charges.

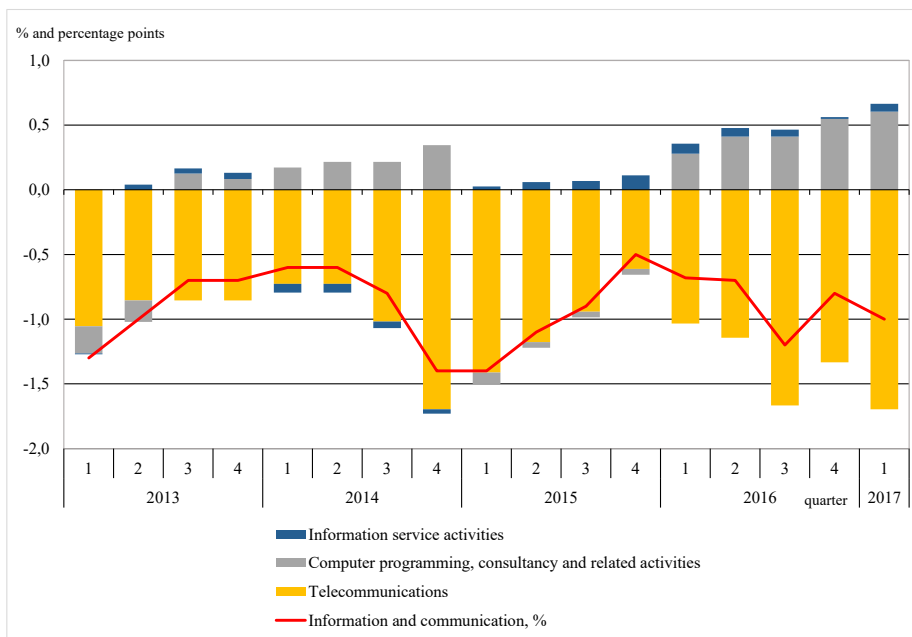
Figure 9: Price indices for telecommunications services in Hungary, 2012-2016 (2010=100)



The importance of telecommunications in the section level SPPI is illustrated by Figure 10

The 1.0% fall of information and communication prices in the 1st quarter of 2017 was mostly influenced by telecommunications (by 1.7 percentage points), while computer programming, consultancy and related activities lowered the average decrease of charges by 0.6 percent and information service activities by 0.1 percent.

Figure 10 : Contribution to changes in Hungarian information and communication services producer price indices, (B2All, compared to the same period of the previous year)



Data availability and sources

Similar to turnover information, pricing information from a variety of sources can be used to construct an index for the telecommunication industry. Sources could be administrative data, survey data, prices collected from the internet and prices collected for the CPI.

If a statistical agency chooses to take a survey approach, the timing and frequency of data collection will need to be evaluated against the availability of data and potential burden on those who will be providing the data.

Likewise, if administrative data is to be collected from an industry regulator, an appropriate frequency for price delivery needs to be negotiated that allows adequate time for data cleaning, analysis and derivation of the price index.

An alternative to conducting a price survey or using administrative sources is to use data that is readily available from the internet. Although much data is available on-line, it might not be fit for purpose. Indeed, these data often do not represent actual transaction prices but rather list prices, implying that

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any discounts offered might not be captured.

Alternatively, as is the case in the US, *posted list prices* are often promotional and are specific to first-time customers rather than the price collected for the average customer. Another concern about using internet pricing is the lack of control of the information and the structure of this information posted online. The websites of those service providers can be changed at any time and in many ways without any notice. This entails a potential risk for regular index production.

When collecting of prices is carried out from individual enterprises, it is recommended that an initial visit by a field officer is undertaken. This will brief the respondents and ensure appropriate initial collections. Survey responses should be assessed at each collection to detect changes in service provision specifications and to track corporate usage.

Most data collection is carried out on a compulsory basis quarterly, although some countries collect their data monthly (e.g. Czech Republic, Slovakia).

In Hungary, a general questionnaire specified for telecommunication activities – prepared in close cooperation with the biggest companies is applied. Data refer to the quarterly price of services sold by the resident producer to customers. In principle taxes are excluded; discounts, rebates, surcharges are taken into account. Typically, reported data are sales prices according to the invoice, rather than list prices. Harmonized Index of Consumer Prices at constant tax (HICP-CT) is applied as a proxy to use for calculation of the B2All SPPI as a weighted average of B2B and B2C sub-indices. B2All is used as the deflator of output and B2B for the intermediate consumption. As an alternative deflator for intermediate consumption, an index of the companies' contracts with each other could be used.

In Austria, the basic data are available from the national regulatory authority for Telecommunication (RTR). In principal SPPI's for telecommunications are based on a B2all concept.

Direct volume information

While the deflation approach is generally preferable, the direct measurement of output volumes may also be used in certain cases. Reasons for using this approach could be that, for a certain service industry price data are not available or are maybe not be of sufficient quality. If direct volume data are used, they should be detailed enough to allow the identification of relatively homogeneous service products. However, it is important to mention, direct volume data also have some drawbacks. As far as official statistics are concerned, real output data are often available later than value (turnover) data. They are thus not immediately useful for the purposes of STS (they might, however, be used for an ex post quality control).

There appear not to be many instances in official statistics of direct volume data which might be used for the purposes of an volume index. (ISP Guide, Eurostat)

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3.3 Description of pricing methods and criteria for choice

Given the nature of the industry, especially described in section 1.3 it is advisable that countries that have developed an SPPI for telecommunication services review the index frequently to allow for shifting consumers' trends and to account for the fact that aggregation structures and pricing methods might become obsolete over time. The price-index community has, therefore, put forward the following recommendations to address future developments of a business telecommunications SPPI:

- To move to re-weight the service products on a more frequent basis to capture rapid changes in service consumption. For example, in fixed-wire services, there is a strong, current trend in the provision of corporate, broadband internet-connection services which might affect the structure of SPPI telecommunications services.
- To research methods of capturing the price of bundled service products (with discounts) which is increasing as an industry practice to corporate customers. This is likely to increase as convergence of the telecommunications with media and IT activity increases. For example, the US prices individual contracts with corporate customers in order to reveal common discount practices.
- To use a standard method of quality adjustment of business telecommunications in order to capture the improved transmission of data and speech through improved technology. For example, in wireless services a future trend is identified towards third-generation (3G) communications, which will offer the ability to transmit data at a greater rate than before and support a greater diversity of service.

Price determining characteristics

Price collection is closely linked to the types of contracts offered, irrespective of the pricing method. Both in the field of wired telecommunications as well as in the field of wireless telecommunication, there are old contracts for single types of services, but also increasingly contracts which bundle various types of services. Within a certain type of contract, the individual offers differ in the conditions (e.g. call-by-call prices, telephone flat rates (limited to specific networks), data transmission flat rates with limited high speed volume, data transmission prices by Megabyte, prices for telephone calls abroad ...).

In addition, contracts between network operators and telecommunication providers who buy or lease network capacities, the provision of private line services, and sales of circuit points are objects of the price data collection.

For example, Hungary has three major mobile phone providers that split up the market. In most cases, they recommend using the provider that the customer's friends use because the minute fees within the network are cheaper than to other networks.

Consequently price determining characteristics can be derived from the elements of typical telecommunication contracts:

- Telephone flat rate (yes/no)
- Limitation of the telephone flat rate
- Pricing structure of telephone calls outside the scope of the flat rate
- SMS flat rate (yes/no)
- Limitation of the SMS flat rate
- Pricing structure outside of the SMS flat rate
- Data transmission flat rate (yes/no)
- Limitation of the data transmission flat rate
- Pricing structure of data transmission outside the scope of the flat rate
- Speed of data transmission network
- Type and characteristics of additional services (TV and/or radio transmission, quality of TV signals, number of end devices that can be connected to the service)

The prices for selling and letting of network capacities are based on similar quality characteristics as the contracts with households and business customers. A real challenge for the methodological development of this industry is to consider how to capture the reselling of network capacity as part of other telecommunication activities. This issue seems to be quite similar to those encountered in developing a price index for the wholesale and retail trade services, specifically which pricing method should be used (such as a margin approach) and should a gross or net approach be considered.

The quality of private line services is much easier to determine. It depends on the capacity and length of lines. Prices for sale of circuit points by network operators are regulated and therefore easy to collect.

Price methods chosen

There are a number of potential options for pricing methods for the telecommunications industry and each method will have advantages as well as disadvantages. It was suggested in the 2009 Voorburg Group Sector Paper on telecommunications (Camus, 2009) that the most commonly used pricing methods for this industry are the component pricing method (bill or rate) and the unit value method. In this section, the merits of each method are considered as well as introducing other methods which a statistical agency may wish to consider when developing an ideal survey for the telecommunications industry.

- **Component pricing, including bill method and rate method**

The component pricing with fixed service structure (bill method) assumes that a set of representative telephone bills and prices is available throughout the lifetime of a business telecoms index. The bills in a base year could be used to define the set of services used in a base year and generate the weighting pattern and the respondent is asked to provide the price updates on the bill and the associated discount information. This approach is valid if the price changes are the only movement in the index and there is no change in the service use.

The other alternative within component pricing is the 'rate method'. The concession with the rate



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method is that respondents no longer have to re-evaluate bills for individual service components, but instead provide updated tariffs or rates for a completely specified service (with the price determining characteristics held constant over time).

- **Unit values:**

The unit value is a method implemented by obtaining a unit value price at the lowest level of aggregation, which is the ratio of revenues to quantity for a homogeneous group of products. To achieve a unit value, the revenue of a specified service is divided by the appropriate quantity for the service (i.e. minutes) provided that services are homogeneous. The yielded unit value is multiplied by its base weight and aggregated within categories. In effect, the unit value method can be considered to be the component pricing method on a 'per minute' basis. As with rate information, the telecommunication enterprises record the value and volume measures for their own analytical purposes. In addition to "per minute" or other time related unit values, it can be effective to find average revenue per user (ARPU) or account (ARPA). This information is often found in enterprises' administrative data, and can typically be called upon by respondents or easily found in their quarterly financials. Implementing ARPU/ ARPA has taken on a more prominent role for US SPPI pricing as telecom firms continue to launch unlimited calling, texting, or "everything" plans, limiting the effectiveness of time related unit values to capture accurate price changes. To calculate the ARPU (or ARPA), divide the firm revenue from a specific product line (e.g., post-paid wireless subscribers) for the period by the average number of users (or accounts) in the period. ARPU is preferable to ARPA when measuring wireless prices as each account may have multiple users, commonly referred to as "connections" in their financials. For example, it is very common for a family to have a single account with connections for each family member.

The advantage of this pricing method is that sales volumes are available for the various services of the telecommunication providers quarterly. This gives early knowledge about shifts of consumer preferences. On the other hand, there are rarely homogeneous product groups across different providers to form elementary aggregates. Therefore, very often provider-specific aggregates have to be formed.

Another challenge in the use of unit values is, that both fixed-line telecommunication contracts and mobile telecommunication contracts normally bundle together voice services and internet access. Hence, the calculation of a unit value by division by minutes or by terabyte is not appropriate for these kinds of bundled contracts. In these cases the unit values are calculated by division of turnover by number of contracts. To avoid the risk of a biased index in case of significant changes in the volume of service use, one needs to estimate corrections for an increase of e.g. data transmission.

- **Direct use of prices of repeated services:**

This method can only be applied when services can be directly observed and measured in successive periods i.e. unit price, list price and transaction price. Prices can be collected either via a traditional survey approach or by utilizing the internet. A key point with using this method is that the product specification identified in the initial collection period needs to be as detailed as possible to ensure the

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price determining characteristics are captured and held constant going forward. This is especially important in the telecommunications industry where a typical service being measured will likely include a bundle of options (such as a fixed amount of talk time, download limits etc.). However, it must be assumed that the prices of business to business contracts are not published on the Internet. Thus, this pricing method is rather suitable for the B2C part of the industry than for B2B services.

- **Consumer profiles**

An alternative method which is used especially by HICP/CPI colleagues in the field of telecommunication price statistics is dealing with the so called consumer profiles. Using this method various telecommunication user profiles have to be created by constructing categories of user types depending on their volume of service use. Once developed, the specifications of the profiles in regard to numbers of calls, type of calls, etc. are held constant over time. Normally three different consumer profiles are selected or created respectively (low, medium and high consumers). Consumer profiles can be developed within one provider or more generalized independently of providers. Then the services within each profile are repriced periodically. The bill method can be seen as a variation of the consumer profile approach. The method of consumer profiles is also used by telecommunication companies to develop new telephone plans and tariff structures.

- **Use of CPI proxies:**

Some possible areas with significant demand from households, as well as the possible use of CPI's (HICP-CT) as proxies could be selected by consideration of the following information:

- The content of the related classifications;
- Expansion of the data collection(s) on turnover/turnover structure;
- Weights from the National Accounts;
- Information received from the trade associations or market leader companies;
- Information received from the state authorities,
- Use of special administrative data sources (if any).

For use of existing CPIs as proxies, a more detailed analysis is needed (almost at 6 digit level). Because of heterogeneity of CPA categories (services can be used either for technical/industrial purposes or be used by households), the composition of consumption should be taken into account. In addition, it is important to analyze the weighting structure with the aim of having a weight split that is as accurate as possible when calculating a mixed B2All deflator.

The statistical agency should consider any potential adjustments that may be required before using CPI items in an output index. Particularly the price data may need to be adjusted to account for a difference in periodicity (CPI prices will tend to be collected on a monthly basis whilst SPPi will tend to be collected quarterly) or any changes in taxes that are included in an input price (for example changes

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in VAT). It's important to note that there will be a potential bias in this method if the discounting to customers differs between the consumer and business sectors.

Index estimation

The weighting and aggregation of a price index is constrained by the availability of reliable data (such as turnover) with which a statistical agency can reasonably create a representative weighting structure. As discussed previously in the paper, there are potentially two main sources of data for reweighting a telecommunications price index. A statistical agency could choose to collect the information directly from the respondent (which is likely to prove burdensome, expensive and untimely) or alternatively a regular source of such data maybe available from the industry regulator (again, this source of data is unlikely to be timely).

In the case of the unit value method, the collection of turnover by product is part of the price data collection. Of course the scope of the survey doesn't cover the whole product portfolio of the respondents. Therefore, the statistical agency should advise respondents to submit data for top-selling products. It is useful to check annually whether these products are still the best-selling ones and to update the basket of goods, if the top-sellers have changed. As long as these changes take place within the same elementary index, they do not necessarily lead to an update of the weighing, but nevertheless, keep the basket of goods up-to-date.

For an industry such as the telecommunications industry, where it is recommended that weights are updated on an annual basis, identifying a timely supply of data may prove to be problematic. In reality, a statistical agency is unlikely to be able to update the weighting structure as frequently as recommended. Therefore, a decision is required that balances the quality of the price index against the availability of data. This may lead to a telecommunications price index that is reweighted more frequently than the standard approach of every five years, but less frequently than the recommended approach of annually.

Quality adjustment methods

One form of quality adjustment is to create a hedonic model or price regression based on an isolated and significant variable. The U.S. Bureau of Labor Statistics began using hedonic quality adjustment for broadband items within the Wired Telecommunications Carriers industry for December 2016. This model is re-estimated annually. The adjusted items fall within the Internet access services index. Broadband Internet access services include digital subscriber lines (DSL), cable, and fiber optic services. These services are subject to rapid technological change (from both infrastructure and technology improvements) with download and upload speeds typically increasing over time. Specific items within the U.S. PPI sample are replaced with items with faster download and upload speeds. Since the model is specifically for broadband services, bundled packages that include telephone and cable TV are excluded as price change in these packages could be due to changes in those other services. Information for the variables used in the model is obtained solely from information provided by respondents that are active in the BLS PPI survey.

The value of the increased broadband download or upload speed is the value of the quality adjustment (VQA). Ideally, PPI survey participants would provide this information, but often this does not occur. As a result, a hedonic model is used to estimate the value of the increased speed. The regression formula used in the hedonic model is based on Equation 1, and the results for 2017 are shown in Table 4.

Equation 1

$$\text{Log } P_{it} = \alpha_0 + \beta_2 (\text{Log } X_{2i}) + \beta_3 (\text{Log } X_{3i}) \dots (\beta_k \text{Log } X_{ki}) + u_i$$

Where:

Log P_{it} is the Log price of the *i* th model in period *t*

α_0 is the intercept

Log X_i are the logged variables representing observed product characteristics

$\beta_2 \dots \beta_k$ are the regression/slope coefficients

u_i is the residual or error term

Table 4. PPI Hedonic Model Regression results for broadband internet access for 2017 ^{a,b,c}

Broadband Model March 2017^{a,b,c}

	Estimate	Std Error	t value	P(> t)	VIF
(Intercept)	3.65958	0.09335	39.201	0.000000	-
Log Download Mbps	0.28416	0.04604	6.172	0.000000	7.753284
Residential	-0.38862	0.09856	-3.943	0.000278	3.528327
Company A	0.20904	0.10013	2.088	0.042527	1.341889
Company B	0.21417	0.13514	1.585	0.120004	1.037413
Company C	0.62844	0.16101	3.903	0.000315	1.472805
Company D	-0.42547	0.14005	-3.038	0.003956	1.114284
Company E	-0.11891	0.08129	-1.463	0.150469	1.588124
Log Download: Residential	-0.05708	0.04414	-1.293	0.202524	8.876797

a. Adjusted R-Squared = 0.8028; F = 27.98; RSME = 0.1680822

b. Base Configuration: Base Configuration: Business; Several Companies

c. Dependent variable: Log Price

The significant variables in this model are *Log Download Mbps* and *Log Download: Residential*. These two variables permit changes in download speed (quality) to be valued for both residential and business broadband. In this case, *Log Download: Residential* is not significant, which implies that there is no difference in the pricing behavior for download speed between residential and business broadband Internet access services.

Frequency of price collection and updating of the basket of goods and of weights



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Regarding the timing and frequency of price collection for telecommunications services, an important consideration will be the proposed pricing method and the availability of this data from those who will be providing it. In case a statistical agency chooses to take a survey approach, the timing and frequency of data collection will need to be evaluated against the availability of data and potential burden on those who will be providing the data. Likewise, if administrative data is to be collected from an industry regulator, an appropriate frequency for price delivery needs to be negotiated that allows adequate time for data validation, analysis and derivation of the price index.

For European countries, the frequency of SPPI data transmission is quarterly. On the other hand, the frequency of the service volume indicator will be monthly. How to produce monthly deflators in the future is a methodological challenge for countries. In order not to increase the reporting burden, Hungary tried to solve this issue by using statistical models to disaggregate quarterly indices to monthly.

A final quality consideration for a telecommunications price index is how and when to introduce new services and omit old services from the index. When using a base-year Laspeyres index, introduction of a new service and weight generation can be difficult, with turnover data sometimes not available for the base year. Equally, non-inclusion of new services or continuation of old services can create a bias in the index which can increase with time. The unit value method can partially reduce the need for a quality adjustment methodology as the use of average, weighted prices can accommodate migrations between services within product classes. However, it is recommended that a statistical agency consider rebasing the product and industry weights on an annual basis.

4. Evaluation of measurement

Evaluation of comparability of Price data with Output data

The survey of turnover for the ISIC classes generally doesn't distinguish the services with which these sales are generated. The very large overlap of the classes within the ISIC department 61 therefore plays a minor role in the collection of the output data. However, these overlaps and dependencies within the sector make the calculation of sector-specific producer price indices extremely difficult.

In the U.S PPI uses Census data to weight the price indices. There are different frames used by Census and BLS but the expectation is that the data are comparable. In Norway, collection of annually/ quarterly turnover/output data is on a census basis. Data from SBS are used by the SPPI producers as one input to the total weights (employment groups). The expectation here is also that data is comparable, as long as the statistical unit is comparable.

Further problems in the delineation of the classes and the calculation of suitable SPPIs result from the bundling of products and the non-uniform classification of providers without their own infrastructure, especially in mobile communications.

On the other hand, significant providers of telecommunications services seldom have their economic



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focus outside the ISIC Division 61. Thus, if the scope of the SPPI is reasonably compliant with the product portfolio of the department, comparability of the price indices with the sales indices is more likely given at the department level than at the level of classes.

Summary of main issues and challenges

Business telecommunications is a very dynamic service industry, which is susceptible to both rapid changes in regulation, technology and customer behaviour. There is a global movement towards communications convergence, which may result in the horizontal integration of telecommunication services with IT services (telephone, computer and television). Another characteristic that has become intrinsic in the telecommunications services is bundling of services where consumers buy multiple products combined in one package. As such, accurately capturing current price changes is particularly challenging for this industry.

In terms of turnover, data can be collected via a survey or through administrative sources depending on the resources of statistical agency in tandem the respondents' burden that will impose. The optimal frequency for the data to be collected is sub-annually and, where possible, data should be collected at industry as well as product level. Particular care should be placed on the definition of turnover to ensure that any revenues generated from non-turnover producing activities are omitted from calculations.

Similar to the turnover figures, prices can be collected from a range of sources, namely surveys, administrative data, using CPI data as a proxy as well as information readily available on the internet. In all cases, an assessment needs to be undertaken to ensure data are fit for purpose, allowing adequate time for data cleaning. There are a number of pricing methods used in this industry including component pricing, unit values, direct use of prices of repeated services, consumer profiles and CPI proxies. Provided that the prices for telecommunication products can be directly observed and measured, the most appropriate pricing method for telecommunication services is the direct use of prices (unit price, list price and transaction price). Alternatively, the unit value method or the rate method can be used or a combination of both. The bill method was judged to be the least preferred option for the reasons given in section 5. In selecting the most appropriate pricing method, statistical agencies are required to consider the scope of the index, the handling of bundling services as well as any quality issues.

Finally, due to the constantly changing of the nature of the industry, it is recommended that the service products are reweighted on a more frequent basis, methods that capture the price of bundled services accurately are researched periodically and a suitable quality adjustment method is used.

Future challenges'

- **Classification issues**
- **Continuing rapid changes – is the SPPI methodology able to cope with this ?**
- **FRIBS – measurement issues**

The European plans for the future according to the Framework Regulation for the Integration of Business Statistics, (FRIBS) include the introduction of a new volume indicator for services (index of services production, ISP), including telecommunication activities, based on turnover data and appropriate deflators. Taking into account the international handbooks and guidelines, as the most appropriate



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deflators for services output, the B2All product-based services producer price indices (SPPIs) are considered. Naturally, consistency between turnover/output data and deflators must be ensured.

In the European Union, the observation unit for quarterly services indicators is the enterprise. According to the expected legislation (FRIBS) for SPPIs will be the Kind of Activity Unit (KAU, product approach), nevertheless for yearly structure business statistics (SBS) the enterprise (industry approach) will be mandatory. This fact is likely to cause problems concerning the consistency in the future.²

While the more specific KAU offers advantages compared with the enterprise in terms of homogeneity there are also some disadvantages. Firstly, the choice for a statistical unit in STS services statistics cannot be made independent of other statistics, especially structural business statistics (SBS). A common statistical framework would facilitate the combination of the different statistics. Secondly, where statistical authorities use administrative source for the collection of data (esp. turnover) a collection at KAU-level might technically not be possible. (ISP Guide, Eurostat).

² A kind-of-activity-unit (KAU) is an enterprise or a part of an enterprise. In the latter case it groups together all the offices, production facilities etc. (which could be situated in different locations) of an enterprise which contribute to the performance of a specific economic activity defined at class level (four digits) of the European classification of economic activities (NACE Rev. 2). In order to establish a KAU for statistical purposes the enterprise's information system must be capable of calculating for each KAU some core variables such as value of production, intermediate consumption, cost for manpower, operating surplus, employment and gross fixed capital formation.

A local kind-of-activity unit (LKAU) or an establishment is a part of an enterprise which is engaged in predominately one kind of economic activity (like a KAU) at one specific location or geographic area.

(ISP Guide, Eurostat)

5. International progress

Summary of the detailed status reports

Table 5: Results of the detailed status reports regarding ISIC 61 Telecommunication (16 countries responding)

ISIC J 61 Telecommunication	6110 Wired telecommunications activities	6120 Wireless telecommunications activities	6130 Satellite telecommunications activities	6190 Other telecommunications activities
PPI details >= CPC	2	2	0	1
PPI details >= CPC soon	0	0	0	0
Turnover details >= CPC	1	1	1	1
Turnover details >= CPC soon	0	0	0	0
Industry prices calculated	13	13	3	8
Price collection frequency	8Q/5M/1Q+M	8Q/5M/1Q+M	4Q	7Q/2M
Industry turnover collected	15	15	12	13
Turnover collection frequency	1Q/4M/4A/4A+Q	1Q/4M/4A/4A+Q	3M/4A/4A+Q	1Q/2M/5A/4A+Q
Detailed turnover and prices well aligned	1	1	0	0
Detailed turnover and prices well aligned soon	0	0	0	0
Industry level turnover and prices aligned	12	12	3	8
Industry level turnover and prices aligned soon	1	1	2	1
Other - no industry coverage for prices and/or turnover, etc.	2	2	11	7
Q = Quarterly; M = Monthly; Q+M = Quarterly+Monthly; A = Annually; A+Q = Annually+Quarterly				

The highest coverage regarding SPPIs has been reported for ISIC 6110 wired telecommunication activities and ISIC 6120 wireless telecommunication activities. 13 out of 16 responding countries reported the production of a service producer price index. Regarding the collection frequency, quarterly price collections are prevalent, but 5 countries reported that they collect their data monthly as well. Only 3 countries are calculating SPPIs for ISIC 6130 at the moment, and there is no evidence that further countries are planning to develop SPPIs for this sector in the near future. A possible explanation could be that according to Figure 5 in all these years an almost negligible amount of branch turnover is produced by satellite telecommunication activities.



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Regarding turnover, almost all countries reported that they are collection this information on a regular basis. But these results are expected due to regulations which oblige European countries to collect SBS and STS data. Regarding the timing no favoured frequency could be observed.

Industry level turnover and prices are aligned in the most responding countries for wired and wireless telecommunication followed by other telecommunication services which are aligned in half of the countries.

6. Appendix 1 – Overview of international progress

The survey method is the predominant option across the countries that currently produce price indexes for the telecommunications industry as 22 of 25 collect price data through a survey. The majority of the countries employ the direct use of repeated services to collect data whereas only 2 use the unit value. Table A1 presents the pricing method used by the countries which publish a Telecommunications SPPI.

Table A1 - Summary of the Pricing Methods for Telecommunications SPPI

Pricing Method	Number of countries using the method	List of countries using the method
Transaction	5	AUS, HKG, KOR, CHN, USA
Unit Price / Unit Value	13	NOR, AUT, GER, CAN, FRA, POL, ESP, FIN, SGP, HU, IT, GBR, DNK
Transaction + Model pricing	1	CHE
List prices	4	CZE, POL, SVK, SVN
List and/or Transaction	4	MEX, NZL, SGP, SWE,
Mix of Model/Unit value/List/Prices of repeated services	3	NLD, JPN, HU, USA
Total	30	

The experience of a number of countries in developing a Telecommunications SPPI is provided in more detail below:

In **France**, the data used for the calculation of the producer price index in the industry of telecommunications (NACE 6110, 6120 and 6190) come from surveys to operators conducted by the regulation authority (ARCEP, "Autorité de régulation des communications électroniques et des postes"): a quarterly survey (the main survey) that provides revenue, volume and number of users for a large number of operators, and an annual survey that provides an allocation of the revenue between business and households customers. These surveys make it possible to calculate BtoB and BtoE indices, while consumer price indices are used for the BtoC index.

The producer price indices are based on:

- most often, a unit value method: series are defined as the ratio of revenue to number of users as often as possible, and if the number of users is not available, the ratio of revenue to volume. Each quantity of the ratio aggregates data for all operators in the surveys.
- the regulated fees, when existing (for example: network termination fees charged to MVNO),

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Operators interviewed in the quarterly survey of ARCEP are not contacted by Insee.

The data included in the annual survey, allocating the revenue between business and households, is used for an annual adjustment of the weights of the series.

In **Austria**, the data source for the calculation of unit values is the Austrian Regulatory authority for Telecommunications and Broadcasting (RTR). This regulatory authority is obliged to collect quarterly revenue and volume data in the different fields of telecommunication which are used to calculate unit values on the most disaggregated level for homogeneous service products. Aggregates are calculated for wired telecommunication, wireless telecommunication, broadband internet and leased lines. More details about the survey and the type of provided data can be found at the website of the RTR under <https://www.rtr.at/de/inf/odKEV> (unfortunately only a german version is available).

In **Germany**, turnover and volume data for the calculation of the average values are recorded by a separate survey, as the regulatory authority is not permitted to make these data available to the Statistical Office. As far as possible, the FSO tries to collect the used data volumes and telephone minutes for the offered tariffs. Due to the increasing use of flat rates, providers can often no longer evaluate this data in the required level of detail. Therefore, in many cases, the survey must be limited to the turnover per tariff and the number of users. For the purposes of quality adjustment, the providers try to make available the sum of all data transfers and/or the sum of all telephone minutes, regardless of the tariff. As a result, a B2All price index for telecommunications is calculated which includes both wired and wireless telecommunications services.

Singapore compiles the Telecommunications Services Price Index which includes wired telecommunications, wireless telecommunications and internet access providers. The indices covers both B2B and B2C transactions. A survey questionnaire is sent to the survey respondents on a quarterly basis to collect revenue and volume information. Unit value method is applied to the collection of most services, while some are based on transacted prices provided by respondents or list prices as extracted from the websites.

In **Canada**, the principal data source is a (quarterly) survey that is administered jointly by the relevant regulatory agency (the Canadian Radio-television and Telecommunications Commission) and the country's official statistical agency (Statistics Canada).

This survey collects both revenue and quantity (volume) information for a number of different telecommunications services. This information allows us to construct unit value indexes for the following four telecommunications commodities:

- **Wired (fixed-line, landline) telephone services**
(quantity = # of local and access lines; # of long distance minutes)
- **Wireless (mobile) telephone services**



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(quantity = # of mobile voice minutes (both local and long distance); mobile data traffic (incoming and outgoing) (MB))

- **Cable, satellite and other program distribution services**
(quantity = # of broadcast distribution subscribers)

- **Internet access services**
(quantity = # of dial-up Internet subscribers; # of high-speed (including broadband) Internet subscribers)

The quarterly survey is not a complete census of the entire industry. The survey is to be completed only by a select number of telecommunication and / or broadcasting groups. But, the survey collects information from the largest players in the industry. The number of company responses for this survey is, on average, 28 companies per quarter; however, even fewer companies are able to provide revenue and quantity information for their wireless (mobile) telephone services.

This survey is able to provide data according to whether the customer is classified to one of the following sectors: i) Residential; ii) Business; iii) Retail; and iv) Wholesale.

The revenue information is the basis for the product-level weights used in the index. These weights are updated on an annual basis, to allow for the entry/exit of companies into the industry, to allow firms' information to be included in the index if they haven't previously responded to the survey, and to account for changes in the industry structure.

Poland compiles a B2All price index for telecommunications which includes both wired and wireless telecommunications services. The index for wired telecommunications is compiled using price lists collected from the Internet. For wireless services, data are collected directly from the four largest mobile operators by using a monthly questionnaire. The index for wireless telecommunication is based on a unit value method.

In **Hungary**, data for business-to-business transactions are collected via questionnaires which are completed by market-leader companies. The general methodology was developed with the active contribution of respondents and an individual questionnaire for each respondent is produced taking into account the services provided. The survey started in 2007 for fixed line telephony and mobile services, then in 2010 was expanded to include the providers of satellite and other telecommunication services (as a pilot). For the majority of services, the unit value or a combination of unit value and component pricing for well specified services is used to capture price data. For satellite and other telecommunication activities, the direct use of prices of repeated services and contract pricing approach (e.g. for reselling network capacity) are used.

Currently, indices for B2B as well as for B2All services are compiled and transmitted to Eurostat. Sales to businesses account for about 45% of the total output. The special part of the SBS survey was expanded to allow for the estimation of the turnover generated to B2B and B2C service activities. This facilitated the



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calculation of a B2All index as a weighted average of the B2B and B2C indices (B2C is estimated by Harmonized Indices of Consumer Prices at Constant Tax, HICP-CT).

Japan compiles price indices on telecommunication services including wired/wireless telecommunications and interconnection services for network providers. Indices are focused on business-to-business transactions. For wired telecommunications: "Fixed telephone services," "Leased circuits," "Internet connection services," and "Wide Area Network services," Japan mainly uses the direct use of prices of repeated services, model pricing, and the unit values. For wireless telecommunications: "Cellular phone services and PHS services," and "Mobile data communications services," Japan uses model pricing. For interconnection services for network providers: "Access Charges," Japan uses the direct use of prices of repeated services.

In the **Netherlands** turnover is collected through a mixed model combining administrative data and statistical surveys. Statistical surveys are conducted for enterprises with 10 or more employees while tax (VAT) data is used for the enterprises with less than 10 employees. Data are obtained on a quarterly and annual basis in order to comply with the European regulation on Short-Term Statistics (STS) and Structural Business Statistics (SBS). SPPI data is collected for fixed line (fixed telephone services and Internet connection services) and mobile telephony services. Respondents fill in B2B price baskets and maintain these baskets to keep the included services up to date. One enterprise prefers to deliver unit value data (separate B2B and B2C). With each respondent there is a lot of contact to keep the individual basket up to date. For one enterprise the consumer price index (CPI) data is also included. Unit value data of the Dutch regulatory authority for telecommunications is also collected. This is delivered too late for inclusion in the index calculation but is used for weighting information and to get a better overview of the market.

In **Norway**, unit prices are calculated based on turnover and volumes for the following services: Landline, mobile telephony, mobile and fixed internet broadband, B2B. B2C price is calculated through CPI. The survey for B2B is based on the largest enterprises in the industry, based on turnover. We collect data concerning these units from another survey performed by *National sikkerhetsmyndighet* (Nkom = National Security Authorities). The enterprises in the sample report data for services, for which they have a significant marketshare for business customers.

In **Finland**, price data for telecommunication services is collected through a survey which is used both in the Producer Price Index for Services and the Consumer Price Index. The data includes prices for wireless and wired telecommunications. The unit value method is used to approximate the price change of telecommunication services. The method is implemented by obtaining a unit value price at the lowest level of aggregation, which is the ratio of turnover to quantity (e.g. subscribers, minutes) for each relevant subscription. Quantities (e.g. subscribers, minutes) are used as weights for teleoperators' index. The upper level weights for the telecommunications price index are obtained from the national industry regulator, i.e. Finnish Communications Regulatory Authority.

The **UK** index for business telecommunications comprises fixed line and mobile telephony services. Fixed line activity is dominated by a single service provider with other suppliers using the infrastructure of the main supplier. UK mobile services are supplied by a small number of evenly sized businesses with their own networks. Other mobile suppliers provide virtual networks by securing airtime from one of the major



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providers. The UK telecommunication SPPI has not been reviewed or updated in recent years. The index is based on a unit-value method. It is compiled from the aggregation of unit-values defined as the ratio of revenue to volume for each homogeneous group of products. Turnover and volume data for the whole market is sourced from the UK communications regulator (Ofcom) providing full coverage. The unit-value approach provides a proxy estimate suitable for the telecommunications industry. In addition to minimising bias, it solves the problem of service bundles and escalating tariffs by negating the need to constantly adjust for quality.

Italy compiles two sub sector SPPIs, one for wired and the other for wireless telecommunications, with data collected by two different questionnaires. The total national telecommunications index is obtained by a weighted arithmetic mean of the two sub sector indices. Turnover and volume data are collected for homogeneous classes of services and used to compile unit values, good proxies of the average prices of the services, and then aggregated in a Fisher price index.

In **Croatia**, the main pricing method for telecommunication services is unit value. The data source for the calculation of unit values is the Croatian Regulatory Authority for Network Industries (HAKOM). This regulatory authority is obliged to collect quarterly revenue and volume data in the different fields of telecommunications. It provides full coverage. The main groups of services are: telephone services in fixed network, telephone services in mobile network, renting of networks and lines, television services, access to internet services.