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Mini-paper:

Measuring price development of mobile games in SPPI – Experience from Statistics Finland

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1. Introduction

Do you remember the classic mobile game Snake? Snake was the first but indeed not the last successful Finnish mobile game; most have at least heard of if not played games such as Angry Birds and Hay Day. It has been more than two decades since Nokia published the iconic game, and the mobile game industry has come a long way since. Application stores offer an endless selection of games for download, and mobile game producers make billions of dollars annually around the world.

Price measurement of mobile games became topical at Statistics Finland in 2016-2017, which is when mobile game enterprises were first drawn into the sample in connection with the 2015=100 renewal. As the mobile game industry had become increasingly important in the Finnish economy in the 2010s, it was only a matter of time before they needed to be included in SPPI.

Characteristics of the mobile game industry introduce multiple challenges to measuring price development. Market area is typically not limited by country boarders, and at least for a small economy such as Finland, the majority of turnover comes from abroad. A large variety of monetization models are applicable to mobile games, which affect the appropriate method of price collection. And like in many other services, quality change is difficult to define and eliminate. Classifying the services is not straightforward either, as mobile game enterprises' output is related to programming instead of publishing, at least until the game is done.

This paper aims to describe the characteristics of mobile games and Statistics Finland's experience of including mobile games into the producer price indices for services. This paper is constructed as follows. First, issues related to classification of mobile games are discussed in section 2. Characteristics of mobile games and the mobile game industry are covered in sections 3 and 4. Practical experience of measuring producer price development as well as compiling weights are discussed in sections 5 and 6. Section 7 describes issues that we have encountered especially with quality change. Finally, next steps are reviewed in section 8.

2. Classification

Finding the correct product class for mobile games was not entirely simple as mobile games do not yet have a clear category in the Statistical classification of products by activity (CPA, rev. 2.1) nor in the Statistical classification of economic activities (NACE, rev. 2). The correct section is *J Information and communication services*, but the appropriate class was not evident. To find the right product class, we needed to define the output of the enterprises and to compare the descriptions of the 6-digit-level subcategories in detail.

We faced two different classification issues. First, many of the enterprises related to video games were classified into programming activities although publishing activities may have described their output better. If the industrial classification of the enterprises is incorrect, sampling frame may be unrepresentative for SPPI's needs. Second, there seems to be at least three possible 6-digit-level subgroups for games in CPA classification: *58.21.20 Computer games downloads, 58.21.30 On-line games,* and *62.01.21 Computer games software originals*. Although mobile games are software for which players buy licenses indicating that they belong in group *58.2 Software publishing services*, we investigated all potential options.

Two main questions were considered to determine the proper industrial classification of the enterprises and to place mobile games within the CPA classification. First, does the enterprise sell mobile game programming services to another enterprise or create the software themselves? Second, if output is software, is it the actual software consumers buy and use? Or is it intellectual property such as an algorithm or technology, which is sold to be used in another software?

2.1. Industrial classification of the enterprises

At Statistics Finland, enterprises, whose business is related to video games, were generally categorized under computer programming services. The classification issue was brought to light when the price measurement of mobile games was researched. The industrial classification of video game enterprises was reviewed, and in 2019 some of them were transferred from computer programming activities to publishing. This revision applied several business statistics including wage and salary indices, turnover of service industries, annual national accounts, and employment statistics.

Several reasons may have caused the inaccurate classification. For example, the enterprises may have begun their business in programming services and only later published their first mobile games and their industrial classification in Statistics Finland's inquiries was never corrected. Another likely cause is misinterpretation of the Standard Industrial Classification. News release of the revision was published on Statistics Finland's website on March 7th, 2019[1].

2.2. Classification of mobile games

Next step was to study the differences between the three 6-digit-level subcategories that appeared appropriate based on their names: *58.21.20 Computer games downloads, 58.21.30 On-line games,* and *62.01.21 Computer games software originals*.

According to the description of CPA revision 2.1 on Eurostat's website[2], *58.21.30 On-line games* includes "*provision of games that are intended to be played on the Internet such as provision of role-playing games (RPGs), strategy games, action games, card games, and children's games. Payment may be by methods such as subscription or pay-per-play*." On-line gambling services are excluded from the subcategory. Another similar option is a nearby subcategory *58.21.20 Computer games downloads,* which includes "*electronic files containing computer games that can be downloaded and stored on a local device*".

Neither of the subcategories under *58.21 Publishing services of computer games* explicitly include mobile games, and mobile games contain features that are included in both subcategories: they can often be played online, and they are downloaded and stored on a device. However, *58.21.20 Computer games downloads* refers directly to computers and local devices, not mobile devices.

The description of *62.01.21 Computer games software originals* reveals it to be less suitable. The subcategory includes "*copyrighted intellectual property produced without contract for outright sale (i.e. with all-attendant property rights); intellectual properties for sale that are implicitly or explicitly*

[1] http://www.stat.fi/uutinen/industrial-classification-of-video-game-enterprises-is-reviewed-enterprises-transferred-from-programming-to-publishing. Viewed on July 6th 2023.

[2] Description of CPA Classification on Eurostat's website is available at https://showvoc.op.europa.eu/#/datasets/ESTAT_Statistical_classification_of_products_by_activity,_2.1_%28CPA_2.1%29/data?resId=http:%2F%2Fdata.europa.eu%2Fehl%2Fcpa21%2F620121

protected by copyright (e.g. computer games software)". Key distinction is intellectual property, which refers to, for example, an algorithm or technology in a software or the rights to a finished mobile game. Therefore, this subcategory does not include selling licenses to finished mobile games but intellectual rights to a software that can be sold to another enterprise.

At Statistics Finland, we chose to group mobile games under subcategory *58.21.30 On-line games.*

3. Business models of mobile games

Mobile games can be divided into two main groups based on monetization model: free-to-play and pay-to-play games. As the terms indicate, consumers may download and play free-to-play mobile games without any upfront costs while pay-to-play games must be purchased before trying out the game. The chosen revenue model is often linked with the characteristics of the game.

Although free-to-play games can be played without a fee, enterprises have ways to gain revenue on these games. Free-to-play mobile games can be further divided into three general revenue models: micropayment model, advertisement-based revenue model, and lite versions.

In micropayment model, players can download and play the game for free, but they can also make in-game purchases to speed-up progress. For instance, a player can purchase more resources, get more attempts on a task, or skip a difficult level. This model is generally utilized when new content is regularly added into the game.

Advertisement-based revenue model means that while playing the game is free, enterprises gain revenues from selling advertisement space within the game. This model can be implemented, for example, by building the game itself around a specific product or brand, placing brand assets such as the logo within the game, or selling advertisement space in the game. The player could, for instance, be required to watch an ad between each level or choose to watch an advertisement to gain an item in the game.

Lite versions enable consumers to try a game before deciding to purchase it. Lite versions can be executed in different ways; typically, it is limited in either features or playing time. Players can purchase the full version of the game if they choose to do so.

Pay-to-play games, on the other hand, require a payment before the game can be played. Access to the game may be gained either by a one-time purchase or by a subscription. The one-time purchase model is more likely utilized in games that are not updated after publication and aim to maximize the number of downloads. Subscription-based games are typically continued with regular new content to prolong the time consumers spend playing the game.

In practice, combining these models is common to maximize revenue. Especially the advertisement model is often added as an option for players who do not wish to pay for the games out of their own pockets.

4. Industry description

Mobile games are mainly sold through Apple and Google's application stores. Application stores serve as an intermediary between consumers and mobile game producers. This indicates that mobile game producers belong in SPPI's Business to Business (BtoB) index although consumers are

the making the purchases. Mobile game producers can choose whether to sell their game on only one of the platforms or both. Barriers for market entry are small: Apple charges an annual fee of 99 USD[3] and Google a one-time fee of 25 USD[4] for a license to publish applications on their platforms.

Apple Store and Google Play take a commission on each purchase before transferring the rest of the revenue to the enterprise. Industry experts informed us that commission for applications and in-app purchases excluding subscriptions on both platforms is a flat 30 %. Commission from mobile game subscriptions is 15 % at Google Play. Apple Store charges 30 % for subscriptions for the first year, after which the commission is lowered to 15 %.

Nevertheless, changes in the industry occur and attention needs to pe paid to developments in the market. For example, in March 2021 Google announced a reduced commission of 15 % for non-subscription purchases when annual revenue is under one million USD[5]. Once earnings surpass 1 million USD, commission for all purchases rises to 30 %, which still implies that commission for all but small mobile game producers is 30 %. Other discount programs may exist, which makes the pricing scheme more complex. Thus, the size of the commission depends on several aspects such the game's revenue model, publication date of the game, and total annual revenue of the producer.

According to industry experts, Apple Store sets a fixed price matrix for app purchases, see Figure 1. Example of Apple Store's price matrix. The prices reflect consumer prices; thus, they include Apple Store's commission and value added tax, if VAT is typically included in consumer prices in the market area. There is a producers' version of the matrix, as well, showing proceeds excluding commission and VAT.

Euro territories (except Montenegro) (EUR)

Tier	Customer Price New	Tier	Customer Price New
0	0.00	51	64.99
1	1.19	52	69.99
2	2.49	53	79.99
3	3.49	54	84.99
4	4.99	55	89.99
5	5.99	56	94.99
6	6.99	57	99.99
7	7.99	58	109.99

Figure 1. Example of Apple Store's price matrix. [6]

There are around 90 different tiers ranging from 1,19 € to 1 199,99 € and the increments between tiers are increasing in price. All markets and currencies have their own price matrix following the same logic. Mobile game producers choose applicable prices for their products from the matrix.

[3] Source: https://developer.apple.com/support/compare-memberships/. Viewed on September 5th 2023.
[4] https://support.google.com/googleplay/android-developer/answer/6112435?hl=en. Viewed on September 5th 2023.
[5] Source: https://android-developers.googleblog.com/2021/03/boosting-dev-success.html. Viewed on September 5th 2023.
[6] Source: https://developer.apple.com/support/downloads/price-tier-updates/App-Store-Price-Tier-Updates-October-2022.pdf. Viewed on September 5th 2023.

According to industry experts, enterprises tend to commit to same prices across platforms, thus all prices follow Apple Store's price matrix.

5. Price measurement in practice

According to industry experts, mobile games with the most turnover in Finland follow the micropayment model, which means that their revenue comes from in-game purchases. We collect consumer prices on mobile games and extract the producer's share with the following logic.

$$Producer\ price = consumer\ price - value\ added\ tax - commission$$

If consumer price of an in-game purchase including VAT were 5,99 €, value added tax 24 % and commission 30 %, producer price would be

$$\frac{5{,}99\ €}{1{,}24} * 0{,}70 = 3{,}38\ €$$

Because enterprises typically commit to same prices across platforms and the prices of in-game purchases are picked from Apple Store's price matrix, the changes in the price matrix should describe the development of producer prices quite well according to industry experts. Issues related to this assumption are discussed in section 7 Shortcomings of Statistics Finland's approach.

Mobile games are a global business as consumers all over the world have access to purchase and download applications from Google Play and Apple Store. Internationality of the industry brings its own challenges to statistical offices; some factors to consider are currencies and weights. At Statistics Finland, all prices are converted into euros before index calculation, which affects the elementary indices of mobile games sold outside of the euro area. Weights are discussed in section 6 Weights.

At Statistics Finland, we have chosen to follow prices from mobile game producers' largest market areas. Market areas are chosen so that their cumulative share of total revenue is about 2/3. If Finland is not included among those market areas, it would be added to the list. For each region, we follow the development of about 5 different price tiers, which are commonly used in the producer's mobile games. Industry experts reported that price matrices seldom change, which is why we send out price surveys twice per year. As list prices rarely change, currency exchange rates are the main source of change in prices of mobile games on a month-to-month basis.

6. Weights

Two different dimensions of sales data is needed to weigh the elementary index of a mobile game producer: total revenue from each country and the number of purchases for each product by game and country. A third dimension is added if prices vary between platforms.

Unfortunately, industry experts have informed us that the application stores do not provide product-specific sales data to the mobile game producers. The enterprises only receive their share of total revenue from the platforms. If mobile game producers gather data on consumer behavior and number of sales themselves, our experience is that they seem unwilling to share that information with the statistical office. Therefore, we have not yet managed to compute product specific weights, which means country-specific revenue is equally distributed to all products from

that country. In our method, product refers to a price tier and product specific weights indicate the number of times items in that price tier has been purchased.

At Statistics Finland, we get data on mobile game enterprises' turnover from Statistics on Service Industry Commodities. We utilize the Statistics on International Trade in Goods and Services to divide the enterprise's total turnover between countries where the mobile games are sold. As the prices we follow are from the general price matrix, weights are not divided between the enterprises' different mobile games.

7. Shortcomings of Statistics Finland's approach

Several important aspects of the definition of producer prices are not accounted for in the Finnish approach. Essentially, we measure changes in list prices, and just like most services, mobile games have sales campaigns. By simply following the development of the price matrix we cannot observe discounts because they are not included in our price data. The use of list prices is likely to cause some unreliability in our index.

The price matrix is connected to another important aspect, which we do not catch with the current method of collecting prices: quality change. The treatment of quality change depends on the characteristics of the game. Prices of mobile games following the one-time purchase model may never change, but the next version of the game may be priced differently. If the idea of the game is the same, could that be considered a pure price change? If new content is added to a subscription-based game, should quality adjustments be made?

In mobile games following the micropayment model, we observe the producer's share of the consumer price but not what the player has received for that sum in the game. We do not know whether the service (e.g. resource or item in the game) players buy for a specific amount of money remains comparable with the previous reporting period. For instance, we do not observe quality change if the producer alters the unit price of in-game currency. There are other possible issues related to quality change in micropayment models, as well. Would it be enough to track the unit price of in-game currency, or should it also be considered what the players can purchase with it?

8. Future considerations

Measuring producer prices of mobile games is complex. More than five years ago Statistics Finland set up price collection for mobile games according to the information that was available. The method was researched and discussed with industry experts, but there is no denying that it needs further development to improve accuracy.

We plan to discuss access to more detailed data on both prices and weights with the mobile game enterprises. One option is to follow the prices of commonly purchased resources for the most popular games, which would allow to better control for quality change and to observe the effect of discounts. On the other hand, this option would significantly increase the response burden compared to the current situation as survey frequency as well as the number of services in the survey would likely increase.

The sources of revenue should also be reviewed from time to time to ensure that all relevant prices are included. If a significant share of revenue is generated from the sale of advertising space, that should be included in the survey.