R&D capitalisation: where did we go wrong?

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Summary

Globalisation and the activities of multinational enterprises (MNEs) present an increasing challenge for macroeconomic measures particularly those designed to reflect domestic economies. The very presence of MNEs goes against the basic idea of there being an identifiable and measurable domestic economy consisting of domestic consumers and producers. In a globalised world with limited to no trade barriers, MNEs will operate across multiple national economies, often under a single management or control structure. One of the serious problems that MNEs present for macroeconomic measurement is the issue of assigning economic ownership of Intellectual Property (IP) to the various fractions of a global value chain and therefore to domestic economies . This is an issue for which the international guidance is currently incomplete and still under research by national accountants.

This paper is an attempt to contribute to the discussion of R&D capitalisation by establishing a bridge between the micro and macro worlds. This translation of information on the MNE's business structure to the National Accounts framework will give an indication of real world distortions that national accountants will encounter when measuring the activities of MNEs on a domestic economy basis. By looking at the issue from the perspective of the entire global MNEs activities, rather than from the fractional views as exposed by domestic economy level data, this paper aims to provide new input into the discussion on how economic ownership of IPs should be understood in a future version of the SNA.

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1. Introduction

A significant innovation of the latest SNA update (2008 SNA) is the capitalisation of expenditure on research and development (R&D). In the process of the SNA update, Statistics Netherlands produced several papers on this issue (cf. De Haan & Van Rooijen-Horsten, 2004 and Van Rooijen-Horsten et al., 2007). These papers highlighted several data issues such as: the translation of Frascati based R&D statistics to National Accounts data; assessing service lives of R&D assets; and dealing with possible overlaps between R&D and computer software. This kind of guidance was later formalised in the OECD Handbook on deriving capital measures of intellectual property products (2009). The 1993 SNA implementation included the introduction of computer software capitalisation for which the first country results showed a disparity of applied methods and results. The introduction of R&D capitalisation was 'managed' in a more careful way. Unfortunately, we cannot conclude that R&D capitalisation in the National Accounts has been totally successful.

In the papers produced by Statistics Netherlands, two conceptual concerns were brought to the attention:

1. R&D in the public domain does not necessarily comply with the general definition of an asset in the SNA sense. Economic ownership of public knowledge cannot be claimed by one particular economic agent;
2. Guidance on how to account for R&D flows and stocks inside the multinational enterprise (MNE) is totally lacking.

Regarding the first issue, Statistics Netherlands "lost the battle". Ultimately it was decided that R&D expenditure, both public and private, should be treated equally as fixed assets in the 2008 SNA. The arguments supporting this choice were pragmatic rather than conceptual. Our impression is still that publicly available knowledge contrasts with the general SNA definition of an economic asset.[1] This broad demarcation of R&D assets is also ambiguous and creates implausible outcomes. Therefore we revisit this issue in the subsequent section of this paper before moving on to the issue of globalisation.

In recent years, the second issue on R&D in relation to MNEs and globalisation has received increasing attention. For national accountants, one of the key challenges of economic globalisation is explaining how capital services of intellectual property enter the globally organised production chains. Several developments are complicating this globalisation puzzle. Firstly, the international fragmentation of production chains, inside or outside MNE structures, may imply that business functions such as R&D and software development (i.e. product development and design, development of software inputs) are being separated and (spatially) disconnected from the process of physical transformation (the actual manufacturing of the good embedding the software). Secondly, production chain fragmentation may also enter the stages of physical transformation. Examples of highly fractured and specialised manufacturing webs are those found in the automobile or aircraft industry.

Nowadays some manufacturers entirely offshore the physical transformation stages of production; such 'production arrangers' are also called factoryless goods producers (FGPs). The issue of FGPs was intensively discussed in the UNECE task force on global production (UNECE, 2015). Questions about their economic classification and the kinds of transaction these companies are generally engaged in

[1] The misplaced *conceptual* argument in which public R&D is compared to public infrastructure is discussed later on in this paper.

were, unfortunately, not brought to a final conclusion. Both issues are closely linked to recording R&D or, more generally, intellectual property (IP) flows and stocks.

R&D capitalisation suggests that intellectual products can be accounted for like any other fixed asset in the National Accounts. Our view on globalisation is that this is not the case. This point is picked up in Section 3 of this paper.

An additional complicating factor is that IP, or intangible assets more broadly, may become a vehicle for tax planning. MNEs may locate their IP and report related IP revenues (i.e. royalties) in low tax jurisdictions and subsequently charge affiliated companies, which report substantive shares of the MNEs turnover, for the use of the IP. Such tax planning arrangements may involve a range of special purpose entities (SPEs) located in a variety of countries. A national accountant is usually able to observe only fragments of the tax planning arrangement and is easily misled by the information being obtained at the level of individual SPEs, or other entities in a tax planning arrangement. Judgements on substance or divergences in legal vis-à-vis economic ownership are extremely difficult. This is the main issue in Section 4.

Section 5 winds up with (tentative) conclusions and suggestions for future work.

2. The wheel of knowledge and IP creation

Knowledge cannot be valued in money terms. Any attempt to do is doomed to fail as the importance of knowledge to society cannot comprehensively be evaluated in terms of all 'capital services' obtained by society from our common knowledge base. One crucial part of knowledge is its use for purely scientific reasons i.e., building up new knowledge. Knowledge creation inherently depends on existing knowledge. We call this the 'wheel of knowledge' (which happens to be also a videogame).

Another important problem to confront is that knowledge itself does not depreciate. Codified knowledge may get lost in the course of catastrophic losses (library fire or computer crash), which is according to the SNA not the same as depreciation. Crucial too in the process of knowledge creation is that the complementary tacit knowledge, or human capital, is being maintained, or even expanded, by our educational systems.

In the process of developing an electric automobile in the twenty first century one cannot say that the required knowledge obtained in ancient times, say the invention of a wheel millennia ago, is less significant to the car than more recent inventions, e.g. the development of powerful batteries. As such we cannot argue that the invention of a wheel is at this point of time (partly or fully) depreciated. We are still enjoying, as ever, the fine properties of a wheel.

Equally, we cannot say that contributions from ancient philosophers like Pythagoras or Socrates to contemporary thinking have become less relevant and should therefore be depreciated. But if knowledge does not depreciate then the wheel of knowledge becomes larger and larger, year after year.

How does this thinking contribute to national accounting? The last two versions (1993, 2008) of the SNA underscored rightfully the increasing significance of knowledge as a production factor. Business value and profits increasingly rely on tacit (human capital) and codified knowledge (intellectual property products). This is why computer software, artistic originals, mineral exploration and research and development were included in the SNA list of fixed assets (not human capital which is another story).

This issue of whether intellectual property products have equal properties as other (tangible) fixed assets is picked up in the subsequent sections of this paper. The minimum requirement is that intellectual property products should comply with the general definition of an asset: they are subject to economic ownership and provide future benefits to its owner. In addition, a *fixed* asset must be the outcome of production.

With respect to intangible assets these conditions should be given careful consideration. In relation to R&D performed by businesses we can safely assume that companies are able to claim the benefits from the R&D they fund or carry out themselves. As high tech companies may spend up to ten per cent of their turnover on R&D, it is quite likely that these companies will be receiving a reasonable return to R&D capital and are capable of claiming R&D ownership, most notably by patenting.

In the context of globalisation this paper explains that at the level of a multinational company the concepts of ownership and obtaining benefits are conceptually sound and applicable. When stepping down at the level of individual member companies, or when assessing ownership and R&D returns at country level where these member companies are resident, both concepts become fuzzy and less easily applicable.

We think this is a serious issue. If national accountants are not able to explain how R&D is linked to production and output, they are not capable of accounting properly for R&D flows and stocks. These concerns are picked up in the subsequent sections of this paper.

De Haan et al. (2004) raised the question of what are the conditions under which R&D complies with the general SNA asset definition (at least at the level of a multinational enterprise)? They concluded that due to the exclusive access to knowledge acquired from R&D, the owner may exert a certain level of market power which has a clear and distinct market value. This knowledge may be translated into products with, in the eyes of the consumer, unique and well appreciated properties, not found in the products offered by rival suppliers. The service obtained from knowledge assets will decay in correspondence with the loss in monopolistic power the owner will inevitably experience over time. Competitors will eventually be able to copy the invention or may develop themselves, by way of new R&D projects, product properties which outperform previous product innovations.

This loss in market power causes the knowledge asset to depreciate over time. This depreciation is by definition the outcome of obsolescence as R&D or intellectual property generally will not be subject to wear and tear. The knowledge itself will not disappear, it may generate a positive contribution to society for many years, yet its commercial value will inevitably decline. This distinction between knowledge and its possible commercial value is of crucial importance. The knowledge as obtained from R&D will not depreciate. However, access exclusiveness and its potential commercial value will depreciate. Depreciation refers to the fact that a patent (or exclusive user rights more generally) is time limited and the progression of technology inevitably implies advancing obsolescence.

As a thought experiment it may be worth considering the (part fictional) story of the discovery of penicillin by Alexander Fleming and his refusal to take out a patent or similar believing that the discovery was too important to limits its use. As national accountants the question we should be asking is whether the discovery of penicillin therefore led to a fixed asset? If neither Fleming nor anyone else could claim economic ownership and accrue future benefits due to the knowledge being freely available and usable then there is no fixed asset. Instead there is only knowledge. However had Fleming opted to obtain a patent then there would have been an economic owner and a fixed asset. This example shows that it is the patent, or more generally obtaining exclusive ownership, that gives rise to the fixed asset and not the knowledge or discovery itself. Where knowledge is not protected by any means, a patent or secrecy, a fixed asset cannot be recognised.

Sharing profitable knowledge incurs a cost as it may delimit the monopolistic power of the initial owner. One should be aware that commercial success is often the combination of codified knowledge (the R&D asset) and tacit knowledge (the complementary human capital required to translate knowledge into successful product blueprints). Copying tacit knowledge may be harder than copying R&D assets. This means that exclusive ownership of scientific knowledge is not necessarily safeguarded by patenting but can equally be obtained by way of secrecy or by the exclusive access to the complementary tacit knowledge.

The service lives of patents in the various scientific areas (e.g. pharmaceutics, electronic appliances, IT) may be a reasonable proxy for assessing service lives of patented and non-patented R&D projects. This is how many NSIs go about assessing service lives of R&D assets. As unsuccessful projects are unavoidable in the process of seeking commercial success, it is defendable capitalising expenditure on both successful and unsuccessful projects in the attempt to approximate the overall market value of business R&D capital.

We have seen that the 2008 SNA recommends all R&D to be capitalised, business research and strictly non-commercial, e.g. university research. The argument is that university R&D is a public good which is beneficial to society for a longer time period, similar to public roads or bridges. The arguments below speak against this analogy. Also the 2008 SNA (10.98) explains that "the knowledge remains an asset as long as its use can create some form of monopoly profit for its owners. When it is no longer protected [..] it ceases to be an asset". Yet this wording could be read as that the 2008 SNA itself already rejects the idea of publically shared knowledge as an asset in the SNA sense.

First, with regard to public bridges or roads there is generally no confusion about economic ownership (we leave aside the complexity of public-private operations which is not germane to this discussion). The government is responsible for maintaining the road and may even be liable for damages to users caused by deficiencies. The government has decision power, for example, it may decide to sell the road to a public operator or put the underlying land to another (public) use. In this sense public infrastructure meets the definition of a fixed asset. This may not always be the case for R&D in the public domain. Once in the public domain the R&D asset has become a pure public good. To consider this more fully we first breakdown, probably non-exhaustively, the kinds of research projects carried out in the public domain.

Government bodies may conduct scientific research for various reasons. Some of this research may be linked to commercial purposes and may even be patented (e.g. supporting agriculture or enhancing the circular economy or improving generally the environmental performance of businesses). This type of research is quite comparable to business R&D. When businesses are able to claim the (commercial) revenues of this public research, one may argue that this R&D has been transferred to them. This exclusivity gives rise to economic ownership and therefore is an indicator that such public R&D should be recorded as a fixed asset. Given its purpose this dedicated R&D is likely subject to obsolescence as newer techniques may replace old ones. So, this R&D depreciates in an economically meaningful way. Crucial in this context is whether or not the government grants unconditionally all parties access to this knowledge. If so, the knowledge is in fact a public good and cannot be an economic asset in the SNA sense.

Another example is defence related research. This research may be performed either by commercial or government institutes. One may expect that this research is conducted under strict secrecy since its key purpose is obtaining a military advantage over (potential) enemy states. In relation to dedicated military research there will generally be no misunderstanding about ownership and the beneficiaries of this research. By not publicising such research the government maintains a quasi-monopoly position and is the economic owner of a fixed asset. In the arm's race equal steps taken by potential enemy states will inevitably lead to diminishing the defensive advantages of research projects over time, again implying this research can be depreciated in a meaningful way, even though the purpose of this R&D may be (partly) non-commercial.

Another part of R&D performed in the public domain is purely non-commercial scientific university research. Obviously the origin of scientific research is being claimed by their authors in scientific journals. This is not the same as claiming economic ownership. The main purpose of this research is extending science which requires among other things allowing full access to scientific results, for verification purposes or for allowing other scholars to extend on published findings. The main purpose of university research is feeding scientific debate. In the strict context of university research, notions such as economic ownership and economic revenue become meaningless. Scientific results are shared

and applied by others for the sake of conducting new research. Once academic research has been published the revealed knowledge immediately becomes not only a pure *public* but also a *free* good.[2] A pure public good cannot be a fixed asset as no single owner exists who can claim economic ownership and earn any future benefits. Therefore this element of public R&D does not meet the definition of a fixed asset as it is not subject to economic ownership.

This leads to the following conclusions. The main purpose of most academic research is generating public knowledge over which ownership cannot be claimed by one economic agent, not even a government. The outcome (we hesitate to call this revenue) of research is commonly shared by academia. Therefore academic research, once published, does not meet the definition of an asset. Further, academic research and knowledge in general is not subject to economic depreciation as service lives are, in principle, indefinite. Depreciation functions applied to academic research lack any conceptual underpinning. International standards should not ask national accountants to carry out such phoney calculations.

The meaninglessness of such calculations can be underscored by the following representation of a production function of academic research (in ISIC Rev.4 code 85). In case of public education and research, the SNA convention is to value output (X) as the sum of costs. Let us assume a purely scientific research institute (perhaps allied to a university). Its main current costs are the salaries of researchers (L). According to the 2008 SNA the output of this research institute is R&D which is recorded as gross fixed capital formation. Its depreciation feeds back in the production account of the research institute. We assume that the salaries and labour input are constant in time. We also assume geometric depreciation (d). The production function is represented by equation (1). The capital accumulation function is represented by equation (2).

(1) $X_t = L + d \times R\&D_t$

(2) $R\&D_t = (1-d) \times R\&D_{t-1} + X_{t-1}$

→ $X_t - X_{t-1} = d \times L$

So the remarkable outcome of the SNA convention is that while labour input (L) remains constant over time, each year the R&D output of this research institute will linearly increase by $d \times L$ while the R&D capital stock will annually expand by L.

What is modelled by equations (1) and (2) is the 'expanding wheel of knowledge' which has nothing to do with economic accounting. According to equations 1 and 2, government consumption would annually increase by $d \times L$ while intuitively one would agree that given constant labour input the research institute would generate constant output, according to the SNA convention of non-market output valued at sum of costs and ignoring labour productivity changes.

In other words the R&D output of this research institute should be recorded directly as government consumption and not as gross fixed capital formation.

[2] A public good means that individuals cannot be effectively excluded from use. The use by one individual does not reduce availability to others. Public R&D is also a *free* good as its use is principally unlimited and not subject to depreciation.

3. Corporate R&D property and global R&D networks

3.1 Introduction

At least two complicating factors limit our understanding of how the services of R&D capital enter the global production chain. The first one is the global fragmentation of production and, within the global value chain, the disconnected supply of physical and intangible inputs. The second is that R&D creation itself can be subject to interlinked global research networks. Both issues are considered in this section.

3.2 Globally fragmented value chains

Global production contrasts with the idea of 'national' accounting and this is why so much effort has recently been put into developing guidance supplementing the 2008 SNA (cf. UNECE, 2011, 2015, Eurostat 2014). As explained by the OECD, international production, trade and investments are increasingly organised within so-called global value chains (GVCs), where the different stages of the entire production process, from product design all the way to product distribution and after sales services, are located across different countries.[3]

Intellectual property and information technologies play a fundamental, enabling, role in the global value chain. For example, communication networks enable product development and design to be geographically disconnected from goods fabrication.

The well-known value added breakdown of an iPhone indicates that the physical parts and assembling costs represent roughly half the iPhone retail price.[4] All other value added generated by the iPhone output is connected to the intangible inputs such as R&D, design, marketing and presumably activities such as supply-chain management. The income is generated in different regions of the world.

Graphic presentations of global supply chains nicely show the geographic distribution and clustering of manufactured parts and assembling making up the iPhone, a motor car or an airplane.[5] How R&D feeds in to the global value chain is harder to explain. This issue is often ignored as analysis of global production webs often limit themselves to the physical transformation segments of global production.

However, if according to the 2008 SNA R&D is a fixed asset, like any other (tangible) fixed asset, the National Accounts should be able to explain which entities inside the MNE structure are actually investing in R&D and consuming the concomitant R&D services. In other words, we should be able to explain which (affiliated) entity (in which country) owns the R&D asset and is accountable for its depreciation or more generally the costs of using the R&D asset. Similarly, the accounts should be able to explain how R&D and IP contribute to output and (KLEMS) productivity on a country-by-country basis.

There are several reasons why these questions are difficult to answer:

[3] http://www.oecd.org/sti/ind/global-value-chains.htm

[4] https://www.digitaltrends.com/mobile/IPPhone-cost-what-apple-is-paying/

[5] http://www.aeronewstv.com/en/industry/commercial-aviation/3707-boeing-787-dreamliner-structure-parts-from-around-the-globe.html

1. Basic and applied research provides capacity-enhancing technologies which facilitate product innovation but will not directly result in blue prints of new products.[6] In other words, in contrast to product development, basic research misses a direct link to the goods and services outputs. This being the case, the head office of an MNE seems the most obvious candidate for economic owner of this truly corporate R&D property. It is quite likely that head offices take the (funding) decisions on basic research investments in line with the overall corporate innovation strategy. The latest Frascati handbook (OECD, 2015, par. 3.11) confirms this view: "In large and complex organisations, decisions concerning the strategic direction and financing of R&D activities units tend to occur at a higher organisational level than does the day-to-day management of R&D operations. (..) These decisions can cut across national borders, thus raising a challenge for the statistical authorities and agencies, whose responsibility is often limited to gathering information from resident units." In other words, allocation of basic and applied research or allocating its capital services, to the goods manufacturers inside the MNE is inherently without economic meaning.

2. R&D is different from most activities performed by a corporation in the process of its operation. Research is typically not performed with the expectation of immediate profit. Instead, it is focused on the long-term profitability of a company. As such the way in which R&D feeds into to the production function is unlike other fixed asset categories. Even for computer software, its presence in a local computer or in the cloud is needed in the course of the transformation process in order to deliver its capital services. Obviously, a similar presence is also required for tangible capital items. In contrast, once a potentially successful recipe for a new medical drug, or the technical design of a new motor car, has been being developed, the production process will be set up according to this new blue print, after which the R&D capital has delivered its contribution to output. This does not imply there is no return to R&D capital involved in the course of producing the medical drug or motor car. However, this different mechanism by which R&D contributes to output implies that the R&D asset is not necessarily found in the balance sheet of the entity engaged in the transformation, i.e. the actual fabrication of the drug or motor car. Instead the R&D asset may be on the balance sheet of an affiliated company (in a low tax jurisdiction) or on no balance sheet at all as corporate accounting rules are generally quite restrictive in capitalizing R&D.

3. Inside or outside the MNE's scope, a production network is not just the sum of its component parts. Product development and design are one of the typical activities carried out by the arrangers or principal entities inside global production networks. So these entities are often the main R&D investors inside the global value chain. This is also according to the explanation of factoryless goods producers (FGPs) in the Guide to Measuring Global Production (UNECE, 2015). In this regard FGPs and head offices of MNEs carry out similar tasks: they both manage global supply chains with the aim of optimising network synergy. They are both expected to bring together the intangible and physical stages of global production. The main difference is that FGPs have outsourced the physical transformation activities while inside the MNE these activities are (partly) carried out by affiliated companies. Also different from an FGP, a head office will not necessarily report turnover from sales of goods. Alternatively this turnover is expected to be reported by one or several of the MNEs affiliated goods producers. As product and process innovations obtained from R&D may affect several stages in the production network it seems from a holistic point of view defendable that the

[6] Basic and applied research represents 20% of total business R&D in the US: https://www.nsf.gov/statistics/2017/nsf17320/

FGP or head office is the typical stage where R&D enters the global production chain. Conversely, it is infeasible to assign R&D inputs to the separate transformation stages in the production chain.

4. In the context of an FGP arrangement, R&D may lead to innovations of products assembled and supplied by non-affiliated contract producers in the various parts of the world. The value added and profits generated by these contract producers will typically omit the return to R&D assets as their output prices will exclude R&D costs. The R&D returns are directly captured by the principal of the global production arrangement. Discussions in the global production taskforce (UNECE, 2015) showed that, in the case of a FGP, National Accountants have great difficulties in explaining the nature of the transaction between the contract manufacturer and the principal: the purchase of a good or the purchase of a (manufacturing) service. Our conclusion is that in economic terms the good purchased from the contractor differs fundamentally from the good sold to consumers, even though in physical terms no distinction can be made. This may have implications for the commodity classification in the National Accounts and Balance of Payments. Nowadays in the classifications of goods not only are it's physical characteristics relevant, but also the conditions under which the commodity is transferred from one economic owner to another.
5. In the context of an MNE the output price of the affiliated contract producer may indeed include the return to R&D capital as its output may be directly distributed to the end consumers. However, the required R&D assets may, or may not, be found on the balance sheet of the affiliated manufacturer. It is still possible that headquarters, in its role as global production arranger, provides the R&D inputs, possibly without any intracompany flows of R&D services being observed. In such a situation the R&D profits will be repatriated to the headquarters via property income (dividends or retained earnings).
6. This shows that corporate funding of R&D is not necessarily linked to how and where the R&D is translated into commercial success. Ignoring tax planning for a moment, from the MNEs perspective a spatial determination of generated R&D income is irrelevant as this income will eventually reach the MNE's shareholders wherever generated. Discussions with a number of R&D managers of Dutch multinational companies led to the conclusion that cost redistribution is not common practice (*cf*. de Haan & van Rooijen-Horsten, 2004).
7. Ironically R&D cost accounting (IP related royalty payments) within the MNE is particularly observed in the context of tax planning arrangements. Fair competition authorities, tax authorities and statisticians alike have to evaluate to what extent IP cost accounting arrangements have economic substance. Looking at recent events one must conclude that tax planning arrangements of MNEs may place national accountants in a very difficult position. This issue is further discussed in Section 4 of this paper.

To conclude, (national) IP economic ownership in the context of global production is still not a well understood concept. The arguments above indicate that IP economic ownership seems to usually coincide with the decision making entities in the global value chain. These are the entities that are expected to manage overall the intangible and tangible inputs of production. However such a view has several implications that require further examination:

- Assigning economic R&D ownership to headquarters on behalf of the MNE requires, amongst other things, a careful examination of cross border R&D flows as they are be reported in the international trade in services statistics. R&D conducted by foreign affiliated entities may, or may not, be (partly) funded by headquarters (or by sister companies) or may even have been

purchased. This means that the practicalities of such an approach need to be carefully thought through. Some guidance is already provided by Frascati in showing a data collection scheme for R&D expenditure at the MNE level (Figure 11.2).

- The commodity (CPC) classification should be further examined to address the economic characteristics of the output of captive suppliers in an FGP arrangement.

3.3 Global R&D networks

R&D (Frascati) statistics provide information on R&D expenditure. This is without any doubt crucial information for the purpose of measuring R&D investment. The assumption that R&D expenditure is overall a reasonable approximation of its commercial benefits is not likely to be replaced by an alternative measurement method. The costs of carrying out R&D and maintaining global R&D networks can be statistically observed in a meaningful way on a country-by-country basis. The output allocation of R&D networks on a country-by-country basis is a less clear concept. Of course we can assume that the cost distribution is representative for the investment allocation but this seems to be a rather shaky assumption.

Global R&D networks within MNEs are best illustrated with the help of a few real life examples. The technology firm Samsung has over 50,000 employees working in collaboration on R&D spread across multiple R&D centres in South Korea as well as others in Russia, India, China, Israel, Japan, Poland, the United States and the United Kingdom[7]. Table 1 details some of the R&D activities undertaken by Samsung outside of South Korea.

Table 1
The Samsung R&D network

	Research institute	Country	Type of R&D activities
1	Beijing Samsung Telecommunication	China	Mobile telecommunications standardization and commercialization for China
2	Samsung Semiconductor Chine R&D	China	Semiconductor packages and solutions
3	Samsung R&D Institute India	India	System software for digital products, protocals for wired/wireless networks, application and graphic design
4	Samsung Telecom Research Israel	Israel	Hebrew software for mobile phones
5	Samsung Yokohama Research Institute	Japan	Core next-generation parts and components, digital technologies
6	Samsung Poland R&D Center	Poland	STB SW platform development, EU STB/DTV commercialization
7	Moscow Samsung Research Centre	Russia	Optics, software algorithms and other new technologies
8	Samsung Electronics Research Institute	UK	Mobile phones and digital TV software
9	Dallas Telecom Laboratory	US	Technologies and products for next-generation telecommunication systems
10	Samsung Information Systems America	US	Strategic parts and components, core technologies

Another example is Philips which is a leading technology company operating in the healthcare and consumer electronics sector and one of the largest Dutch MNEs with its technology headquarters

[7] http://www.samsung.com/semiconductor/about-us/research-development/

located in the Netherlands. However Philips also conducts R&D activities across the world as shown in table 2[8].

Table 2
The Philips R&D network

	Research institute	Country	Type of R&D activities
1	Philips Research Shanghai	China	Imaging systems
2	Philips Research Suresnes	France	Healthcare
3	Philips Research Aachen	Germany	Healthcare
4	Philips Research Hamburg	Germany	Imaging systems, biological modelling, computer assisted detection
5	Philips Research Asia	India	Healthcare
6	Philips Research Africa	Kenya	Healthcare, design, user inferface
7	Philips Research Eindhoven	Netherlands	Healthcare and global headquarters for all R&D
8	Philips Research Cambridge	UK	Healthcare
9	Philips Research North America	US	Healthcare, artificial intelligence

Although we did not undertake a full investigation, the literature on R&D management seems to confirm that regional R&D facilities may support local product development as well as the overall MNE's longer term research strategy. For example Papanastassiou & Pearce (2005) find that local R&D laboratories in the UK are mostly funded by the parent company of the MNE group. This is considered as being powerfully indicative of the manner in which such decentralised operations are now integral to the ways in which these companies seek to apply existing core technologies and to regenerate and broaden the scope of these crucial knowledge competences. It depicts a process of refocusing of decentralised R&D away from the short-term objective of assisting particular subsidiaries to apply existing technologies to their specific competitive situation, towards positions integral to the more sustained technological and competitive development of the MNE group. In contrast to independently operating R&D facilities, close cooperation between the regional R&D units within an MNE is expected to provide substantial externalities, in the form of systematic group-level spillover benefits. Central financial participation in the funding of laboratories can be seen as crucial in developing the necessary interdependencies between decentralised R&D units, and in securing the cohesive growth of intra-group knowledge flows.

Some MNEs like Apple follow quite aggressive strategies in obtaining the knowledge required for strengthening global competitiveness. Recently Apple opened R&D units in Berlin, the French Alps and New Zealand, all in the close neighbourhood of companies with a strong record in certain scientific areas (e.g. mapping or augmented reality). In several cases these companies lost employees to Apple soon after Apple opened its new R&D unit.[9] This shows that the choice of location of newly established R&D units is on occasion solely driven by knowledge acquisition, the availability of human capital/tacit knowledge and not by locating the R&D unit close to those MNE affiliates that are supposed to transform the R&D to product innovation, output and commercial success.

The existence of R&D networks within the MNE structure appears to have similar implications for the National Accounts as the existence of fragmented production chains. While the geographical

[8] https://www.philips.com/a-w/research/locations.html
[9] https://www.bloomberg.com/news/articles/2017-09-21/apple-s-global-web-of-r-d-labs-doubles-as-poaching-operation.

distribution of R&D costs within the MNE structure as reflected by Frascati based statistics is likely to be reasonably well measured, the distribution of the created R&D assets inside the MNE is not well understood. Particularly for the smaller national firms, there will likely be a strong geographical correlation between R&D activities and the obtained commercial gains. In those cases it is reasonable to assume that the location of R&D activity coincides with R&D asset ownership. However, within the MNE framework this assumption cannot generally be made on solid grounds. As R&D strategies and R&D funding are expected to result from the overall corporate strategy, the choice of considering R&D as genuine corporate property seems attractive. However, as mentioned the practicalities of such a choice should be carefully considered.

4. Intellectual Property and tax planning

One may argue that R&D capitalisation in the 2008 SNA revealed (but not necessarily caused!) the National Accounts' vulnerability to problems arising from globalisation as MNEs may use IP assets as vehicles for tax planning. The goal of such tax planning is to shift revenue to units within the MNE structure that are tax resident in low tax jurisdictions and therefore minimise the global tax liability of the MNE. This is often achieved through the use of royalty and licence agreements linked to IP assets. Units of an MNE will typically be required to pay a royalty charge to another unit within the MNE for the right to produce or use assets intrinsic to the production process. In doing so profit from sales in higher tax jurisdictions can be transferred to units in lower tax jurisdictions, minimising the global tax liability for an MNE. Such constructions are often used by MNEs in the technology industry where R&D and other forms of intellectual property play a crucial role. The lack of a physical presence of IP assets lends themselves to such constructions as they can be easily located and relocated around the world at little cost. Under such conditions, the observable global value chain of MNEs reflects the artificially created reality rather than what could be considered the true production linked economic reality. We should also note that movable tangible assets such as transportation equipment may also be subject to tax planning arrangements as their (legal) ownership can be assigned to a leasing company resident in a low tax jurisdiction.

The two real life examples of Google and Nike explored in this section highlight the expected consequences of following, as a national accountant, the legal reality as revealed in source statistics, rather than looking through the legal reality and picturing the MNEs' real economic substance, which can only be seen after the entire 'elephant' has been observed. It should be emphasised that all information on both cases has been obtained from public sources such as news articles and business reports and does not disclose information from official statistics as collected for individual companies.

4.1 The Double Irish with a Dutch Sandwich[10]

Explaining the case

The 'Double Irish with a Dutch sandwich' is a name given to a specific business construction which is designed to minimise the MNE's global tax liability. This technique has most prominently been used by tech companies, because these firms can easily shift large portions of profits to other countries by assigning intellectual property rights to subsidiaries abroad. From 2015 onwards Irish tax legislation does not allow companies to use the Double Irish Dutch Sandwich for new tax plans. Existing plans can be continued until 2020. This may have severe repercussions for national statistics as in response MNEs may restructure their business and set up alternative tax planning schemes. Business restructurings may also be the response to the recent US tax reforms.

One of the MNEs using the Double Irish Dutch Sandwich construction is Alphabet more commonly known as Google.[11] Its main ingredients, which are typical for the Double Irish Dutch Sandwich recipe, are as follows.

[10] A detailed legal explanation of the Double Irish with a Dutch Sandwich is given in ''From the Double Irish to the Bermuda Triangle'' J. Brothers, November 2014, Tax Analysis.
[11] https://fd.nl/ondernemen/1180304/google-sluisde-vorig-jaar-15-mrd-royalties-door-nederland

The parent company at the top of the corporate hierarchy is Alphabet Inc. This company is based in Mountain View, California, USA. Although most of the ultimate parents of a Double Irish Dutch Sandwich structure are resident in the US, this is not necessarily the case. Google Inc. sits below Alphabet Inc. in the hierarchy and is the top of the structure for what can best be described as the everyday Google internet functions e.g. search, maps, email. Beneath Google Inc. sits a large number of companies operating across the world.

One of them is Google Ireland Holdings Unlimited, which is an Irish incorporated entity managed and controlled from a low tax jurisdiction, in this case Bermuda - a common choice. This is an SPE registered in Ireland but not liable for tax in Ireland. Rather it is tax liable in Bermuda from where it is officially managed and controlled. This type of holding companies with only holding activities has no physical presence and zero employees, or only sufficient employment to fulfil a strict legal requirement i.e., the only employees are directors or shareholders who are normally non-Irish residents.

Google Netherlands Holding B.V. is a Dutch resident company. It is an SPE type unit with no employees and no activities other than "financing and participating in affiliated companies".[12] This Dutch SPE receives royalty payments from Google units in Ireland and Singapore which are directly transferred to Google Ireland Holdings Unlimited, minus a small amount of administrative costs.

Google Ireland Limited is an Irish registered company that undertakes real economic activities in Ireland. It also has a wider role outside Ireland of being the company that closes all deals for Google AdWords across Europe. AdWords represents a large portion of Google's revenue. It has been estimated that as much as 88 per cent of Google non-U.S. revenue is recorded by Google Ireland Limited[13]. Together these Google affiliates, representing the double Irish Dutch sandwich, operate as follows.

Google Ireland Holdings Unlimited Company owns various IP rights which it licences to Google Netherlands Holding B.V. who in turn are then sublicensing these rights to Google Ireland Limited. Google Ireland Limited uses the sublicenses in its production process and generates revenue. In doing so it is liable to pay royalty fees to Google Netherlands Holding B.V. as a result of using the IP.

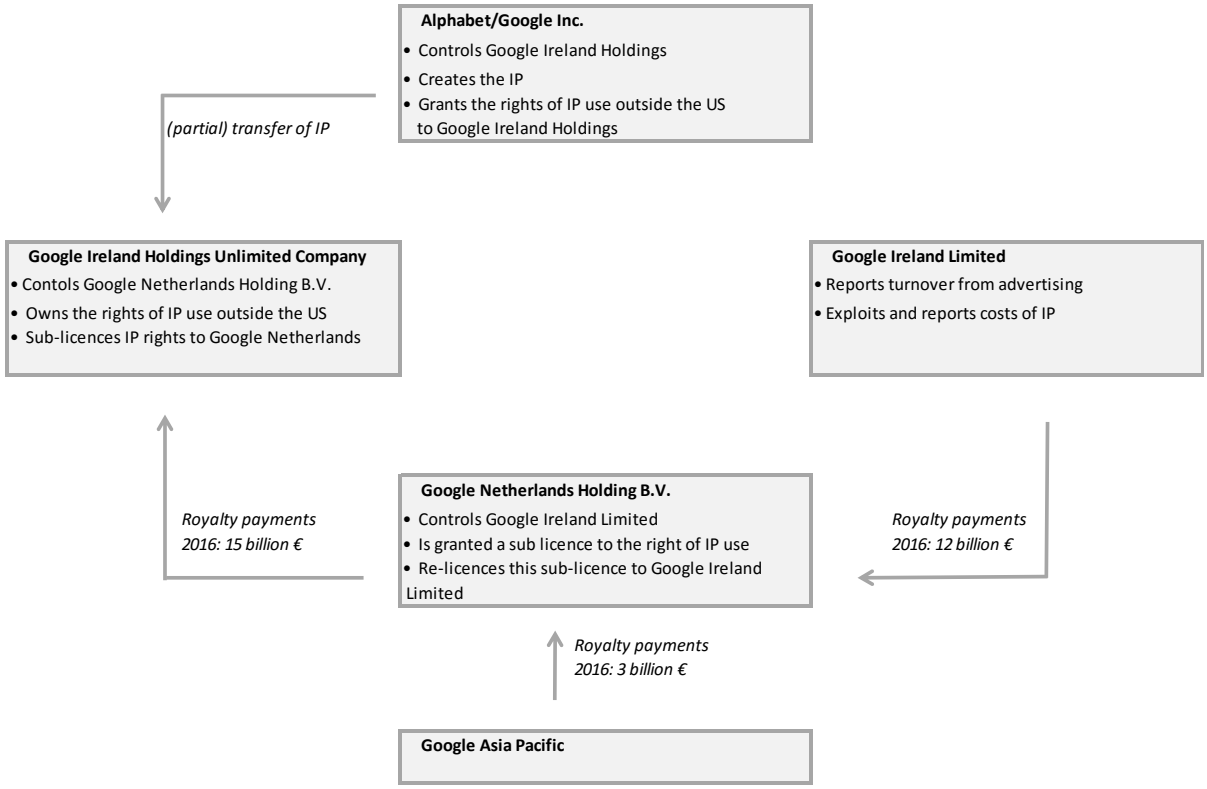
Google Netherlands Holdings B.V. is also liable to pay royalty fees to Google Ireland Holdings Unlimited Company on account of the licencing agreement between the two. As such the royalty payments make their way from Ireland via the Netherlands back to an Irish registered company but controlled, managed and liable to pay corporation tax in Bermuda. Google Netherlands Holdings B.V. acts only to funnel cash flows between units. In comparison with the value of the royalty flows little profit remains in the Netherlands.

The Dutch SPE is not an essential hub in the tax planning arrangement. Rather it is an additional insurance layer against potential withholding tax liabilities arising on direct royalty payments The zero rate of withholding taxes on incoming and outgoing royalty payments between Ireland and the Netherlands allows this royalty flow to be seen as being taxed already (though at a zero rate) meaning the potential tax liability is therefore removed. Typically the Dutch SPE will pay on virtually identical royalty payments to the Irish Holding unit as it receives. In 2015 over 99.9% of the royalties received

[12] Google Netherlands Holdings B.V. Annual Report 2016
[13] van Geest, van Kleer and Smits, 2015, p.64

by Google Netherlands Holdings B.V. were repaid to Google Ireland Holdings.[14] An overview of the Google structure is presented in Figure 1.

Figure 1
A double Irish Dutch sandwich: the Google case



National Accounts implications

There are several concerns when translating the information obtained from each of these entities to National Accounts statistics.

- The arrangement requires that IP ownership is transferred from the ultimate parent (in the US) to the Royalty and Licence company in a low tax jurisdiction (Bermuda), in the Google case this is Google Ireland Holdings. This apparent IP transfer, raises several questions. For example, would this be an IP purchase/sale, and if so, what would be a representative market value of such an intra-company transaction? But perhaps an even more fundamental issue is whether or not this transaction has economic substance at all. Is Google Ireland Holding, besides the legal owner, also the economic owner of this IP? One may expect that, despite this arrangement, strategic decisions about IP creation and allocation continue to be made in the US, even in cases where part of its IP ownership is transferred to an affiliated company abroad. A practical question is whether such an international intragroup IP transaction will be recorded

[14] As calculated based on data from Google Netherlands Holding B.V. annual report 2015, publically available at www.kvk.nl. Royalties received 14,.963 billion euros, royalties repaid 14,951 billion euros.

in all the countries involved in a symmetrical way. In other words, will the value representing the export of the IP from the US equal the import value as reported in Bermuda/Ireland?

- Another question is the country of residence of the Google Ireland Holdings Unlimited, as this company is registered in Ireland but managed and controlled in Bermuda and also tax liable in Bermuda. Which country should conceptually be recording this unit in their National Accounts and which country is actually doing this?
- Google Netherlands Holding B.V. is registered in the Netherlands, files annual returns to the Dutch Chamber of Commerce and is liable for tax in the Netherlands. As Google Netherlands Holding B.V. lacks a domestic parent it must be considered a self-standing resident institutional unit in the Netherlands. Google Netherlands Holding B.V. is granted a sub licence for the IP assets but no information of its value is shown in business reports. From the point of view of the Netherlands, Google Netherlands Holding B.V. does not carry out significant economic activity, has no employment and appears to do no more than funnelling financial flows from one country to another. In doing so it fully acts on behalf of its foreign parent. The inflow of funds equal outflows with a small margin covering local costs. From the point of view of the Netherlands, it is defendable that these in- and outflows are recorded as financial transactions and not as IP related services imports and exports. But from the point of view of Ireland such a recording would create an asymmetry as Google Ireland Limited is expected to report an import of IP services from the Netherlands, or perhaps directly from Bermuda?

The Bermuda triangle

Given the residency issue of Google Ireland Holdings Unlimited, it is not unlikely that this entity will show up neither in Irish nor in Bermudan statistics. In other words, in the world of statistics the Bermuda triangle appears a real threat. This view is strengthened by simply comparing the value of the royalty transactions involved to the annual GDP figure for Bermuda. In 2015 Bermudan GDP was 5.9 billion US dollars.[15] This amount is far less than the 14.9 billion euros that Google's Dutch subsidiary paid in 2016 to its Bermudan subsidiary. The tentative conclusion is that earnings of Google Ireland Holdings Unlimited Company are not included in Bermudan measures of GDP. The compilers of Bermudan GDP may not view this unit as being resident in Bermuda, or otherwise may not conceive Google Ireland Holdings Unlimited as the producer of IP services with a 14.9 billion euros turnover.

The Double Irish with a Dutch Sandwich strategy is known to be used, or have been used by other large companies than just Google. Attempting to extrapolate out from this one case study to quantify with any degree of accuracy what might be the total of unrecorded GDP is near impossible without vast amounts of time and resources. Even then the wall of corporate secrecy would act as a serious impediment to obtaining good estimates of globally unrecorded output.

Research undertaken in other areas does allow some read across in attempts to come to a ball-park estimate for the global problem. For instance Garcia-Bernardo et al (2017) analyse corporate global ownership structures from a network analysis approach and in doing so designate certain countries as either sink or conduit financial centres. The authors identify Bermuda as one of the largest sink offshore financial centres in that it is the net recipient of far more foreign capital than would be

[15] Official estimate of Bermudan government, https://www.gov.bm/bermuda-economic-statistics

expected given Bermuda's level of GDP. The question remains whether this lost income should be recorded in Bermuda's GDP at all.

Guvenen et al (2017) attempt to reattribute foreign earnings of U.S. led MNEs to study what impact this has on measures of U.S output and industry productivity. In doing so they reattribute earnings from Bermuda to the US of 35 billion US dollars which represents the equivalent of almost 6 times Bermudan GDP. The authors conclude that current US measures of output suffer from measurement errors arising as a result of earnings by US corporations being shifted to countries with relatively low tax rates. The authors also indicate that repatriated earnings from the United Kingdom Islands in the Caribbean including the British Virgin Islands, Cayman Islands and Turks and Caicos Islands as equal to 4.8 times the GDP of these lands. The largest repatriation, 28% of the total, is actually from the Netherlands. This shows that the problem of profit shifting does not necessarily have to involve what could be termed the traditional tax paradises.

This paper makes no attempt to put a value on the total of global unreported value added. Rather it concludes that this total will be large. If the coverage of just one MNE in the National Accounts alone is responsible for 15 billion US dollars of missed output then the total of all MNEs could easily exceed 100 billion dollars. Zucman (2015) indicates that profit shifting to low tax jurisdictions outside the US represents an amount of 130 billion US dollars. One may expect that most of this capital income will not be reported in any country's GDP. Compared to global GDP of around 75 trillion dollars this unobserved income may still seem small. But as indicated by Guvenen et al. tax planning arrangements may have significant and undesirable effects on the macroeconomic indicators at national level.

4.2 The case of Nike

A so-called "closed" Dutch limited partnership, in Dutch a 'commanditaire vennootschap' or C.V., is used by several American MNEs such as Nike, General Electric, Heinz, Caterpillar, Time Warner and Foot Locker.[16] The C.V. tax planning route has brought the Netherlands under accusation of being a tax haven for American companies similar to places as the Caymans Islands, Switzerland and Bermuda. How the C.V. construction works is explained with the help of the Nike example.

Also in this case IP assets are a key element in the tax planning arrangement. As explained in the UNECE Global Production Guide (2.17) the value of sports brands such as Nike may partly originate from R&D, i.e. the development of "a the midsole, the most important part of an athletic shoe, that cushions and protects the foot". Otherwise it is quite clear that sports brands such as Nike are also the outcome of intensive marketing which is in the strict 2008 SNA sense a non-produced asset. When observing the profit and loss accounts and balance sheets of royalty and licences companies, the distinction between produced and non-produced intangible assets, also in terms of related capital services or royalty receipts, is not easily made. This point is addressed later on in this section.

From a National Accounts perspective the tax planning arrangement for Nike looks similar to that of Google in that specific units within the MNE own IP assets intrinsic to the production process for which they are reimbursed by other units within the MNEs global value chain for the use of those IP assets. However Nike does not use Irish registered units but rather a specific type of Dutch legal construction,

[16] https://thecorrespondent.com/6942/bermuda-guess-again-turns-out-holland-is-the-tax-haven-of-choice-for-us-companies/417639737658-b85252de

Nike Innovate C.V. is a subsidiary of the Nike Group. It is registered with the Dutch Chamber of Commerce, though with its official address recorded as being in Oregon in the United States. The activities of the business are recorded by the Dutch Chamber of Commerce as 'holding IPP rights, financing R&D and buying-out third party licences'. As reported in the international media, Nike Innovate C.V. is the legal owner of IP assets including trademarks and designs belonging to the Nike Group[17]. It is useful to emphasise that purchased marketing assets and goodwill are also assets in the SNA sense, however they are classified as non-produced and therefore not considered as intellectual property products.

According to the Dutch tax law C.V.'s are transparent entities and therefore not liable to Dutch corporate income tax. However under US tax law the C.V. is seen as liable for tax in the Netherlands. This miss classification can result in certain C.V.'s being liable for corporate income tax in neither the Netherlands nor the US. In effect such C.V.'s become stateless[18].

If Nike Innovate C.V. is not liable to pay corporation tax in the Netherlands, it will also not appear in tax data used by Statistics Netherlands for compiling economic statistics. Also, as Nike Innovate C.V. is not registered with an address in the Netherlands, this entity is not surveyed for official statistics. As a result, Nike Innovate C.V. remains uncovered by the official statistics for the Netherlands. Nor should it be expected that this entity will show up in the statistics of any other country.

The Netherlands also hosts Nike Europe Holding B.V., which is a holding company for other Nike units within Europe including Nike Europe Operations Netherlands B.V.. This unit is the European headquarters of Nike with around 2000 employees in the Netherlands. Nike Europe Holding B.V. has a branch located in Belgium, where the Nike Customer Service Center is located. The customer service centre provides central warehousing activities to its subsidiary Nike Europe Operations Netherlands B.V. which is the owner of the inventory held at the warehouse and which is the main commercial entity of the Nike group in Europe and the Middle East. As explained in the financial report[19] the warehousing activities involve all supply-chain related activities, including receipt, storage, order handling and the shipment of Nike products.

The principal business activity of Nike European Operations Netherlands B.V. is given as the marketing and selling of athletic footwear, apparel, equipment, accessories and services[20]. For the year June 2015 to June 2016 the unit recorded revenues of 8.4 billion euros, the majority of which were generated outside the Netherlands by its subsidiaries. Nike Europe Operations Netherlands B.V. and its subsidiaries generate revenue by selling goods across Europe and beyond, either directly to consumers, or via independent distributors and licensees.

Revenue of Nike Europe Holding B.V. is solely limited to the services provided by the customer service centre to Nike Europe Operations Netherlands B.V. for which they are reimbursed on a cost plus mark-up basis. For the year from June 2015 to June 2016 this revenue is recorded as 262 million euros. However Nike Europe Holding B.V. recorded for the same period general and administrative expenses of 1.268 billion euros. Of this 1.017 billion euros is recorded as trademark royalties, ''in connection

[17] https://www.irishtimes.com/business/how-nike-slashes-its-tax-bill-between-the-netherlands-and-bermuda-1.3281665

[18] http://leidenlawblog.nl/articles/what-about-cv-bv-structures-and-state-aid

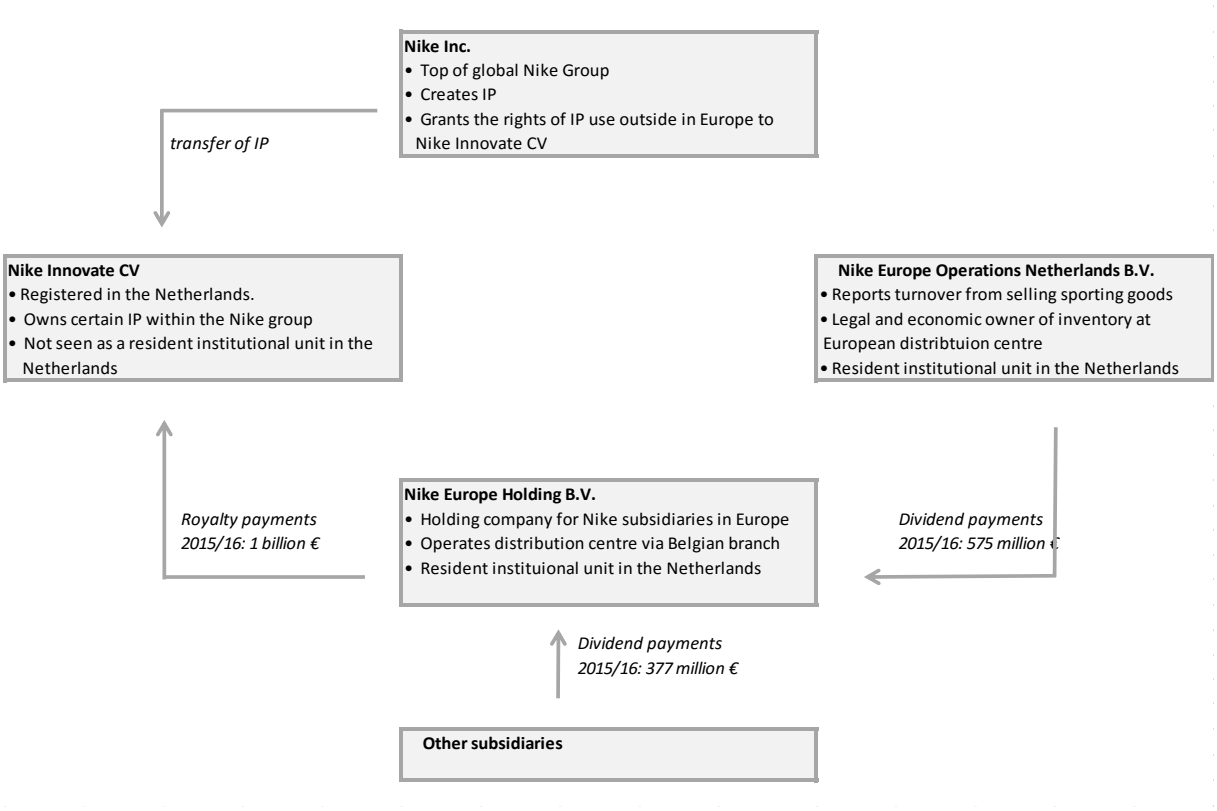
[19] Nike Europe Holding B.V. financial report for year ending May 2016, publically available from www.kvk.nl

[20] Nike European Operations Netherlands B.V. financial report for year ending May 2016, publically available from www.kvk.nl

with the distribution and commercial exploitation of Nike Intangible Property and Nike marks.''[21] The result of making a royalty payment far in excess of revenue is that Nike Europe Holding B.V. records an operating loss which is then financed by dividends from its subsidiaries and principally from Nike Europe Operations Netherlands B.V. This description of Nike's operations in the Netherlands has been the case since November 2012 when Nike Europe Holding B.V entered into a "a certain agreement in connection with the distribution and commercial exploitation of Nike intangible property and Nike marks.''[22]

Figure 2 details the transactions that take place between the units under discussion with additional details taken from the publically available annual reports filed at the Dutch Chamber of Commerce.

Figure 2
The Nike case



As mentioned the case of a sports shoes manufacturer was also a prominently used example in the UNECE Guide to Measuring Global Production. The example was used to discuss the production arrangements between a principal and contracted foreign suppliers including the more specific issues of merchanting and FGPs. However the particular issue of IP assets being held in an, as far as National Accounts measures are concerned, stateless entity was not discussed. Before the information revealed from the Paradise Papers, such an example was simply too bizarre to imagine.

As a commanditaire vennootschap, Nike Innovate C.V. is not required to file annual accounts with the Dutch Chamber of Commerce. Obtaining details on any of this entity's transactions is therefore difficult. The accounts of Nike Europe Holding B.V. do not reveal the names of the recipients of the

[21] ibid
[22] Nike Europe Holding B.V. financial report for year ending May 2013 publically available from www.kvk.nl

royalty payments within the Nike Group. Media reports have identified Nike Innovate C.V. as being the recipient of royalty payments from Nike's European headquarters in the Netherlands[23].

In addition, from a conceptual viewpoint, it is not clear how the income flows related to non-produced intangible assets such as brand names should be recorded in the National Accounts. Marketing assets, trademarks and designs fall outside the fixed assets boundary. As explained by BMP6 (par. 10.140) trademark revenue, payments for use of brand names, and so forth include aspects of property income (i.e., putting a non-financial non-produced asset at the disposal of another unit) as well as aspects of services (such as the active processes of technical support, product research, marketing, and quality control). The recording of income flows obtained from non-produced intangible assets such as trademarks and brand names is not explicitly addressed in the 2008 SNA.

National Accounts implications

- As several US companies seem to use the C.V. structure, it is expected that the revenues of these C.V.'s will not be accounted for in either the GDP of the US or the Netherlands. This is due to the peculiar tax status of these C.V.'s. The repercussion for statistical measurement is that Nike Innovate C.V. has no resident status. This would imply that the more benign sounding Dutch Polder is equally as dangerous to global GDP as the Bermuda Triangle. Both places function as royalty income sinks. Looking at the substance of the arrangement one would probably argue that the actual economic ownership of the Nike brand name is still in the hands of Nike headquarters in Beaverton, Oregon, US.
- At the same time, one may expect that the service charges for using the Nike Brand will be (implicitly) recorded in business surveys as production costs of Nike European Operations Netherlands and perhaps of other affiliated companies. Whether these cost charges are 'at arm's length' cannot be assessed.
- Also, the 2008 SNA is not particularly clear on whether these expenses should be part of the current cost of production, i.e. intermediate consumption, at all. The Nike case shows that non-produced assets can be put at the disposal of other units to use in the production process. If done so the owner of the assets may receive royalty or licence payments in exchange. This can be the case with marketing assets such as trademarks, logos or brand names. Royalty payments in exchange for the use of marketing assets would differ from those for produced assets as marketing assets are classified in the SNA as non-produced assets. This raises the question of how royalty payments for the use of non-produced assets should be recorded.
- Besides loopholes caused by differences in tax policies, the National Accounts seem to suffer from a similar kind of mismatches. Entities such as Google Ireland Holdings and Nike Innovate CV appear to be stateless in the eyes of the National Accountant. This may partly result from differences in how national accountants put in practice the SNA guidelines on e.g. the residency principle or statistical units.

[23] https://www.theguardian.com/news/2017/nov/06/nike-tax-paradise-papers

5. Conclusion

Unlike Lynch & Thage (2017) we generally support the choice of capitalising R&D expenditure in the National Accounts. It is beyond doubt that knowledge investments are crucial for the competitiveness of firms. As successful knowledge investments will generate returns over a range of years, it is difficult to ignore the concept of knowledge capital in the National Accounts. Doing so would inevitably diminish the relevance of national accounting.

At the same time we argue that the 2008 SNA approach of R&D capitalisation has been reckless. The 2008 SNA is insufficiently clear in explaining under which conditions knowledge truly represents an economic asset in the SNA sense. As argued in this paper knowledge becomes an economic asset under the following conditions:

1. The economic owner has *exclusive* ownership over the knowledge;
2. This exclusive ownership is expected to generate for its owner an economic (competitive) advantage and a return on investment.

Exclusive ownership enforced by a patent, secrecy or by other means (having access to the complementary tacit knowledge) is a precondition for the existence of a knowledge asset. As a consequence, capitalisation of freely accessible academic research as recommended in the 2008 SNA is a regrettable mistake that should be rectified.

Also within the enterprise group the concept of knowledge (R&D) ownership is insufficiently understood. The National Accounts methodology does not acknowledge that decisions on R&D programs and funding or often made by headquarters and affect the entire MNE structure. As such the international guidelines do not adequately explain how knowledge capital is linked to the MNE and international value chains. For example the SNA does not provide guidance on whether knowledge capital ownership should be identified at the level of the establishments, enterprises or enterprise groups. Additional guidance on these general principles is highly needed. This paper shows that R&D ownership is most easily identified at the level of the enterprise group. Assigning its ownership to lower levels in the MNE structure such as establishments, as is done for other fixed capital asset categories, is not straightforward.

In the National Accounts production is described at the level of establishments or kind of activity units. Their classification is according to ISIC. Similarly, a KLEMS type productivity analysis usually requires that inputs and outputs of production can be statistically described at the level of establishments. Our impression is that R&D is different from other fixed assets. Particularly within the global value chain R&D is not easily linked to the individual fragments of the global value chain and cannot be assigned to individual ISIC establishment classes. The Frascati Manual (OECD, 2015) recommends collecting R&D statistics at the level of the institutional unit (i.e. the enterprise) and not the kind of activity unit. Vancauteren et al. (2018) show that for the analysis of patent ownership the enterprise as statistical unit is essential in the construction of patent datasets as firms tend to register patents (and R&D) under separate firm names.

Additionally, the 2008 SNA does not provide any guidance at all on what to do with R&D (or IP) ownership in the context of tax planning. The UNECE Global Production Guide suggest following legal ownership as a second best alternative. This paper shows that this solution is unsatisfactory from an

analytical point of view. Following legal ownership seems to imply that portions of IP related income are not accounted for at all, neither from a national nor global viewpoint. This cannot be the outcome of international accounting guidelines.

Finally this paper shows that official statistics as collected at national level will not necessarily reveal the tax planning arrangements MNEs are undertaking. Official statistics can only fulfil its key task of informing the public when national accountants combine their efforts in making sense of the data collected from internationally operating companies. The work on data sharing the UNECE is currently undertaking is therefore a very welcome initiative. Also, one may hope that the OECD Base Erosion and Profit Shifting (BEPS) initiative becomes beneficial not only for government finance but also for official statistics.

Our recommendations to improve the recording of R&D and IP in National Accounts are the following:

- As explained the definition of (R&D) knowledge assets in the SNA requires refinement to explain that freely shared knowledge is not an asset in the SNA sense;
- The issue of R&D asset ownership inside the MNE requires continued investigation. As a starting point it is worth investigating whether R&D ownership could and should be assigned to the enterprise group or its headquarter. This is where decision making on R&D programs and budgets often take place. However, from a statistical measurement point of view this proposal has undoubtedly several practical implications which need to be considered. For example:
    - This would require rerouting in the accounts the IP transactions of artificial brass plate type royalty and licences companies. In the case of Google the supply of IP services would directly come from Alphabet in the US instead of being supplied by the Google Ireland/Netherlands holdings. The transactions between the latter units could be restricted to the financial accounts. An work out example is presented in the annex.
    - Another proposed step is assigning the R&D from regional R&D units to headquarters (cf. Tables 1 and 2). From the perspective of the country (A) in which this R&D facility is resident the recording of its output would be export rather than gross fixed capital formation. The accounts of country (B) domiciling the headquarters would show the R&D gross fixed capital formation which originates from import. The R&D would subsequently be depreciated in country (B).

  Obviously, this requires a concerted action of all the countries involved. Such accounting solutions can only work when national statistical offices start working closely together.
- Throughout the world, and of course on a confidential basis, national accountants must start sharing their data and knowledge on MNEs with the main goal of improving the common understanding of MNE structurers and the recording of MNE activities on a country by country basis. Recent experiences show that accounting for MNEs is no longer achievable on an individual country basis. The accurate recording of IP transactions and ownership inside the MNEs requires international statistical coordination in order to avoid the existence of GDP sinks such as the Bermuda Triangle and the Dutch Polder. The international organisations should facilitate such data sharing initiatives. Some of them, Eurostat, UNECE and OECD have already started doing so.

- Statisticians and National Accounts compilers should inform the public that tax planning is not only an issue for government revenue but also for official statistics. This may sound naïve as tax base erosion is of course primary an issue of social fairness in terms of fair tax bill sharing between citizens and companies and in terms of fair corporate completion. However, one of the undesired consequences of non-published arrangements between MNEs and tax authorities is that statisticians are seriously hampered in their task to inform the public properly on the actual state of economic affairs and the nature of activities companies are undertaking in their countries.
- National accountants need to be vocally supportive of a country by country company reporting as recommended in the OECD's Base Erosion and Profit Shifting prevention initiative as a way to ensure better national and global economic data.[24]
- Future updates of SNA should consider the recording of non-produced non-financial assets (marketing assets) particularly in the context of tax planning strategies within MNEs. The 2008 SNA should as a minimum elaborate on the advice of BPM6 for how to deal with income (rent) obtained from the ownership of non-produced assets i.e. trademark and marketing assets.

[24] http://www.oecd.org/tax/beps/country-by-country-reporting.htm

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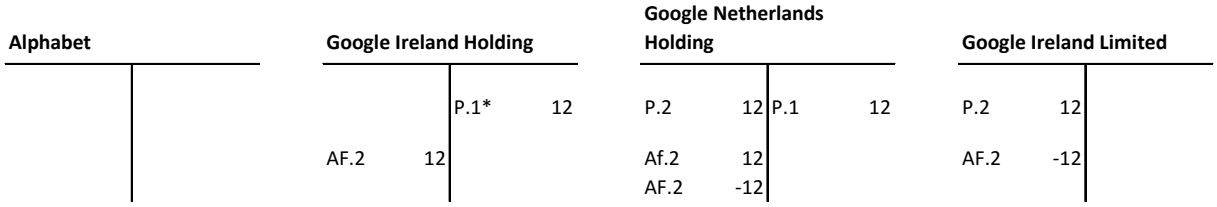
Annex – Google case: rerouting of IP transactions

The concerted accounting treatment of Google, as proposed in this paper, would be to identify Alphabet as the genuine producer of the IP services as consumed by Google Ireland Limited (and of course as consumed by any other non-US Google affiliate). This coincides with the economic ownership of the IP being assigned to Alphabet in the US (in contrast of legal ownership). Of course this would imply that Google Ireland Holding is no longer identified as a royalty and licences firm. In fact both Google Ireland and Google Netherlands holdings would be classified as purely financial vehicles, "Other financial intermediaries" (S.127), with no output. Google Ireland Holding Their main purpose seems to be managing the international cash flows on behalf of the mother company.

Legal representation



Economic interpretation