W(h)ither R&D in the SNA?

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(The views expressed in this paper are those of the authors. They do not necessarily reflect the views of the institutions the authors represent.)

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Summary

One of the main topics of the introduction of the System of National Accounts (SNA) 2008 was the treatment of research and development (R&D) as gross fixed capital formation.

In this paper two issues are discussed concerning this new concept of R&D gross fixed capital formation (GFCF):

- The influence on GDP (and its components)
- The role of national accounts guidelines in the context of legal systems

From a political point of view the impact of the introduction of R&D GFCF on the level of GDP was the outstanding issue. It is discussed what factors determines this impact on GDP and how these factors can be assessed.

National accounts are based on guidelines, handbooks, recommendations and so on. These can be regarded as laws or quasi-laws. As every law underlies a specific legal system, it is investigated if this topic is relevant for national accounts.

The paper concludes with some recommendations that are maybe useful for further revisions.

Keywords: System of National Accounts, Gross domestic product, Research and Development, Legal system, Comparative Law

JEL classification: B52, E01, O30

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1 Introduction

One of the main topics of the introduction of the System of National Accounts (SNA) 2008 was the treatment of research and development (R&D) as gross fixed capital formation. Both the Blue Book from 1968 as well as the SNA 1993 had treated R&D as intermediate consumption.

In this paper two issues are discussed concerning this new concept of R&D gross fixed capital formation (GFCF):

- The influence on GDP (and its components)
- National accounts guidelines in the context of legal systems

From a political point of view the impact of the introduction of R&D GFCF on the level of GDP was the outstanding issue. It is discussed what factors determine this impact on GDP and how these factors can be assessed.

National accounts are based on guidelines, handbooks, recommendations and so on. These can be regarded as laws or quasi-laws. As every law underlies a specific legal system it is investigated, if this topic is relevant for national accounts and for the concepts concerning the capitalisation of R&D.

For this purpose the paper is organised as follows. After this introduction the treatment of R&D as gross fixed capital formation in the SNA 2008 is discussed. It is shown on what guidelines the new concept is based and then the impact on the level of GDP is the subject.

In the third part of this paper the issues are discussed that determine this impact on the level on GDP:

- Property of R&D as a produced asset
- Delineation of R&D gross fixed capital formation and intermediate consumption
- Calculation of R&D market production
- Service life of R&D assets

Especially, it is investigated if the data are plausible and how the plausibility of the data could be checked respectively.

The treatment of R&D as GFCF in the national accounts is based on several guidelines: the SNA 2008 itself, but also the "Handbook on Deriving Capital Measures of Intellectual Property Products" (OECD, 2010). In Europe the guidelines are described more specifically in the ESA 2010 and the "Manual on measuring Research and Development in ESA 2010" (European Union, 2013 and Eurostat, 2014a). In the case of Europe, the ESA 2010 is a compulsory regulation for the member states of the European Union. Other guidelines have at least characteristics of legal statements.

Therefore, in the fourth part of this paper these guidelines are discussed under the aspect of comparative law and legal systems respectively. Firstly, the system of civil law and the system of common law are discussed. Then, it is investigated if national accounts guidelines are based on a specific legal system and what the consequences are. This is illustrated with two cases concerning the treatment of R&D as gross fixed capital formation.

2 R&D in the SNA 2008

2.1 The introduction of the new guidelines

When the System of National Account of 1968 (SNA 1968) – the Blue Book – was revised, it has already been discussed to treat expenditures on research and development (R&D) as gross fixed capital formation. It was acknowledged that R&D fulfils the properties of an (intangible) asset what means that they are entities over which ownership rights are enforced and from which economic benefits can be derived by their owners over a period of time. But for various reasons the expert group that was responsible for the revision of the SNA 1968 could not decide to introduce the concept of capitalized R&D. Therefore, in the SNA 1993 R&D was still treated as intermediate consumption.

During the process of revision that has led to the SNA 2008 the situation has changed. Already the Canberra II Group recommended that

- The SNA 1993 should be changed to recognise the outputs of R&D assets, and the acquisition, disposal and depreciation of R&D fixed assets should be treated in the same way as other fixed assets.
- All R&D output should be treated as an asset, irrespective of its nature or whether it is made freely available. In the latter case, the asset should be recorded on the balance sheet of the owner of the original and be regarded as providing a free service until it becomes obsolete.
- The definition of an asset should be reviewed to ensure it covers the assets of non-market producers adequately. (United Nations, 2005, p. 1)

Finally, the revised SNA which was adopted in March 2008 by the Statistical Commission of the United Nations, stated that

> "Research and development is treated as capital formation except in any cases where it is clear that the activity does not entail any economic benefit for its owner in which case it is treated as intermediate consumption." (SNA 2008, Paragraph 6.230).

Following the revision of the SNA the European Union adopted the new European System of Accounts (ESA 2010) that is fully compatible with the guidelines of the SNA 2008 but is some more detailed and more precise in its definitions of transactions and positions. Meanwhile, many countries have implemented the SNA 2008. The European Union implemented in autumn of 2014 the new standards of the ESA 2010 and most other OECD countries already publish data according to the SNA 2008.[1]

The introduction of new concepts in the national accounts is as labour-intensive as complex. To easier this challenge the guidelines are supplemented by various handbooks, manuals etc. For instance, the OECD has published the "Handbook on Deriving Capital Measures on Intellectual Property Products" (OECD, 2010) that was written by the Canberra II group of the OECD. Additionally, there are several handbooks published by the United Nations for special topics. For instance the "Handbook of National Accounting: Financial Production, Flows and Stocks in the System of National Accounts" (United Nations, 2013) and the "Guidelines on Integrated Economic Statistics" (United Nations, 2014)

The SNA 2008 is a guideline which is applied by countries on a voluntary base. The situation for the European countries differs. As its predecessor the ESA 2010 is compulsory for all member states of the European Union. It has the format of a European regulation adopted by the European parliament and the Commission and it was published as a law in the *Official Journal of the European Union* (European Union, Council of the/European Parliament, 2013).

[1] See van de Veen (2015) for an overview.

2.2 The impact of the treatment of R&D as GFCF

The introduction of R&D as gross fixed capital formation has brought some substantial changes to the system. To assess these changes it is useful to have a look at the different transactions involved in R&D activities:

- If the output of R&D was purchased, it was treated as intermediate consumption (IC) so far. Now it is gross fixed capital formation (GFCF) and th purchase of a capital good respectively.
- If a market producer conducted R&D to use the results for himself, then it was output (for own final use) and IC. Now it changes to GFCF.
- R&D of non-market producers was part of their consumption expenditures. Now it is also treated as GFCF.
- The external trade with output of R&D changes from exports and imports of intermediate products to trade with capital goods.

The most important change for national accounts is the impact on GDP (and GNI)[1]. The additional R&D output (for own final use) increases GDP in a direct manner. The treatment of R&D of non-market producers changes only the structure of GDP from consumption to gross fixed capital formation. But the increase of GFCF leads to an increase of consumption of fixed capital. And this increase leads to an increase of GDP.

The impact on the components of GDP is different. There is an increase in GFCF (which is a tautological issue), an increase in fixed assets and in consumption of fixed capital. Also income increases (due to an increasing net operating surplus assumed for R&D of market producers). Because the R&D of non-market producers is now treated as GFCF, the consumption expenditures decrease. The net exports and imports remain unchanged.

Especially for the use of statistical indicators for political purposes it is important that actually all indicators based on national accounts' figures are affected. This concerns general economic indicators like income per capita, intensity of foreign trade, measures of productivity as well as special indicators like the relation of R&D expenditures to GDP. And in the European Union there is a special situation as political targets and activities are partly based on national accounts figures in a direct manner.

Table 1 shows the impact of the introduction of the SNA 2008 for the OECD countries in 2010. The overall impact for all countries ranges from 0.2 per cent for Luxembourg to 7.6 per cent for the Netherlands. The overall impact is mainly influenced by the introduction of new concepts and especially by R&D. For all OECD Countries the impact of the introduction of R&D capital is 2.2 per cent in 2010.

But as the intensity of R&D differs from country to country, also the impact of R&D on GDP differs substantially. To illustrate this, the last column of Table 1 shows the relation "Gross expenditure on Research and Development (GERD) to GDP". The relation for all OECD countries is 2.34 per cent but it ranges up to approximately four per cent (Finland: 3.9 per cent and Israel: 3.97 per cent). For different reasons, it could be assumed that the impact of the capitalisation of R&D on GDP can be expected to be a little less than the GERD to GDP ratio suggests (Aspden, 2007, p. 5). Indeed, for the OECD-total and for the majority of countries, this assumption is confirmed by the data.

[1] The impact of the capitalization of R&D on GDP and GNI is almost identic.

Table 1: The impact of the benchmark revision on the level of GDP, in year 2010

Country	Overall impact	Of which			GERD to GDP
		New concepts		Statistical benchmark revision	
		Total	Of which: R&D		
	[%]				
Australia	4.4	3.9	1.4	0.5	2.19
Austria	3.2	3.8	2.3	-0.6	2,80
Belgium	2.8	2.5	2.4	0.3	2.10
Canada	2.5	1.7	1.2	0.8	1.82
Chile	n.a.	n.a.	n.a.	n.a.	0.33
Czech Republic	4.3	3.1	1.2	1.2	1.40
Denmark	2.5	2.7	2.6	-0.2	3.00
Estonia	1.2	1.4	0.9	-0.2	1.62
Finland	4.7	4.2	4.0	0.5	3.90
France	3.2	2.4	2.2	0.8	2.24
Germany	3.3	2.7	2.3	0.6	2.80
Greece	1.8	1.3	0.6	0.6	0.67
Hungary	1.6	1.6	1.2	0.0	1.17
Iceland	5.5	1.4	1.4	4.1	2.61
Ireland	4.2	3.6	3.5	0.6	1.69
Israel	6.4	2.3	2.2	4.1	3.97
Italy	3.4	1.5	1.3	1.9	1.26
Japan	n.a.	n.a.	n.a.	n.a.	3.25
Korea	7.8	5.1	3.6	2.7	3.74
Luxembourg	0.2	1.6	0.5	-1.4	1.51
Mexiko	0.9	1.5	1.4	-0.6	0.45
Netherlands	7.6	1.7	1.8	5.9	1.86
New Zealand	1.3	1.3	1.1	0.0	1.26
Norway	1.5	1.6	1.4	-0.1	1.68
Poland	1.5	1.2	0.5	0.2	0.74
Portugal	4.1	2.1	1.3	2.0	1.59
Slovak Republic	1.9	1.8	0.6	0.1	0.63
Slovenia	2.1	2.0	1.9	0.1	2.10
Spain	3.3	1.6	1.2	1.7	1.40
Sweden	5.5	4.4	4.0	1.1	3.39
Switzerland	5.9	3.5	n.a.	2.3	n.a.
Turkey	n.a.	n.a.	n.a.	n.a.	0.84
United Kingdom	4.9	2.3	1.6	2.6	1.77
United States	3.7	4.0	2.5	-0.3	2.74
OECD-Total	3.8	3.1	2.2	0.7	2.34

*Australia: 2007 data; Denmark: 2008 data; Mexico: 2008 data The change of 1.5 %-point for R&D also includes mineral exploration and evaluation.; Norway: 2011 data. Greece, Iceland, New Zealand, Switzerland: 2011 data for "GERD to GDP". GERD = Gross Expenditure on Research and Development. Source: OECD (2014) and van de Veen (2015).

To illustrate the impact on the components of GDP Table 2 shows some data for Germany 2010. The overall impact was 3.3 per cent and the impact of R&D 2.3 per cent. As it could be expected gross capital formation has increased and consumption expenditures of government and private non-profit institutions have decreased.

Table 2: Impact of revision on GDP and ist components. Germany 2010

Item	In current prices			
	Total impact		Of which: R&D	
	Bill. EUR	%	Bill. EUR	%
Consumption expenditures of private households	11.157	0.8	0.000	0.0
Consumption expenditures of government	6.721	1.4	– 2.818	– 0.6
Consumption of private non-profit institutions	– 0.539	– 1.4	– 0.128	– 0.3
Gross capital formation	70.530	16.3	59.959	13.8
Net exports	– 6.649	– 4.7	0.000	0.0
Gross domestic product	81.220	3.3	57.141	2.3

Source: Räth and Braakmann (2014) and own calculations.

The introduction of R&D as GFCF was the main factor of the revision. As Table 2 shows there were various changes with different sign. For instance, net export were not influenced by R&D. But they decreased by 4.7 per cent. The impact of R&D on the consumption expenditures of government was negative. But this effect was overcompensated by other changes.

3 Issues concerning the impact of R&D capitalisation on GDP

In this section the issues are discussed that are responsible for the impact of R&D capitalisation on the level of GDP. The focus is set on four issues. These are:

- The property of R&D as a produced asset
- Delineation of gross fixed capital formation and intermediate consumption of R&D
- Market production of R&D
- Consumption of fixed assets

The first two issues will then be discussed again in section 4.

3.1 The property of R&D as a produced asset

In the process of revising the SNA it was clear that R&D should be treated as an asset. And finally, it was introduced as an (intangible) fixed asset into the accounts.[1] A fixed asset is the result of a process of production, a *produced* asset.

Another way, proposed by Lynch (2014), would be to treat R&D as a non-produced asset. This in an interesting aspect insofar as the impact on the accounts is different: As a non-produced asset the results of R&D would treated similar to land. It would be put as Other Changes of Assets into the accounts and payments to access the asset would be an transfer of income. The level of GDP would not increase, "but would introduce a series of income transfers between owner and users of the assets. This would be equivalent to the treatment of copyright payments to authors, as part of the total value of a book." (Lynch, 2014).

[1] The term *intangible* is no longer used in the SNA. Intangibles are replaced by intellectual property products. See Hill (2014) for a discussion of the term *intangible*.

The rationale for this treatment as a non-produced asset cannot be discussed in detail here. But the key point of the rationale is the question if the SNA 2008 allows a treatment of R&D similar to the models of originals and copies. If yes, the point of Lynch (2014) is coherent. If it is not, the chosen method of treating R&D as produced asset would be preferable. In section 4 this issue is discussed again.[1]

3.2 Delineation of GFCF and IC

One of the issues of the introduction of R&D capital in the national accounts was the delineation of gross fixed capital formation and intermediate consumption. During the process of revision several items were discussed to include them into the asset boundary or to exclude them from it. For instance, it was discussed about

- All R&D activities as gross fixed capital formation
- Freely available R&D
- Selection of R&D by socio-economic purposes
- Successful versus unsuccessful R&E

The SNA 2008 states:

> "Research and [experimental] development consists of the value of expenditures on creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and use of this stock of knowledge to devise new applications. This does not extend to including human capital as assets within the SNA. The value of research and development (R&D) should be determined in terms of the economic benefits it is expected to provide in the future. This includes the provision of public services in the case of R&D acquired by government. In principle, R&D that does not provide an economic benefit to its owner does not constitute a fixed asset and should be treated as intermediate consumption. Unless the market value of the R&D is observed directly, it may, by convention, be valued at the sum of costs, including the cost of unsuccessful R&D, as described in chapter 6." (SNA 2008, paragraph 10.103)

And it excludes patents from this new intangible asset:

> "With the inclusion of R&D expenditure as capital formation, patented entities no longer feature as assets in the SNA. The patent agreement is to be seen instead as the legal agreement concerning the terms on which access to the R&D is granted. The patent agreement is a form of licence to use which is treated as giving rise to payments for services or the acquisition of an asset." (SNA 2008, paragraph 10.105)

The ESA 2010 is not more precise in the delineation of R&D gross fixed capital formation, but there exists a recommendation from the OECD:

> **"Recommendation 1.3**: As a general rule, all expenditures on intellectual property products, either purchased or produced on own account, should be recorded as gross fixed capital formation if they are expected to provide economic benefits for the owner. Only in cases where units specialise in producing a type of intellectual property product for sale should acquisitions of that type of product be expensed, or if it is clear that they are completely embodied in another product: for example software copies purchased to be embedded in computers for sale, or other specific information exists such as the existence of a license with a duration of one year or less." (OECD, 2010, p. 12)

[1] The rationale could be that the results of R&D are based on ideas or on inspiration. And this cannot be regarded as production. On the other hand, R&D itself constitutes an economic branch. And a famous quote from Thomas A. Edision suggests that R&D is rather a produced than a non-produced asset: Genius is one per cent inspiration, ninety-nine per cent transpiration."

Especially, for the case of R&D the handbook states:

> **Recommendation 2.8:** All expenditures on purchases of R&D or on R&D production by market producers in the Scientific Research and Development industry (Division 72 ISIC Rev. 4) should be recorded as intermediate consumption, or otherwise expensed, on the presumption that such units produce R&D for sale, and any purchases are incorporated in products for sale. Only when specific information is available to the contrary should acquisitions of R&D be recorded as gross fixed capital formation, such as cases when a unit takes out a patent and sells licences to use." (OECD, 2010, p. 13)

Summing up the delineation of R&D gross fixed capital formation and intermediate consumption can be described as follows

- All R&D activities should be capitalised
- Except the purchases of R&D products by the R&D industry.

The basic idea of this delineation is very clear. If produced technological knowledge is used to produce goods and services, then the knowledge is a factor of production and a fixed asset. But if the knowledge is embedded in other knowledge, then the latter will be the asset and the former is treated as intermediate consumption. Figure 1 shows the most common flows of R&D products and the distinction between GFCF and IC.

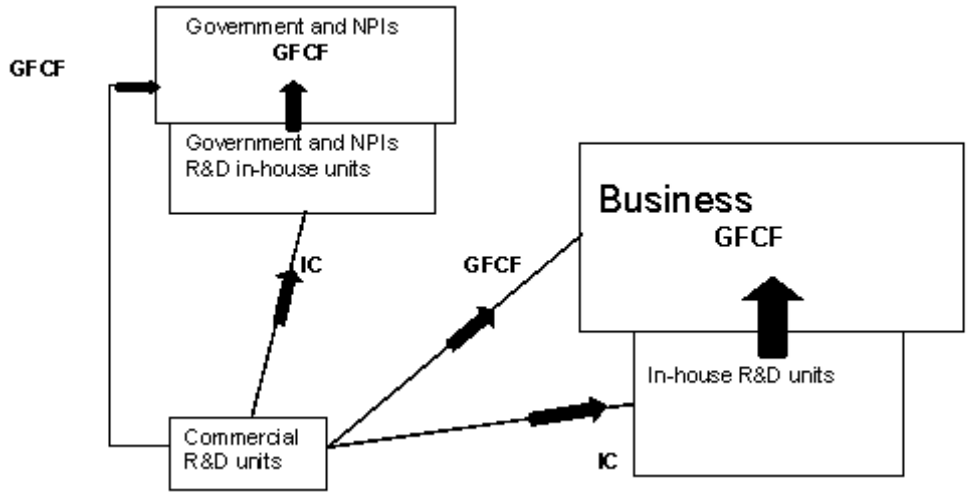

Figure 1: Example of the most common flows of R&D products between domestic sectors[1]

On the other side it is thinkable (and maybe usual) that enterprises outside the R&D branch buy R&D results to embed them into the own R&D output. In this case it would be treated as the purchase of a capital good whereas it would be intermediate consumption when purchased by the R&D branch.

Also, it is possible that

- a commercial R&D unit purchases a R&D product intended to be used in the production of goods and services other that R&D as a secondary activity.
- an enterprises purchases a R&D product. And the product is not used for the production of goods and services but for improving own R&D results (Annahme: keine getrennte in-house R&D unit.

[1] Eurostat, 2014, p. 7

In these cases the chosen delineation of GFCF and IC could be misleading. Another kind of delineation would be more appropriate.

The delineation of R&D GFCF and IC – including the issues mentioned above like successful R&E etc. cannot be discussed in detail here. In section 0 this issue will be discussed again.

3.3 Market production of R&D

If a market producer is conducting R&D, a new product – the R&D output – is produced. This product can be sold to other entities or it can be used for the production of goods and services. In the latter case, the treatment of R&D as output and as GFCF leads to an increase of GDP in form of R&D output for own final use. In the former case according to the SNA 1993 it was already treated as output but not as gross fixed capital formation. For the producer of the output it was market production. And for the purchaser of the goods it was the purchase of an intermediate good. According to the SNA 2008 it is the purchase of a capital good or a fixed asset.

Therefore, the shares of market production and production for own final use determine the impact of R&D capitalisation on GDP. A method to calculate these shares is to determine total R&D output and to determine the level of market production. Then R&D output for own final use is the remainder. Usually there is only data available for the inputs of R&D especially R&D expenditures, number of employees etc. But there is no information about the use of this output. Therefore, it may be the usual way to calculate output for own final use as the difference of total R&D output of market producers and the market production of these entities.

Table 3: Output and Exports. Germany 1991 - 2013

	All goods and services			R&D		
Year	Output	Exports		R&D output	R&D exports	
	Bill. EUR		%	Bill. EUR		%
1991	2731,497	374,884	13,7	34,851	2,132	6,1
1995	3185,621	417,876	13,1	37,284	2,755	7,4
2000	3748,898	652,501	17,4	46,346	4,480	9,7
2005	4167,708	868,295	20,8	53,901	6,150	11,4
2010	4773,172	1089,649	22,8	65,253	10,222	15,7
2011	5107,213	1209,385	23,7	70,087	11,692	16,7
2012	5128,242	1262,872	24,6	74,271	12,878	17,3
2013	5194,150	1280,127	24,6	77,043	15,036	19,5

Source: Adler et. al. (2014) and Deutsche Bundesbank (2015), own calculation.

It is not easy to assess the quality of such calculations as they may be very country-specific. One possible way would be to have a look at the relation of market production to total R&D output of market producers. In Germany it is approximately 25 per cent of R&D output of market producers that is sold. This may be plausible: On the one hand it can be assumed that the major part of research results is for internal use, because it is not simple to protect the own product by patents etc. completely. On the other hand there are specialised research corporations that are explicitly market producers with R&D as their main activity. In the European Union there have been trial calculations in many member states to prepare the decision if the capitalisation of R&D is feasible in their country. From this data it is principally possible to calculate the relation “R&D market output to R&D output of mar-

ket producers". But the results for this indicator differ substantially from country to country and are not reported here.[1]

Another opportunity to check the plausibility of the share of market production is to investigate the part of R&D output that is exported to other countries.

Table 3 presents some figures for Germany. From 1991 to 2013 the share of exports on output has increased continuously from 13.7 per cent to 24.6 per cent. In this space of time the share of exports of R&D services to R&D output has increased by factor 3 that comes along with an increase of R&D exports by factor 7. In all periods the share for total exports on total output exceeds the analogous share for R&D.

All in all these figures stand for the increasing importance of R&D and for increasing international flows of R&D or technology etc. On the other side it can be assumed that the figures on R&D exports (and imports) are overestimated. For instance, the exports of R&D services can be compared with the funding of R&D from abroad. Not in general but maybe for international flows it should be assumed that the funder of R&D purchases the output.[2] For instance in 2011 from abroad an amount of 3,158 Bill. EUR was funded for research in Germany. That would not fit to the R&D exports shown in Table 3: Output and Exports. Germany 1991 - 2013 (12,878 Bill. EUR)[3] Another hint for some inconsistency in the foreign trade data is given by the relation "R&D exports to R&D market production". Beginning in 1991 this indicator is approximately 0.5 and 2012 and 2013 it exceeds 1 what means that more R&D output is sold abroad than at home.

3.4 Service life of R&D assets

The impact of GDP for non-market producers is not determined by their own-account production but by their consumption of fixed capital. Therefore, the method chosen to calculate R&D capital and consumption of fixed capital for this calculation is of interest.

Generally, the net stock of capital for a given period is determined by the past investment and the depreciation on accummulated investment. Assuming a geometric approach for depreciation the stock of R&D capital K in period t consists of the capital of the previous period that is reduced by consumption of fixed capital according to a constant depreciation rate δ plus gross fixed capital formation of that period. This can be written as

$$K_t = I_{t-1} + (1-\delta) \cdot K_{t-1}$$

with I as gross fixed capital formation. K can also be expressed in terms of the former investment in R&D:

$$K_t = I_{t-1} + (1-\delta) \cdot I_{t-2} + (1-\delta)^2 \cdot I_{t-3} + \ldots + (1-\delta)^{\infty} \cdot I_{t-1-\infty} = \sum_{\tau=0}^{\infty} I_{t-\tau} \cdot (1-\delta)^{\tau}$$

To calculate the capital stock according to this equation it is necessary to have a time series of all former investment on R&D that is not yet written off and (at least) an assumption for the rate of depreciation. The problem is that these time series are often not available. But if it is assumed that

[1] The crucial factor not to report this indicator here is the confidentiality of the underlying data. Additionally, the quality of these trial calculations cannot be compared with the quality of the data that were published after the introduction of the SNA 2008.

[2] A common purpose of funding of R&D is to give incentives for private R&D, because the characteristic of research results as a public good may lead to an under-investment in R&D. This purpose usually fails for R&D abroad.

[3] For funding of R&D in Germany see Stifterverband (2013b), p. 16.

the growth rate of R&D gross fixed capital formation was constant in the past, the latter equation can be simplified to

Assuming that gross fixed capital formation is growing with a constant rate c, then K can expressed as

$$K_t = I_{t-1} + \frac{I_{t-1}}{1+c} \cdot (1-\delta) + \frac{I_{t-1}}{(1+c)^2} \cdot (1-\delta)^2 + \ldots + \frac{I_{t-1}}{(1+c)^\infty} \cdot (1-\delta)^\infty = I_{t-1} \sum_{\tau=0}^{\infty} \left(\frac{1-\delta}{1+c} \right)^\tau .$$

As a sum of an infinite geometric series this can be simplified to

$$K_t = I_t \cdot \frac{1}{1 - \frac{1-\delta}{1+c}} = \frac{I_{t+1}}{\delta + c}$$

Now an initial stock of capital can be estimated that depends only on gross fixed capital formation of the following period, the average growth rate of gross fixed capital formation and a constant rate of depreciation. The advantage of this method is that it is easy to calculate and the data requirements are little. The growth rate c could be estimated by the average growth rate of gross fixed capital formation or R&D expenditures respectively. The remaining question is to determine the rate of depreciation and the corresponding life span of the R&D capital.

Table 4: Service lifes of R&D assets in industries with high R&D intensity. Germany 2011

Code (NACE, Rev. 2)	Industry	Servcie life [years]
20	Manufacture of chemicals and chemical products	21
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	18
26	Manufacture of computer, electronic and optical products	10
27	Manufacture of electrical equipment	10
28	Manufacture of machinery and equipment n.e.c.	16
29	Manufacture of motor vehicles, trailers and semi-trailers	8
30	Manufacture of other transport equipment	12
62	Computer programming, consultancy and related activities	9
72	Scientific research and development	12
84	Public administration and defence, compulsory social security	10
85	Education	10
86	Human health services	11

Source: Adler et. al. (2014)

If no data is available it is possible to assume a rate of depreciation that seems to be plausible. The EU Task force on R&D has recommended a life span of ten years. This would correspond to an average depreciation rate of approximately 20%.[1]

For Germany there are some data available based on a survey for the year 2011.[2] The results are shown in Table 4. It can be seen that for the majority of industries the service life of R&D assets ex-

[1] Applying the geometric method an investment is never written off completely. But this fact is neglected here. In Germany another approach for the measurement of capital is used. See Schmalwasser and Schidlowski (2006).

[2] See Grave and Kladroba (2013).

ceeds the proposed service life of ten years. If this results holds also for other countries it means that the consumption of fixed capital on an R&D asset is distributed over a longer periods and the consumption of fixed capital for a given year is lesser that for countries with a constant service life of ten years.

4 National accounts in the context of legal systems

4.1 Civil law and common law

Every country has its own legal system that can be described by institutions or rules and the way these rules are applied and enforced. Additionally, there exist legal systems or legal structures for groups of countries like the United Nations, the European Union etc. Beside the variety of all these legal systems it is possible to attach most countries to either the legal system of *civil law* or to *common law*.[1] These systems of law can be described by several characteristics.[2]

The first feature is the **origin and spread** of these systems: Both civil law and common law originate from Europe. Civil law can be dated back to the ancient Rome, and particularly to the Emperor Justinian who reigned from 527 – 565. It has influenced the (private) law in the majority of countries in Europe, Africa and South America. Civil law is the tradition of law with the highest prevalence in the world. Common law originates from medieval England. Today, it is the base of private law in the United States, the United Kingdom, Australia, New Zealand, India and many Caribbean Countries.[3]

The outstanding feature of civil law is the **codification** of its basic principles. All rules concerning a special topic are collected systematically way in a code. Prominent examples are the *codex iustinianus* from the ancient Rome and the French *Code Napoléon* or *Code Civile*. It is the purpose of codification to provide with rules that are abstract and that can be applied on all cases which are conceivable. In civil law codification is the main source of law.

Even if codification can also be a feature of common law it is not as important as **precedents**. Common law is developed by judges and decisions of courts. If a case is investigated the decision is tied down to former decisions. If there is no former similar case, the judges can make law by precedent. The purpose is to ensure the consistency of decisions, to treat similar facts similar and to avoid that similar cases are treated in a different way in different occasions.

Another feature would be the kind of **logical reasoning** that can be attached to the legal systems. As civil law is based on general principles or guidelines that are applied to special cases it can be attached to deductive reasoning. Common law could rather be attached to inductive reasoning as special cases are used to constitute future decisions.

The main features of civil law and common law are summarised in Table 5. Even if this list is not exhaustive it should be clear that the differences between common law and civil law are substantial. It is not the intention of this paper to discuss and to assess the systems. Rather, it is discussed if the features of legal systems described above are important for national accounts.

[1] For further insights into the field of comparative law and legal systems see David and Brierley (1978) and Glenn (2010).

[2] A third group of legal systems it religious law that refers to religious traditions, for instance the Christian canon law or the Islamic sharia. But this group of legal systems is not discussed here. Also, it is neglected that legal systems in practice usually can be influenced by more than one legal tradition.

[3] These lists are not exhaustive. See JuriGlobe (2105) for further details.

Table 5: Comparison of civil law and common law		
	Civil law	Common law
Origin	Ancient Rome (Code of Justinian)	Medieval England
Prevalence	Most European, African and South American countries	United States (except Louisiana), United Kingdom (except Scotland, Guernsey and Jersey), Australia, New Zealand, Canada (except Quebec), India
Codification	Important. Primary source of law	Minor importance. Codices are subordinated to precedents.
Law creating institution	Legislature	Jurisdiction
Precedent	Minor importance	Core of the legal system. Case law
Logical reasoning	Deductive reasoning	Inductive reasoning

4.2 Are national accounts based on a legal system?

The question now is what the link to national accounts is. As described in section 2 national accounts are based on various kind of guidelines, recommendations. They can be characterised as laws or they are laws in an explicit manner. But if these guidelines are laws or quasi-laws, then the question raises what the underlying legal system is. To find an answer, the various features of legal systems can be used.

Most guidelines are only quasi-laws. They are developed, discussed and adopted by supranational or international institutions. But usually they are only recommendations for the countries these institutions represent. They are no compulsory laws. So, it would be impossible to assign them explicitly to a *legal system*. Also the legal systems of the countries represented by these institutions are not helpful here.

This is also valid for the European Union. Here, national accounts guidelines have the form of a law. But is it not easy to decide if the process of producing these laws corresponds rather to common law than to civil law.

Furthermore, it has to be stressed that the guidelines of national accounts are discussed here within the framework of private law that by now has been the main subject of comparative law. The relations of countries are subject to public international law or to supranational law.

Concerning *codification* there is a much clearer picture. The guidelines of national accounts are based on various handbooks supplemented by manuals, recommendations and so on. Codification is rather a characteristic of civil law than common law. Therefore, the existence of these standards for national accounts corresponds to civil law.

Also the missing relevance of *prejudices* corresponds to civil law. In the framework of supranational institutions there seems to be absolutely no relevance of prejudices, because the guidelines are quasi-laws. If a country has a problem to introduce a special rule based on a quasi-law, then it is free to deviate from it und to apply another rule.

For the European Union sometimes it may be the case that after adopting a guideline it proves not to be sufficient for all purposes. Then, it is usual to supplement the guideline with additional provi-

sions.[1] But these additional provisions should not be mixed with prejudices. Additional provisions are a very usual part of civil law. They do not compete against the guideline but make it easier to apply it.

But on closer examination there can be find some signs of the importance of prejudices and of common law in the guidelines on national accounts. This shall be shown by two special issues of R&D capitalisation.

4.3 Issues of R&D capitalisation according to civil law and to common law

The special issues here have already been discussed in section 3. These issues or *cases* are

- The property of R&D as a produced asset
- The delineation of R&D gross fixed capital formation and intermediate consumption.

Originally, the issue of the **property of R&D as a produced asset** was discussed by Lynch (2014). The initial point here is provided by the paragraphs 6.208 to 6.212 of the SNA 2008 and especially paragraph 6.208:

> "The production of books, recordings, films, software, tapes, disks, etc. is a two-stage process of which the first stage is the production of the original and the second stage the production and use of copies of the original. The output of the first stage is the original itself over which legal or de facto ownership can be established by copyright, patent or secrecy. The value of the original depends on the actual or expected receipts from the sale or use of copies at the second stage, which have to cover the costs of the original as well as costs incurred at the second stage." (SNA 2008)

Lynch (2014) argues that this paragraph is applied to R&D. It sets out a theoretical foundation for the handling of R&D in the national accounts which generates inconsistencies. Finally, he suggests another model for the treatment of R&D (and intangibles in general).

This rationale depends on the question if the model of copies and originals can be or has to be applied to R&D. Using the principles of civil law and common law, the answer to this question is quite different.

From the point of view of civil law there are some doubts and the rationale would be as follows: Paragraph 6.208 is part of a section that discusses the output of particular industries. Within this section R&D is subject of paragraph 6.207. Paragraph 6.208 only discusses originals and copies whereas R&D is not mentioned in this paragraph. Therefore the rules for originals and copies cannot be applied to R&D.[2]

On the other side, if the principles of common law are used, it would be possible to apply paragraph 6.208 on R&D. As described above in common law the rules have not that deductive strictness and it is possible that the authors of the SNA 2008 have had this in mind, when they wrote these paragraphs on R&D and on originals and copies.

In section 3.2 the **delineation of R&D gross fixed capital formation and intermediate consumption** was discussed. The rules concerning the capitalisation of R&D were summarised as follows:

- All R&D activities should be capitalised
- Except the purchases of R&D products by the R&D industry.

The question here is, if this delineation and the way that has led to it correspond rather to civil law or to common law.

[1] The manuals concerning the introduction of R&D capital could be seen as such provisional guidelines.

[2] A detailed investigation of this question according to civil law would have to include several further issues that are not mentioned here. And possibly the result of the investigation would be different. But as this case was only for illustration, the rationale here may be sufficient.

If a new concept is introduced and the provisions for this concept have to be developed, one possible way would be to have a look on existing general rules and try to apply these rules to the special subject of R&D. This corresponds to deductive reasoning and to civil law respectively.

In this way the definition of a (fixed) asset is essential. The SNA 1993 states:

> "Fixed assets are defined as produced assets that are themselves used repeatedly, or continuously, in processes of production for more than one year." (SNA 1993, Para. 10.7)

And assets themselves are

> "defined as entities:
>
> (a) Over which ownership rights are enforced by institutional units, individually or collectively; and
>
> (b) From which economic benefits may be derived by their owners by holding them, or using them, over a period of time." (SNA 1993, Para. 10.2)

That means that three properties are essential to constitute a fixed asset:

- Used in production processes
- Ownership
- Economic benefits
- Held longer than an accounting period

National accounts having civil law in mind now would use deductive reasoning and apply the four criteria shown above to find an appropriate delineation of R&D. And then a possible delineation of R&D fixed assets and GFCF would possibly be given by

- Market output of market producers
- Own-account production of market producers
- Market production of non-market producers.

This is only one possible solution. It is not intended to propose another delineation or R&D assets and GFCF. The only purpose is to show to what kind of definition the strong application of civil law would lead.

On the other hand the definition chosen and recommended by the OECD and the European Union seems more to be created with common law in mind. It was discussed rather autonomously with a special outcome only applied to R&D. It has its own rationale but it rather seems to be developed inductive than deductive.

5 Concluding remarks

It was the intention of this paper to show that the subject of comparative law could be applied to the guidelines of national accounts. Even if there is no direct impact of the traditions of civil law and common there could be identified some influences of both traditions. Civil law finds its expression in the guidelines, the principles and rules of national accounts themselves. And the way, specific solutions are developed has rather the characteristic of common law, at least for the issues discussed here.

It was not the intention to assess civil law and common law either to recommend one of these traditions to be more appropriate for national accounts' purposes. But for future revisions of the concepts of national accounts it could be fruitful to have in mind that these traditions exist and that they have an impact on the creation, application and interpretation of the rules that constitute the national accounts.

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