

FOUNDATIONS, METHODOLOGY, AND SELECTED RESULTS OF A SATELLITE ACCOUNT FOR THE GERMAN HEALTH ECONOMY¹, 2005

Markus Schneider, Thomas Krauss, Uwe Hofmann, and Aynur Köse

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Reisingerstr. 25, D-86159 Augsburg, Germany, www.basys.de

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Summary

The German Health Satellite Accounts (GHSA) is fully integrated into the System of National Accounts (SNA). Hence, the implications of the goods and fiscal operations of the healthcare industry for the overall economy can be made transparent. In order to combine the different statistical approaches to create a coherent and consistent analytical tool, the input-output table of 2005 was used. 507 groups of commodities delineate the health economy from the rest of the economy. In addition, the multiple contractual relationships between private and social insurance are structured by differentiation into a basic and voluntary coverage. The compilations show substantial differences as compared to the System of Health Accounts (SHA) because of the wider concept of GHSA.

Background

Germany's high rate of healthcare expenditure by international standards is well recognized and a permanent issue of discussion. It can be traced to its comprehensive provision of medical care for the whole population with short waiting lists, comprehensive benefit packages, and a high density of medical professions and medical facilities. However, often, health care expenditures are regarded one-sidedly as just another cost factor. In contrast, the contribution of health to the economic development is well documented. Through its sheer size the developments in the health economy have significant consequences for the macro economy. Within SNA, the health economy cuts right across many different industries and institutional sectors. Understanding the macroeconomics of the health economy becomes key issue for both economic policy and health policy.

The OECD, WHO, EU, and other international organisations base their analysis of the health economy on macroeconomic figures derived from national health accounts statistics. In

Europe, the OECD Manual "A System of Health Accounts" provides the common standard for data collection by the statistical offices. The set of core tables in the SHA addresses three basic questions: where does the money come from? (sources of financing); where does the money go to? (providers of health care services and goods); what kind of (functionally-defined) services and what types of goods are purchased? Not touched are questions like: What is the gross value added of the health economy? What is the intermediate consumption and which are the interconnections between branches of the health economy and the overall economy? What is the productivity of the branches of the health economy? What are the import and export flows and as a result the trade surplus?

From a macroeconomic perspective, the indicators presented by SHA are rather incomplete. In Germany, the Federal Ministry of Economics and Technology (BMWi) has therefore funded a research project to describe all areas of the health economy in a GHSA connected to the SNA. First results were presented in November 2009 (*Henke, Neumann, Schneider* 2009). Both, the national accounts and the health accounts departments of the German Federal Statistical Office (Destatis) contributed to this work.

Fortunately, the design of the GHSA could be built upon national and international experience. Destatis compiles annually health expenditures, health personnel, and cost-of-illness accounts (*Müller, Böhm* 2009). The methodology of these accounts follows the recommendation of the OECD SHA Manual (*OECD* 2000) and the national guidelines laid down in the revision of the German health accounts (*Sarrazin* 2000). In Germany, first compilations about health spending were already made in the seventies, extended in following by several research projects. *Geigant* 1986 and *Sarrazin/Statistisches Bundesamt* 1992 made an attempt to expand the approach to a satellite account. Internationally, different developments of satellite accounts for health were proposed by *PAHO* 2005 and *Quintela* 2007.

Satellite accounts focus attention on the production of characteristic goods and services that are typical in the functional field of analysis. In this regard, it is necessary to identify the characteristic products and industries and estimate their production account. SNA 2008 (29.141) emphasises the following four additional accounts that would extend the SHA into a full satellite account for health of SNA (*United Nations* 2009):

- Production account and health care value added by the health care industry,
- Intermediate inputs to the production of health care industries by type of input,
- Gross capital stock of the health care industry,
- An input-output table of health care industries.

Apparently, such an integrated health account into the national accounts will benefit from the richness of data within then national accounts and the possibility to compile a comprehensive set of economic indicators for the health

economy. Although the health dimension goes beyond the market activities captured by national accounts any expansion to these non-market activities requires in a first step a consistent compilation of the health economy in the existing framework of the national accounts. Therefore, the presentation of the health economy is a necessary first step but remains a first step to a more comprehensive model (*Abraham, Mackie* 2005).

Results

Total supply and use of health commodities

The GHSA captures the economic activities of the health economy for the year 2005. As main results the health economy has a considerable export surplus, a large share of economy's total workforce, a markable predominance of service industry, a high share of value added,

Figure 1: Abridged Health Input-Output-Table of the GHSA (€billion at basic prices and in %, 2005)

Branches (CPA)	Intermediate consumption by product groups				Final consumption				Total use
	Non-health products	Core health sector	Extended health sector	total	Final consumption expenditure	Gross capital Formation incl. CI	Exports	Total final consumption	
Products (CPA)									
Non-health	1,846.1 (41.6)	62.1 (1.4)	28.4 (0.6)	1,936.6 (43.6)	1,304.9 (29.4)	353.8 (8.0)	842.5 (19.0)	2,501.3 (56.4)	4,437.8 (100.0)
Core health sector	2.7 (1.0)	15.6 (5.6)	1.3 (0.5)	19.7 (7.0)	217.0 (77.7)	1.3 (0.5)	41.5 (14.8)	259.8 (93.0)	279.5 (100.0)
Extended health sector	13.5 (13.8)	5.3 (5.4)	3.4 (3.4)	22.2 (22.7)	61.3 (62.5)	1.5 (1.5)	13.0 (13.3)	75.8 (77.3)	98.1 (100.0)
Total at basic prices	1,862.4 (38.7)	83.0 (1.7)	33.1 (0.7)	1,978.5 (41.1)	1,583.3 (32.9)	356.6 (7.4)	897.1 (18.6)	2,836.9 (58.9)	4,815.4 (100.0)
Net taxes on products	49.4 (22.6)	6.2 (2.8)	1.8 (0.8)	57.4 (26.3)	134.5 (61.6)	26.8 (12.3)	-0.4 (-0.2)	160.8 (73.7)	218.2 (100.0)
Total at purchasers' p.	1,911.8 (38.0)	89.2 (1.8)	34.8 (0.7)	2,035.8 (40.4)	1,717.8 (34.1)	383.4 (7.6)	896.6 (17.8)	2,997.7 (59.6)	5,033.6 (100.0)
Gross value added	1,819.6 (89.8)	158.9 (7.8)	47.9 (2.4)	2,026.4 (100.0)					
Total output	3,731.4 (91.9)	248.1 (6.1)	82.8 (2.0)	4,062.2 (100.0)					
Imports	706.4 (93.8)	31.4 (4.2)	15.3 (2.0)	753.1 (100.0)					
Total supply	4,437.8 (92.2)	279.5 (5.8)	98.1 (2.0)	4,815.4 (100.0)					
Labor force (in thousand)	33,469 (86.2)	4,052 (10.4)	1,325 (3.4)	38,846 (100.0)					

and significant spillover effects in other industries. The Health-Input-Output-Table presented here makes it possible to exhibit the supply for the health commodities in consistent differentiation from the supply of the overall economy.

The key results of the GHSA are summarised in the abridged Health-Input-Output-Table (see Figure 1). In 2005, total supply of the German health economy at basic prices has been about 7.8% of commodities within the overall economy (€377.6 billion of €4,815.4 billion). About 12.4% of the supply is imported. The share of exports on total demand has been 14.4%.

As expected, the Core Health Sector (CHS: € 279.5 billion), that is defined by health care goods and services of SHA, dominates the health economy, most of that provided by inpatient and outpatient health care providers as hospitals, rehabilitation clinics, nursing homes, offices of general practitioners, specialists and dentists, pharmacies and retailers of medical goods. However, the wider perspective taken by the GHSA adds in the Extended Health Sector (EHS) € 98.1 billion health related activities as medical education and training, research & development, services for disabled and handicapped persons, functional food and clothing.

Differences between GHSA and SHA

Total supply (domestic production and imports) of the health economy is by definition higher than the consumption of health care goods by residents, namely those covered by SHA. According to calculations for the year 2005, total supply is about 30% higher than the domestic consumption of health goods. What explains the large difference? First, part of the total supply of health products is used for intermediate consumption, part is exported, and finally part of this supply contributes to changes in stock or is invested. Within the CHS, the final consumption expenditure of private households, of NPISH and of the government, the GHSA records a value of € 217.0 billion. In SHA, the corresponding value at purchasers' prices amounts to € 222.9

billion. The total supply in the CHS (€ 279.5 billion) additionally differs from health expenditure by exports, investments (incl. changes in inventory - CI), as well as intermediate consumption used by the production branches within the CHS.

Gross Value Added, Health labour and productivity

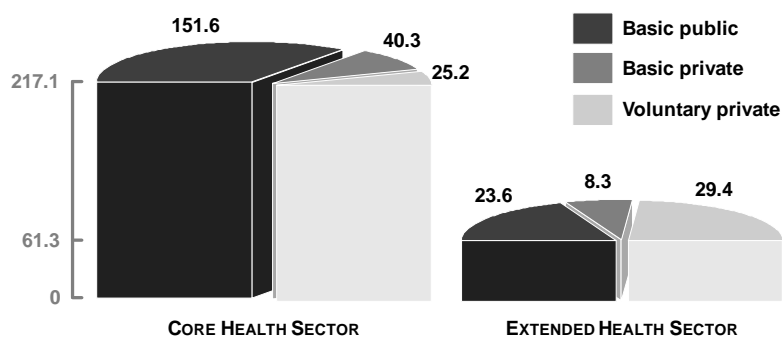
In 2005, the share of GVA of the health economy was 10.2% of the total economy. The GVA share is thus higher than the production share, at 8.1%. One factor in particular is contributory here. The health economy, as a service industry, has a lower input of intermediate consumption than the non-health industry. By integrating the health economy with the overall economy, however, indirect and induced value added shares and employment effects also have an impact, which can then be quantified in the input-output analysis.

Although the health economy is in general quite labour intensive, there is great variation of productivity, measured here as value of production per employed person. The labour force in 2005 was about 5.377 million people employed within the health economy. 4.052 million (75.4%) of them worked in the CHS and 1.325 million (24.6%) in the EHS. According to the extended demarcation of the health economy, almost one seventh of the labour force (13.8%) works within the health economy, 10.4% in the CHS and 3.4% in the EHS.

Public and private financing, compulsory and voluntary coverage

In consumption, a notable feature of GHSA is the distinction between the basic and the voluntary health commodity market. The first commodity market is characterized by compulsory coverage and is mainly public financed. In contrast, the second health commodity market is completely privately financed, either by voluntary insurance or out-of-pocket payments. In total, the basic health commodity market in the German health

Figure 2: Financing of final consumption expenditures in core and extended health sector (€billion, 2005)



economy amounts to € 222.8 billion in basic prices, the voluntary market to € 54.6 billion. As expected most commodities in the primary market are public financed with low or no cost-sharing. In Germany, nonetheless, private insurance for products of the compulsory benefit package is not insignificant. On the basis of the coverage criterion (compulsory, voluntary), the primary and the secondary market emerge for products in both the CHS and EHS.

Differentiating the results by products diverse financing structures are revealed. Whereas the final consumption expenditure of the government dominates in prevention, inpatient and outpatient medical care, long-term care, and medical goods within the CHS except "services of private insurance to cover basic health risks", the secondary market has the highest share in almost all products within the EHS (except education and training, and research & development). In the EHS, due to 'new' health-related products, final consumption expenditure in the secondary market amounts to almost half of health final consumption expenditure overall. Obviously the willingness to pay for health products outside the basic coverage is a growing market.

Methodology

In contrast to SHA, the GHSA is fully integrated into SNA. Hence the implications of the goods and fiscal operations of the health economy for the overall economy can be made transparent. In order to combine both statistical

approaches, SHA and SNA, to create a coherent and consistent analytical tool, the input-output table has been used. The linkages between supply and use have been delineated both within the healthcare industry and with the rest of the economy. In addition, the numerous contractual relationships between private and social insurance, public and private financing were outlined.

By this, a complete picture of the various healthcare markets including the production of intermediate commodities is developed.

Health commodities and non-health commodities

The production boundary of the health economy is determined by all health commodities. These commodities comprise only a part of the commodities of the whole economy and can be described by the basic equation of the static open Leontief model, which can be written as

$$Ax + y = x.$$

This equation forms the central model of the GHSA for the use of health and non-health commodities, which is organised as symmetric Input-Output-Table by products and branches, showing different parts of the economy, non-health care, core health services, and extended health services.

In the demarcation of the health economy, health commodities have to be distinguished from non-health commodities. This is sometimes not easy as the same commodity can serve different purposes. As criteria served the recommendations of the SHA manual for the core health services on the one side and practical procedures used in several market studies (Kartte, Neumann 2007) for the extended health services. The borderlines defined by SHA focus on the consumption of health care by the resident population, and are by this too narrow for the analytical purposes of the health economy. Therefore, the GHSA

combines two accounting systems, namely the SNA and SHA, and a variety of other data sources, to a comprehensive statistical system, which core piece is the health IOT (Krauss, Schneider, Hofmann 2009).

Steps of compilation of the Health Input-Output Table

In order to get a product by product IO-Matrix based on the product technology assumption, following formula can be used:

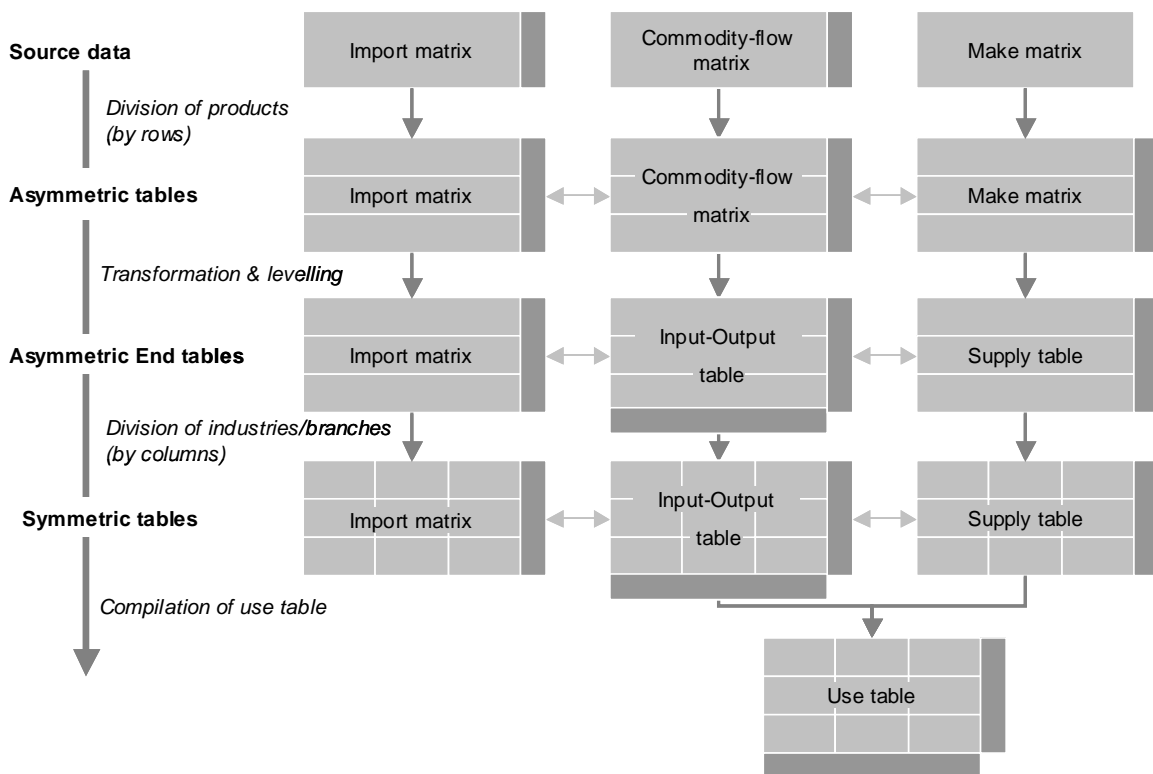
$$\text{Use table} = \text{IO coefficient matrix} * \text{Supply table}$$

The product technology assumption states that each product is produced in its own specific way, irrespective of the industry where it is produced. The methodology of the GHSA follows the procedure of the creation of input-output-tables of Destatis. Therefore, first the make matrix (as part of the supply table) and the commodity-flow matrix (the basis for the input-output-table) are calculated. The use matrix, which indicates the intermediate consumption of products by industries, is later compiled with the help of the input-output-table and the make-matrix, following the

formula above. As the HIOT is a product by product matrix with underlying product technology assumption, this procedure is commonly known as the ‘reverse model A’ (Eurostat 2008, p. 352). For the GHSA this approach offers the advantage, that the tables can be constructed from the question: “Which goods and services are needed to produce a health product?” The import matrix is calculated in accordance to the input-output-table. In every step all matrices have to be reconciled among each other.

The separation of health and non-health commodities of the total basket of the 3.118 products in the Input-Output Accounts is based on 524 health related products of the German Systematic Classification of commodities in the Input-Output Accounting (SIO). For the CHS detailed data from the German SHA were adopted and used as so called keys to compile the share devoted to health. For the EHS, data from market studies and surveys were used to estimate the share of health related products in comparison to product groups of the SIO classification.

Figure 3: Steps in the compilation of the HIOT and HSUT of GHSA



Relationship between SHA and Health Satellite Accounts

The coordination of the compilations with SHA was fundamental for developing the system. SHA current health expenditure relates to the resident population, such that it should exclude any consumption of health care goods and services by non-residents (exports) but should include the final consumption by residents outside of the territory (imports). One could say GHSA and SHA complement each other. They overlap in consumption but treat other elements differently. GHSA describes the entire value chain of health commodities and their supply and demand. SHA primarily aims to describe final consumption from perspective of health care provision and financing including expenditure on individual diseases. While GHSA comprises the income generated by the production of healthcare products, SHA describes the expenditure of households and all third-party payers.

Although the concept of current expenditure on health as defined in SHA mainly overlaps with the SNA aggregate “final consumption expenditure” of the GHSA, it includes some components, which are not considered as consumption in SNA. These components are capital formation, nursing allowances for paid home care by household members, occupational health services, imports of services, and taxes of health care industries. Obviously, the total supply of health commodities of the health economy differ from the healthcare expenditure calculated in the German SHA, especially because of the inclusion of intermediate consumption, exports, the extended demarcation of the health economy, and some methodological deviations, e.g. the taking into account and calculation of trade margins. One important issue in this context is that different price concepts are used. As the figures in GHSA are mainly in basic prices one has to consider the net taxes (taxes minus subsidies) and trade margins on products, too.

Data

Central data sources for the GHSA are the health-related statistical systems of Destatis and the input-output statistics of the SNA. The commodity matrix and the make matrix provide basic information about the production structure of goods by “homogenous branches“ (commodity matrix) as well as for the categories of final use and information about production structure of industries by products (make-matrix). The national accounts data sources were critically analyzed regarding the linkages to the German SHA and German Health Labour Accounts, which are built bottom-up from different statistics. In the case of deviations further data sources were considered for the proof of plausibility.

Additional data sources for the definition of the health-related share of goods and economic sectors have been the market research data as well as regular retail and tax statistics for the EHS. The development of a database including all relevant data was an important part of the project. However, despite the richness of available statistics in the areas of the health economy, there are some data gaps regarding information on gross capital formation, gross capital stock of the health care industry, and external trade of health care services, as well as prices, which could not be closed during the project.

Discussion

Economic policy

One of the basic queries is for what policy questions the GHSA is able to make estimates? For economic policy the development of human capital and productivity is the primary objective of any growth policy. Furthermore, links with the overall economy and internationally also underpin the importance of the health industry. It contributes in many ways to growth and employment. The GHSA strives to provide data for answering the questions who produces what health products,

what intermediate consumption comes from which industries, what is the impact on employment and how productive is each segment of the health industry. From a macroeconomic point of view a much broader set of questions can be analysed by GHSA than by SHA. The GHSA has been used to record data for the health economy and to compile key indicators like:

- Total Supply and Use of the health economy as part of the total economy,
- GVA and employees in health economy and by branch of industry,
- Intermediate consumption (consumed and provided to others),
- Interrelationships with the total economy (supply/use tables),
- Trade balance (import and export flows),
- Primary income distribution by factors of production,
- Labour productivity, and
- Income and employment multipliers.

Taking into consideration the overall development of the health economy and its impact for the society, reliable indicators about the performance of the health economy are crucial for both health and economic policy. The contribution of the health economy to gross value added and employment can be verified in the framework of GHSA. Additionally, both the contribution to growth and the labour force in the health economy can be compared to the other branches of the overall economy. Moreover, the limits of the national accounts regarding the description of dynamic processes have to be considered. The supply of socio-economic indicators by GHSA substantially depends on the boundaries of the GHSA. Thereby process indicators for the economic policy are important, like the contribution of the health economy regarding:

- Adequate economic growth (Gross-value-added),
- Price stability,
- Full employment,
- Fiscal stability (e.g. deficit financing), and
- Balanced foreign trade accounts.

The GHSA provides economic policymakers with an instrument for observing and

controlling structural and fiscal interventions in the health economy. The integrative design of the GHSA, including the German implementation of SHA, facilitates, among other things, an assessment of the budget impacts of health policy interventions in the coverage by private and social health insurance. In addition, the orientation of the CHS to the OECD "System of Health Accounts" (SHA) lays the foundations for an international comparability of results.

The need to balance increasing needs for health care and scarce public resources confronts economic and health policy makers in all countries. Many instruments have been developed to assess benefits and costs of medical technologies at the micro-level. However, the macroeconomic tools are rather limited. One particular question is the impacts of cost containment measures on final demand in health care and the economy as a whole. The compilation of production multipliers by the Leontief Inverse $(I-A)^{-1}$ shows variations of these multipliers for different branches of the health economy between 1.47 and 2.38. As a result quite different consequences from policy interventions can be expected. Moreover, policy simulation needs to capture the dynamic aspects of expanding the health economy by public finance and the results of the health care on the income redistribution. Further developments of GHSA have to consider these aspects on different types of households.

Health policy

Efficiency is the main objective, which health policy and economic policy have in common. Here, one aspect is cost control which is often viewed from the perspective of achieving cost savings for public funds. In this context it is necessary to pay attention to the efficiency of the provision of health services without neglecting the various relations between them. The many interconnections and wide variety of organizational structures within the health care economy make reforms of health care provision and financing increasingly complex. The GHSA is a valuable analytical tool for the analysis of quantitative effects. However, there is presently no "health stock" in the model. A

key question remains how to compile the impacts of more or less medical care on health of the population.

In the health sector, the measurement of productivity turns out to be difficult. Since, contrary to the prices in the private sector, the prices in the public sector do not reflect the marginal utilities of the buyer. Therefore, different approaches were developed by international organizations, statistical offices and research institutes. A distinction between activities, outputs and outcome has to be carried out in the analysis of productivity in health care. Activities are e.g. surgical intervention, laboratory tests, home visits or consultations. Output covers a series of treatment steps and represents thereby a number of activities (treatment episode). The definition of outcome is, if the output is extended by the caused use (e.g. changes of the health status, reduction of waiting times or also additional comforts at hospitals).

In the further development of GHSA, also health related production within households should be taken into account. There is an increasing criticism of existing measures of economic performance through SNA. For example, *Stiglitz, Sen, Fitoussi* 2009 request that more attention should be paid to relation of health with human capital development, levels of education, and environment, as well as to differences among population groups. When linking macro accounts to health both health and economic policy have some common interests. Linked is the integration of health accounts and human capital accounts. A final point includes the variables having an impact on health as health threats and diseases. On the one side, health monitoring systems show falling work accident rates and mortality by major disease groups. On the other side, fat intake, drug consumption, stress, and accidents from sporting activities are rather increasing. In total, the impact of non-health care variables on health might be rather higher than health care. Non-health care variables should therefore be a substantial element of any health satellite account.

Outlook

This first attempt of developing an input-output table of German health economy has provided new insights into the structure of supply and use of health care, both into CHS and EHS. The aim of further studies is to include dynamic aspects, extend employment accounts, and introduce health and socio-economic indicators. One crucial question related to the measurement of the impact of health care on economic growth is the growth of health care prices. In general, health care prices rise faster than the consumer prices because one expects lower productivity within the health economy caused by Baumol's cost disease (*Baumol* 1985). However, the developments of total factor productivity of the health economy and the total economy in Germany show similar structures which need further analysis.

Another key question is the impact of a growing health economy on overall economic growth (*Zon, Muysken* 2003, *Suhrke et al.* 2005). Critical issues from a statistical and economic point of view are the measurement of deflation, financial accounts, and the integration of input-output tables with standard accounts into a Health Social Accounting Matrix.

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