

# **Compiling production accounts and measuring volume of residential nursing care activities and residential care activities for the elderly and disabled by linking individual data to transactions on the kind-of-activity level**

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## **Abstract**

The area of residential nursing care activities and residential care activities for the elderly and disabled is a representative example for a constellation in which the availability of data sources for the compilation of National Accounts aggregates is often scarce. In a situation of lacking primary statistics approaches to close data gaps have to be developed for the compilation of exhaustive and coherent product and production accounts. Moreover because of missing benchmarks plausibility checks for analysing the quality of the results must be created. In the first step solutions to overcome such data limitations for the compilation of accounts will be presented. It will be depicted how data on the unit level as well as on the associated transactions are arranged according to the underlying conceptional and classificatory framework of National Accounts.

By integrating physical variables the calculation framework can be extended for the purpose of price and volume measures. In order to derive representative volume indicators according to Atkinson (2005) quality of outputs (as well as of inputs) must be taken into account.

An indicator for the quality of outputs can be estimated by using data from register-based census information at the individual level. These data are aggregated to the level of local kind of activities and linked to the National Accounts dataset. The result is a set of National Accounts variables and volume measures which allow for the analysis of indicators on the national and on the regional level as well as according to types of producers.

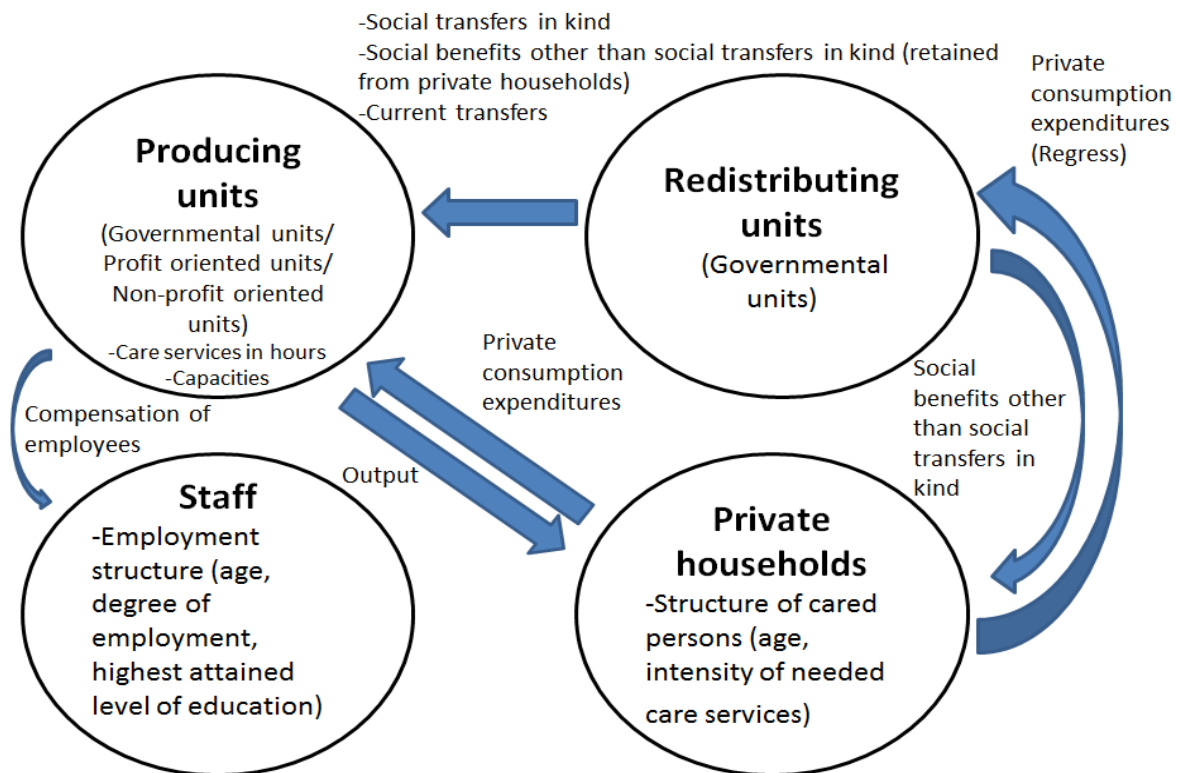
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# 1 Introduction

Because of non-existing obligations to report data for producing units in the service industries classified at NACE-2-digit levels 84-94 (Public administration, compulsory social security; Education; Human health and social work activities; Arts entertainment and recreation; Other service activities) the availability of detailed primary statistics is often scarce. Moreover in many cases there don't even exist any secondary statistics which fulfill the needs to compile National Accounts figures.

In a significant number of cases the NACE divisions 87.1 (Residential nursing care activities) and 87.3 (Residential care activities for the elderly and disabled)<sup>1</sup> contribute large parts to the entire production within the NACE-section Q (Human health and social work activities). Their outputs are intensively used for public and private consumption. For several parts of the Supply-Use-system (SU) in the activity NACE 87.1 and 87.3 some crude basic information can be gathered. Unfortunately this information is in most cases only available at a very high aggregate level and can therefore not be used for accurate plausibility checks for transactions as well as for the classification of producing units to different types of producers. This situation raises the question how, even under the given data restrictions, an exhaustive, coherent and self-contained information system for the involved participants and their mutual relations can be created. This system allows the compilation of detailed product and production accounts which on the one hand can be fully integrated into the system of National Accounts and on the other hand enable plausibility checks. This system must also be open for extensions like regional disaggregations as well as for price and volume measures. In this context also the connection with input and output data in physical units is established. The following illustration shows the main components of such a system.



<sup>1</sup> Hereinafter these two activities are presented as aggregates and quoted as activity NACE 87.1 and 87.3.

This information system is created by identifying various data sources for producing and distributing units and transactions which will be classified into the statistical framework for the compilation of accounts according to the guidelines of ESA 2010. Subsequently it will be linked to personal data.

## **2 Data sources**

Despite missing primary business statistics in activity NACE 87.1 and 87.3 there exist data sources to process toward fulfilling the requirements of National Accounts compilation. In many cases both assembling a comprehensive register on producing units as well as collecting of received or paid transactions can be performed with this information.

A predominant part of statistical units is covered by business registers of statistical offices which contain contact details and usually give an insight into the structure of enterprises, their appendant producing local kind-of-activity units, the classification by institutional sector and NACE and identification numbers for the buildings. Government departments at local levels or private non-profit associations provide inventories on residential (care) homes for the elderly with address data and capacities which complement the official business registers.

In public authorities accounts government controlled producing and distributing units keep records on transactions.<sup>2</sup> National tax statistics are based on reported sales revenues, preliminary turnover tax returns, corporate income tax statements and pay slips to national fiscal authorities by different producing units. These data can be utilized to determine the basic values for production accounts. This can also be carried out by using databases on commercial registers to obtain annual financial statements and explanations concerning components of profit and loss accounts.

Data on pay slips to employees and pensioners are reported by issuing institutions to national fiscal authorities or to associations of social security organizations. These are processed into wage tax statistics and contain the amounts of remuneration. Besides this some personal information like social position, age, degree of employment, duration of the received payments and place of residence or rather of work can be extracted from that data. If current transfers for persons with need of care are paid by social security funds conclusions can be drawn to individual care intensities. Central Population Registers often represent the backbone of the Register-based Census which comprises information on the population's level of education or residence.

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<sup>2</sup> In the following social transfers in kind only concern the transaction D.632 (Social transfers in kind-market production purchased by general government and NPISHs).

Use of data sources for the compilation of production/product accounts of activity/product NACE/CPA 87.1 and 87.3 with linkages to personal data			
Data source	Information on		
	Units	Transactions	Persons
Business register of statistical offices	Adress data and identification of buildings Structure of enterprises Classification by NACE and institutional sector		
Inventories on residential (care) homes for the elderly by government departments/private non-profit associations	Adress data Capacities Care service categories Name of operating company		
Accounts of public territorial authorities	Classification by NACE and institutional sector	Transaction in products (Production, Intermediate consumption) Distributive transactions (Compensation of employees, Social transfers in kind, Other current transfers)	
Tax statistics	Classification by NACE	Transaction in products (Production, Intermediate consumption) Distributive transactions (Compensation of employees) Taxes on products (Value added type taxes)	Social position Age Degree of employment Care intensities
Annual financial statements of commercial registers	Adress data Structure of enterprises	Transaction in products (Production, Intermediate consumption) Distributive transactions (Compensation of employees)	
Register-based Census			Level of education Residence

As can be seen in the illustration above, there is a broad range of data available for the compilation of product accounts. Unfortunately there are no data available for private consumption expenditures because institutional households like retirement homes are in accordance with the regulations for household budget surveys not part of that primary statistics. So these amounts have to be estimated in another way.<sup>3</sup> Moreover if there is indication that the characteristic production of activity NACE 87.1 and 87.3 is imported or exported this requires the consultation of foreign trade and balance of payment data. But in most cases this kind of production will be produced and consumed exclusively domestically.

### 3 Linkage of data sources

In the first step an exhaustive list of producing units is established. By referring to the data sources with information on producing units the particular producers of the product of CPA divisions 87.1 (Residential nursing care services) and 87.3 (Residential care services for the elderly and disabled)<sup>4</sup> are identified. These producers are classified by NACE and are at the same time allocated to institutional sectors and identified as market or non-market producers.

The linkage of producing units to transactions must be carried out at the most detailed level possible. It is the target to find for each producer at least the four transactions production, intermediate consumption, wages and salaries and employers' social contributions. Ideally, separate accounts covering all four types of transactions can be calculated for each individual producer. If for some producing units separate accounts are only available as aggregate data these sums of transactions are merged at the aggregate level. In a second step, they are disaggregated back to the single unit level. In the worst case no transactions at all can be found in primary data sources. Up to this point a matrix with the identified four types of transactions in the rows for each producing unit in the columns is generated.

<sup>3</sup> In this paper the remaining amount from the product account is taken for private consumption data.

<sup>4</sup> Hereinafter these two products are presented as aggregates and quoted as product CPA 87.1 and 87.3.

The stepwise allocation of transactions leads to an arbitrary missing data pattern. Observed data come from the upstream linkages. A Markov chain Monte Carlo (MCMC) method cares for the imputation of the furthermore missing observations.

Following Yuan (2011) this method creates multiple imputations by using simulations from a Bayesian prediction distribution for normal data. The data augmentation is applied by repeating an imputation I-step and a posterior P-step:

1. Imputation I-step: With estimated mean vector and covariance matrix, this step simulates missing values for each observation independently. If variables with missing values for observation  $i$  are denoted by  $Y_{i(mis)}$  and variables with observed values by  $Y_{i(obs)}$ , then the I-step draws values for  $Y_{i(mis)}$  from a conditional distribution  $Y_{i(mis)}$  given  $Y_{i(obs)}$ .
2. Posterior P-step: This step simulates the posterior population mean vector and covariance matrix from the complete sample estimates which are then used in the I-step. Without prior information a noninformative prior is used or other informative priors can also be used. According to Yuan (2011) a prior information about the covariance matrix may help stabilize the inference about the mean vector for a near singular covariance matrix.

The two steps are iterated long enough for the results to be reliable for a multiply imputed data set and the goal is to have the iterates converge to their stationary distribution and then to simulate an approximately independent draw of the missing values. That is, with a current parameter estimate  $\theta^{(t)}$  at  $t^{th}$  iteration, the I-step draws  $Y_{mis}^{(t+1)}$  from  $p(Y_{mis}|Y_{obs}, \theta^{(t)})$  and the P-step draws  $\theta^{(t+1)}$  from  $p(\theta|Y_{obs}, Y_{mis}^{(t+1)})$ . This creates a Markov chain  $(Y_{mis}^{(1)}, \theta^{(1)}), (Y_{mis}^{(2)}, \theta^{(2)}), \dots$ , which converges in distribution to  $p(Y_{mis}, \theta|Y_{obs})$ .

In the end a dataset without data gaps is available. The results are checked to make sure that outputs always satisfy plausible per-capita production figures and relations between the figures of output, intermediate consumption and compensation of employees. If any implausible figures are found the reasons are analysed and the figures are substituted if necessary. After that step a full set of production accounts for activity NACE 87.1 and 87.3 can be compiled. Because the compilation of accounts at the most detailed microeconomic level is intended from the very start of the linking procedure the production accounts can be regionally displayed at various levels of NUTS-classes.

Furthermore the dataset is complemented by elements to compile product accounts. The social transfers in kind from accounts of public territorial authorities that concern the product CPA 87.1 and 87.3 are determined. Finally private consumption expenditures for that product arise as the balancing item by solving the equation for product accounts in which supply for each product equals the sum of all uses.

This dataset which contains all relevant variables for SU-data in activity NACE 87.1 and 87.3 and product CPA 87.1 and 87.3 according to the system of NA is the central framework for all subsequent linkages of personal data. Within the scope of calculating volume measures according to Atkinson (2005) quantity and quality aspects have to be considered for outputs as well as for inputs. Usually data on outputs in physical units for all the single individual producing units in an economic territory will not be available on the basis of primary statistics. In such a situation it would be possible to analyse household data given by the register-

based census. In these data sets any information on residence can act as the linkage variable to allocate persons to institutions which provide product CPA 87.1 and 87.3. These data provide information on persons' care intensities. With that persons' received care services can be calculated and regarded as equivalent for production in physical units. Otherwise these data can be estimated by assuming increasing care intensities by age. Instead of this data describing health conditions with conclusions on needed care services can be integrated.

Employees can be allocated to producing units by utilizing address data from employers' issues of pay slips. Any personal identification code can act as linkage variable to merge the allocated employees with data on their educational background from register-based census. With this step better-trained workers are identified as well as the average age or an indication for the degree of employment in these institutions.<sup>5</sup>

In most cases personal data refer to a fixed appointed date. So these stock data have to be transformed into flow data to relate the information on persons with those on transactions. This is done by connecting stock data at several points in time.

For the calculation of volume indices it is the target to find a matrix for each producing unit (objects) which describes the supplied care services to persons in physical units.

Given are Objects  $O_i = 1, \dots, o$  and Persons  $P_j = 1, \dots, p$ .

Then for each object  $O_i$  a matrix  $M_i$  is generated where  $M_i = (m_{jk})$  and  $i \in \{1, \dots, o\}$ . The entry  $m_{jk}$  is the value generated by the following function:

$$m_{jk} := \tau(P_j, k)$$

where  $\tau$  gives the number of care hours for the person  $P_j$  at day  $k$  when  $k \in \{1, \dots, 365\}$ .<sup>6</sup> The resulting output matrix for a given object has the following structure:

$$M_i = \begin{pmatrix} m_{1,1} & \dots & m_{1,365} \\ m_{2,1} & \dots & m_{2,365} \\ \vdots & \ddots & \vdots \\ m_{j,1} & \dots & m_{j,365} \end{pmatrix}, \text{ so total output of object } i \text{ is given as } \sum_{j=1, k=1}^{p, 365} m_{jk}$$

It is clear that each value  $m_{jk}$  depends on the information of the number of persons with the principal residence in the specific object  $i$  as well as on the care intensity in hours received by the person  $P_j$  each at a given day  $k$ .<sup>7</sup>

<sup>5</sup> Until now only output data in physical terms have been calculated and merged yet. On the basis of small data sets it was also analysed how to arrange the data processing for inputs like employees. Because this part is in the early stages at the moment only results for output data are presented here.

<sup>6</sup> In the case of leap year it is obvious that  $k \in \{1, \dots, 366\}$ .

<sup>7</sup> It must be emphasised that the value per day can exceed 24 hours especially for the case when a person needs very intensive care all day long provided by more than one employee of the nursing staff.

## 4 Results

In this section results from the work on an information system on the flow of product CPA 87.1 and 87.3 by making use of Austrian data are presented.

Producers of the product CPA 87.1 and 87.3 (Residential nursing care services; Residential care services for the elderly and disabled) and care places											
NUTS level 3	Sum producers	NACE 86.1 General Government (S.13), Non-Market Producers	NACE 87.1+87.3 Private Corporations (S.11+S.14), Market Producers	NACE 87.1+87.3 Public Corporations (S.11), Market Producers	NACE 87.1+87.3 Non-Profit Corporations (S.11), Market Producers	NACE 87.1+87.3 General Government (S.13), Market Producers	Sum care places	Places for residential care	Places for nursing care	Places for residential nursing care	Places for assisted living
AT111 Mittelburgenland	8	.	3	.	5	.	333	0	333	0	0
AT112 Nordburgenland	22	.	12	.	10	.	963	12	608	343	0
AT113 Südburgenland	15	.	3	.	12	.	938	29	690	183	36
AT121 Mostviertel-Eisenwurzen	20	1	8	10	1	.	1.626	46	1.485	27	68
AT122 Niederösterreich-Süd	23	.	6	10	7	.	1.903	147	1.546	206	4
AT123 St. Pölten	11	1	2	3	4	1	1.432	174	1.245	13	0
AT124 Waldviertel	15	.	2	8	5	.	1.565	99	1.406	0	60
AT125 Weinviertel	8	.	1	5	1	1	794	13	750	31	0
AT126 Wiener Umland-Nordteil	18	1	2	7	7	1	2.342	169	2.152	21	0
AT127 Wiener Umland-Südteil	26	.	8	9	8	1	2.464	306	1.832	315	11
AT130 Wien	92	12	15	.	65	.	18.329	8.416	8.820	664	429
AT211 Klagenfurt-Villach	41	2	14	3	18	4	3.173	337	2.381	345	110
AT212 Oberkärnten	23	1	6	.	9	7	1.343	32	921	390	0
AT213 Unterkärnten	26	1	7	.	10	8	1.499	40	1.349	81	29
AT221 Graz	58	4	32	.	21	1	4.295	131	2.891	1.273	0
AT222 Liezen	16	.	2	2	5	7	808	60	541	194	13
AT223 Östliche Obersteiermark	33	2	11	.	11	9	2.107	5	1.419	607	76
AT224 Oststeiermark	45	1	28	.	11	5	2.394	0	1.896	498	0
AT225 West- und Südsteiermark	50	.	37	.	11	2	2.321	24	1.667	545	85
AT226 Westliche Obersteiermark	29	1	18	1	7	2	1.468	0	936	532	0
AT311 Innviertel	22	.	1	2	4	15	2.034	10	1.325	699	0
AT312 Linz-Wels	50	.	2	16	15	17	5.363	87	3.435	1.773	68
AT313 Mühlviertel	21	.	2	2	2	15	1.878	83	825	888	82
AT314 Steyr-Kirchdorf	18	.	1	3	2	12	1.728	10	630	1.058	30
AT315 Traunviertel	28	.	12	6	10	2.318	8	341	1.939	30	
AT321 Lungau	4	.	.	1	3	236	0	94	135	7	
AT322 Pinzgau-Pongau	32	.	13	.	3	16	1.768	61	890	771	46
AT323 Salzburg und Umgebung	46	.	6	15	13	12	3.492	27	1.294	2.110	61
AT331 Außerfern	2	.	1	.	1	144	0	81	63	0	
AT332 Innsbruck	37	1	1	23	9	3	3.105	73	982	1.847	203
AT333 Osttirol	3	.	3	.	.	367	67	128	172	0	
AT334 Tiroler Oberland	15	.	.	7	5	3	781	19	554	196	12
AT335 Tiroler Unterland	35	.	4	10	6	15	1.916	130	754	983	49
AT341 Bludenz-Ebengener Wald	18	.	8	.	5	5	629	25	555	14	35
AT342 Rheintal-Bodenseegebiet	38	.	18	4	9	7	1.854	119	1.605	69	61
<b>Total</b>	<b>948</b>	<b>28</b>	<b>260</b>	<b>170</b>	<b>307</b>	<b>183</b>	<b>79.710</b>	<b>10.759</b>	<b>48.361</b>	<b>18.985</b>	<b>1.605</b>

In the year 2013 there were 948 producers of the product CPA 87.1 and 87.3 in Austria which can be found more in the NUTS 1 region Western Austria (AT3) with 369 producing units and Southern Austria (AT2) with 321 producing units. However comparing the capacities indeed the producers of NUTS 1 region Eastern Austria (AT1) with 32689 care places exceed those of the other regions by far. Across all regions the producers provide 79710 care places which are subdivided into 48361 places for nursing care, 18985 places for residential nursing care, 10579 places for residential care and 1605 places for assisted living. Of course only on the basis of these categories and capacities a reliable conclusion regarding care intensities or utilization cannot be drawn.

Surprisingly the vast majority of the production comes from characteristic producers which are all market producers. About 40% of these local kind of activity units are operated by public authorities which are controlled by government. But only 211 of these are part of general government (S.13). And even within this institutional sector most of these producing units are classified as market producers. The few non-market producers are all units classified in the activity NACE 86.1 (Hospital activities). Furthermore it seems remarkable that there is not a single unit in the institutional sector Non-profit institutions serving households (S.15). The reason for this is the same as for producing units of the public sector namely that the products are sold at economically significant prices and cover at least a majority of the production costs.<sup>8</sup> This market production is solely consumed by private households and by social transfers in kind.

<sup>8</sup> The basic principles for the classification of institutional units to types of producers, institutional sectors and to corresponding local kind-of-activity units are laid down in ESA 2010 sections 2.135-2.152 in connection with the guidelines of production in the sections 3.37-3.39.

The production account for the entire activity NACE 87 and 88 (Residential care activities; Social work activities without accommodation) shows the contribution of product CPA 87.1 and 87.3.

Production Account Activity NACE 87 and 88 (Residential care activities; Social work activities without accommodation)																				
NUTS level 2 regions	Total: NACE 87+87, S.11-S.15, Market and Non-Market Producers			NACE 87.1+87.3, Private Corporations (S.11+S.14), Market Producers			NACE 87.1+87.3, Public Corporations (S.11), Market Producers			NACE 87.1+87.3, Non-Profit Corporations (S.11), Market Producers			NACE 87.1+87.3, General Government (S.13), Market Producers			NACE 87+88, Rest, S.11-S.15, Market and Non-Market Producers				
	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added	P.1 Production	P.2 Intermediate consumption	B.1g Gross Value added		
Current prices, Mio. EUR																				
AT11 Burgenland	186,1	68,6	117,6	25,3	7,7	17,5	-	-	-	55,4	18,3	37,2	-	-	-	-	-	105,4	42,6	62,9
AT21 Carinthia	1.003,1	308,3	694,8	57,9	22,7	35,1	257,1	82,2	174,9	97,2	33,2	64,0	10,3	4,2	6,1	-	-	580,6	166,0	414,6
AT13 Vienna	1.594,5	545,2	989,3	100,2	37,0	63,2	-	-	-	428,8	133,1	295,8	-	-	-	-	-	1.005,5	375,1	630,3
AT21 Carinthia	405,7	157,1	248,7	39,7	14,5	25,2	3,1	0,9	2,2	82,7	29,3	53,4	40,1	10,4	29,7	-	-	240,1	102,0	138,1
AT22 Styria	1.271,2	394,5	876,7	203,7	76,0	127,7	2,9	1,5	1,4	148,4	47,1	101,3	80,1	18,0	62,1	-	-	836,1	252,0	584,1
AT31 Upper Austria	1.119,3	340,3	779,0	11,9	4,7	7,3	127,6	31,8	95,7	85,4	28,8	56,6	223,4	54,8	168,6	-	-	671,1	220,1	450,9
AT32 Salzburg	392,9	128,1	264,8	5,7	2,2	3,5	73,4	25,9	47,5	40,8	11,9	28,9	42,6	16,1	26,5	-	-	230,3	72,0	158,3
AT33 Tyrol	555,5	174,4	381,1	13,6	3,4	10,1	137,0	31,7	105,3	40,9	14,7	26,3	26,4	6,5	19,9	-	-	337,6	118,1	219,5
AT34 Vorarlberg	238,6	73,0	165,6	37,2	13,5	23,7	10,9	2,6	8,3	38,5	13,0	25,5	8,7	2,7	6,0	-	-	143,2	41,2	102,1
AT Austria	6.706,9	2.189,4	4.517,5	495,2	181,7	313,5	612,0	176,6	435,4	1.018,2	329,3	689,0	431,5	112,7	318,8	-	-	4.149,9	1.389,1	2.760,8

The activity NACE 87 and 88 produced products in the amount of about 6.706,9 million euros. For this purpose intermediate consumption of 2.189,4 million euros was necessary whereby value-added of 4.517,5 million euros resulted. Moreover these data can be disaggregated to the various Austrian regions, here the results are presented at the NUTS 2 level.<sup>9</sup>

The product account for product CPA 87.1 and 87.3 compares total supply with total use.

Product Account product CPA 87.1 and 87.3 (Residential nursing care services; Residential care services for the elderly and disabled)			
		Supply	Use
Transaction		Current prices, Mio. EUR	
D.211 Non-deductible VAT		125,2	-
D.632 Social transfers in kind		-	1.206,7
P.31 Individual private consumption expenditure		-	1.669,7
	NACE 87.1+87.3, Private Corporations (S.11+S.14), Market Producers	495,2	-
	NACE 87.1+87.3, Public Corporations (S.11), Market Producers	612,0	-
P.11 Market output	NACE 87.1+87.3, Non-Profit Corporations (S.11), Market Producers	1.018,2	-
	NACE 87.1+87.3, General Government (S.13), Market Producers	431,5	-
P.131 Payments for non-market output	NACE 86.1, General Government (S.13), Non-Market Producers	194,2	-
<b>Total</b>		<b>2.876,4</b>	<b>2.876,4</b>

It can be seen that in addition to the production of producers of activity NACE 87.1 and 87.3 those of the activity NACE 86.1 of 194,2 million euros and non-deductible VAT on products in of 125,2 million leads to a total supply at purchasers' prices of 2.876,4 million euros. On the use side public authorities are purchasing the product CPA 87.1 and 87.3 for 1.206,7 million euros by social transfers in kind, the rest of total supply of 1.669,7 million euros was consumed by private households.<sup>10</sup>

<sup>9</sup> Because of the fact that the most detailed level for transactions and units is intended to be found the production accounts are available at NUTS 3 level or even regionally more disaggregated.

<sup>10</sup> As there are no data available for domestic interregional import and export flows the product account for the product CPA 87.1 and 87.3 can not be regionally disaggregated.



The linkage of institutional data with personal data provides an insight into the use of their supply, differentiated with respect to levels of care intensities, and enables the calculation of their production in physical units.

Use of the product CPA 87.1 and 87.3 (Residential nursing care services; Residential care services for the elderly and disabled) in physical units																
NUTS level 3	Number of producing units	Cared persons male	Cared persons female	Mean age	Level of care 0	Level of care 1	Level of care 2	Level of care 3	Level of care 4	Level of care 5	Level of care 6	Level of care 7	Mean Rate of utilisation	Supplied care hours	Change in volume	Implicit price index
AT111 Mittelburgenland	8	87	222	81.40	13	5	18	41	99	86	23	24	92,80	633.954	1,20	0,93
AT112 Nordburgenland	19	159	382	79.90	72	9	56	82	125	146	29	22	66,10	1.011.149	1,03	1,12
AT113 Südburgenland	15	207	492	80.60	58	12	55	112	184	186	56	36	74,50	1.421.174	1,09	1,02
AT121 Mostviertel-Eisenwurzen	17	364	803	79.40	66	14	111	156	268	332	93	127	81,40	2.536.237	1,00	1,04
AT122 Niederösterreich-Süd	20	377	988	80.90	97	30	138	144	338	399	121	98	78,90	2.796.003	1,03	1,03
AT123 St. Pölten	11	286	644	78.50	68	17	85	113	249	233	95	70	64,90	1.970.439	1,01	1,06
AT124 Waldviertel	13	331	928	82.20	49	6	57	125	323	414	155	130	89,50	2.852.801	1,03	1,01
AT125 Weinviertel	6	229	503	80.50	31	14	67	93	206	193	72	56	94,20	1.544.305	1,05	0,95
AT126 Wiener Umland-Nordteil	18	466	1.227	82.10	106	20	101	184	461	558	158	105	72,30	3.601.329	1,01	1,06
AT127 Wiener Umland-Südteil	22	410	1.292	81.80	183	43	131	203	477	418	172	75	74,10	3.388.332	1,00	1,02
AT130 Wien	80	2.834	9.908	83.60	2.349	1.375	2.312	1.788	1.938	1.832	829	319	77,10	20.287.281	0,99	1,09
AT211 Klagenfurt-Villach	37	568	1.559	81.70	211	81	217	400	528	472	138	80	73,60	3.950.286	1,03	1,05
AT212 Oberkärnten	22	318	682	81.50	99	39	109	176	295	201	50	31	77,20	1.849.709	1,05	0,99
AT213 Unterkärnten	24	348	882	79.90	128	27	150	169	304	297	97	58	82,80	2.394.146	1,05	1,02
AT221 Graz	47	626	1.826	82.40	175	56	206	346	594	622	314	139	69,10	5.078.406	1,06	1,02
AT222 Liezen	15	152	455	82.70	22	7	33	107	136	164	108	30	84,10	1.371.013	1,02	1,05
AT223 Östliche Obersteiermark	33	505	1.359	83.00	62	24	165	253	469	539	218	134	88,50	4.050.025	0,98	1,10
AT224 Oststeiermark	41	530	1.279	80.70	110	14	112	258	415	552	238	110	82,00	3.962.619	1,01	1,06
AT225 West- und Südsteiermark	48	660	1.075	75.40	168	30	163	238	363	415	267	91	75,00	3.668.253	1,03	1,01
AT226 Westliche Obersteiermark	27	324	843	81.30	50	13	84	168	316	331	137	68	85,40	2.540.383	1,01	1,03
AT311 Innviertel	22	531	1.470	82.70	78	17	169	432	458	566	185	96	98,40	4.199.540	0,99	1,05
AT312 Linz-Wels	48	1.173	3.618	83.60	184	80	401	928	1.081	1.456	429	232	89,80	10.271.267	0,98	1,02
AT313 Mühviertel	19	445	1.170	82.30	65	21	113	275	362	508	157	114	86,30	3.524.968	1,00	1,01
AT314 Steyr-Kirchdorf	17	353	1.128	83.10	41	18	136	312	304	426	162	82	90,40	3.220.453	0,98	1,06
AT315 Traunviertel	26	553	1.526	82.60	96	33	256	507	428	547	129	83	92,10	4.184.060	0,97	1,04
AT321 Lungau	4	55	151	80.30	15	4	22	38	53	56	14	4	87,30	412.921	0,98	1,07
AT322 Pinzgau-Pongau	32	466	1.138	82.00	143	54	169	348	376	311	141	62	90,70	3.063.612	0,98	1,07
AT323 Salzburg und Umgebung	42	741	1.952	82.90	206	77	326	580	489	637	259	119	82,30	5.273.369	0,99	1,05
AT331 Außerfern	2	23	83	82.30	9	5	14	12	16	25	21	4	79,60	219.208	0,99	1,07
AT332 Innsbruck	36	687	1.809	80.70	435	93	297	413	451	548	220	89	80,90	4.363.579	1,00	1,00
AT333 Osttirol	3	86	267	83.60	24	14	39	40	55	118	47	16	96,20	753.240	0,96	1,05
AT334 Tiroler Oberland	14	132	346	80.50	66	9	57	70	95	114	55	12	65,40	921.782	1,03	1,01
AT335 Tiroler Unterland	32	445	1.004	81.10	207	49	197	225	320	326	102	23	82,80	2.541.350	1,06	0,99
AT341 Bludenz-Bregenzner Wald	17	149	283	80.20	41	12	32	70	82	98	78	19	74,20	908.091	0,98	1,09
AT342 Rheintal-Bodenseegebiet	32	470	1.055	80.30	125	29	97	251	386	285	68	88	88,90	3.255.870	1,01	1,01
<b>Total</b>	<b>869</b>	<b>16.090</b>	<b>44.349</b>	<b>81,36</b>	<b>5.852</b>	<b>2.351</b>	<b>6.695</b>	<b>9.657</b>	<b>12.942</b>	<b>14.512</b>	<b>5.654</b>	<b>2.776</b>	<b>81,79</b>	<b>118.021.154</b>	<b>1,02</b>	<b>1,04</b>

For the year 2013 reliable data for 16090 male and 44349 female persons resident in one of 869 producing units of activity NACE 87.1 and 87.3 at the appointed date of register based census were identified. The rate between the registered persons and the capacities gives the intensity of use. In many cases the producing units are clearly below full use of capacity.

Moreover with the linked data a volume indicator for outputs in physical units can be calculated which considers the duration of stay as well as care intensities. A combined view on data on beginning and end of registration as residence and on dates of death gives the duration of stay in days during a given year. Personal care intensities can be deduced from the Austrian Federal Long Term Care Allowance Act which defines seven levels of care need. These levels range from at least 65 hours of care per month (level 1) and more than 180 hours of care per month in combination with complete immobility (level 7).<sup>11</sup> In total the involved producing units are responsible for more than 118.0 million care hours.

Output in monetary units as well as in terms of care hours were even calculated for the previous year. Thereby the change in volume is measured. By extrapolating the figures at current prices for the previous year with the volume index production for 2013 at previous year's prices and with that implicit price indices are calculated.

<sup>11</sup> The figures of level 0 in the table concern to people with principal residence in one of the institutions at the appointed date of register based census without classification of eligibility for payments from the Austrian Federal Long Term Care Allowance Act.

## 5 Conclusions

Detailed production and product accounts for producing units can be compiled by linking corresponding data sources on transactions and personal data despite non-existing primary statistics. The results allow regional disaggregation with plausibility checks and the deduction of volume indices.

In further works the presented outputs in physical terms will be amended by quality adjustments to generate data that measure the characteristics which affect utility provided by the received care services. By considering these elements the outcome can be interpreted as quality-adjusted output.<sup>12</sup>

Moreover a further objective is the integration of input data, especially data on care staff. Especially a distinction between the degree of employment or educational background per employee is of high importance for the calculation of meaningful quality-adjusted volume indices. Moreover the distribution of employment to institutions is useful for the improvement of the regional allocation of transactions which is of high importance for producing units as part of regional or local authorities.

In addition for the purpose of the distribution approach a very detailed insight into the employment structure is given for the calculation of annual average of jobs or full-time equivalents.

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<sup>12</sup> See Eurostat (2013B), p. 48