Women's GDP – a time-based input-output analysis

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1. Introduction

The System of National Accounting (SNA) offers a broad variety of indicators to measure a country's economic performance. Most of the indicators focus on transactions carried out in monetary units. This is particularly true for the core indicator of the SNA - the traditional Gross Domestic Product (GDP). The GDP reflects the money value of the annual, half-yearly or quarterly economic output, produced by the domestic industries' employees. Thus, the concept fully accounts for paid work. In contrast, unpaid work remains unconsidered.

However, measured in time units, average unpaid work per person, which amounts in average to more than 3 hours per day, clearly exceeds average paid work that accounts, related to the whole population, for approximately 2 hours per person and day. Thus, societies rely likewise on paid and unpaid work. Therefore, satellite systems which analyse unpaid work in further detail are linked with the central framework of national accounts.

For the study at hand, unpaid work includes all activities that can be delegated to someone else. In this context, unpaid activities are differentiated by household chores, child and elderly care as well as community services. The money values of these activities define the household production as a whole (EUROSTAT, 2003; SCHÄFER and SCHWARZ, 1994). Finally, the summation of traditional GDP and household production can be considered the extended GDP (SCHÄFER, 2004a).

Contrary to the traditional GDP, the extended version accounts for activities of employed and (for any reason) not employed persons. This, in turn, allows for a more detailed analysis of people's activity patterns and leads to a better understanding of socio-economic interdependencies in modern societies.

The idea to incorporate economic and societal activities into a common system of national accounting traces back to Nobel laureate Richard Stone (STONE, 1970). All the same,

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enormous data requirements prevented the implementation of Stone's "System of Social and Demographic Statistics" (SSDS) in the mid 1970s (UNITED NATIONS, 1975; STAHMER, 2003).

Nowadays, the concept of "Social Accounting Matrices" (SAM), which was introduced in the early 1990s, follows the idea to provide more insights into socio-economic interrelationships. In doing so, emphasis is placed on income formation, distribution and application (KEUNING, 1991; KLOSE, OPITZ and SCHWARZ, 2005).

Despite the successful establishment of the SAM and satellite systems, which deal with household production, in the sphere of national accounting, there is a long way to go in order to realise Stone's dream to draw a complete picture of economic, demographic and societal interactions. In this context, the different role of socio-demographic groups is, from the perspective of national accounting, of particular relevance. Therefore, the study at hand subdivides the population by status of employment, age groups and gender. However, for the sake of clarity, tables and figures focus on the differentiation by gender and show, in the end, women's contribution to traditional GDP and household production.[1]

While manifold literature can be found with regard to women's performance in household production (e.g., REID, 1934; UNITED NATIONS, 1996; MEIER, KÜSTER and ZANDER, 2004), women's professional life is mostly scrutinised with regard to the conflict area of family work and professional career (e.g., JURCZYK and LANGE, 2002). However, some studies published by Statistik Austria and Statistics Netherlands particularly deal with women's share in household production and traditional GDP (FRANZ, 1996, 1998; KEUNING and TIMMERMANN, 1995).[2]

In contrast to the Austrian studies, the present work does not start from men's and women's different wages, but from the gender-specific paid and unpaid working time. Detailed empirical data from the German "Mikrozensus 2000" and the Institute for Employment Research (IAB) allow for the socio-demographic differentiation of employees and for further subdivision by industries and level of qualification. Finally, the recent time budget survey provides detailed information about men's and women's unpaid workload (STATISTISCHES BUNDESAMT, 2003, 2004).

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[1] Model results are based on a classification of the German population by three age groups: persons younger than 18 years, adults aged between 18 and 65 years and senior citizens of 65 years and older.

[2] Both studies follow different approaches and are hardly comparable with the study at hand. Nevertheless, the Austrian study shows similar results. In contrast, results differ significantly compared to the Dutch study that assigns smaller shares to female employees.

In order to link working hours with the traditional monetary indicators of the SNA, the German input-output table for the year 2000 and its inverse matrix are applied (STATISTISCHES BUNDESAMT, 2005). While the SNA provides the information of the industries' gross value added (GVA), the time use data determine the allocation by gender.[3]

Such an approach would imply an equal productivity of women and men, who work in the same industry. This assumption is at least questionable. Therefore, the genders' level of qualification is taken into account in a last step. This, in turn, allows for a more precise identification of the gender-specific quality of paid work. To a smaller extent, discrepancies in educational attainments also affect activities of unpaid work.

Though the study at hand highlights the German situation, the approach could in principle be applied for other economies as well. This is particularly true, if, on the one hand, employment statistics differentiate working hours by gender and industries and, on the other hand, time use data allow for a gender-specific analysis of activities related to household production.

2. Time use

2.1. Paid work

In the year 2000, women accounted for approximately 51% of the population in Germany. However, due to a significantly smaller participation rate, compared to the male population, female employees just made up for about 46% of all employees. Considering the volume of work, the high relevance of part-time work further reduced the women's share. While almost 95% of male employees work full-time, women's share of full-time employment comes up to slightly less than 62%.[4]

Relating to one person, men's average annual working time comes up to more than 1,700 hours per employee. In contrast, women's average annual working time is below 1,200 hours per employee. In total, women's volume of paid work amounted to 20.6 billion hours. This refers to about 36% of the total volume of paid work (STATISTISCHES BUNDESAMT, 2001). Table 1 classifies population, employment and volume of paid work by gender.

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[3] The European Commission provides detailed information about men's and women's time use at European scale (e.g. EUROPEAN COMMISSION, 2004 and 2005).

[4] With regard to Switzerland, women's shares in population (51.1%) and employment (44.0% of employees) were quite similar to Germany in the year 2000. While about 47% of female employees in Switzerland worked full-time, men's corresponding share came up to about 90%. Thus, similar to the German situation, women's share considering the volume of work can be expected to be significantly below 40% (BUNDESAMT FÜR STATISTIK, 2005).

Table 1: Population, employees and volume of paid work by gender, Germany, 2000

	Population (in 1000)	Employees (in 1000)	Volume of paid work (mill. hours)
Women	42 088 _51.2%_	17 681 _45.6%_	20 593 _36.3%_
Men	40 124 _48.8%_	21 067 _54.4%_	36 109 _63.7%_
Total	82 212 _100.0%_	38 748 _100.0%_	56 701 _100.0%_

Source: STATISTISCHES BUNDESAMT 2001, chapter 3 and 6

Following the approach of a socio-economic input-output analysis (STAHMER, SCHAFFER and HERRCHEN, 2004), the study at hand attributes the working hours to categories of final demand. The latter are based on the traditional input-output tables for Germany and include private and public consumption, investments and exports. A detailed analysis of private and public consumptions further allows for the separate identification of the final demand for educational and health services (SCHAFFER, 2005).

Furthermore, the planned integration of household chores, child and elderly care as well as community services, which comes along with the extension of the production frontier, requires the allocation of consumer durables as investment goods without influencing the level of traditional GDP. As a consequence thereof, consumer durables are shifted from private consumption to investments. Main reason for the reclassification is the planned monetarisation of household production that is based on the valuation of unpaid working hours and the depreciation on consumer durables (see chapter 3.2).

The amount of working hours necessary to satisfy the final demand for domestically produced goods T^{dom}, is calculated according to equation (1). Empirical work of the Institute for Employment Research (IAB) and additional estimates of the Federal Office of Statistics based on the German "Mikrozensus 2000" allow for a separation of working hours by gender and 71 production branches. In order to combine the volume of work with monetary input-output data, working hour coefficients by gender (T_{SAM}) are derived from the division of separated working hours with the (total) production value of the respective branch. Finally, the application of the classical Leontief inverse matrix allows for the allocation of directly and indirectly needed working hours to the different categories of final demand (STAHMER 2004;

STAHMER, SCHAFFER and HERRCHEN, 2004). The following relations set up the basic equations for the market production:

$$T^{dom} = T_{SAM} \cdot B^{dom} \cdot Y^{dom} \tag{1}$$

$$T_{SAM} = \begin{pmatrix} t_{female} \\ t_{male} \end{pmatrix} \tag{2}$$

$$B^{dom} = (I - A^{dom})^{-1} \tag{3}$$

t_i: Row vector (n elements) of working hour coefficients differentiated by gender. The vector results from the division of working hours related to n (=71) branches' by the corresponding production values.

T_{SAM}:   s x n matrix of working hour coefficients by s demographic groups and n branches.[5]

I: Unity matrix.

A^{dom}:   n x n monetary matrix of input-coefficients (domestic production of the German economy in 2000).[6]

Y^{dom}:   n x k matrix of monetary final demand of domestic production (by n commodity groups and k (=7) categories of final demand.

Following these equations, table 2 shows the annual direct and indirect paid labour inputs by gender to satisfy the different categories of final demand.

Table 2: Direct and indirect contributions to satisfy final demand in million hours, Germany, 2000, (domestic production)

	Consumption of educational services	Consumption of health services	Other private con-sumption	Other public services	Investments		Export	Total
					Capital goods	Consumer durables		
Women	1 488 *50.3%*	4 399 *62.9%*	7 790 *39.0%*	1 700 *34.0%*	1 703 *19.4%*	572 *36.0%*	2 942 *25.8%*	20 593 *36.3%*
Men	1 469 *49.7%*	2 594 *37.1%*	12 197 *61.0%*	3 300 *66.0%*	7 081 *80.6%*	1 017 *64.0%*	8 450 *74.2%*	36 109 *63.7%*
Total	2 956 *100.0%*	6 993 *100.0%*	19 987 *100.0%*	5 000 *100.0%*	8 784 *100.0%*	1 589 *100.0%*	11 392 *100.0%*	56 701 *100.0%*

In order to satisfy, for example, the total demand for health services, approximately 7 billion working hours are necessary. Labour inputs include direct inputs, namely medical services, and indirect inputs, such as the production of chemicals as intermediate input of

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[5]   Calculations differentiate by gender and three age groups (s = 6 demographic groups). However, for the sake of clarity, presented results are specified by gender only.

[6]   It is assumed that each of the n industries produces goods that belong to one out of n commodity groups.

pharmaceuticals. Women's direct and indirect contributions amount to almost 4.4 billion working hours which relates to a relative share of 62.9%.

2.2. Unpaid work

People do not only consume market goods, but show a considerable demand for private non-market services. In order to include these services into the calculations, the production frontier is extended to private non-market activities, which could in principle be delegated to other persons.[7] In the following, private non-market services are subdivided into three categories: household chores (housework and do-it-yourself activities), child and elderly care as well as community services.

Women invest in average about 1,410 hours per year and inhabitant for activities of household production. Thus, women's contributions add up to approximately 59.3 billion hours. This complies with 61.6% of total unpaid working hours. Men's contribution, in contrast, is limited to approximately 920 hours per inhabitant which amounts to 36.9 billion hours. Interestingly, annual unpaid work is very similar for employed and not employed persons. While annual unpaid working hours of not employed women add up to approximately 1,430 hours per person, employed women still spend about 1,370 hours for household chores and other unpaid work. Considering men, hardly any difference can be identified.

Table 3 shows the unpaid working time by three categories of household production. For comparison, the total volume of paid work is given as well.

Table 3: Volume of unpaid work by activity and gender in million hours, Germany, 2000

	Household chores	Child and elderly care	Community services	Total volume of unpaid work	Volume of paid work	Total volume of paid and unpaid work
Women	51 461 *62.0%*	6 330 *65.6%*	1 463 *41.4%*	59 254 *61.6%*	20 593 *36.3%*	79 847 *52.3%*
Men	31 517 *38.0%*	3 317 *34.4%*	2 071 *58.6%*	36 904 *38.4%*	36 109 *63.7%*	73 013 *47.7%*
Total	82 978 *100.0%*	9 647 *100.0%*	3 534 *100.0%*	96 159 *100.0%*	56 701 *100.0%*	152 860 *100.0%*

Source: STATISTISCHES BUNDESAMT, 2003.

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[7] Thus, the approach relies on the third-party criterion, introduced by REID (1934) and further specified e.g. by EUROSTAT (2003).

Household production requires considerably more time inputs than formal employment. Thus, men's higher contribution to industrial production is more than compensated by women's dominating role in household production. With regard to the total volume of paid and unpaid work, women's working hours amount to almost 80 billion hours per year or about 1,900 hours per woman and year. Subsequently women's share in the sum of paid and unpaid working hours adds up to approximately 52%. In contrast, men's total working hours account for approximately 73 billion hours per year. This corresponds to 1,820 hours per person and year in 2000. Figure 1 illustrates men's and women's annual working time per inhabitant (related to the male and female population respectively) and per employee.

Figure 1: Men's and women's individual time use for paid and unpaid work per year
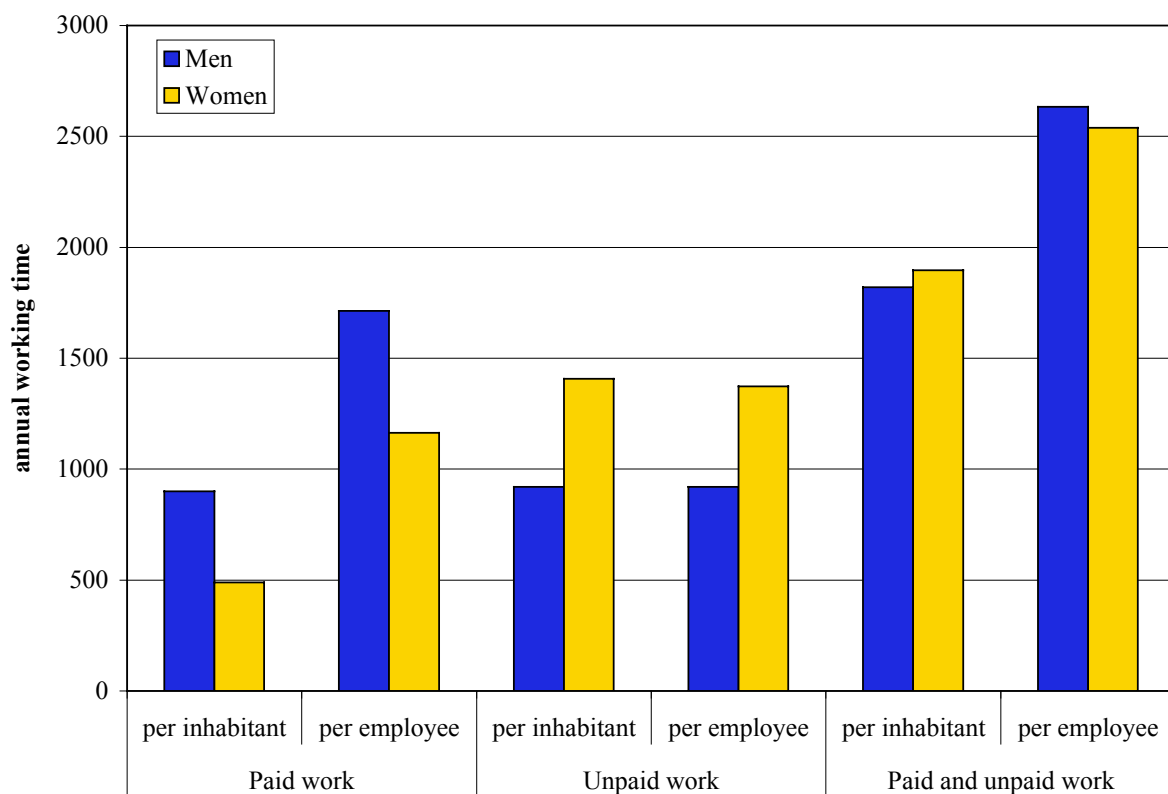
Since the employees' time use for unpaid work hardly differs from unpaid working hours of not employed persons, average total working hours are, of course, considerably higher for employed persons. This is particularly true for male employees, who show the highest overall workload of all considered groups.

3. Money values

3.1. Traditional GDP

Time use data provide a first insight into men's and women's labour inputs. However, men's and women's contribution to market production is additionally determined by labour productivity, which differs significantly for the considered branches. For the moment, it is assumed that labour productivity is equal for men and women working in the same branch. Thus, the gender-specific shares of the industries' net value added is split according men's and women's labour inputs. However, the calculation of GDP demands for the gender classification of the gross rather than the net value added. Therefore, the depreciation, which just defines the difference between gross and net value added, has to be assigned to the gender groups as well. Based on the assumption that the utilisation of capital goods is independent from the employees' gender attributes, the depreciation is split up according to the genders' labour inputs.[8]

Equations (4) and (5) account for the genders' contribution to the industries' GVA supplemented by the position "taxes – subsidies on products", the Leontief inverse matrix and the final demand of domestic products. This, in turn, allows for the calculation of men's and women's direct and indirect contributions to satisfy the final demand (STAHMER, 2004)[9].

$$V^{dom} = V_{SAM} \cdot B^{dom} \cdot Y^{dom} \qquad (4)$$

$$V_{SAM} = \begin{pmatrix} v_{female} \\ v_{male} \end{pmatrix} \qquad (5)$$

v_i: Row vector (n elements) of gross value added coefficients by gender group i. The branches' value added (including "taxes – subsidies on products"), relate to the respective production values.

Following equations (4) and (5), the men's and women's direct and indirect contributions to satisfy the different categories of final demand can be estimated for the German economy in 2000. Table 4 gives an insight into the results.

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[8] Alternatively, the depriciation could be subdivided by gender according to the current production structure of capital goods. Consequently women's contributions to the industries' GVA would, due to men's dominating labour inputs in this field, decline marginally.

[9] The relationship between SNA indicators and input-output tables is discussed in further detail by PYATT (1999).

Table 4: Women's direct and indirect contributions in money values (billion Euro) to satisfy final demand, Germany, 2000 (domestic production)

| | Consumption of educational services | Consumption of health services | Other private con- sumption | Other public services | Investments | | Export | Total (GDP) |
					Capital goods	Consumer durables		
Women	43.7 *50.1%*	110.1 *59.6%*	305.9 *37.1%*	54.0 *34.0%*	69.0 *22.3%*	37 363 *32.4%*	106.2 *26.0%*	707.3 *34.8%*
Men	43.6 *49.9%*	74.7 *40.4%*	517.6 *62.9%*	104.9 *66.0%*	240.7 *77.7%*	38.3 *67.6%*	302.9 *74.0%*	1322.7 *65.2%*
Total	87.3 *100.0%*	184.8 *100.0%*	823.5 *100.0%*	158.9 *100.0%*	309.7 *100.0%*	56.7 *100.0%*	409.1 *100.0%*	2030.0 *100.0%*

Slightly different shares compared to the calculations in time units (table 2) result from the discrepancies of the industries' labour productivities. Considering, for example, the satisfaction of final demand for health services, women's share is extraordinary high in providing nursing services. However, labour productivity is rather low in this field. Men's participation, in contrast, is particularly strong with regard to pharmacy and medical engineering – two highly productive industries. Consequently, women's overall share to satisfy demand for health services decreases from 62.9%, measured in time units, to 59.6% in money values. While women's shares to satisfy the demand for private consumption goods and consumer durables declines as well (by 1.9% and 3.6% respectively), their share in the production of capital goods increases by 2.9%. Shares related to the production of education services, other public services and exports are more or less the same in time units and monetary terms.

Men's and women's direct and indirect contributions to satisfy the different final demand categories just amount to the German GDP of roundabout 2030 billion Euro in the year 2000. Thus, women's GDP amounts to approximately 707 billion Euro which represents a share of 34.8% of total traditional GDP.

The model calculations rely on the domestic industries' gender-specific value added. Consequently, the totals given by table 4 solely account for the domestic contributions to satisfy the final demand. In order to identify the complete final demand of the German economy, imports of intermediate and final goods must be added.

3.2. Household production

The integration of informal work demands for the extension of the production frontier and the monetarisation of private non-market services. For this purpose, the genders' time efforts in

household production are evaluated according to the generalist approach (SCHÄFER and SCHWARZ, 1994; CHADEAU, 1992). In doing so, the wage rate of a house servant is applied. In the year 2000, average net wages amounted to approximately 7 Euro per hour. Since the rate includes neither income taxes nor ancillary wage costs for the employer, the respective calculation can be seen as minimum evaluation (min). The consideration of employers' full costs, when hiring house servants, which added up to slightly more than 15 Euro, defines the maximum evaluation (max) (SCHÄFER, 2004a).

Besides labour costs, the extension of the production frontier comes along with additional capital costs. Consumer durables, now defined as capital goods, are used for household production and can, in turn, be depreciated, e.g. on a straight-line basis.[10] In line with the gender classification of depreciation on capital goods, it is assumed that the usage of consumer durables depends on the activity only. Thus men's and women's share of depreciation equals the corresponding share of working hours. Table 5 shows the outcomes of the calculations.

Table 5: Labour inputs for private non-market services in billion Euro, Germany, 2000

	Household chores		Child and elderly care		Community services		Total	
	Min	Max	Min	Max	Min	Max	Min	Max
Household production in money values (working hours)								
Women	358.2	786.7	44.1	96.9	10.2	22.4	412.4	906.0
Men	219.4	481.9	23.1	50.7	14.4	31.7	256.9	564.3
Household production in money values (depreciations on consumer durables)								
Women	18.6		2.6		0.4		21.7	
Men	11.4		1.5		0.6		13.5	
Household production in money values (total)								
Women	376.8 *62.0%*	805.4	46.7 *65.6%*	99.5	10.6 *41.4%*	22.8	434.1 *61.6%*	927.7
Men	230.8 *38.0%*	493.3	24.6 *34.4%*	52.2	15.0 *58.6%*	32.2	270.3 *38.4%*	577.7
Total	607.6 *100.0%*	1298.7	71.3 *100.0%*	151.7	25.6 *100.0%*	55.0	704.4 *100.0%*	1505.4

The sum of labour and capital costs defines the value of household production (SCHÄFER, 2004b; LANDEFELD and MCCULLA, 2002). Thus, the minimum (*maximum*) evaluation of household production leads to a female contribution of approximately 434 (*928*) billion Euro (61.6%). In contrast, men's contributions come up to ca. 270 (*578*) billion Euro (38.4%).

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[10] The Federal Statistical Office assigns depreciation to roundabout twenty commodity groups, particularly vehicles, furniture and household appliances, by taking into account acquisition cost and by anticipating the average life-span of consumer durables (SCHÄFER, 2004b).

Since men's and women's contributions are valued with the same wage rate, relative shares just equal the shares derived from the time use analysis.

3.3. Extended GDP

Based on the results for the traditional GDP and the household production, the gender-specific extended GDP - defined as the sum of both – can be identified (SCHAFFER and STAHMER, 2006). Figure 2 gives a first idea of gender-specific contributions. With regard to household production, the figure accounts for minimum and maximum evaluation.

Figure 2: Women's and men's contribution to GDP (in billion Euro), Germany 2000
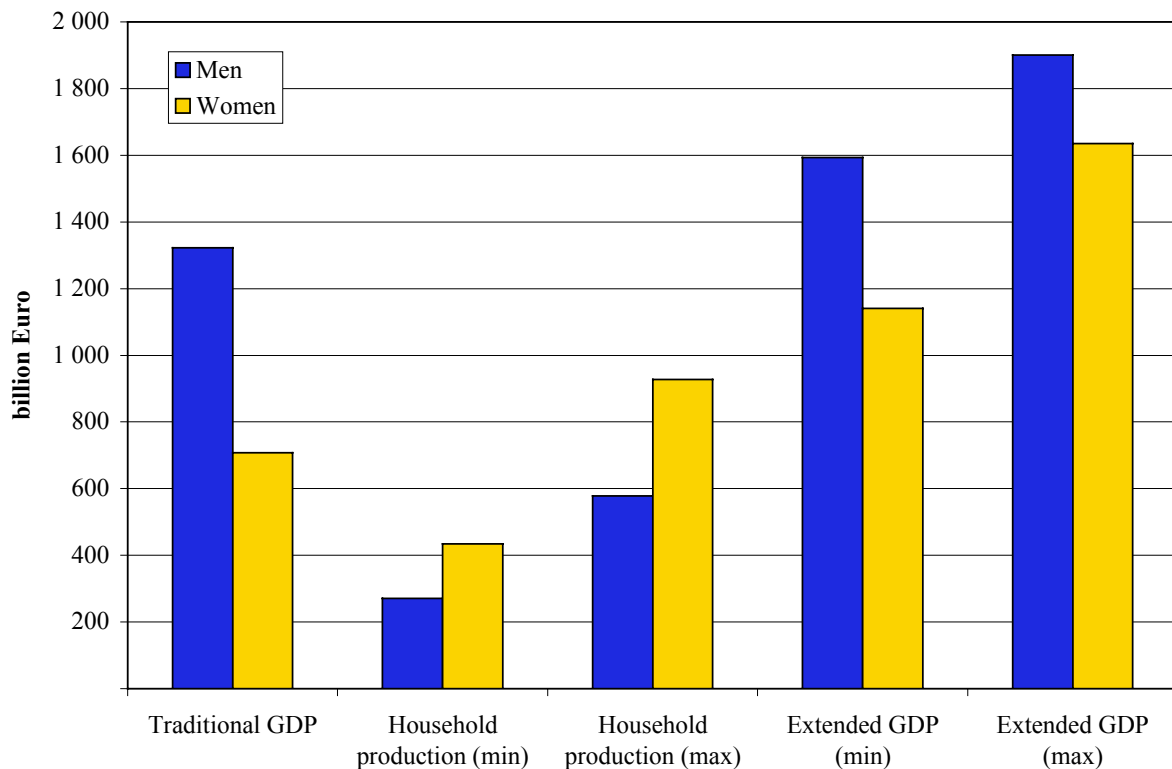
In case of minimum evaluation of household production, the traditional GDP accounts for almost three fourth of the extended GDP. Subsequently, men, who dominate traditional GDP, hold a share of about 58% of the extended GDP. Vice versa women's paid and unpaid work in money values amounts to 42% of the extended GDP. The application of high wage rates for unpaid work increases the relative importance of private non-market activities. This, in turn, enhances women's overall share to the extended GDP from 42% to 46%.

Considering time units, men's inputs are almost the same for paid and unpaid work. Due to the significantly higher monetary evaluation of professional work, men's contributions to the

traditional GDP clearly exceed their contributions to household production. This is true in case of minimum evaluation of unpaid work, but also holds in case of maximum evaluation.

Women's unpaid working hours almost triple their time use for professional work. All the same, professional work exceeds their contributions to household production in money values, if the minimum wage rate is applied for the evaluation of household activities. However, in case of maximum evaluation, women's unpaid work outranges their contributions to the traditional GDP.

The calculated results rely on the assumption that men and women, who are employed in the same industry, show equal labour productivities. However, duties and responsibilities can indeed differ significantly within the same industries. Consequently, the next step foresees a more detailed analysis of the quality of work performed by male and female employees.

4. Quality of work

4.1. Educational attainments and weighting factors

The quality of work is mainly driven by educational attainments that can be classified into general and occupational education. With regard to young men and women, who currently run through the educational system, general educational attainments are very similar. In contrast, occupational attainments still differ significantly. This does not hold anymore for university degrees, but is true for the remaining occupational education. Besides university, young men often choose for polytechnical and technical schools as well. In contrast, young women seem to avoid technical schools and choose for universities or apprenticeships. Table 6 provides a brief overview of the young men and women visiting different types of schools and universities. Since the table does not account for technical schools (dominated by young men), college of education (dominated by young women), universities of art etc., the total number of pupils and students does not reflect the exact number of young persons visiting educational institutions.

Table 6: Young men and women visiting educational institutions, Germany, 2000

	General education				Occupational education		
	Primary school	Secondary school ("Hauptschule")	Secondary modern school ("Realschule")	Grammar school ("Gymnasium")	Apprentice-ship	Poly-technic	University
Young women	1 707 *48.9%*	681 *45.2%*	637 *50.9%*	1 220 *54.4%*	687 *68.0%*	157 *36.8%*	568 *49.4%*
Young men	1 781 *51.1%*	827 *54.8%*	614 *49.1%*	1 025 *45.6%*	324 *32.0%*	270 *63.2%*	583 *50.6%*
Total	3 488 *100.0%*	1 508 *100.0%*	1 251 *100.0%*	2 245 *100.0%*	1 011 *100.0%*	427 *100.0%*	1 152 *100.0%*

Source: STATISTISCHES BUNDESAMT, 2001

The planned differentiation of labour inputs according to quality characteristics demands for a ranking of educational attainments. For the study at hand, the ranking follows the International Standard Classification of Education (ISCED).[11] In general, educational attainments rise with ISCED numeration:

- ISCED 0: Pre-primary education; holds for children visiting kindergarten.
- ISCED 1: Primary education or first stage of basic education; holds for persons who finished primary school.
- ISCED 2: Lower secondary or second stage of basic education; holds for persons who successfully finished secondary (modern) school.
- ISCED 3: (Upper) secondary education; further subdivided into 3A and 3B. ISCED 3A is assigned to persons with university or polytechnic entrance qualification. 3B holds for persons who finished secondary (modern) school and apprenticeship.
- ISCED 4: Post-secondary non-tertiary education; holds for persons with university entrance qualification and finished apprenticeship.
- ISCED 5: First stage of tertiary education; further subdivided into 5A and 5B. The classification 5A accounts for alumnis of universities and polytechnical schools. Persons who successfully finished technical schools are assigned to ISCED 5B.
- ISCED 6: Second stage of tertiary education; holds for persons who finished their doctorate.
- ISCED 9: Persons that cannot be assigned to any of these groups.

Table 7 assigns men and women to ISCED groups 1 to 6. Members of ISCED group 0 and 9 remain unconsidered.

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[11] A more detailed definition of the ISCED groups can be found at the following internet address: http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm.

Table 7: Men and women by ISCED groups 1 to 6, Germany, 2000

	1	2	3B	3A	4	5B	5A	6
				ISCED group				
	Inhabitants (in 1000)							
Men	1 540 *48,4%*	5 406 *33,7%*	15 456 *49,5%*	1 334 *49,6%*	1 157 *43,7%*	3 474 *60,9%*	3 976 *60,5%*	408 *72,0%*
Women	1 641 *51,6%*	10 624 *66,3%*	15 798 *50,5%*	1 353 *50,4%*	1 489 *56,3%*	2 235 *39,1%*	2 593 *39,5%*	158 *28,0%*
Total	3 181 *100,0%*	16 030 *100,0%*	31 254 *100,0%*	2 687 *100,0%*	2 646 *100,0%*	5 709 *100,0%*	6 569 *100,0%*	567 *100,0%*
	Thereof employed persons (in 1000)							
Men	345 *57,6%*	2 858 *47,9%*	10 244 *53,6%*	717 *53,1%*	910 *45,4%*	2 511 *61,0%*	3 154 *61,5%*	329 *71,8%*
Women	253 *42,4%*	3 107 *52,1%*	8 886 *46,4%*	633 *46,9%*	1 093 *54,6%*	1 608 *39,0%*	1 971 *38,5%*	129 *28,2%*
Total	598 *100,0%*	5 965 *100,0%*	19 130 *100,0%*	1 351 *100,0%*	2 003 *100,0%*	4 119 *100,0%*	5 125 *100,0%*	458 *100,0%*
	Paid working hours (in million)							
Men	524 *66,7%*	4 638 *56,9%*	17 119 *62,9%*	1 091 *59,8%*	1 574 *54,6%*	4 599 *69,4%*	5 883 *70,5%*	681 *78,0%*
Women	262 *33,3%*	3 520 *43,1%*	10 083 *37,1%*	735 *40,2%*	1 311 *45,4%*	2 024 *30,6%*	2 465 *29,5%*	192 *22,0%*
Total	787 *100,0%*	8 158 *100,0%*	27 202 *100,0%*	1 825 *100,0%*	2 885 *100,0%*	6 623 *100,0%*	8 349 *100,0%*	873 *100,0%*

Source: Based on STATISTISCHES BUNDESAMT, 2003.

The table shows the number of persons assigned to the respective ISCED group and the gender-specific share. Due to the particular relevance of paid work, the employed persons are considered separately. The corresponding paid working hours complete the data set.

In general, women's shares continuously decrease. Looking, for example, at ISCED group 3A, women account for approximately 50% of the group members, if employed and not employed persons are considered. However, due to their generally lower participation rate, women's share drops to approximately 47% of ISCED 3A employees. Finally, female employees account for only about 40% of total working hours performed by ISCED 3A employees. This in turn points to the significantly lower average working time compared to male employees.

Table 7 provides the gender-specific percentage for each ISCED group. However, the data also allows for a detailed analysis of men's and women's allocation to different ISCED groups. About 73% of female employees show educational attainments that correspond to ISCED 1, 2, 3B or 3A. Vice versa approximately 27% dispose of higher qualification levels

(ISCED 4, 5B, 5A or 6). Employed men's share of higher qualification amounts to 33%. Thus, men do not only dominate industrial production with regard to the volume of professional work, but their labour inputs rely on average on slightly higher qualification levels.

Considering not employed persons, discrepancies are even stronger. While only 8% of not employed women show high qualification levels, approximately 18% of not employed men dispose of educational attainments that correspond to ISCED group 4, 5B, 5A or 6.

In order to weight men's and women's volume of paid and unpaid work, weighting factors have to be defined in the next step. For the study at hand, these factors result from the annual depreciation of the persons' accumulated time use for educational activities.[12] In this context, the following activities are taken into account (STAHMER, EWERHART and HERRCHEN, 2003):

- time use of students for qualification (at schools, universities or at home),
- paid working hours of teachers, professors and employees at schools and universities,
- other directly and indirectly paid labour inputs necessary to obtain educational services (e.g. working hours for the production of teaching materials, the construction of schools etc.)

Following the approach suggested by STAHMER, EWERHART and HERRCHEN (2003), table 8 shows the weighting factors for educational attainments and corresponding ISCED groups. The standardised weights result from the division of the original weighting factors by 285. This weighting factor corresponds to the finalisation of secondary school.

With regard to general education, weighting factors are cumulative, this means the University entrance qualification includes the time depreciation of kindergarten and primary school. After four years of primary school, students either decide for secondary, modern secondary or grammar school. Thus, time rates of the respective type of school are added to the rates attributed to primary school.

Occupational education is cumulative for technical schools, which demand for finished apprenticeship and experience on the job, and for doctorates that require a university degree.

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[12] The model of depreciating the accumulated time of education corresponds with the national accounting concepts of reproducible capital. Thus, the same rate of annual depreciation is applied during the real time of using the different elements of general and occupational education respectively.

Table 8: Weighting factors for educational attainments in hours per person and year and standardised weighting factors

| | General educational attainments and ISCED group | | | | | | |
| | | | | | | Grammar school | |
	No general education ISCED 0	Kinder-garten ISCED 0	Primary school ISCED 1	Secondary school ("Hauptschule") ISCED 2	Secondary modern school ("Realschule") ISCED 2	Polytechnic entrance qualification ISCED 3A	University entrance qualification ISCED 3A
Hours per person and year	0	44	44+82=126	126+159=285	126+197=323	126+282=408	126+323=449
Standardised weighting factors	0,00	0,15	0,44	1,00	1,13	1,43	1,58
	Occupational education and ISCED group						
	No occu-pational education	Vocational preparation, unskilled labour	Appren-ticeship ISCED 3B/4	Technical school ISCED 5B	Polytechnic ISCED 5A	University ISCED 5A	Doctorate ISCED 6
Hours per person and year	0	19	56	56+43=99	212	308	308+151=459
Standardised weighting factors	0,00	0,07	0,20	0,35	0,74	1,08	1,61

Source: Based on STAHMER, EWERHART and HERRCHEN (2003)

4.2. Weighted contributions to GDP

Starting from the volume of work in time units which is given by gender and ISCED groups, working hours are weighted according to the sum of the standardised factors concerning general and occupational education of employed persons. Thus, both the quantity of work, given in working hours, and the quality of work, measured in terms of educational attainments, determine the calculations. Taking into account the weighted volume of work, gender-specific shares of the traditional GDP can be derived by following the methodology outlined in sections 2.1 and 3.1.

Considering, for example, the consumption of health services, women's unweighted share accounts for 59.6% (table 4). However, female employees in the field of public health, pharmacy, medical engineering and other related industries show, in average, slightly lower educational attainments. Therefore weighting factors assigned to women's working hours are smaller compared to the factors that are taken into account for men's inputs. Subsequently, women's weighted share declines in money values as well (according table 9 by –3.8%).

Since the industries' GVA remains the same, decreasing contributions identified for one gender group must just be equalised by increasing contributions of the other group. Therefore men's contributions to satisfy final demand of health services increase for the weighted calculations.

Table 9 provides men's and women's weighted contributions to satisfy the diverse categories of final demand. For reasons of comparison, the table accounts for changes compared to women's former unweighted share.

Table 9: Men's and women's weighted contributions in money values (billion Euro) to satisfy final demand, Germany, 2000 (domestic production)

| | Consumption of educational services | Consumption of health services | Other private con-sumption | Other public services | Investments | | Export | Total |
					Capital goods	Consumer durables		
Women	41.7	103.1	293.7	52.7	66.2	17.7	101.4	676.4
	47.7%	*55.8%*	*35.7%*	*33.2%*	*21.4%*	*32.4%*	*24.8%*	*33.3%*
compared to unweighted shares	*-2.4%*	*-3.8%*	*-1.4%*	*-0.8%*	*-0.9%*	*0.0%*	*-1.2%*	*-1.5%*
Men	45.6	81.7	529.8	106.2	243.6	39.0	307.7	1353.6
	52.3%	*44.2%*	*64.3%*	*66.8%*	*78.6%*	*67.6%*	*75.2%*	*66.7%*
Total	87.3	184.8	823.5	158.9	309.7	56.7	409.1	2030.0
	100.0%	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Due to men's domination in higher ISCED groups, which are of high relevance for any sector, their weighted contributions further increase. With regard to the weighted calculations, women have even lost their formerly leading position in the education sector. Solely the demand for health services is now, in the majority, satisfied by women's labour inputs.

In total, women's share declines by 1.5%. Thus, their weighted share just amounts to one third (33.3%) of the traditional GDP.

4.3. Weighted contributions to household production

While occupational education significantly determines men's and women's contribution to the industries' GVA, its relevance for housework is clearly limited. However, it can be assumed that a certain level of general education affects household production in a positive way. This means, that persons, who finished grammar school might be slightly more efficient in

organising household chores or performing community services.[13] Consequently, unpaid working hours are weighted in accordance to the factors related to general education only. Since women show, in average, slightly lower general educational attainments, their weighted shares in household chores and community services decrease marginally compared to men's contributions. This is true for employed persons, but particularly holds for not employed persons. Shares considering care services remain more or less unchanged. This points to the fact that young men and women, who take care for their children, dispose of very similar degrees.

Table 10 shows the weighted labour inputs for the household production. The total money values remain constant. Thus higher values by one group compensate for decreasing weighted contributions of the other group. The depreciation on consumer durables remains unchanged.[14]

Table 10: Weighted household production in billion Euro, Germany, 2000

	Household chores		Child and elderly care		Community services		Total	
	Min	Max	Min	Max	Min	Max	Min	Max
	Household production in money values (weighted working hours)							
Women	357.1	784.4	44.1	96.9	10.0	21.9	411.2	903.2
Men	220.5	484.3	23.0	50.6	14.6	32.1	258.1	567.0
	Household production in money values (depreciations on consumer durables, unchanged)							
Women	18.6		2.6		0.4		21.7	
Men	11.4		1.5		0.6		13.5	
	Weighted household production in money values (total)							
Women	375.7 803.0		46.8 99.6		10.4 22.3		432.8 924.9	
	61.8%		*65.6%*		*40.6%*		*61.4%*	
compared to unweighted shares	*-0.2%*		*0.0%*		*-0.8%*		*-0.2%*	
Men	231.9 495.7		24.5 52.1		15.2 32.7		271.6 580.5	
	38.2%		*34.4%*		*59.4%*		*38.6%*	
Total	607.6 1298.7		71.3 151.7		25.6 55.0		704.4 1505.4	
	100.0%		*100.0%*		*100.0%*		*100.0%*	

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[13] The weighting only refers to the ability of organising unpaid work. Though a better organisation might improve the quality of unpaid work to some extend, efficiency does not relate to other determinants, such as the talent to cook or the human factor in terms of care services.

[14] While the activities related to unpaid work are weighted according the general education, the usage of consumer durables is considered to be independent from the educational attainments. This means, that the time, used for cooking, is weighted but the depreciation of the kitchen is not.

4.4. Weighted contributions to extended GDP

Though women's educational attainments more and more conform to men's achievements, higher educational levels can still be observed for male employees. On the one hand, this can be explained by relatively strong differences in terms of education for older age groups. On the other hand, pregnancy and subsequent parental leave significantly hampers careers of highly educated women. Thus, women's weighted share in the traditional GDP, which again can be derived from their contributions to satisfy final demand, slightly decreases from about 34.8% (table 4), according to the calculations in section 3, to about 33.3% (table 9).

With regard to the weighted evaluation of the household production, women's marginally lower general educational attainments come along with a slightly decreasing share from 61.6% (table 5) to 61.4% (table 10) in the field of unpaid work.

Table 11 summarises the findings with regard to women's contributions to weighted traditional and extended GDP.

Table 11: Men's and women's contributions to weighted and extended GDP in billion Euro, Germany, 2000

	Traditional GDP	Household production		Extended GDP	
		Min	Max	Min	Max
Women	676.4 *33.3%*	432.8 *61.4%*	924.9 *61.4%*	1109.2 *40.6%*	1601.3 *45.3%*
compared to unweighted shares	*-1.5%*	*-0.2%*	*-0.2%*	*-1.1%*	*-0.9%*
Men	1353.6 *65.2%*	271.6 *38.4%*	580.5 *38.4%*	1625.2 *59.4%*	1934.1 *54.7%*
Total	2030.0 *100.0%*	704.4 *100.0%*	1505.4 *100.0%*	2734.4 *100.0%*	3535.4 *100.0%*

In case of the minimum evaluation of household production, women's share in the extended GDP declined by 1.1% compared to the unweighted calculations and amounts to approximately 40.6%. The application of the higher wage rate comes along with a final share of about 45.3% - which corresponds to a reduction of 0.9% compared to the unweighted shares.

Though the results are based on a macroscopic approach, the findings also allow for a first estimate of average individual contributions, illustrated by figure 3.

Figure 3: Men's and women's individual contribution to traditional GDP, household production and extended GDP, Germany, 2000
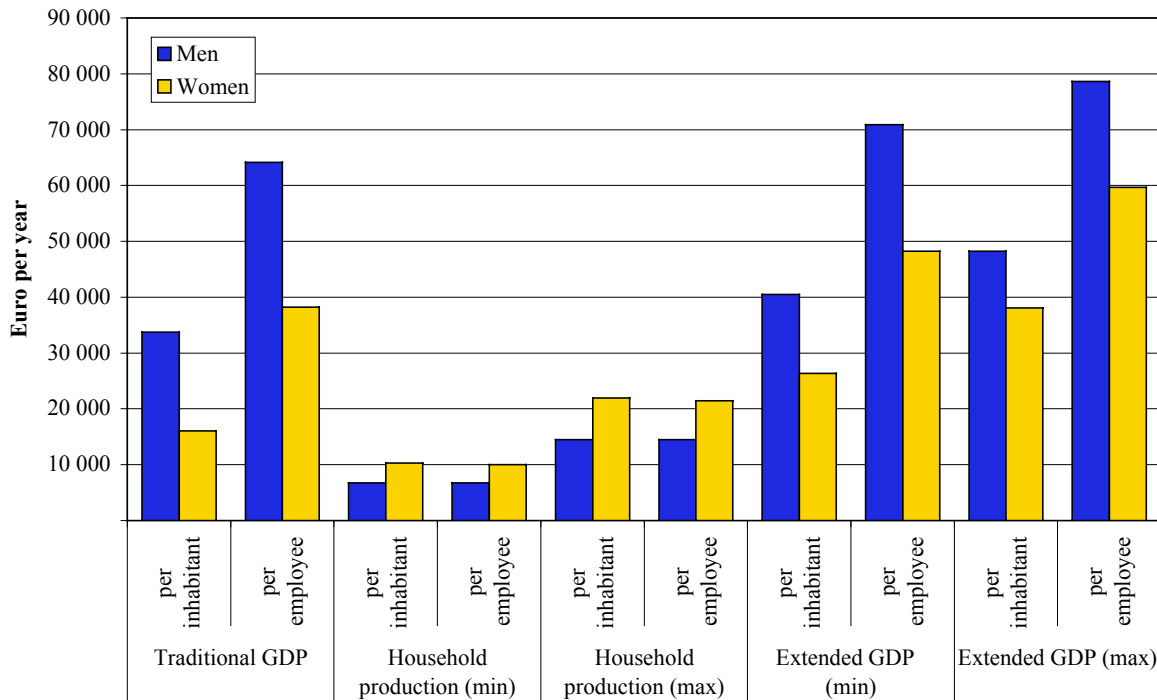
Considering, for example, male employees, weighted contributions to the traditional GDP make up for approximately 64,200 Euro per year and person. In contrast, female employees produce an annual value added of approximately 38,200 Euro per woman. The strong difference mainly derives from the significantly smaller average annual paid working time. Considering outputs per professional working hour, contributions add up to approximately 37 Euro per hour for male employees and 33 Euro for female employees respectively.

With regard to household production, women's personal contributions of almost 10,300 Euro per person, or even 22,000 Euro in case of maximum evaluation, significantly exceeds men's valued efforts that amount to 6,800 Euro or 14,500 Euro respectively. Again, discrepancies result from the different working time. On an hourly basis, men's and women's labour productivities are more or less the same.

5. Conclusions

Women account for approximately 51.2% of the population in Germany. Taking into account the total volume of paid and unpaid work, women's share rises to about 52.3%. However, as soon as work is considered in money values rather than in time units, women's share decreases significantly.

Women's lower participation rate and their relatively strong preference for part-time employment lead to a share of 36.3% with regard to the total volume of professional working hours. However, women are, compared to men, affiliated more often to labour- rather than capital-intensive industries. Furthermore, educational achievements are slightly lower compared to men's average qualification levels. This, in turn, leads to slightly lower labour productivities assigned to women's working hours compared to men's labour inputs. Subsequently, women's share in money values (traditional GDP) drops to 33.3%.

In contrast to professional work, women show high shares about 61.5% in the field of unpaid work, no matter if contributions are measured in time units or money values.[15]

Based on a maximum evaluation of household production women's overall contributions to an extended GDP, defined as the sum of traditional GDP and household production, correspond to a share of approximately 45.3%. The share further decreases to about 40.6% if minimum wage rates are applied.

Figure 4 provides a final overview on women's shares regarding the volume of work and the extended GDP. Considering the money values, the shares refer to women's weighted contributions.

Figure 4: Women's shares in population, volume of work and weighted GDP
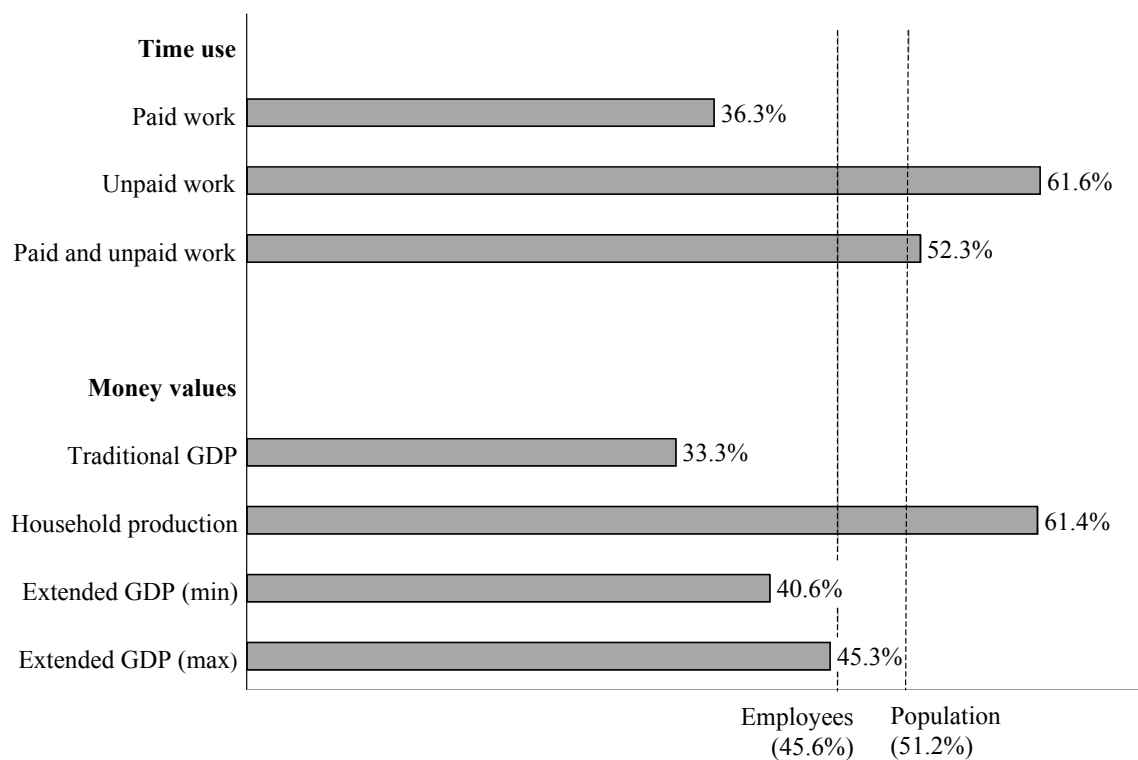
The weighting of working hours, which is based on educational attainments, aims to incorporate the quality of work. However, some quality characteristics neither refer to ISCED-standards nor affect the extended GDP, but, all the same, add to social welfare. Characteristics such as personal sympathy, devotion or love cannot be taken into account. This is partly true for market production, but particularly holds for child and elderly care, gardening or other activities of household production. There is a difference - between the perfect omelette prepared by a house servant and the burned something out of the boy friend's kitchen, between the garden, designed by a gardener and the own garden or between nannies' and fathers' bedtime stories - and the difference cannot be measured in money values but could very well affect social welfare. Thus, the paper at hand indeed shows women's share in the extended GDP, but women's (and men's) contribution to social welfare remain undetected.

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SUMMARY

The study at hand identifies women's and men's share in the traditional gross domestic product (GDP), the household production and its sum - the extended GDP.

For this purpose, German time use data are combined with the monetary input-output table for the year 2000 and the corresponding Leontief inverse matrix. While the application of the input-output analysis allows for the identification of the industries' direct and indirect contributions to traditional GDP, time use data define the gender-specific paid and unpaid volume of work.

Finally, detailed information on men's and women's educational attainments are taken into account. This, in turn, gives an idea about the gender-specific quality of work.

ZUSAMMENFASSUNG

Die vorliegende Arbeit untersucht welchen Beitrag Frauen und Männer zum traditionellen Bruttoinlandsprodukt (BIP) und zur Haushaltsproduktion beitragen.

Die Berechnung der geschlechts-spezifischen Anteile am traditionellen BIP basiert auf einer Verknüpfung von bereichsweisen Erwerbsarbeitszeiten und traditioneller Input-Output-Analyse. Die Zuordnung der unbezahlten Arbeitsstunden auf Männer und Frauen lässt sich aus den Zeitverwendungsdaten ableiten. Aus der anschließenden monetären Bewertung resultieren die geschlechts-spezifischen Anteile an der Haushaltsproduktion.

Um die Qualität der beruflichen bzw. der unbezahlten Arbeit zu ermitteln, findet das unterschiedliche Ausbildungsniveau von Männern und Frauen bzw. Erwerbstätigen und Nicht-Erwerbstätigen Berücksichtigung.

Die Ergebnisse ermöglichen schließlich eine Berechnung der Anteile am erweiterten BIP, das als Summe aus traditionellem BIP und Haushaltsproduktion definiert wird.

RÉSUMÉ

Notre étude examine les contributions des femmes et des hommes au produit intérieur brut (PIB). Le calcul des composants du PIB spécifiques par différentes sexes est basé sur une combinaison de statistiques sur l'utilisation du temps avec une analyse d'entrées-sorties (analyse input-output). La répartition des heures de travail impayées sur les hommes et femmes est déduite des tableaux sur l'utilisation du temps. Une évaluation de ces heures en

forme monétaire résulte dans les proportions de la production des ménages spécifiques aux sexes. Afin de déterminer la qualité du travail professionnel et du travail impayé, l'étude tient en compte les différents niveaux d'éducation des hommes et des femmes ainsi que des employees et non-employees.

Les résultats permettent la détermination de la contribution des femmes et des hommes au PIB généralisé, qui est défini comme la somme du PIB traditionnel et de la production des ménages.