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This paper is from the
GTAP Annual Conference on Global Economic Analysis
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Netherlands Bureau for Economic Policy Analysis

Improving capital income shares in the GTAP database

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Paper to be presented at
7th Annual Conference on Global Economic Analysis
June 17 - 19, 2004
Washington, D.C., United States

A preliminary version (14 June 2004). Please do not quote or cite. Comments are welcome

Abstract

This paper aims to improve the value of capital income shares in the GTAP database. From the GTAP database 5, it appears that capital shares vary a lot over regions and sectors; they range from less than 10% till over 80%. Based on information from the OECD STAN database, we conclude that variation in capital incomes shares is less than suggested in the GTAP database. Moreover, accounting for income of self-employed substantially reduces capital income shares in some sectors.

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1 Introduction

The value of capital income shares, defined as the share of payments for capital in value added, plays an important role in CGE models. For example, in assessing the effectiveness of tax policies to reduce CO_2 emissions one might want to look at the impacts of taxing capital intensive sectors.

From the GTAP database 5 we can conclude that capital shares vary a lot over regions and sectors. They range from less than 10% till over 80%. Moreover, we notice that in the agricultural sectors and the metal products and transport equipment industries this share is much lower than in the other sectors. We also observe that, on average, the value of capital income shares in developing regions is higher than in OECD countries and also exceeds those of Eastern Europe and the Former Soviet Union regions.

We can wonder if these values represent reality. It is well-known that in the GTAP database labour payments in general don't include the imputed labour payments for self-employed persons. Corrections for these payments may have a substantial effect on the labour income shares and thus on the capital income shares, especially in the agricultural and service sectors. This raises the important question what amount of income should be attributed to the self-employed. Different methods can be used to make the corrections. This paper discusses the various alternatives that are available and assesses the impact of these corrections.

Using the OECD STAN database for Industrial Analysis, we have established a database, from which we can obtain total input separated in capital and labour income. Capital income shares derived from this database will differ from the present shares in the GTAP database, which are in most cases based on input-output tables of separate countries. Most importantly, the STAN database contains information of self-employed including non-wage workers per sector and OECD country that is not available in the GTAP database.

In the next section we discuss definitions and the results from this database compared to data from the GTAP-5 database. In section 3, the method of calculation to impute labour payments for self-employed persons per sector and OECD country will be explained. Some alternatives to correct these results for the non-wage workers will be discussed. In the next section we present the development of capital income shares in some OECD countries between 1970 and 2001. Moreover we investigate the relation between these shares and the GDP per capita for these countries. The paper ends with conclusions and recommendations for future research.

2 The capital income share in the GTAP database compared to the OECD STAN database

2.1 Definition of the capital income share

The most common definition for the capital income share is the share of payments for capital in value added. This definition needs some more specific attention. Payments for capital is often considered as the sum of Consumption of fixed capital and Net operating surplus and mixed income. For value added it is important to know that in this case the Value added at **Factor costs** is meant.

In the GTAP database the value added at factor costs can be calculated as the sum of land, natural resources, labour payments and capital. This total is very often taken from the information from individual input-output tables from various contributors for a specific year, which not necessarily equals the benchmark year of the GTAP database. From these tables compensation of employees is often considered to be equal to labour costs per sector. Given the total amount for value added the residual is considered to be capital including land and natural resources. At a later stage of data collection these last two variables are determined at the GTAP centre for some sectors and all regions[1]. In order to compare the capital income shares with those of the OECD STAN database we include land and natural resources in the capital input.

In the OECD STAN database for Industrial Analysis data for Labour Costs (Compensation of employees), Consumption of Fixed Capital and Net Operating Surplus is available for a reasonable number of OECD countries, ISIC rev. 3 sectors and a good number of years. One has to pay special attention to the country-specific notes, since Net Operating Surplus in many countries includes the Consumption of Fixed Capital.

2.2 Comparing the shares of the two databases

For 1997 we compare the capital shares of the GTAP 5 Database with those of the OECD STAN database. We have chosen some aggregated sectors to show these results[2]

- Agriculture
- Manufacturing

[1] More information can be found in the "GTAP-5 Data Package Documentation", which is available at: http://www.gtap.agecon.purdue.edu/databases/v5/v5_doco.asp

[2] In the appendix we show the concordance of the STAN DATA sectors with the GTAP sectors.

- Services
- Total

The results of this comparison for four OECD countries and the above mentioned sectors can be found in Figures 2.1 and 2.2

Figure 2.1 Capital income shares in 1997, France and Germany

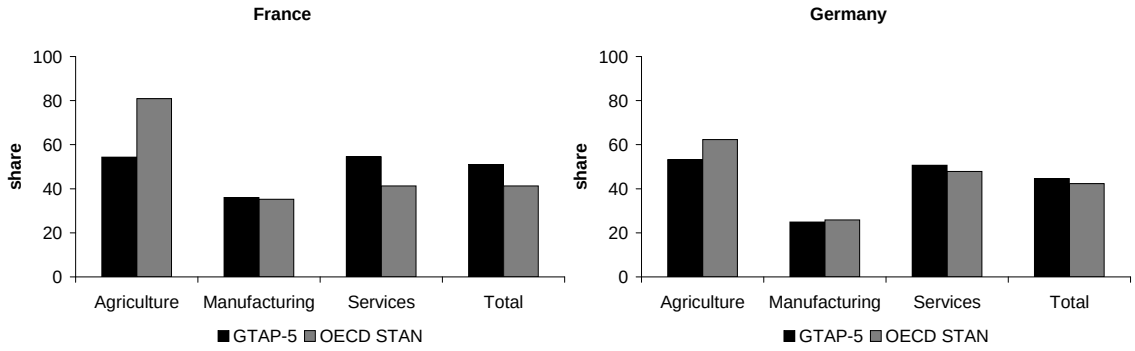
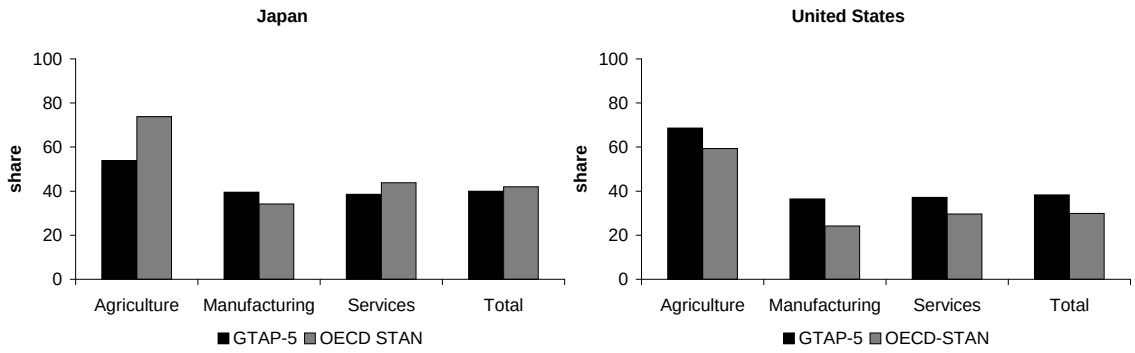


Figure 2.2 Capital income shares in 1997, Japan and United States



The results show the following differences. The capital shares in 1997 for manufacturing and services sectors in the four countries are lower in the OECD STAN database than in the GTAP-5 database. The difference is most profound for the United States, where we see a difference of around 7 percent points. For agriculture sectors the differences are larger than in the other sectors are the other way around for France, Germany and Japan. Finally we can conclude that variation between the shares is higher in the STAN database than in the GTAP database.

3 Imputed labour payments for self-employed persons

In the STAN database the number of self-employed is calculated by subtracting the Number of Employees from Total Employment. To have an idea about the increase in the number of employees in the four countries and three sectors as a result of properly accounting for the number of self-employed, we have calculated the increase of this number for 1997, as can be seen in table 3.1.

Table 3.1 Increase in number of employees in 1997 as a result of including self-employed persons

	France	Germany	Japan	United States
	percentage increase			
Agriculture	149.4	104.8	447.6	69.6
Manufacturing	4.9	4.5	8.2	2.3
Services	8.3	12.3	13.6	7.0
Total	11.2	11.8	19.3	8.1

It is clear that for these four OECD countries the increase is by far the highest in agriculture with a very high percentage for Japan. For services we see a larger increase than in manufacturing. This makes sense, because more self employed persons can be found in this sector.

In this paper, the imputed labour payments for self-employed equals the number of this latter number of persons multiplied by the average wage income of employees in this particular sector. For the same countries and sectors as in the previous section this adjustment results in the capital income shares are showed in Figures 3.1 and 3.2.

Figure 3.1 Capital income shares in 1997 in France and Germany with correction for imputed labour payments for self employed persons

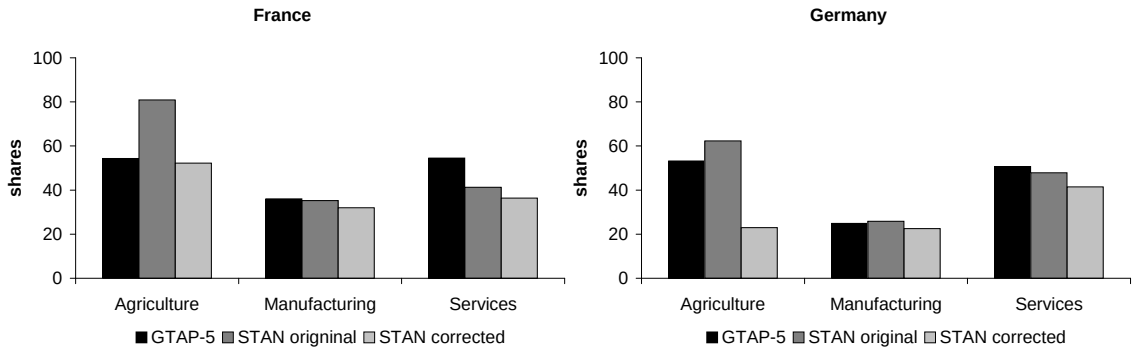
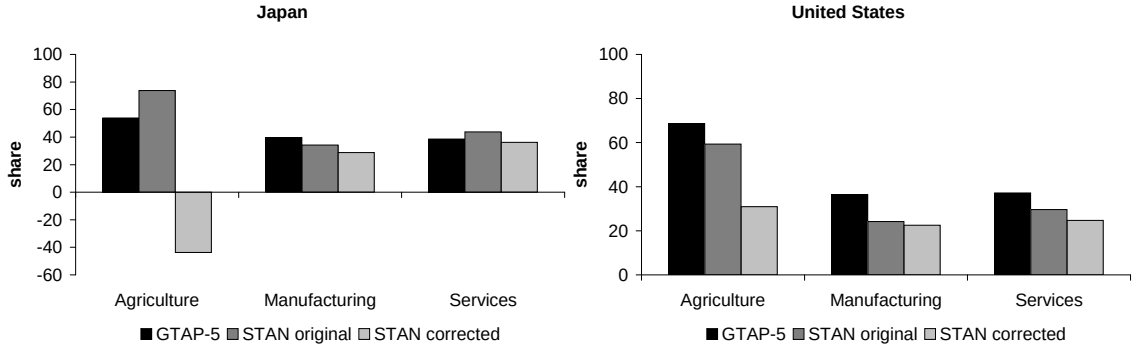


Figure 3.2 **Capital income shares in 1997 in Japan and United States with correction for imputed labour payments for self employed persons**



We see that the shares decrease by less than 10 percent points in manufacturing and services. We observe a higher decrease in services than in manufacturing, since we have established from table 3.1 a slightly higher increase in the number of employees in the services sector than in manufacturing. In the next section we pay more some attention to results for some more developing countries.

The decrease in agriculture is substantial. The level in Japan is theoretically impossible, because it has a negative capital income share, which means that probably too much labour income has been attributed. However, with an increase in the number of employees of more than 400 percent in this sector for Japan, a result like this is possible. Further research on this problem is necessary.

To compare these corrected results with the GTAP-5 database shares we have added the latter shares to the figures. The shares for agriculture in this case differ substantially between GTAP-5 and the OECD STAN database. For Germany and United States the level for the sector is corrected to around 20 percent points, which is much lower than in the GTAP-5 database. We have to bear in mind that this level still includes the shares for land and natural resources, of which the sum is even higher than 20 percent points for these countries.

For the other sectors we can conclude that all the levels for the four counties are between 3 and 9 percent points lower in the corrected OECD STAN database than the GTAP-5 database. Finally, here we see a lower variation between the shares in the STAN database than in the GTAP database.

As was said before, the number of self-employed persons includes the number of non-wage workers. These numbers will be relatively high in developing countries and in some sectors like

agriculture and services. From an economic perspective it is reasonable to assign these non-wage workers with an amount of average wage per employee, although the average wage per worker should be lower than the average wage per employee. We have chosen here two simulations to take these corrections into account:

- In agriculture and the service sectors the average wage per self employed person equals 75% of the wage of employees in the same sectors
- In agriculture and the service sectors the average wage per self employed person equals 50% of the wage of employees in the same sectors

The results of these adjustments for the capital shares for the four OECD countries can be found in Figure 3.3 and 3.4

Figure 3.3 Capital income shares in 1997 in France and Germany with 75 and 50% corrections for imputed labour payments for self employed persons

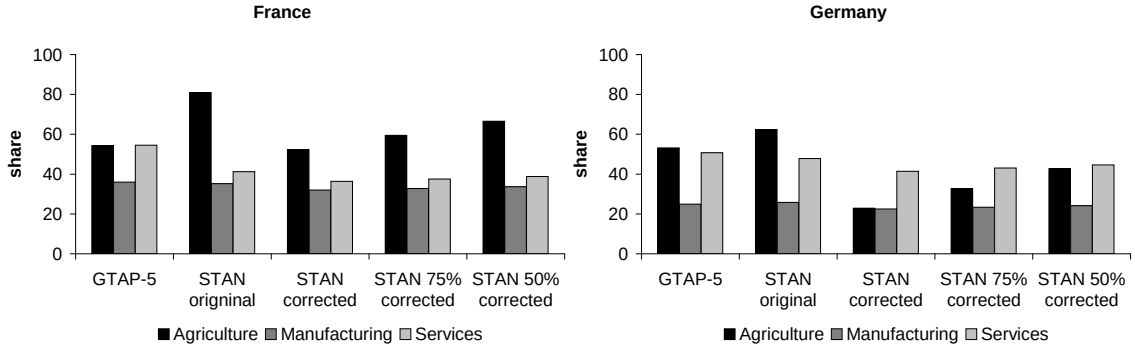
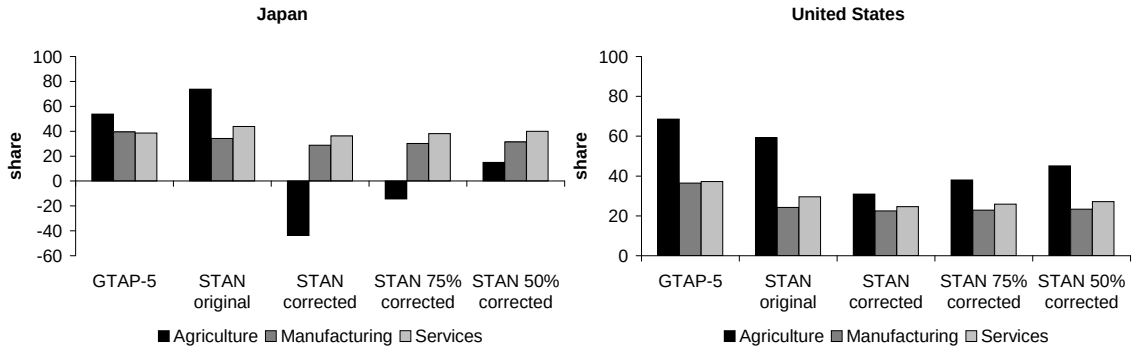


Figure 3.4 Capital income shares in 1997 in Japan and United States with 75 and 50% correction for imputed labour payments for self employed persons



It is obvious that the corrections in the simulations of 75% and 50% correction of the self employed persons with an average wage of the employees in the same sector is less than in the 100% corrections. Finally, we notice that for Japan a 50% correction in agriculture leads to a positive capital income share in 1997 of around 15 % points.

4 Other features of these new capital income shares

4.1 More disaggregated sectoral capital shares for the four OECD countries

In this subsection we will show some more detailed results of capital income shares for the four OECD countries. There are interesting aspects in these results:

1. In some sectors the shares are much higher than in the others (petroleum, coal products, electricity, gas and water and business services nec)
2. In the remaining sectors the variation between the capital income shares is not very high. In the next version of this paper we will show the absolute difference of shares in the GTAP-5 database with the ones presented here.
3. Even for these reporters some shares are theoretically wrong, like motor vehicles and parts in the United States, or they are not available.

If we compare the capital income shares of specific sectors of the OECD STAN database with those of the GTAP-5 database then we can conclude that:

1. The overall standard deviation for France and Germany is much lower in the OECD STAN database than in the GTAP-5 database. For Japan it is the other way around, whereas for United States we see hardly any differences. We have to bear in mind however, that in this table the shares for the OECD STAN database have not yet been corrected for imputed income of self employed persons. Moreover not all the data for Japan and United States are available, which make the comparability with the GTAP-5 database numbers a bit difficult.
2. The variation of shares in the sector petroleum and coal products in the OECD STAN database is not as volatile as in the GTAP-5 database
3. The capital income shares in Germany for the sectors Eletronic, Machinery and equipment nec are very low according to the GTAP-5 database, especially if we look at the levels for the other countries. In the OECD STAN database only numbers for France and Germany are available and the German numbers are much closer to the French results.

4. In some services sectors (like insurance) we see some odd differences between countries in the GTAP-5 database. These differences are much less profound in the OECD STAN database

Table 4.1 Capital Income Shares excluding corrections, 1997

	France		Germany		Japan		United States	
	GTAP-5	OECD STAN	GTAP-5	OECD STAN	GTAP-5	OECD STAN	GTAP-5	OECD STAN
Agriculture	54.3	80.9	53.2	62.4	53.8	73.8	68.5	59.3
Food	52.7	45.8	64.9	38.8	44.1	26.9	57.1	36.9
Textiles and Wearing apparel	27.2	31.2	16.9	25.1	27.7	2.9	24.9	17.7
Leather products	24.9	27.4	22.7	25.4	31.6	52.7	32.6	24.2
Wood products	34.8	32.3	26.6	38.0	32.6	10.7	37.6	23.8
Paper products, publishing	34.5	30.8	24.4	34.5	37.8	28.0	41.8	23.9
Petroleum, coal products	12.4	59.1	96.1	51.3	66.9	82.9	47.8	58.0
Chemical, rubber, plastic products	38.2	40.4	19.5	30.1	47	51.0	47.5	38.3
Mineral products nec	42.9	33.2	42.1	34.0	41.3	24.0	37.1	27.2
Ferrous and non-ferrous metals	37.7	30.3	20.7	24.1	44	46.0	24.1	25.4
Metal products	32.2	29.2	20.1	25.9	32.1	30.7	25.1	28.7
Motor vehicles and parts	28.5	36.0	25.8	19.4	35.8	NA	18.4	-11.4
Transport equipment	37.2	21.1	13.6	13.3	25.2	NA	22.3	7.7
Electronic equipment	33.3	27.4	2.6	14.4	40.6	NA	31.4	NA
Machinery and equipment nec	25.7	27.6	5.7	19.4	36.5	NA	31.8	NA
Manufactures nec	36.8	43.0	29.6	24.2	36.8	26.2	33.8	27.1
Electricity, gas and water	100	54.7	62.7	59.7	75.6	70.0	60.7	59.7
Construction	32.8	31.9	33.8	30.8	20	34.7	21.9	29.0
Trade	44.2	35.0	38.1	27.7	24.4	25.8	27.7	23.2
Transport	39.7	35.5	29.6	30.4	25.9	19.9	30.3	22.7
Communication	51.6	40.5	58.4	56.9	45.8	61.3	57.1	29.7
Financial services nec	61.8	41.1	32.6	48.0	46.9	NA	34.5	39.8
Insurance	6.4	16.1	56.6	32.9	18.3	NA	21.2	34.0
Business services nec	57.1	65.6	99.3	79.9	48.1	76.3	60.5	58.5
Other services	50.4	22.2	40.4	26.3	20.4	27.4	16.8	8.0
Total	51	41.3	44.6	42.4	40	42.0	38.3	29.9
Standard deviation	18.1	14.6	24.7	16.3	13.9	23.4	14.8	15.2

4.2 Some indication of capital shares for "new" OECD countries

In table 4.2 we show some results of capital income shares of "new" OECD countries. We can call these countries middle income countries and these shares give us some indications of the levels in developing countries. In the sectors and countries mentioned, the shares are in general much higher than what we saw in Figure 2.1 and 2.2, especially for Korea and Mexico.

Table 4.2 Capital shares of some "new" OECD countries excluding corrections in 1997

	Korea	Hungary	Poland	Mexico	Czech Republic
	share (in %)				
Agriculture	89.2	64.0	81.2	85.6	49.7
Manufacturing	50.7	46.7	40.1	73.1	47.4
Services	43.3	48.9	50.9	66.2	NA
Total	48.2	49.3	49.4	67.6	48.8

In Table 4.3 we managed to correct some countries and sectors for imputed income of self-employed persons. We notice that corrections are higher than what we have seen in Figure 3.1 and 3.2. A much higher correction for services in Korea is visible, which is an indication that in this sector a large number of persons are self-employed in this sector. Finally there are theoretically wrong corrections for agriculture in Korea and Poland.

Table 4.3 Capital shares of some "new" OECD countries including corrections in 1997

	Korea	Hungary	Poland	Mexico	Czech Republic
	share (in %)				
Agriculture	-60.3	32.1	-182.4	NA	NA
Manufacturing	40.7	40.0	33.6	NA	NA
Services	9.7	39.5	37.4	NA	NA
Total	17.3	38.7	19.9	NA	NA

N.B. Mexico and Czech Republic can't be corrected, since information about self-employed is not available.

4.3 Development of capital income shares

If we would like to look at a certain development of the capital income share in time, we have two options:

1. Look at capital income share related to macro GDP per capita.
2. Look at time series of capital income shares of a sector over several countries

We have carried out these options for 19 OECD countries in the OECD STAN database and the main sectors. The results can be found in the following figures.

Figure 4.1 **Capital income shares excluding corrections related to GDP per country for 19 OECD countries in 1997: agriculture and manufacturing**

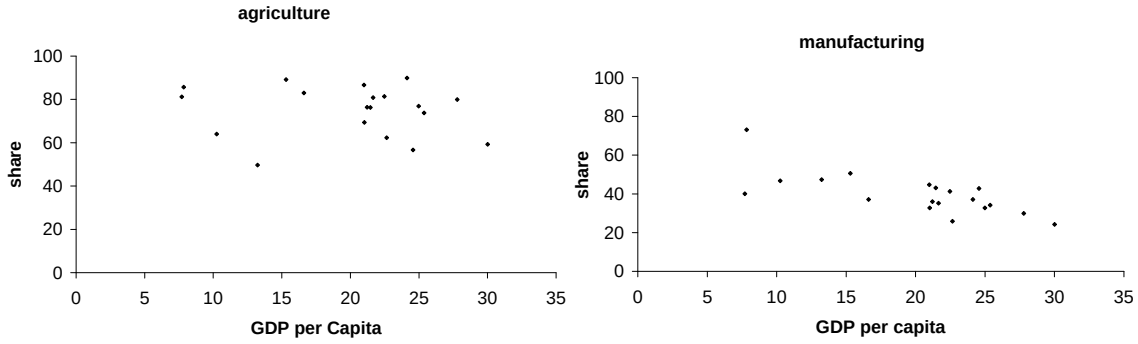


Figure 4.2 **Capital income shares excluding corrections related to GDP per country for 19 OECD countries in 1997: services and total**

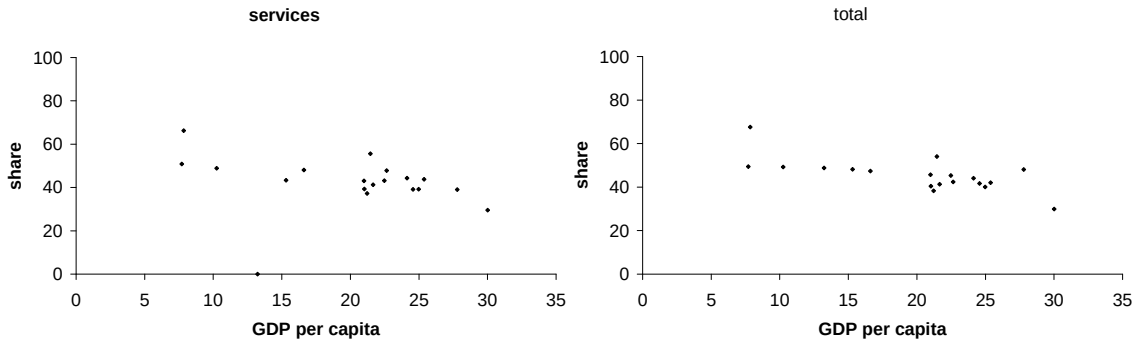
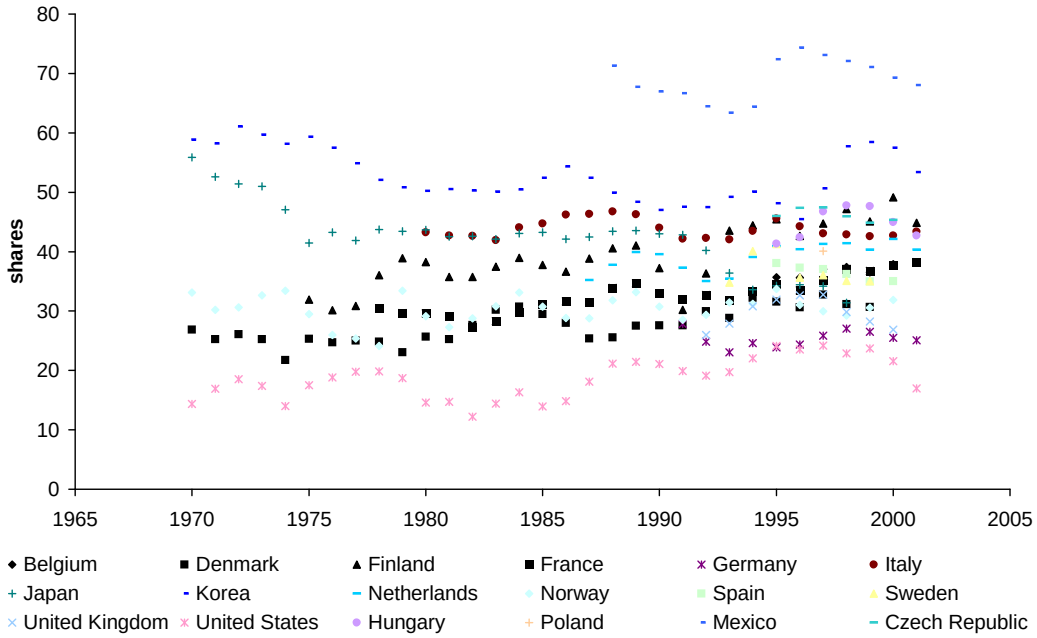


Figure 4.3 Capital income shares for manufacturing sector for 19 OECD countries



In figure 4.1 and 4.2 we observe a slight decreasing development for manufacturing and service sectors. These developments, however, are not confirmed by the time series of the 19 OECD countries of the shares of this sector. Some countries, like Netherlands, show a decrease until 1997, but other countries, like United States, have an increasing tendency over the whole period. Further research on this issue is necessary.

5 Conclusions and recommendations for future research

This paper aims to improve the value of capital income shares in the GTAP database. The main conclusions are:

1. Based on information from the OECD STAN database, we conclude that variation in capital incomes shares is less than in the GTAP database, especially if we correct the shares for a certain imputed wage for self employed persons.
2. Correcting the shares for income of self-employed substantially reduces capital income shares in some sectors, especially in agriculture sectors.
3. It looks like as if the correction for capital income shares in developing countries has a greater effect than in developed countries.
4. It is not clear if capital income shares tend to converge to a specific level over time

Recommendations for future research are:

1. Get more insight in the development of capital income shares over time. Examine more detailed information on OECD STAN database
2. Use other sources, like information from International Labour Organization, where data from developing countries is available. Moreover more information about the separation of non-wage workers per main sectors can be found.

Appendix: Concordance of the STAN sectors with the GTAP sectors

GTAP code (GSC2)	Description	STAN code (ISIC REV. 3)
1-14	Agriculture, hunting forestry and fishing	01-05
19-26	Food products, beverages and tobacco	15-16
27-28	Textiles and Wearing apparel	17-18
29	Leather products	19
30	Wood products	20
31	Paper products, publishing	21-22
32	Petroleum, coal products	23
33	Chemical, rubber, plastic products	24-25
34	Mineral products nec	26
35-36	Ferrous and non-ferrous metals	27
37	Metal products	28
38	Motor vehicles and parts	34
39	Transport equipment nec	35
40	Electronic equipment	30+32
41	Machinery and equipment nec	29+31+33
42	Manufactures nec	36-37
43-45	Electricity, gas and water	40-41
46	Construction	45
47	Trade	50-55
48-50	Transport	60-63
51	Communication	64
52	Financial services nec	65+67
53	Insurance	66
54	Business services nec	70-74
55-56	Other services	75-99