Data Appendix of "Sector-Level Frictions and Aggregate Productivity"

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February 15, 2007

1 Data

This appendix provides information on the data used in "Sector-Level Frictions and Aggregate Productivity" (Aoki 2007).

1.1 Sources

The sector-level data, except for capital input, are taken from the OECD STAN database (OECD 2006c), for the period 1970 to 2003. Capital input is taken from the OECD ISDB (OECD 1999a) for the period 1970 to 1993 (OECD 2005 and OECD 1999b are these manuals). Other country-level data used for the analysis (the hours worked data for TTFP and the PPP data) are also collected from the OECD. All data are annual. The countries I use for the analysis are West Germany (until 1991), Germany (from 1991), France, Italy, Japan, the UK, and the US.

Note that since the time period of the data covered for a sector is different across countries (and sectors), the estimation period is different between countries.

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1.2 Sector classification

The sectors I include in my analysis are (1)"Agriculture, Hunting, Forestry and Fishing," (2)"Mining and Quarrying"+"Total Manufacturing," (3)"Electricity, Gas and Water Supply," (4)"Wholesale and Retail Trade; Repairs," (5)"Transport and Storage and Communication," and (6)"Financial Intermediation" (plus for the analysis in appendix D.4, (7)"Real Estate, Renting and Business Activities"). I exclude the "Community, Social and Personal Services" sector because it mainly consists of non-market activities. The definition of sector classification according to STAN and ISDB is essentially the same for the sectors that were chosen for this study (while STAN is based on ISIC rev.3, ISDB is based on ISIC rev.2).

I exclude the "Hotels and Restaurants" sector, which is usually included in the "Wholesale and Retail Trade; Repairs" sector, except for the UK, because such data is not available for Japan (for Japan, "Hotels and Restaurants" is included in "Community, Social and Personal Services" sector). However, I include "Hotels and Restaurants" in "Wholesale and Retail Trade; Repairs" for the UK because of data availability.

1.3 Value added and capital input

I use "Value added at Market prices" from the STAN database as the sector's value added. Further, I use "gross capital stock including OECD estimates" from the ISDB as the sector's capital input.

1.4 Labor input

I use total employment with adjustment for labor input to calculate all the indexes except for TTFP (and except for the analysis in appendix D.5). I use hours worked times the total employment with adjustment to calculate TTFP. The reason that total employment with adjustment is used for labor input except for TTFP is mainly due to the availability of data on sector-level hours worked. Thus, for most of my study, I implicitly assume that the hours worked are different between countries but equal across sectors.

1.4.1 Total employment

I calculate total employment in a manner such that in the agricultural sector, one self-employed or unpaid family worker is counted as β percentage of one employee while in other sectors, he or she is counted as one employee.

There is a reason for using this method of calculation. Suppose that we consider self-employed and unpaid as being of equal weight with employee and that we calculate each sector's labor share by the formula

$$\text{labor share} = \frac{\text{CE}}{\text{EE}} \cdot \text{EN},$$

where CE, EN, and EE denote the compensation of employees, the total employment, and employees, respectively. Then, the labor share exceeds unity (and the capital share is less than zero) in the agricultural sector for some countries (West Germany, Germany, and Japan). This might be due to the fact that there are many part-time farmers who are self-employed or unpaid family workers in the agricultural sectors.

Therefore, I calculate the adjusted total employment in the agricultural sector as follows:

$$(\text{adjusted EN}_{\text{agr}}) \quad = \quad \text{EE}_{\text{agr}} + \beta(\text{EN}_{\text{agr}} - \text{EE}_{\text{agr}}).$$

I assign $\beta = 0.5$ and also assign other values for a robustness check in appendix D.3.

1.4.2 Hours worked

Hours worked for TTFP: I use data on average hours worked per employee collected from the Labour Market Statistics of OECD Corporate Data Environment (OECD 2006a). This data reflects the average hours worked of the entire economy of each country. I don't use the hours worked data in STAN database for TTFP due to the following two reasons: (1) Data on sector-level hours worked is not available for some countries. (2) In the STAN database, countries only provide labor input data adjusted for hours worked with different definitions – some countries (France, Italy, and the US) provide

full-time equivalent jobs while one country (Japan) provides hours worked by employees.

Hours worked for appendix D.5: Data on full-time equivalent jobs is available for France, Italy, and the US; such data "is defined as total hours worked divided by average annual hours worked in full-time jobs" (OECD 2005) for each sector. On the other hand, data on the hours worked by employees for each sector is available for Japan. I directly use data on full-time equivalent jobs as labor input for RTAE for France, Italy, and the US. For Japan, since the data on hours worked by employees do not take the self-employed into account, adjustment is needed. I adjust it in the same manner as in the case of the total employment adjustment in section 1.4.1 of this data appendix.

1.5 Capital share

I calculate the capital share of sector i, s_{Ki}, as

$$s_{Ki} = 1 - \frac{V_{Li}}{V_{Fi}}. \tag{1}$$

V_{Li} is labor income and is calculated from

$$V_{Li} = \begin{cases} R_{\text{agr}} \cdot (\text{adjusted EN}_{\text{agr}}) & \text{if sector } i \text{ is the agricultural sector,} \\ R_i \cdot \text{EN}_i & \text{otherwise.} \end{cases}$$

R_i is the compensation of employees per employee (CE/EE). For EN and adjusted EN, see section 1.4.1 of this data appendix. V_{Fi} is the value added at factor costs, which has

the following relation with other variables.

$$\begin{aligned}
\text{Value added at Factor costs} &= \text{Compensation of Employees} \\
&\quad +\text{Consumption of Fixed capital} \\
&\quad +\text{Net operating surplus and Mixed income} \\
&= \text{Value added at Market prices} \\
&\quad -\text{Indirect taxes less Subsidies} \\
&\quad -\text{Trade and transport costs.}
\end{aligned}$$

I calculate α_i equal to s_{Ki} due to the following reason: Suppose that indirect tax is assumed to be in the form of output tax, that the firm's problem with output taxes is described as section 2.2 of Aoki (2007), and that we assume Cobb-Douglas CRS production function. Then, the first-order condition becomes

$$\alpha_i = 1 - \frac{p_L L_i}{(1-\tau_i)V_i}.$$

For each country, there are years when V_{Fi} is not available, even though the value added at market price V_i and labor income V_{Li} are available.[1] For these periods, I calculate s_{Ki} as follows.

$$s_{Ki} = 1 - \frac{V_{Li}}{(1-\tau_i')V_i},$$

where τ_i' is the indirect tax calculated at the nearest year when V_{Fi} is available.

1.6 Conversion to the 1990 US dollar

In order to calculate the TTFP, I convert the value added and capital stock to the 1990 US prices.

In order to convert the value added used for TTFP, I first calculate real value added whose base year is 1990 and then convert it using purchasing power parity (PPP) (PPP

[1] V_{Fi} is unavailable for Germany for 2003, for France before 1977, for Italy before 1979, for Japan before 1989, for the UK before 1991, and for the US before 1988.

data is taken from OECD 2006b).

Although the original capital stock data taken from the ISDB is expressed in 1990 US prices, the PPP conversion rate is different from the PPP above (as in Table 1, the original PPP used for capital stock is 15–30% higher). If the original PPP is used, the capital stock of these countries becomes much smaller. It overestimates the effect of the frictions on aggregate productivity (i.e., RTAE/TTFP) because the differences in aggregate productivity between these countries and the US become smaller (and because RTAE is indifferent to the value of PPP). In order to avoid this bias, I reconvert capital stock using the same PPP used for value added. Since ISDB uses old national currencies while STAN uses the euro for countries in the EU, I first convert old national currencies into the euro and subsequently convert them into the US dollar. I use the irrevocable conversion rates from Schreyer and Suyker (2002) for conversion of the old European national currencies. (the same rates are used in STAN).

	West Germany	France	Italy	Japan	UK
Original PPP	1.281809	1.158917	0.913096	218.7	0.845
The PPP that I use	0.9848	0.9943	0.6888	189.2402	0.5938
Difference	26%	15%	28%	14%	35%

Table 1: PPP for capital stock. National currencies per US dollar. (The euro is used for West Germany, France, and Italy.)

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