Disaggregating Labor Payments by Skill Level in GTAP

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Abstract

This paper outlines an approach to disaggregating labor payments in the GTAP, global economic data base. The split between low- and high-skilled labor is based on occupational data. High-skilled labor is assumed to consist of managers, administrators, professionals, and para-professionals. Data are gathered on this occupational split, by sector, in fifteen different economies, and these are mapped to GTAP sectors. Regression analysis shows a systematic relationship between GDP per capita and the national stock of tertiary and secondary educated labor on the one hand, and the sectoral labor payments split on the other. This model is used to predict labor splits, by sector, in the remaining GTAP regions. The results are evaluated in terms of the implied economywide skilled - unskilled labor payment ratio. Overall, the results seem promising enough to warrant inclusion in the GTAP, version 4 data base.

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1. Introduction[1]

The original GTAP formulation has three primary factors: capital, agricultural land and labor (Hertel, 1997). Although this formulation can offer insights into the determinants of shifts in wage-rental ratios, it can have little to say about actual wage dispersion (McDougall and Tyers, 1995). By splitting labor into two types on the basis of skill level, production (unskilled) and professional (skilled), additional insight may be obtained. Both types of labor have basic education, while the skilled may be differentiated by occupations requiring advanced training. However, in many developing countries, these two types of labor still make up a collective minority. Most workers have little education and those skills they do have are very specific, usually to agriculture (Wood, 1994). Tyers and Yang (1997) have addressed this problem by introducing a third category of workers, those unskilled workers whose only training is very specific to the rural sector (farm labor). However, this additional breakdown introduces further technical problems so it will not be attempted here.

No complete global data set has been available to disaggregate employment by type of worker in each industry.[2] Although we have used the ILO data for some developing countries, its sectoral coverage is quite aggregate. Therefore, the main thrust of our approach to date is country-specific by necessity. We begin with source data from labor force surveys and the national census. For this purpose, the most standardized classification of workers by type uses the ILO occupational classification.[3] Although some data on human capital endowments (such as years of schooling) are available, we have used them only as a last resort, fearing that they present more serious

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[1]This technical paper represents an attempt to bring together the findings from a variety of diverse research projects relating to the breakdown of labor demand by sector, into skilled and unskilled components. A major input was provided by two of the authors, Vo and Tyers, who compiled a database of sectoral labor splits for 13 GTAP regions. These data were developed in the context of a World Bank-funded project assessing the impact of trade on relative wages in the OECD. Further contributions were made by Zhi Wang, who provided source data for Hong Kong as well as additional international data which he assembled in conjunction with another project aimed at this same question. Finally, there were significant inputs from Jing Liu at The Center for Global Trade Analysis at Purdue University and Nico Van Leeuwen from the Netherlands Bureau for Economic Policy Analysis (CPB). Despite our best editorial efforts, the reader will find that this paper still reflects the diversity of these contributions. However, we believe that the combined product is greater than the sum of the individual parts.

[2]Data available from the ILO Yearbook goes some way to addressing this need but two major limitations remain. First, only the number of workers is fully disaggregated by occupation and industry and the wage data provided are insufficient to extend this to payments. Second, the industries identified are broad, including only manufacturing as a whole.

[3]The definition of professional- and production-workers is based on the ILO International Standard Classification of Occupations (ISCO). See Australian Bureau of Statistics (1990). Skilled labor in GTAP is defined based on occupational categories. Generally, managers and technicians are considered to be skilled labors since these occupations required some kind of advanced training beyond secondary education. Others are defined as unskilled (Table 1). This definition is partially motivated by convenience, since the information based on different occupations are relatively easy to get.

standardization problems. The occupational split we use is summarized in Table 1A, in terms of the ILO one-digit occupations. That table also summarizes several other occupational splits to be used later in this paper.

This work on the labor splits was begun in the context of the 37 GTAP sectors used in versions 1-3 of the database (Table 2A). The target data for each individual country included: total annual payments by industries to labor of each type, the number of full time equivalent workers of each type, and the average wage each is paid. Obviously, only two of the three are necessary, but the pair available differs across countries. The results for each region comprises two 37 by 2 matrices: one is "body count" matrix giving the numbers of full time equivalent workers in 37 sectors by 2 types of labor, professional (skilled) vs. production and farm laborers (unskilled); and the other is an employment payment matrix.

Much of the work in producing this database involved coming to grips with inconsistencies in the occupational classifications used by different governments, (see Tables 1B and 1C). Similar problems arose in mapping between the industrial classifications used in the country-specific data and the ISIC-based (international standard industry code) GTAP industrial groups (Tables 2A-2D). The steps involved for each country or group of countries are outlined in Figure 1. The first is to construct an n by k matrix of payments to k categories of labor force across n industries from the original data. In the second step, this n by k matrix will be transferred into an n by 2 matrix with the 2 columns referring to payments to skilled and unskilled labor. In the last step, the country-industry concordance in Hambley (1993) and Ryan (1992) is used to transfer the n by 2 matrix to the required 36 by 2 matrix. Since we could not access the original survey data for all GTAP regions, we then develop a statistical model designed to predict labor payment shares in the unobserved regions on the basis of regression on some observable macro variables, including GDP/outputs and the average years of tertiary education in the population.

The paper proceeds as follows. In section 2 we begin by considering the case of particular region, namely Hong Kong. We go through the procedures necessary to develop a GTAP-based labor split for this region in great detail in order to introduce the reader to the basic procedures employed in this study. Sections 3 and 4 briefly introduce available information for other regions, for which detailed descriptions are supplied in the appendix and brief summaries are given in the text. Section 5 of this technical paper outlines the basic statistical model that we develop for purposes of estimating labor shares by individual sector. This model is estimated and its in-sample performance is evaluated. We then use the model to predict labor splits in the unobserved regions and integrate the results into the GTAP framework. This permits us to estimate economy-wide payment shares of skilled and unskilled labor in the version 3 data. When the results are compared with the ILO employment data, skilled/unskilled wage differentials for each region can be inferred. This provides a crude consistency check on the overall sectoral labor split. Since completion of this work, the version 4 database has become available. In order to extend the labor splits to the version 4 sectoral and region level, we apply the same procedures as before. However, now a new observation is provided –

namely India. We discuss the Indian case in some detail in Section 6, as it illustrates the challenges of developing labor splits for less industrialized economies.

2. The Case of Hong Kong

Overview:

The case of Hong Kong presents a fairly typical example of the problems confronted in developing a labor splits data base for an industrialized economy. Thus it is useful to go through it in some detail. The 1991 Hong Kong Population Census was the latest source available at the time this work was done. Hong Kong's statistics are grouped into 27 sectors (Table 2B), nine occupational categories, and 11 divisions of annual wage distributions. Three census tables are relevant. These are condensed and summarized in Tables 3-5 of this document Table 3 is a 27x9 industry by occupation employment data matrix (body count). Table 4 is a 9x11 occupation by wage distribution matrix. Table 5 is a 27x11 industry by income distribution data matrix. Given the difference in industry classifications between Hong Kong and GTAP, the ISIC has been used as the guideline for mapping (see Table 2B). The next step involves aggregating of the labor force into skilled and unskilled categories based on their occupation description. We then obtain an initial estimate of payments based on average wages. Finally, the RAS technique is used to adjust the data to match observed row and column sums. Let us now consider these steps in more detail.

Concordances:

Most of the industrial sectors are fairly easy to match up (Table 2B). Standard problems arise when the GTAP sector is relatively more aggregated than the Hong Kong sectors (GTAP sector 34, for instance) while some of them are more disaggregated (GTAP sectors 13-17 correspond to one sector in Hong Kong). However, one sector of source data named 'unclassifiable' does not match any GTAP sector. Since it is also relatively small, it is simply discarded. Another problem is that two of the GTAP sectors (25&31) could not be matched to any specified manufacturing sector in Hong Kong, so both of them map to 'other manufacturing'. Finally, note from Table 2B, that there are some overlapping categories. Both *storage and warehouse* and *communication* map to *trade and transport* (sector 34) in GTAP, for instance. We further aggregate the 27 Hong Kong sectors into 20 sectors to work around this problem.

To match GTAP's labor division, nine occupations are aggregated into two types of labor. The skilled labor category includes *Managers and administrators, Professionals, and associate professionals* and the unskilled category includes all others. In this way, a 20x2 'aggregated industry' by labor type, employment data matrix is obtained.

Labor Payments and CAS:

Next, we must turn to the question of earnings. The income sum data by industry are reported in Table 5. Here, the data on male and female workers are summed up and the average monthly incomes (measured in $ Hong Kong) for groups one to 11 are estimated to be: 800, 1500, 3000, 5000, 7000, 9000, 12500, 17500, 25000, 45000, and 0.[4] In this way, a 20x1 industry sum of payments vector is obtained. Using a similar approach, the 2x1 income sum of payments vector by labor type (skilled and unskilled only) is obtained based upon Table 4.

If we assume initially that wage rates across industries are the same, then the average wage rates of all sector as a whole by labor types are obtained by the formula:

average wage rate = total payment by skill level/employment body count.

The data on the right hand side of this formula may be obtained from the 20x2 body count matrix and from the 2x1 payment vector by skill level. The resulting 2x1 wage vector by skill level is then combined with 20x2 body count matrix to get the initial payments matrix.

At this point, we have a 20x2 body count matrix, a 20x1 sector payment sum vector, a 2x1 vector for the labor payment sum, and the sector mapping between Hong Kong and GTAP. The goal is to fully utilize the available information and to obtain the 20x2 payment matrix. The RAS program is the appropriate tool for establishing consistency. Given an initial matrix and row and column sum targets, the RAS procedure is used. It first scales each row of the matrix so that each row of the adjusted matrix adds up to the corresponding row target. It then scales each column of the matrix from the previous step so that each column of the newly adjusted matrix adds up to the corresponding column target. After that a row imbalance in the matrix is expected so row-scaling step needs repeated. These row and column operations are repeated again and again until the required accuracy is attained. Mathematically, RAS can converge in a finite number of steps under very general conditions.[5]

Table 6 reports pre- and post-RAS labor payments for Hong Kong. The first column presents the result of the mapping described above. Please note that these 20 sectors can not be further disaggregated based on the GTAP sector classification without additional information. The second

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[4] For most of the income groups, the mean values of the income ranges are taken as the proxies. For the group labeled 'under $1000', $800 is used as the mean due to the implicit effect of the minimum wage rate set by government. While $800 may not be the right number, it will not make significant difference given the fact that the number of workers in this group accounts only a small portion of total employment for each industry (less than 4% for most industries). Similarly, $45000 is used to approximate the mean of the group labeled '$30000 and over'. The group with average income of zero stands for unemployed.

[5]Selection of the initial matrix is not to facilitate convergence of the RAS program but to set a starting point such that the equilibrium makes economic sense. Theoretically, we could have infinite number of solutions to satisfy the target column sum and row sum since we have 20*2=40 variables but 20+2=22 constraints.

and third columns are from the initial payment matrix (obtained using the methods described above). The sum of these two columns equals the last row, titled 'target occupation sum'. The fourth column is the target industry sum vector that we require. In running the program, RAS checks if the initial matrix already satisfies the row targets. If so, then RAS stops running at the first step. In the case of Table 6, however, there are discrepancies for all sectors (rows) between target sums and real sums. This means that implicit wages are not equal across industries. RAS therefore adjusts each row by having all elements multiplied by a scalar such that target row sums are reached. Columns 5 and 6 report the resulting 20x2 payments matrix. Finally, if we assume that all sub-sectors belonging to the same aggregated sector have the same payment shares when the data are not detailed enough to permit further disaggregation, then this 20x2 payment share matrix may be readily converted to the final labor payment split matrix (36x2) shown in Table 7.[6]

It is noticeable that the payment share of skilled labor in Hong Kong in 1991 is fairly high (see also Table 20 for comparisons across regions). The highest skilled payment shares are in the service sectors 32-36 (generally higher than 40%), and the second highest group relates to professional, labor-intensive manufacturing (sectors 22-25 and 29-30) with skilled labor payment shares on average around 40%. The other manufacturing sectors have the third highest shares. The lowest share group is that represented by agriculture (sectors 1-8) with skilled labor payments accounting for little more than 10% of the total wage bill. Such results are generally consistent with our expectations given the fact that Hong Kong is a land-scarce, trade and offshore assembly - orientated economy. A major limitation of this work lies in the level of disaggregation of the agricultural sector. As the reader may have noticed, the detailed information about sub-sectors of agriculture is unavailable and sectors 1-7 all show the same shares in table 7. Fortunately, the agricultural sector is only a small portion of the Hong Kong economy. However, as we will see below, this same type of problem also arises in many of the economies with large agricultural sectors.

3. Other Payment Split Data

Table 8 summarizes the complete set of labor split data currently available. Most of this derives from earlier work by two of the authors (Vo and Tyers). In each case the labor split is made for 1992 or a nearby year, as well as for an earlier period.[7] While the information available for each region varies greatly, the basic idea for obtaining the final payment share data is very similar to that used for Hong Kong. The payment share data are obtained either by directly utilizing extant payment split

[6]Theoretically, we could make the sector mapping between Hong Kong and GTAP either before or after RAS adjustment and the results will be practically the same. However, in this case, it is better to use RAS before further disaggregation of sectors to save the further assumption about the payment distribution among more disaggregated sectors.

[7]The contrast between the two different periods was initially used in estimating the effects of technology shocks on factor proportions. Here, we use these as additional observations from different stages of development.

data (the Australian case) or combining the occupational body count data and the wage distribution data (USA case). Depending upon the original information, some special assumptions and adjustments may be used. For instance, in the Canadian case it is assumed that proportions of earnings by industry for all occupations are the same as in US. The Japanese case involves much more complicated assumptions and adjustments, as income levels are used to infer the presence of skilled labor. A complete set of documentation of the procedures used for each region is supplied in the appendix. The resulting skilled labor payment shares are reported in Table 9.[8]

In reviewing the primary labor payment share data in Table 9, it is clear that service sectors have the highest skilled labor payment share for all regions regardless of the stage of development. To further analyze the data, we also compute Pearson correlation coefficients among sample regions and present the results as Table 10. The USA, Canada, EU, and Australia appear to have similar patterns and the correlation is high among them. They each exhibit relatively high payment shares for skilled labor (denoted as MHP for More Highly Paid) in agriculture and MHPs remain quite stable across all 36 sectors. The results for Hong Kong are quite similar to those of Japan for 1992. The patterns for developing countries (Indonesia 1992, Philippines 1986, and Thailand 1985) are also correlated with one another. Their common feature is that their shares for agriculture sectors are extremely low compared both with developed regions and with their own manufacturing sectors. This makes sense since developing country agriculture tends to be dominated by laborers who do not have much formal education. However, the MHP share in the manufactures and service sectors of Philippines 1986 and Thailand 1985 seem incredibly high compared with those of the developed economies. This appears to be due to a non-comparable definition of skilled labor. This leads us naturally into a discussion of limitations of these data.

4. Limitations of the Work to Date

Although these labor payment share data represent the best available information from current sources, they suffer from some significant limitations. Therefore caution is advised when using them for cross-region comparisons. The first limitation rests with the diversity of data sources. For instance, Taiwan's data derived from two different sources (collected by different agencies) which might adapt different criteria in constructing these data. Therefore there is considerable scope for differences to be introduced.

The second limitation has to do with the definition of skilled labor. While most of the developed economies distinguish skilled labor from unskilled labor according to their occupations, some developing regions, notably Thailand and Philippines (Table 14), classify labor types based on level of education or length of employment. Under the code of their labor classifications, high school graduates are denoted as skilled labor. This differs from the more industrialized economies, where

[8]The unskilled labor payment share plus the skilled labor payment equals one.

skilled labor generally has some kind of post-secondary education. As a result, Thailand and Philippines have very high skilled payment shares relative to other regions in all sectors but agriculture (Table 15). This leads us to omit these countries from our final data set.

The cases of the EU and Japan are a little more complicated. The EU uses a manual and non-manual labor split but the results were adjusted to match the professional vs. production labor division following the observed pattern in Australia. Since both MHP-LHP and Manual-Nonmanual dichotomies at the industry level are available for Australia, the proportional difference at the industry level may be derived. This proportional correction factor is then applied to the EU for each industry to obtain the approximated professional and production payment split (see appendix).

In the Japanese case, the payment bill and employment body count is available for both sexes of each industry. Based on previous wage survey data and some added assumptions, the average wages of male production workers and professional workers were set, and they are the same across all industries. Given the information above, the number of male and female production and professional workers were derived, but only the male professional workers are captured in the skilled labor category. There may be several potential problems with such approach. Firstly, it is forced to assume that female professionals receive comparable wages to male production workers. Secondly, it ignores the wage difference across industries.

A third limitation of the labor-split source data relates to the insufficient level of disaggregation. Remember that the version 3 GTAP database includes eight sub-sectors for agriculture and forestry (version 4 includes a dozen), but most of the regions aggregate the data for agriculture into one sector, and the data for agriculture are missing altogether for Japan. Also for most of the regions, the level of disaggregation for manufactures is not detailed enough to provide a complete mapping to GTAP industries, and this is the reason that the data for several sectors are the same for some countries (noticeably Brazil, Thailand, Philippines, and Indonesia). Indeed, the data for some regions are very rough. For example, Brazil's data are derived from the ILO and aggregated by agriculture, manufactures, and a few service sectors only.

The last limitation has to do with the method of adjustment. Often one country has incomplete information for a task, and another country happens to have complementary information. In such cases, another country's pattern is imposed to overcome the data deficiency provide that two countries involved are reasonably similar in certain aspects. As mentioned above, similarity of occupation wage distribution across industries between USA and Canada and similarity of labor structure measurement between Australia and the EU are assumed in obtaining split data for Canada and the EU, respectively. In the case of Korea, the payment share split data for Taiwanese agriculture have been used to fill the vacuum. So the data for sectors one to eight in Table 9 are the same for Korea and Taiwan.

Despite all of these limitations, we believe that these source data on labor splits contain some important information which should be taken into account in GTAP. The next section discusses how

we extend the payment split data in Table 9 to the full GTAP database in order to make use of this information in the analysis of global economic issues.

5. An Extension to the full set of GTAP Regions.

5.1 Introduction:

The primary labor split data for this subset of GTAP regions must somehow be extended to the other, non-sampled regions. A simple and straightforward way to solve this problem is to map all 30 GTAP regions into corresponding sample regions based on some broad notion of their respective the stages of development. Then the mapped sample region's labor split data could be used as a proxy for the non-sampled region. While such a method has the advantage of simplicity, the mapping is inherently a subjective exercise. Besides, it produces results with little variation across regions. An improved approach is to first explore the linkage between labor payment shares and other region-specific characteristics that are observable, subsequently making predictions for non-sampled based on these linkages. Such an approach is more objective and it may offer some insight into the determinants of skilled labor intensities. In the next section, we first initiate an idealized model and address the intuition the model implies. We then present a similar, but empirically practicable model as a second best alternative.

5.2 Methodology

A natural way to explore the linkage between skilled labor payment shares and other region-specific factors is to postulate a mathematical relationship between them. One such model can be expressed as follows:

$$R = F(\textit{stage of development, educational attainment}) \qquad (1)$$

Where R is the ratio of skilled to unskilled wages. Since body count data at the industry level are generally available, the payment share data could be derived if the corresponding wage ratio data can be obtained. The "stage of development" variable is usually measured by GDP per capita. There are two relevant measures for educational attainment: the average years of tertiary education and the average years of secondary education for the national labor force.[9] (Other variables might also be

[9] Two other variables which could measure educational attainment are (1) the percentage of working forces which have earned an associate or higher degree and (2) the percentage of working forces which have high school diploma as highest degree.

included if deemed reasonable and if they were widely available.) This yields the following equation:

$$R = F(GDPC, TER, SEC) \quad (2)$$

Where R is the ratio of skilled to unskilled wages, GDPC is per capita GDP, and TEC and SEC are average years of tertiary and secondary education of the entire work force, respectively.

What are the likely effects of GDPC, TER, and SEC on the wage ratio R? Intuitively, the higher is the stage of development of a country, the smaller is the relative premium of skilled over unskilled labor because of: (a) their relative marginal value in economy (lower when skilled labor is in greater supply), (b) the mandatory minimum wage rate for unskilled labor in many developed economies, and (c) the smaller difference between urban and rural areas in developed regions. The sign for TER is unknown *a priori*. An increase in TER could come from two sources: one is the increase in the percentage of the labor force with advanced training, and the other is the extended length of advanced training for those professionals already having a tertiary degree. Since we implicitly assume that those with an advanced degree should be classified as skilled labor and those without any tertiary education are very likely be classified as unskilled labor, these two sources are likely to have opposite effects on the variable R. On the one hand, an increase of the number of skilled labor generally lowers its relative wage. On the other hand, additional training for those with advanced degrees increases the wage gap between skilled and unskilled labors. Therefore the relationship between R and TER is inconclusive without additional information. The relationship between R and SEC should be negative since an increase of SEC is likely to raise the general education level of those classified as unskilled labor, thereby rendering them more productive.

Since we do not have access to wage ratio data at the industry level, we are forced to use the skilled labor payment share in its place so that:

$$MHP = F(GDPC, TER, SEC), \quad (3)$$

where MHP is the skilled labor payment share, and the other variables defined the same as above. While equations (3) and (2) differ only slightly, their economic implications are quite different. Theoretically, both GDPC and TER are expected to have positive effects on MHP. The logic follows: high income regions normally employ a higher portion of people working as professionals, which more than compensates for the relatively lower wage ratio in contribution to the payment share. As mentioned above, the TER variable is positively related, either to the portion of people defined as skilled labor or to the income level of the so-called skilled labor, or both. In any case, TER is expected to be positively related to the payment share.

5.3 Functional form

We explore three alternative functional forms for equation (3), namely: non-transformed, semilog-transformed, and log-transformed:

$$Mhp=a_0+a_1SEC+a_2TER+a_3GDPC \quad (4)$$

$$Mhp = a_0+a_1 \ln SEC+a_2 \ln TER+a_3 \ln(GDPC) \quad (5)$$

$$\ln(Mhp) = a_0+a_1 \ln(SEC)+a_2 \ln (TER)+a_3 \ln(GDPC) \quad (6)$$

The log transformation is intended to smooth out the effects of explanatory variables, especially GDPC which differ widely across regions.[10]

Since we have 36 sectors in the version 3 sample, the total number of dependent variables is 36. There are three explanatory variables for each regression. The OLS (Ordinary Least Square) regression technique is used here.

5.4 The Data

Before formally analyzing the relationship between the skilled labor payment share and other explanatory variables, we need to discuss the reliability and accuracy of data that will be used. The average length of per capita tertiary and secondary education for some countries from 1980 - 1987 are available from the World Bank.[11] Since these time series data display a very stable pattern over time we extrapolate backward to 1970 and forward to 1992 to obtain data to match to observations. These data are also later used for prediction purposes. In the cases of Hong Kong and Taiwan, education data are unavailable. Consequently, education data from Singapore and Korea are taken as proxies for Hong Kong and Taiwan, respectively. GDP per capita data are also obtained from the World Bank. We use the constant real GDP measured at the 1987 prices. Table 11 lists the data used for the regression analysis. Table 12 gives the data used for purposes of predicting 1992 splits.

5.5 Regression Results

Having identified a problem with the definition of skilled labor in the Philippines and Thailand (discussed above), we implement the regression both with and without these two regions' data. Table 13 reports the overall fit of each regression using alternative functional forms, and the two different samples. Overestimation of these two regions' high skilled labor payment shares has a significant impact on the overall fitting of all three models in the manufactures and service sectors. After the Philippine and Thailand data are removed, the average R-square values for all three models increased from between 0.20 and 0.30, to .50, which we deem to be quite acceptable for a cross-

[10] In addition to models (4)-(6), we also considered the possible transformation of the dependent variable as follows: TMHP = MHP/(1-MHP). One of the major advantages of such a transformation is to increase the range of dependent variable. Another advantage is that TMHP is somewhat similar to wage ratio and closer to our ideal model. However, empirical results with this model were not promising.

[11] The data is from Nehru, Swanson and Dubey 1993 'A New Database on Human Capital Stock' Policy research working paper 1123, Washington DC: World Bank.

section model of this type. In all subsequent results we focus only on the sample excluding Thailand and the Philippines.

In checking the results, we also found that the sign of the coefficient on the secondary education variable is indeed negative, as expected, in 70 percent of the sectors. However the significance levels of these variables, as shown by the t-values in table 14 are very low in all three models. This likely arises from the high degree of correlation among explanatory variables: the correlation coefficients between TER and SEC or GDP are in the neighborhood of 0.6, while the correlation coefficient between SEC and GDP is as high as 0.9. Therefore we have chosen to omit the secondary education variable from our regression model.

After the SEC variable is dropped, the R-square values for all three models change very little (Table 15). Table 16 reports the estimated coefficients when SEC is excluded. We see that the results for the per capita GDP variable are of the expected sign in all but one sector. However, the tertiary education stock has a mixed – often negative – impact on skilled labor shares.

5.6 Limitations

There are a number of limitations to the statistical model employed in this section. The first lies in the small sample size and the incompleteness of data. When Thailand and the Philippines are excluded, we have only 12 observations. Also, we have taken Singapore and Korea's education data to approximate those of Hong Kong and Taiwan. Further, the dependent variables are intertwined with elements of some regions being imposed on other regions' data discussed above.

The second limitation is the uneven distribution of sample regions across the development spectrum. Currently, most of the sample regions belong to the group of middle to high-income economies. It is possible that the lack of low income countries' data will affect the reliability of the model for predictive purposes.

Discussion of the Indian labor split data below will show how difficult it is to obtain this kind of information in poorer countries. In light of this fact, perhaps something could be done to make use of the data from the Philippines and Thailand. The simple method of erasing them from the regression is unlikely to be the most efficient way to utilize all the available information. One possible solution may be to include them in the sample with a common dummy variable for both of them to account for the measurement error associated with skilled labor being proxied by a high school diploma. Another possibility is to adjust them such as was done with the EU.

5.7 Evaluation of Model Performance

Table 15 illustrates that no single model dominates the other two in terms of overall fit based on R-square values for the 36 sectors. On average, the R^2 in the non-transformed model is slightly higher

than the other models. Also the simple non-transformed model has a relatively more even distribution of R^2 values across sectors comparing with other two models, whereas the R square value for sector 32 is only 5% for semi-transformed model and the overall fit for sectors 9 and 36 are similarly poor for the fully log-transformed model.

Another criteria for comparing models involves checking their robustness in prediction. Here, we find that the simplest model (non-transformed) turns out to be the most robust: all predicted 1992 values for the entire version 3 GTAP matrix (all 36 sectors and 30 regions) fall between zero and one which is consistent with theory. Ten negative figures show up in the prediction for model 2 and many more (27) are negative for the third model. This criterion is important since our ultimate goal is to predict shares for other regions. Therefore, we prefer this simple version model to the others even though other two models may perform slightly better for some individual sectors.[12] Finally, we prefer simplicity to complexity, other things being equal.

Once the model has been selected, the next step is to test the accuracy of prediction as compared to the sample points. We find the results are generally acceptable in the sense that on average the differences between the predicted and observed values are less than 20% for most regions in sample. The Pearson correlation coefficients reported in Table 17 range from 0.60 to 0.99. However, it is found that some sample countries exhibit a tendency towards overestimation (notably Japan 70, Canada 86, and Brazil 92), while some tend to be systematically underestimated (EU88, Australia 91 and Taiwan 90 for instance). It is likely that we have omitted some important explanatory variables in these cases.

5.8 Predictions for Other GTAP Regions

Having selected a regression model, we are now in a position to predict labor splits for all 36 sectors in all 30 regions of the version 3 database. The corresponding variable values for all GTAP regions in 1992 are listed in Table 12. By plugging these explanatory variables into the regression model, we obtain the 36x30 GTAP high skill labor payment share matrix required for the version 3 database. We must then decide if the predicted data should be overridden by the actual data for the sample regions. We believe that predicted data for Philippines and Thailand are better than actual data. We also use predicted data for Indonesia and Brazil since their actual data suffer from excessive over-aggregation. While the actual data are not available for the version 3 base year of 1992 in all sample regions, most of them are for the year of 1991 or 1992 with the exception of Canada (1986) and EU (1988). Since these two regions are relatively mature, slow growing economies, their actual data are still deemed acceptable. Therefore, for seven regions: USA, Canada, Australia, EU, Japan, Taiwan,

[12] Some may suggest to pick up the best fitting model sector by sector. We are reluctant to do so fearing that some difficulties may arise from the comparisons across sectors.

and South Korea, we have used the actual data instead of the payment splits predicted by the model.[13] Table 18 presents the full set of labor payment splits for the version 3 GTAP data.

5.9 Overall Evaluation of Version 3 Splits

To evaluate this approach to obtaining labor splits at industry level, we check what these labor splits imply about relative wages when they are imbedded in the GTAP database and combined with ILO "body count" data. The 36x30 high skilled labor payment matrix is obtained by element-wise multiplying the 36x30 skilled labor payment share by the corresponding GTAP labor payment data (also a 36x30 matrix). We sum across the rows in the resulting matrix to obtain a prediction of the economy-wide total skilled labor payment for each of the 30 GTAP regions. The economy wide skilled labor payment ratios for all 30 regions may then obtained by dividing this value by the total labor payment. The results are listed in Table 19. It is noticeable that these share-weighted MHP ratios are much higher than their corresponding mean MHP. The reason is that sectors 33-36 are the most heavily weighted among all 36 sectors for the 30 regions in terms of total labor payments, and these sectors happen to have the highest MHP values. It is also noticeable that developed economies generally have a higher skilled labor payment share than developing economies which is in line with our earlier hypothesis.

Next, we combine the economy-wide skilled labor body count data from the ILO with these payment share estimates to derive the implied economy-wide wage ratios for these regions. Table 20 gives the relevant data and the implied economy-wide wage ratios of skilled labor to unskilled labor for these 16 GTAP regions.[14] In general, the results indirectly confirm our earlier hypotheses. The developed regions show the lower skilled to unskilled wage ratios, while the low income regions have higher ratios. The case of Japan is a little odd: its ratio is much higher than other economies at the same stage of development such as USA and Canada. This may relate to the definition of skilled labor in that region. Japan has taken as skilled labor only the male professionals, who tend to have much higher income than their female counterparts. While such an adjustment may not seriously affect the labor payment share, it significantly reduces the skilled labor body count. The estimated wage ratio for Canada is less than one. While the usage of actual 1986 Canada payment share data may underestimate the 1992 figures, we believe the main reason lies in the omission of much of the government service sector (sector 36 in GTAP) in the Canadian IO table. (Note this sector is not only one of the highest skilled labor intensive sectors but also one of the biggest sectors.) China has the lowest ratio among all low-income regions. In summary, these implied wage

[13] The predicted values are still used for some sectors of those regions where the actual data are missing.

[14] The ILO tables do not provide the labor body count information for all 30 GTAP regions. Only these 16 regions' body count data are comparable.

ratios are not wildly out of line – despite the rather eclectic mix of data used to estimate them. Therefore we believe the proposed methodology represents a good starting point.

6. Application to the GTAP version 4 data.

In the wake of the preceding work, which was undertaken prior to the construction of the GTAP version 4 database, we made a serious attempt to obtain additional data from countries at lower income levels. After extensive scrutiny of the Chinese Labor Statistical Yearbook (1995), it was determined that the sectoral coverage was insufficient to justify its inclusion in the database. However, India was included and the next subsection describes this effort in more detail.

6.1. The Case of India

The procedures used for India were similar to those used in the Hong Kong case, with a few notable exceptions. Employment by occupation was obtained from the *Manpower Profile India, Yearbook 1996*, edited by the Institute of Applied Manpower Research (Table 21). Data refer to the year 1981, and the source mentioned in the original tables is the 1981 *Census of India*.

The Indian industrial classification is not very detailed and can be attributed to 7 sectors. No information is available about the sectoral annual wage distribution in India. Therefore we are restricted to sectoral compensation of employees as can be found in the National Accounts Statistics of the United Nations. The 1993 issue provides us with the cost components of Value Added including the compensation of employees in 6 sectors. Since 1981 is not directly available it is estimated given the 1980 and 1985 values. Table 22 is the final result.

The sectors in tables 21 and 22 are mapped to the industrial classification in GTAP, as shown in Table 20. The sectoral average wage rate for India is calculated as total earnings in Table 22 divided by the total employment in Table 21. The overall, high-skilled versus low-skilled earnings ratio is published by the Union Bank of Switzerland. They have gathered information of wages of 10 professions in Bombay. Leaving out the numbers for secretaries, which are deemed unreasonable, the resulting earnings ratio is 2.37. This ratio is imposed for all the individual sectors. Therefore, we do need to make use of the RAS procedure. (This is a deviation from the Hong Kong case.) Application of the RAS procedures in the Indian case leads to perverse results. In particular it generates within-sector cases where low-skilled wages exceed high-skilled wages. The reason is that wages differ between sectors. The average wage in low-skilled intensive sectors are much lower than in high-skilled intensive sectors. To avoid the consequences of this aggregation paradox we assumed that the observed relative wage applies to each of the sectors individually. This generates a macro ratio of skilled to unskilled wages equal to 6.63.

Overall, the results for the case of India limited, at best. The number of sectors is very small, 6 sectors are disaggregated to 37 for GTAP version 3 and further to 50 sectors for GTAP version 4. Furthermore the data are quite old (1981). Moreover, some of the underlying assumptions can be called in to question. The number of employees is based on the number of main workers by industry according to a 1981 census in India. Furthermore, the level of the labor payments had to be obtained from different sources. This raises the possibility of inconsistencies. Nevertheless, we believe that the addition of this observation in a low income economy is sufficiently important to warrant inclusion in the sample.

6.2. Labor splits for version 4

While version 4 has more sectors and regions than does version 3, the underlying principles for estimation remain the same. Of course, we have more information for regression and prediction as the Indian data has been added to the sample. In addition, we were able to obtain agriculture skill labor share date for four more regions, namely, EU, Korea, Thailand, and Philippines. These additional observations are very important, since agriculture data are missing from some of the countries in version 3 (discussed above) and there is widespread suspicion that the previously predicted agriculture shares are overestimated. Results from the GTAP version 4 regression model are reported in Table 24. This regression model is used, in conjunction with updated GDP per capita and educational attainment variables, to predict labor splits for all 45 regions at the 36 sector, version 3 level. The procedure is exactly the same as described in previous sections. Since the 50 sectors in version 4 are the consequence of further disaggregation of version 3, we simply let the sectors in version 4 take the same values as their parent sector in version 3. Table 25 summarizes the GTAP skilled payment shares for the version 4 database. Table 26 reports data from the ILO and the implied wage ratios for countries where they can be computed. These show many of the same characteristics as the version 3 ratios and generally seem quite reasonable.

7. Summary and Conclusions

This paper outlines an approach disaggregating labor payments in the GTAP, global economic data base. The split between low- and high-skilled labor is based on occupational data. High-skilled labor is assumed to consist of managers, administrators, professionals, and para-professionals. Data are gathered on this occupational split, by sector, in fifteen different economies, and these are mapped to GTAP sectors. Regression analysis shows a systematic relationship between GDP per capita and the national stock of tertiary and secondary educated labor on the one hand, and the sectoral labor payments split on the other. This model is then used to predict labor splits, by sector, in the remaining GTAP regions. The results are evaluated in terms of the implied economywide skilled - unskilled labor payment ratio, as well as the implied wage ratio. Overall, the results seem promising enough to warrant inclusion in the GTAP, version 4 data base.

The results outlined in this paper should be viewed as preliminary. The estimated labor payment splits could be improved by the inclusion of more data for low income economies, where the current sample is very limited. It is hoped that future contributions of national data to the GTAP data base will include this type of occupational split. In addition to improving the data for the particular country in question, this will also enlarge our sample for the regression analysis.

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Figure 1: Flowchart of Processing Procedure

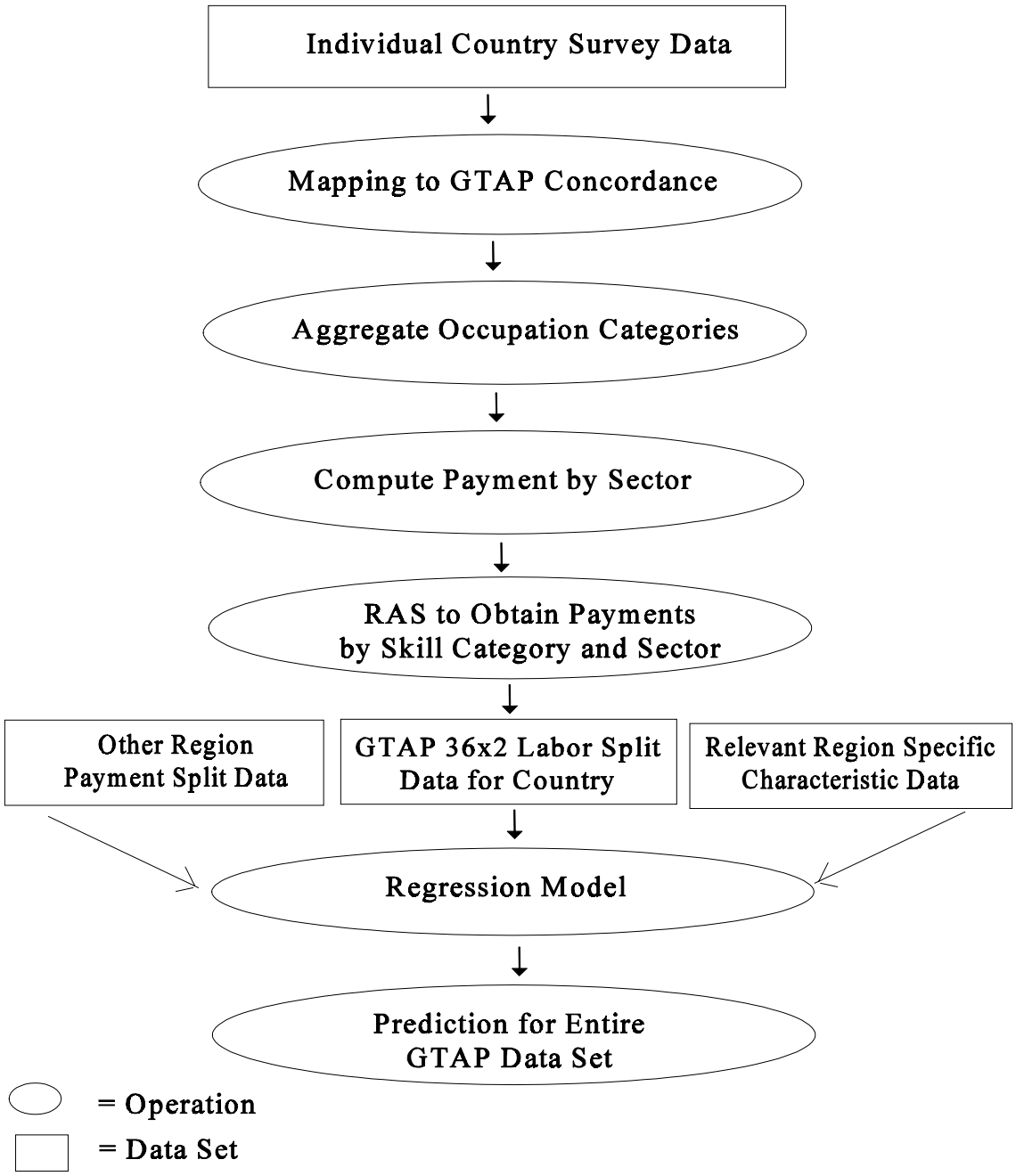

Table 1. Alternative Classification of Workers Used in this Study

Table 1A. The Classification of Workers by Occupation by the ILO

Professional workers (Skilled Labor)
1. Managers and Administrators (including farm managers)
2. Professionals
3. Para-professionals

Production workers (Unskilled Labor)
4. Tradespersons
5. Clerks
6. Salespersons and Personal Service Workers
7. Plant and Machine Operators, and Drivers
8. Laborers and Related Workers
9. Farm Workers

Table 1B. The Classification of Workers by Occupation in India

Professional workers (High-Skilled Labor)
0-1. Professional, Technical, and Related Workers
2. Administrative, Executive, & Managerial Workers

Production workers (Low-Skilled Labor)
3. Clerical & Related Workers
4. Sales Workers
5. Service Workers
6. Farmers, Fishermen, & Related Workers
7 -8-9. Production & Related Workers, Transport Equipment Operators, & Laborers
X. Workers not Classified by Occupation

Table 1C The Classification of Workers by Occupation According to Union Bank of Switzerland

High-skilled
Managers
Engineers

Low-skilled
Teachers
Drivers
Mechanics
Building Laborers
Industrial Workers
Cooks
Clerks
Secretaries

Table 2. GTAP V.3 Sectoral Classification and Associated Mappings

Table 2A: GTAP V.3 Labor Using Sectors*

No	Description	No	Description
1	Paddy Rice	19	Wearing Apparels
2	Wheat	20	Leather etc.
3	Grains	21	Lumber
4	Non Grain Crops	22	Pulp Paper etc.
5	Wool	23	Petroleum And Coal
6	Other Livestock	24	Chemicals Rubbers & Plastics
7	Forestry	25	Nonmetallic Minerals
8	Fisheries	26	Primary Ferrous Metals
9	Coal	27	Nonferrous Metals
10	Oil	28	Fabricated Metal Products
11	Gas	29	Transport Industries
12	Other Minerals	30	Machinery And Equipment
13	Processed Rice	31	Other Manufacturing
14	Meat Products	32	Electricity Water And Gas
15	Milk Products	33	Construction
16	Other Food Products	34	Trade And Transport
17	Beverages &Tobacco	35	Other Services (Private)
18	Textiles	36	Other Services (Govt.)

Source: GTAP version 3.

* Note that this table omits sector number 37: Ownership of Dwelling, which uses no labor.

Table 2B. Industry Mapping for Hong Kong Data Base

Industry Classification in Hong Kong	GTAP Match
Manufacturing	
Food, beverage and tobacco	13~17
Textile	18
Wearing apparel except footwear	19
Footwear and leather products	20
Wood and wood products	21
Paper products, printing, and publishing	22
Chemicals, petroleum, and associated products	23
Rubber and plastic products	24
Basic metal industries and metal products (except machinery)	27,28
Machinery and electronic products	29,30
Professional scientific equipment and photographic, optical goods	29,30
Other manufacturing	25&31
Construction	33
Wholesale, retail and import/export trades	34
Restaurants and hotel	35
Transportation and related services	34
Storage and warehouse	34
Communication	34
Financing, insurance, real estate and business services	35
Community and social services	36
Recreational and cultural services	35
Personal and household services	35
Agriculture	1-7
Fishing	8
Mining and quarrying	9-12
Electricity, gas and water	32
Unclassifiable	0 (discarded)

Note: The GTAP match is based upon table 3, Splitting labor by Occupation in GTAP by Tyers: For GTAP 37 sectors description, see GTAP version 3 documents.

Table 2C: Industry Mapping for Indian Data Base

Industry Classification in India	GTAP Match
Agriculture, Forestry, Fishing and Hunting	1-14
Mining and Quarrying	15-18
Manufacturing	19-45
Construction	46
Trade and Commerce	47
Transport, Storage and Communication	47
Other Services	48-49

Table 2D. Industry Mapping for ILO Data Base

Industry Classification in India	GTAP Version 4 Classification
Agriculture, hunting forestry & fishing	1-14
Mining and quarrying	15-18
Manufacturing	19-42
Electricity, gas and water	43-45
Construction	46
Wholesale/retail trade, restaurant and hotels	47
Transport, storage and communications	47
Financing, insurance., real estate and business services.	48-49
Community, social and personal services	48-49
Not adequate, described	
Unemployed persons not previously employed	
Unemployed persons previously employed	
Total	

Table 3. Working Population by Industry and Occupation

	Skilled Labor Occupation			Skilled	Unskilled	
Industry	Manager	Professional	ASPF*	Total	Total	Total
Food, Beverage & Tobacco	2330	300	1595	4225	22719	26944
Textiles	6585	204	3099	9888	59222	69110
Apparel	17325	413	10298	28036	208617	236653
Footwear & leather Prod	2778	22	895	3695	14514	18209
wood prod	1342	28	185	1555	11422	12977
Paper prod & printing	8033	428	4081	12542	45489	58031
Chemicals, petroleum, and coal	2687	402	1928	5017	9715	14732
rubber & plastic products	8608	211	2869	11688	47320	59008
metal industry	7742	236	2081	10059	57229	67288
Mach & electronic products	15387	5355	15344	36086	109781	145867
Scientific equipment, etc.	2715	170	1825	4710	20430	25140
Other manufacture	3800	166	1914	5880	28282	34162
Construction	8610	4128	10487	23225	164626	187851
Wholesale trade	12957	485	8307	21749	33661	55410
Retail trade	26866	771	10781	38418	180219	218637
Int'l trade	38300	1596	13934	53830	66878	120708
Restaurants & hotel	15141	241	3961	19343	197288	216631
Transportation, storage, etc.	15985	3913	12790	32688	232998	265686
Finance, insurance etc.	36066	24535	66837	127438	159730	287168
Community &social service	6355	46923	90893	144171	175864	320035
Recreational & cultural service	3484	5804	7752	17040	26643	43683
Personal & household service	4289	240	4247	8776	166629	175405
Agriculture	405	86	223	714	14498	15212
Fishing	342	8	18	368	11689	12057
Mining & quarrying	42	14	30	86	796	882
Electricity, gas & water	399	1720	2578	4697	13767	18464
Unclassified	674	932	957	2563	6590	9153

*: ASPF = associate professional

Source: Hong Kong 1991 Population Census table c9, edited by author.

Table 4. Working Population by Occupation and Income Distribution

Monthly Income (HK $)	Manager	Professional	ASPF	Skilled	Unskilled	Total
Under $1000	10846	1872	4734	17452	73732	91184
$1000~1999	0	237	1032	1269	90162	91431
$2000~3999	9317	1582	17645	28544	528822	557366
$4000~5999	21175	3562	51819	76556	718406	794962
$6000~7999	26856	7778	51516	86150	374853	461003
$8000~9999	24341	9794	42834	76969	144557	221526
$10000~14999	57797	24640	61614	144051	98945	242996
$15000~19999	28506	12983	25219	66708	17446	84154
$20000~20999	31086	14419	14173	59678	7539	67217
$30000 +	34908	22402	8352	65662	4082	69744
unpaid family works	4415	62	971	5448	28072	33520
TOTAL	249247	99331	279909	628487	2086616	2715103

*: ASPF = associate professional

Source: Hong Kong 1991 Population Census table c18, edited by author.

Table 5. Working Population by Industry, Sex and Income Level (HK$ / Month)

Industry\sex and wage distribution	Sex	<$1000	<$2000	<$4000	<$6000	<$8000	<$10000	<$15000	<$20000	<$30000	$30000+	Unpaid	Total
manufacturing	M	14996	9364	75401	145647	89679	38705	38751	12206	10798	9901	1228	446676
	F	15779	29084	130144	93133	25239	8844	7946	2302	1623	1316	6035	321445
construction	M	12008	6093	28562	45777	40688	19234	14995	3871	2617	2615	169	176629
	F	453	448	2480	3421	1768	783	820	233	175	131	510	11222
trade & sales	M	10874	5851	49922	113891	78275	32602	34617	12498	11495	9965	3693	363683
	F	9119	9331	63776	89090	32921	11988	11425	3101	2425	1811	12716	247703
Transportation	M	4636	2825	25761	75240	57841	22939	18417	5409	4003	3669	234	20974
etc.	F	1108	785	6701	17152	8743	3899	3633	1026	643	358	664	44712
Financial Services	M	3496	1093	21062	39471	28773	17306	23250	10218	10436	16394	119	171618
	F	2190	869	12537	39441	23159	12876	12964	4452	3274	3081	707	11555
Communication	M	5347	8176	34677	59630	42507	30474	41511	15226	11726	15173	374	264821
& Social services	F	6930	14667	97322	60446	22703	17945	30383	11918	6602	3845	1541	274302
Agricultural	M	1294	889	2320	2698	1260	432	452	160	135	59	555	10254
	F	901	625	964	564	150	37	86	17	8	7	1599	4958
Fishing	M	863	542	1800	1835	815	276	469	138	228	165	1396	8527
	F	385	273	567	291	99	9	102	14	32	12	1746	3530
Mining &	M	8	7	76	204	238	144	57	9	30	17	0	790
Quarrying	F	8	0	7	45	25	7	0	0	0	0	0	92
electricity &	M	182	118	1032	4098	4291	2004	2097	1030	623	935	0	16410
Water	F	14	8	247	687	486	282	213	60	32	25	0	2054
Unclassified	M	405	226	1244	1431	935	533	598	179	203	180	50	5984
	F	188	157	764	770	408	207	210	87	109	85	184	3169

Source: Hong Kong 1991 Population Census table c19, edited by author.

Table 6. The Hong Kong Labor Split Data and RAS Outcomes (initial matrix and row and column)

	Initial Matrix			Results: RASed Matrix		Share of Labor Payment	
GTAP Sector No.	Skill Labor Payment	Unskilled Labor Payment	Target Industry Sum	Skilled labor Payment	Unskilled Labor Payment	Skill Labor	Unskilled Labor
0 Total	37496.9	35409.98	68618.9	34621	33998	0.505	0.495
1~7 Total	10445.88	77901.95	60647.5	6927	53720	0.114	0.886
8 Total	5383.87	62808.38	53177.4	4050	49128	0.076	0.924
9~12 Total	1258.187	4277.138	7102.3	1566	5536	0.221	0.779
13~17 Total	61812.09	122075.8	176995.6	57962	119034	0.327	0.673
18 Total	144662.2	318216.9	430371.2	130915	299456	0.304	0.696
19 Total	410168.9	1120959	1216257	316600	899700	0.260	0.740
20 Total	54058.15	77987.92	113215.9	45283	67933	0.400	0.600
21 Total	22749.78	61373.71	74937.6	19693	55245	0.263	0.737
22 Total	183490.5	244425.5	397459.1	166636	230823	0.419	0.581
23 Total	73399.12	52201.5	138528.5	79635	58894	0.575	0.425
24 Total	170996.4	254264	379243.7	148943	230300	0.393	0.607
25 & 31 Total	86024.88	151967.4	236041.5	83202	152839	0.352	0.648
26~28 Total	147164	307508	404391.6	127454	276938	0.315	0.685
29~30 Total	596848.8	699661.4	1210644.8	545600	665100	0.451	0.549
32 Total	68717.49	73974.07	189645.8	89481	100165	0.472	0.528
33 Total	339783.6	884583.1	1299118.8	350400	948700	0.270	0.730
34 Total	2146013	2760560	4971793	2127000	2845000	0.428	0.572
35 Total	2525108	2956867	5474698.8	2469000	3006000	0.451	0.549
36 Total	2109233	944968.1	3503917.7	2390000	1114000	0.682	0.318
Total	9194815.6	11211991.1	20406806.7	9195000	11210000	0.451	0.549
Target Occupation Sum	9194815.6	11211991.1					

Note: 0 is the industry classed as ‘unclassified’ in the original Hong Kong stat and is discarded after RAS procedure.

Table 7. The Skilled Labor Payment Shares for Hong Kong

1	Paddy Rice	0.114	19	Wearing Apparels	.260
2	Wheat	0.114	20	Leather etc.	.400
3	Grains	0.114	21	Lumber	.263
4	Non Grain Crops	0.114	22	Pulp Paper etc.	.419
5	Wool	0.114	23	Petroleum And Coal	.575
6	Other Livestock	0.114	24	Chemicals Rubbers & Plastics	.393
7	Forestry	0.114	25	Nonmetallic Minerals	.393
8	Fisheries	0.076	26	Primary Ferrous Metals	.315
9	Coal	0.221	27	Nonferrous Metals	.315
10	Oil	0.221	28	Fabricated Metal Products	.315
11	Gas	0.221	29	Transport Industries	.451
12	Other Minerals	0.221	30	Machinery And Equipment	.451
13	Processed Rice	0.327	31	Other Manufacturing	.352
14	Meat Products	0.327	32	Electricity Water And Gas	.472
15	Milk Products	0.327	33	Construction	.270
16	Other Food Products	0.327	34	Trade And Transport	.425
17	Beverages &Tobacco	0.327	35	Other Services (Private)	.451
18	Textiles	0.304	36	Other Services (Govt.)	.682
				Ownership of Dwellings	n.a.

Note: The unskilled labor payment share is one minus skilled labor share.

Table 8. Summary of 14 Samples of Labor Payment Split

Region	Year	Reference	Skilled Labor Definition Basis	Sector Disaggregation	Special Feature
USA	1992	92 CPS	Occupation	Quite Detailed	/
CAN	1986	86 Census	Occupation	Not Available	Impose USA Pattern [1]
AUS	1991	ORANI	Occupation	Quite Detailed	/
EU	1988	Eurostat	Manual / non-manual but adjusted	Detailed	Impose Australia pattern[1&2]
Japan	1970 & 1992	Japan Wage Survey	Male professional workers	No Agriculture sector data	/
Taiwan	1979 & 1990	DG-budget & Dept. of Agriculture & Forestry	Occupation	Quite Detailed	See note 3
South Korea	1991	Korea National Statistical	Office workers	No Agricultural sector data	Impose Taiwan 1992 pattern[1&2]
Brazil	1992	ILO	Occupation	Very rough	/
Indonesia	1992	Sakarnas Survey	Wage & education Level	Rough	/
Philippines	1986	APEX model	Workers finishing high School education	Rough for manufacture & agriculture sectors	See note 4
Thailand	1985	PARA CGE Model	Employee based on Term of length	Rough for manufacture & agriculture sectors	See note 4
Hong Kong	1991	1991 CPS	Occupation	Rough for Agriculture	RAS
India	1981	1981 census	Occupation	Rough for all sectors	RAS

Source: see appendix for details in all regions excepting Hong Kong and India. These are discussed in more detail in the body of the paper.

Note: (1) these regions assume structural similarities between themselves and others with available data for payment distribution across occupation & industry

(2) ILO and Bank of Switzerland data are used for adjustment in some aspects.

(3) Taiwan data used different sources for agriculture & other sectors.

(4) Serious overestimation of skill labor payment share.

Table 9. The Skilled Labor Payment Shares: Actual Data

YEAR	1970	1979	1985	1986	1986	1988	1990	1991	1991	1991	1992	1992	1992	1992
Sector\Region	JPN	TWN	THA	PHL	CAN	EU	TWN	AUS	KOR	HKG	USA	JPN	IDN	BRA
1	.	0.132	0.011	0.08	.	0.368	0.213	0.348	0.213	0.114	0.371	.	0.028	0.224
2	.	0.132	0.011	0.081	0.195	0.364	0.213	0.348	0.213	0.114	0.371	.	.	0.224
3	.	0.132	0.022	0.08	0.195	0.367	0.213	0.348	0.213	0.114	0.371	.	0.028	0.224
4	.	0.132	0.011	0.08	0.195	0.316	0.213	0.348	0.213	0.114	0.371	.	0.047	0.224
5	.	0.132	0.011	0.172	.	0.394	0.213	0.348	0.213	0.114	0.465	.	.	0.224
6	.	0.132	0.022	0.101	0.208	0.402	0.213	0.348	0.213	0.114	0.465	.	0.033	0.224
7	.	0.132	0.356	0.121	0.193	0.209	0.213	0.305	0.213	0.114	0.397	.	0.047	0.224
8	.	0.132	0.504	0.081	0.204	0.397	0.213	0.191	0.213	0.076	0.446	.	0.033	0.224
9	0.14	0.085	0.399	0.461	0.268	0.295	0.087	0.192	0.145	0.221	0.141	0.41	0.261	.
10	0.14	0.202	0.399	0.461	0.268	0.665	0.244	0.398	.	0.221	0.431	0.41	0.261	.
11	0.14	0.202	.	0.461	0.268	0.665	0.244	0.398	.	0.221	0.431	0.41	.	.
12	0.14	0.125	0.399	0.461	0.268	0.323	0.218	0.239	0.152	0.221	0.283	0.41	0.261	.
13	0.221	0.276	0.675	0.468	0.18	0.279	0.234	0.253	0.268	0.327	0.239	0.31	0.115	0.141
14	0.221	0.229	0.675	0.468	0.18	0.263	0.245	0.253	0.243	0.327	0.141	0.31	0.115	0.141
15	0.221	0.233	0.675	0.468	0.18	0.248	0.212	0.253	0.202	0.327	0.141	0.31	0.115	0.141
16	0.221	0.323	0.675	0.468	0.18	0.239	0.343	0.253	0.254	0.327	0.271	0.31	0.115	0.141
17	0.224	0.209	0.675	0.468	0.182	0.269	0.187	0.253	0.213	0.327	0.324	0.39	0.115	0.141
18	0.129	0.154	0.55	0.415	0.119	0.211	0.242	0.273	0.163	0.304	0.178	0.272	0.155	0.141
19	0.175	0.105	0.55	0.415	0.161	0.178	0.144	0.274	0.162	0.26	0.216	0.153	.	0.141
20	0.175	0.092	0.55	0.415	0.145	0.195	0.179	0.274	0.124	0.4	0.2	0.153	0.155	0.141
21	0.2	0.138	0.356	0.448	0.151	0.194	0.214	0.194	0.174	0.263	0.226	0.351	0.117	0.141
22	0.206	0.195	0.586	0.448	0.3	0.301	0.199	0.295	0.296	0.419	0.355	0.415	0.239	0.141
23	0.248	0.23	0.675	0.55	0.271	0.548	0.204	0.454	0.201	0.575	0.356	0.376	0.239	0.141
24	0.231	0.235	0.675	0.55	0.352	0.37	0.262	0.397	0.281	0.393	0.439	0.37	0.239	0.141
25	0.141	0.17	0.675	0.487	0.19	0.25	0.212	0.248	0.21	0.352	0.252	0.378	0.239	0.141
26	0.177	0.172	0.399	0.464	0.165	0.269	0.172	0.289	0.206	0.315	0.206	0.368	0.239	0.141
27	0.155	0.209	0.675	0.464	0.165	0.248	0.23	0.289	0.224	0.315	0.244	0.378	0.239	0.141
28	0.178	0.173	0.399	0.505	0.208	0.248	0.221	0.258	0.221	0.315	0.278	0.361	0.239	0.141
29	0.128	0.217	0.687	0.505	0.302	0.283	0.268	0.245	0.231	0.451	0.387	0.4	0.239	0.141
30	0.199	0.247	0.489	0.505	0.37	0.38	0.322	0.39	0.269	0.451	0.478	0.382	0.239	0.141
31	0.227	0.147	0.518	0.433	0.207	0.237	0.226	0.263	0.185	0.352	0.285	0.345	0.065	0.141
32	0.263	0.381	0.897	0.554	0.257	0.574	0.391	0.365	0.152	0.472	0.332	0.417	0.493	0.239
33	0.292	0.117	0.81	0.427	0.193	0.242	0.216	0.254	0.167	0.27	0.251	0.421	0.154	0.176
34	0.255	0.294	0.576	0.457	0.195	0.27	0.335	0.281	0.206	0.428	0.207	0.387	0.084	0.159
35	0.331	0.365	0.56	0.682	0.381	0.536	0.369	0.483	0.352	0.451	0.628	0.407	0.32	0.529
36	0.303	0.659	0.914	0.82	0.641	0.563	0.775	0.654	0.473	0.682	0.494	0.365	0.553	0.529

Source: see appendix. Note "." missing value.

Table 10. The Pearson Correlation Coefficients of Sample Regions (Actual Data).

YEAR	1970	1979	1985	1986	1986	1988	1990	1991	1991	1991	1992	1992	1992	1992
Sector\Region	JPN	TWN	THA	PHL	CAN	EU	TWN	AUS	KOR	HKG	USA	JPN	IDN	BRA
JPN70	1.00	0.61	0.53	0.58	0.40	0.23	0.54	0.49	0.52	0.57	0.36	0.14	0.21	0.67
TWN	0.61	1.00	0.57	0.65	0.73	0.45	0.93	0.66	0.78	0.72	0.31	0.22	0.67	0.61
THA	0.53	0.57	1.00	0.81	0.30	0.00	0.41	0.04	0.23	0.78	-0.23	0.06	0.58	-0.01
PHL	0.58	0.65	0.81	1.00	0.53	0.17	0.49	0.28	0.39	0.88	-0.09	0.29	0.79	0.17
CAN	0.40	0.73	0.30	0.53	1.00	0.59	0.77	0.78	0.79	0.57	0.64	0.39	0.71	0.70
EU	0.23	0.45	0.00	0.17	0.59	1.00	0.43	0.73	0.48	0.16	0.67	0.48	0.53	0.67
TWN	0.54	0.93	0.41	0.49	0.77	0.43	1.00	0.71	0.76	0.59	0.41	0.17	0.61	0.71
AUS	0.49	0.66	0.04	0.28	0.78	0.73	0.71	1.00	0.71	0.41	0.68	0.20	0.54	0.75
KOR	0.52	0.78	0.23	0.39	0.79	0.48	0.76	0.71	1.00	0.46	0.58	0.25	0.41	0.68
HKG	0.57	0.72	0.78	0.88	0.57	0.16	0.59	0.41	0.46	1.00	0.00	0.08	0.72	0.18
USA	0.36	0.31	-0.23	-0.09	0.64	0.67	0.41	0.68	0.58	0.00	1.00	0.43	0.22	0.68
JPN92	0.14	0.22	0.06	0.29	0.39	0.48	0.17	0.20	0.25	0.08	0.43	1.00	0.39	0.22
IDN	0.21	0.67	0.58	0.79	0.71	0.53	0.61	0.54	0.41	0.72	0.22	0.39	1.00	0.45
BRA	0.67	0.61	-0.01	0.17	0.70	0.67	0.71	0.75	0.68	0.18	0.68	0.22	0.45	1.00

Table 11. The Values of Explanatory Variables for Sample Regions

Region/Yr.	TER	SEC	GDPC	Region/Yr.	TER	SEC	GDPC
JPN70	0.279	3.002	14268	AUS91	0.605	2.346	16848
TWN79	0.173	0.961	4397	KOR91	0.545	1.852	6484
THA85	0.181	0.461	1221	HKG91	0.32	1.863	15812
PHL86	0.69	1.342	759	USA92	1.82	3.108	23268
CAN86	0.835	2.499	19411	JPN92	0.713	3.801	29498
EU88	0.467	1.873	18765	IDN92	0.103	0.595	695
TWN90	0.514	1.778	8831	BRA92	0.291	0.333	2663

Note: For education data, HKG uses SGP data and TWN uses Korea data

Table 12. The Values of Explanatory Variables for 30 GTAP Regions at 1992

Region/Var.	TER	SEC	GDPC	Region/Var.	TER	SEC	GDPC
AUS	0.628	2.399	17087	USA	1.82	3.108	23268
NZL	0.628	2.399	11869	MEX	0.366	0.979	3797
JPN	0.713	3.801	29498	CAM	0.262	0.848	1619
KOR	0.576	1.926	7045	ARG	0.722	0.474	6869
IDN	0.103	0.595	695	BRA	0.291	0.333	2663
MYS	0.107	1.735	3123	CHL	0.405	0.836	3146
PHL	0.845	1.693	835	RSM	0.479	1.032	1689
SGP	0.333	1.863	17581	E_U	0.566	2.104	20377
THA	0.297	0.616	1953	EU3	0.698	2.743	25134
CHN	0.035	0.921	359	EFT	0.537	2.382	31335
HKG	0.333	1.863	16694	CEA	0.537	2.382	2124
WN	0.576	1.926	9932	FSU	0.537	2.382	2142
IDI	0.14	1.102	275	MEA	0.301	0.925	2273
RAS	0.13	0.878	319	SSA	0.031	0.345	563
CAN	1.12	3.046	19815	ROW	0.136	1.344	1204

Note: For education data, NZL uses AUS data; HKG uses SGP data; TWN uses Korea data; CEA and FSU use EFT data.

Table 13 The overall fit of the regression: R-Square values for different models across GTAP Sectors w**ith** and **without** Philippines and Thailand data. Please note that these models include both tertiary and secondary education data as independent variables

Model/ Sector	Non-transformed (1)		Semilog-transformed (2)		Total-log-transformed (3)	
	With	Without	With	Without	With	Without
1	.6687	.606	.7445	.6796	.7894	.7590
2	.5408	.4166	.6348	.4154	.6947	.4887
3	.5977	.5180	.6972	.6193	.7212	.6616
4	.6004	.5409	.7040	.6283	.7208	.6887
5	.7087	.6908	.7168	.6716	.8171	.7565
6	.6851	.6462	.7447	.6969	.7262	.6834
7	.3935	.6941	.4627	.7609	.4681	.8213
8	.3719	.6320	.3786	.7113	.3150	.6399
9	.0201	.5776	.2657	.2049	.2034	.0772
10	.3059	.5292	.1491	.2378	.3197	.3344
11	.2977	.5993	.1435	.4878	.2950	.5832
12	.0941	.6260	.2787	.2373	.3375	.1759
13	.0484	.3565	.1088	.5496	.1251	.5678
14	.0758	.5493	.1463	.7238	.1339	.6219
15	.0694	.6561	.1523	.7559	.1344	.7301
16	.0705	.1648	.1047	.3361	.1273	.3486
17	.0157	.7187	.1193	.6482	.1097	.6327
18	.0587	.3111	.1555	.2367	.1781	.2178
19	.1667	.1733	.4113	.3738	.3950	.3019
20	.0712	.1815	.1248	.2024	.1433	.2003
21	.0855	.6667	.3113	.6049	.3249	.5127
22	.0326	.5881	.1299	.4334	.1254	.4393
23	.0699	.6039	.0067	.3892	.0263	.4261
24	.0895	.7111	.1755	.6220	.2092	.6121
25	.0391	.4556	.2053	.2056	.1996	.1984
26	.0057	.5736	.2709	.2807	.2685	.2580
27	.0428	.3718	.2048	.2101	.1932	.2096
28	.0662	.5192	.3735	.3583	.4326	.3377
29	.0731	.5205	.1485	.3214	.1531	.2875
30	.2430	.6752	.2521	.5925	.3101	.5414
31	.0302	.7168	.094	.7727	.1306	.7760
32	.1830	.4326	.1875	.0547	.1936	.1716
33	.0078	.8065	.1351	.7262	.0819	.5246
34	.0221	.4394	.0478	.6152	.0349	.6203
35	.4409	.7316	.4436	.6628	.5542	.6446
36	.3792	.3072	.3790	.4563	.2966	.0936
Average	.213	.536	.295	.486	.314	.471

Note: (1) $Mhp=a_0+a_1SEC+a_2TER+a_3GDPC$
$Mhp = a_0+a_1SEC+a_2TER+a_3 \log(GDPC)$
$Mhp = a_0+a_1 \log(SEC)+a_2 \log (TER)+a_3 \log(GDPC)$

Table 14 T-ratios associated with the Secondary Education Variable in three models

Sector	<1>	<2> Model	<3>		<1>	<2> Model	<3>
1	-0.7646	-0.4915	-0.3676	19	-0.7742	-0.3059	-0.5609
2	-0.6392	-0.5570	-0.4330	20	-0.4787	-0.5179	-0.7412
3	-0.7027	-0.3769	-0.3661	21	+0.5293	+0.1671	+0.6188
4	-0.7897	-0.4324	-0.3918	22	-0.6611	+0.4922	+0.5883
5	-0.5417	-0.4748	-0.2799	23	-0.1073	-0.5250	+0.7846
6	-0.5176	-0.3306	-0.4419	24	-0.4159	-0.9974	+0.3618
7	+0.9255	-0.3281	-0.3197	25	-0.4417	+0.5226	+0.6032
8	-0.3251	-0.1487	-0.3711	26	-0.5593	+0.3480	+0.5510
9	-0.3230	+0.3115	+0.7855	27	-0.7099	+0.4306	+0.4726
10	-0.0693	-0.5303	-0.3154	28	-0.7443	+0.2882	+0.3206
11	-0.1026	-0.2013	-0.1133	29	-0.2646	-0.9723	+0.7406
12	-0.1760	+0.4932	-0.9223	30	-0.2589	-0.6458	+0.5773
13	+0.8476	-0.7873	+0.8476	31	+0.9260	+0.7653	-0.9457
14	+0.7554	+0.9875	+0.9371	32	-0.0924	-0.8179	-0.9753
15	+0.9573	+0.8910	-0.8705	33	+0.2542	+0.0297	+0.5396
16	+0.6319	-0.7610	+0.7511	34	+0.9273	-0.8221	-0.7549
17	-0.9876	+0.4516	+0.7387	35	-0.0127	-0.0345	-0.0289
18	-0.5281	-0.8599	-0.9267	36	-0.1483	-0.0350	-0.4398

Note: (1) $Mhp=a_0+a_1SEC+a_2TER+a_3GDPC$
$Mhp = a_0+a_1SEC+a_2TER+a_3 \log(GDPC)$
$Mhp = a_0+a_1 \log(SEC)+a_2 \log (TER)+a_3 \log(GDPC)$

Table 15 The overall fit of regression: R-Square values for different models across GTAP sectors w**ith** and **without** secondary education variables (exclude Philippines and Thailand data)

Model/ Sector	Non-transformed (1)		Semilog-transformed (2)		Total-log-transformed (3)	
	With	**Without**	**With**	**Without**	**With**	**Without**
1	.606	.5983	.6796	.6443	.7590	.7118
2	.4166	.3876	.4154	.3691	.4887	.4144
3	.5180	.5051	.6193	.5615	.6616	.6077
4	.5409	.5349	.6283	.5844	.6887	.6446
5	.6908	.6564	.6716	.6207	.7565	.6616
6	.6462	.6183	.6969	.6403	.6834	.6476
7	.6941	.6937	.7609	.7158	.8213	.7863
8	.6320	.5616	.7113	.5792	.6399	.5838
9	.5776	.5095	.2049	.0697	.0772	.0666
10	.5292	.2606	.2378	.1815	.3344	.2013
11	.5993	.2805	.4878	.2663	.5832	.2767
12	.6260	.5049	.2373	.1804	.1759	.1747
13	.3565	.3534	.5496	.5452	.5678	.5656
14	.5493	.5434	.7238	.7237	.6219	.6216
15	.6561	.6560	.7559	.7553	.7301	.7292
16	.1648	.1389	.3361	.3279	.3486	.3399
17	.7187	.7187	.6482	.6207	.6327	.6272
18	.3111	.2737	.2367	.2335	.2178	.2159
19	.1733	.1628	.3738	.2647	.3019	.2648
20	.1815	.1250	.2024	.1568	.2003	.1886
21	.6667	.6487	.6049	.4908	.5127	.4964
22	.5881	.5775	.4334	.3967	.4393	.3810
23	.6039	.4409	.3892	.3555	.4261	.4204
24	.7111	.6845	.6220	.6220	.6121	.5667
25	.4556	.4110	.2056	.1613	.1984	.1691
26	.5736	.5161	.2807	.1914	.2580	.2221
27	.3718	.3606	.2101	.1421	.2096	.1535
28	.5192	.5123	.3583	.2545	.3377	.2449
29	.5205	.4343	.3214	.3213	.2875	.2771
30	.6752	.6152	.5925	.5809	.5414	.5221
31	.7168	.7164	.7727	.7700	.7760	.7758
32	.4326	.1736	.0547	.048	.1716	.1715
33	.8065	.7699	.7262	.4876	.5246	.5002
34	.4394	.4387	.6152	.6126	.6203	.6153
35	.7316	.3893	.6628	.3902	.6446	.3308
36	.3072	.0856	.4563	.0195	.0936	.0187
Average	0.536	0.468	0.486	0.413	0.471	0.422

Note: In doing the regression, we also try the transformation of TMHP=MHP/(1-MHP) as dependant variable. The results are not significantly improved, so we choose non-transformation model to maintain the simplicity

(1) $MHP = a_0 + a_1 TER + a_2 GDPC$

(2) $MHP = a_0 + a_1 TER + a_2 \log(GDPC)$

(3) $MHP = a_0 + a_1 \log(TER) + a_2 \log(GDPC)$

Table 16 The regression coefficients of non-transformed model (MHP = f(TER, GDPC)) For v3 GTAP database.

Sector	Constant	Tertiary(1)	GDPC(2)	Sector	Constant	Tertiary(1)	GDPC(2)
MHP1_8	0.0147	0.0246	0.0006	MHP23	0.2057	-0.1139	0.0133**
MHP9	0.1223	-0.1173	0.0104**	MHP24	0.1939	0.0484	0.0066**
MHP10	0.1865	0.0308	0.0079	MHP25	0.1702	-0.0449	0.0065**
MHP11	0.1385	0.0267	0.0105	MHP26	0.1757	-0.0845*	0.0073**
MHP12	0.1421	-0.0156	0.0074**	MHP27	0.1859	-0.0472	0.0057
MHP13	0.1906	-0.0470	0.0054**	MHP28	0.1732	-0.0190	0.0055**
MHP14	0.1919	-0.1116**	0.0069**	MHP29	0.1738	0.0283	0.0063
MHP15	0.1806	-0.1179**	0.0075**	MHP30	0.1966	0.0676	0.0066
MHP16	0.2090	-0.0142	0.0035	MHP31	0.1208	-0.0254	0.0087**
MHP17	0.1351	-0.0155	0.0082**	MHP32	0.3449	-0.1285	0.0065
MHP18	0.1609	-0.0541	0.0048	MHP33	0.1385	-0.0683	0.0096**
MHP19	0.1419	0.0081	0.0022	MHP34	0.2004	-0.1195	0.0093**
MHP20	0.1541	-0.0418	0.0041	MHP35	0.3551	0.1314*	0.0001
MHP21	0.1264	-0.0374	0.0068**	MHP36	0.6118	0.0300	-0.0053
MHP22	0.1803	-0.0073	0.0077**				

Note: (1) Tertiary data is measured as the years of tertiary education of average people
(2) The unit of GDPC data is thousand US dollar.
(3) India data is not included.

Table 17 Pearson Correlation Coefficients of the Predicted Data and Actual Data

Year	1970	1979	1986	1988	1990	1991
Region	JPN	TWN	CAN	EU	TWN	AUS
Correlation Coef.	0.601	0.944	0.891	0.755	0.901	0.877
Year	1991	1991	1992	1992	1992	1992
Region	KOR	HKG	USA	JPN	IDN	BRA
Correlation Coef.	0.837	0.815	0.987	0.719	0.803	0.786

Table 18 The Result of Skilled Labor Payment Share for GTAP Version three

Sector/ Region	AUS	NZL	JPN	KOR	IDN	MYS	PHL	SGP	THA	CHN
1	0.348	0.238	0.393	0.213	0.110	0.131	0.157	0.268	0.133	0.103
2	0.348	0.238	0.312	0.213	0.156	0.165	0.213	0.237	0.175	0.149
3	0.348	0.226	0.346	0.213	0.116	0.132	0.170	0.242	0.138	0.109
4	0.348	0.224	0.312	0.213	0.124	0.135	0.194	0.222	0.148	0.116
5	0.348	0.266	0.390	0.213	0.130	0.146	0.220	0.267	0.161	0.119
6	0.348	0.244	0.369	0.213	0.106	0.122	0.199	0.244	0.138	0.095
7	0.305	0.215	0.232	0.213	0.127	0.128	0.248	0.167	0.159	0.115
8	0.191	0.223	0.286	0.213	0.108	0.116	0.227	0.192	0.143	0.096
9	0.192	0.172	0.410	0.145	0.117	0.142	0.032	0.266	0.108	0.122
10	0.398	0.299	0.410	0.260	0.195	0.214	0.219	0.335	0.211	0.190
11	0.398	0.279	0.410	0.228	0.149	0.174	0.170	0.331	0.167	0.143
12	0.239	0.221	0.410	0.152	0.146	0.164	0.135	0.268	0.152	0.144
13	0.253	0.225	0.310	0.268	0.190	0.202	0.155	0.270	0.187	0.191
14	0.253	0.204	0.310	0.243	0.185	0.201	0.103	0.276	0.172	0.190
15	0.253	0.195	0.310	0.202	0.174	0.191	0.087	0.273	0.160	0.179
16	0.253	0.242	0.310	0.254	0.210	0.218	0.200	0.266	0.212	0.210
17	0.253	0.222	0.390	0.213	0.139	0.159	0.129	0.274	0.146	0.138
18	0.273	0.184	0.272	0.163	0.159	0.170	0.119	0.227	0.154	0.161
19	0.274	0.173	0.153	0.162	0.144	0.150	0.151	0.184	0.149	0.143
20	0.274	0.177	0.153	0.124	0.153	0.162	0.122	0.213	0.150	0.154
21	0.194	0.184	0.351	0.174	0.127	0.144	0.100	0.234	0.129	0.128
22	0.295	0.268	0.415	0.296	0.185	0.204	0.181	0.314	0.193	0.183
23	0.454	0.292	0.376	0.201	0.203	0.235	0.120	0.401	0.198	0.206
24	0.397	0.303	0.370	0.281	0.203	0.220	0.240	0.326	0.221	0.198
25	0.248	0.219	0.378	0.210	0.170	0.186	0.138	0.269	0.169	0.171
26	0.289	0.209	0.368	0.206	0.172	0.189	0.110	0.276	0.165	0.175
27	0.289	0.224	0.378	0.224	0.185	0.199	0.151	0.271	0.183	0.186
28	0.258	0.227	0.361	0.221	0.175	0.188	0.162	0.264	0.178	0.174
29	0.245	0.267	0.400	0.231	0.181	0.197	0.203	0.294	0.195	0.177
30	0.390	0.317	0.382	0.269	0.208	0.224	0.259	0.335	0.229	0.201
31	0.263	0.208	0.345	0.185	0.124	0.145	0.107	0.265	0.130	0.123
32	0.365	0.342	0.417	0.152	0.336	0.352	0.242	0.417	0.320	0.343
33	0.254	0.210	0.421	0.167	0.138	0.161	0.089	0.285	0.137	0.140
34	0.281	0.235	0.387	0.206	0.195	0.217	0.107	0.324	0.183	0.200
35	0.483	0.439	0.407	0.352	0.369	0.369	0.466	0.400	0.394	0.360
36	0.654	0.568	0.365	0.473	0.611	0.599	0.633	0.529	0.610	0.611

Table 18 The Result of Skilled Labor Payment Share for GTAP Version three (Cont'd)

Sector\ Region	HKG	TWN	IDI	RAS	CAN	USA	MEX	CAM	ARG	BRA
1	0.114	0.213	0.109	0.108	0.336	0.371	0.153	0.128	0.201	0.138
2	0.114	0.213	0.157	0.156	0.195	0.371	0.188	0.171	0.226	0.177
3	0.114	0.213	0.116	0.115	0.195	0.371	0.155	0.133	0.200	0.142
4	0.114	0.213	0.126	0.125	0.195	0.371	0.163	0.143	0.210	0.150
5	0.114	0.213	0.132	0.131	0.376	0.465	0.182	0.155	0.245	0.165
6	0.114	0.213	0.108	0.107	0.208	0.465	0.159	0.132	0.223	0.142
7	0.114	0.213	0.133	0.131	0.193	0.397	0.170	0.153	0.229	0.158
8	0.076	0.213	0.113	0.111	0.204	0.446	0.159	0.136	0.224	0.144
9	0.221	0.087	0.109	0.110	0.268	0.141	0.119	0.108	0.109	0.116
10	0.221	0.244	0.193	0.193	0.268	0.431	0.228	0.207	0.263	0.216
11	0.221	0.244	0.145	0.145	0.268	0.431	0.188	0.162	0.230	0.174
12	0.221	0.218	0.142	0.142	0.268	0.283	0.165	0.150	0.182	0.157
13	0.327	0.234	0.186	0.186	0.180	0.239	0.194	0.187	0.194	0.191
14	0.327	0.245	0.178	0.180	0.180	0.141	0.177	0.174	0.159	0.178
15	0.327	0.212	0.166	0.168	0.180	0.141	0.166	0.162	0.147	0.166
16	0.327	0.343	0.208	0.208	0.180	0.271	0.217	0.211	0.223	0.214
17	0.327	0.187	0.135	0.136	0.182	0.324	0.160	0.144	0.180	0.152
18	0.304	0.242	0.155	0.155	0.119	0.178	0.159	0.155	0.155	0.158
19	0.260	0.144	0.144	0.144	0.161	0.216	0.153	0.148	0.163	0.150
20	0.400	0.179	0.149	0.150	0.145	0.200	0.154	0.150	0.152	0.153
21	0.263	0.214	0.123	0.124	0.151	0.226	0.139	0.128	0.146	0.134
22	0.419	0.199	0.181	0.182	0.300	0.355	0.207	0.191	0.228	0.199
23	0.575	0.204	0.193	0.195	0.271	0.356	0.214	0.197	0.214	0.208
24	0.393	0.262	0.203	0.202	0.352	0.439	0.237	0.217	0.274	0.226
25	0.352	0.212	0.166	0.166	0.190	0.252	0.178	0.169	0.182	0.174
26	0.315	0.172	0.166	0.167	0.165	0.206	0.172	0.165	0.165	0.171
27	0.315	0.230	0.181	0.182	0.165	0.244	0.190	0.183	0.191	0.187
28	0.315	0.221	0.172	0.172	0.208	0.278	0.187	0.177	0.197	0.182
29	0.451	0.268	0.179	0.179	0.302	0.387	0.208	0.191	0.238	0.199
30	0.451	0.322	0.208	0.207	0.370	0.478	0.246	0.225	0.291	0.234
31	0.352	0.226	0.120	0.120	0.207	0.285	0.145	0.128	0.162	0.137
32	0.472	0.391	0.329	0.330	0.257	0.332	0.323	0.322	0.297	0.325
33	0.270	0.216	0.132	0.133	0.193	0.251	0.150	0.136	0.155	0.144
34	0.428	0.335	0.186	0.188	0.195	0.207	0.192	0.184	0.178	0.190
35	0.451	0.369	0.374	0.372	0.381	0.628	0.404	0.390	0.451	0.394
36	0.682	0.775	0.615	0.614	0.641	0.494	0.603	0.611	0.597	0.606

Table 18 The Result of Skilled Labor Payment Share for GTAP Version three (Cont'd)

Sector\ Region	CHL	RSM	E_U	EU3	EFT	CEA	FSU	MEA	SSA	ROW
1	0.150	0.142	0.368	0.355	0.397	0.149	0.149	0.136	0.104	0.116
2	0.188	0.188	0.364	0.294	0.305	0.194	0.194	0.177	0.150	0.160
3	0.153	0.149	0.367	0.317	0.345	0.156	0.156	0.140	0.110	0.122
4	0.163	0.164	0.316	0.290	0.304	0.171	0.171	0.150	0.117	0.129
5	0.182	0.182	0.394	0.360	0.380	0.192	0.192	0.164	0.120	0.137
6	0.159	0.159	0.402	0.339	0.359	0.169	0.169	0.141	0.096	0.113
7	0.176	0.188	0.209	0.229	0.203	0.198	0.198	0.159	0.115	0.132
8	0.163	0.171	0.397	0.271	0.263	0.181	0.181	0.144	0.096	0.115
9	0.108	0.084	0.295	0.302	0.385	0.081	0.082	0.111	0.125	0.119
10	0.224	0.215	0.665	0.406	0.450	0.220	0.220	0.214	0.192	0.200
11	0.182	0.169	0.665	0.420	0.480	0.175	0.175	0.170	0.145	0.155
12	0.159	0.147	0.323	0.318	0.367	0.150	0.150	0.154	0.146	0.149
13	0.189	0.177	0.279	0.293	0.335	0.177	0.177	0.189	0.192	0.191
14	0.168	0.150	0.263	0.287	0.348	0.147	0.147	0.174	0.192	0.185
15	0.156	0.137	0.248	0.286	0.351	0.133	0.133	0.162	0.181	0.174
16	0.214	0.208	0.239	0.287	0.311	0.209	0.209	0.213	0.211	0.211
17	0.155	0.142	0.269	0.330	0.383	0.144	0.144	0.149	0.139	0.143
18	0.154	0.143	0.211	0.243	0.282	0.142	0.142	0.156	0.162	0.159
19	0.152	0.150	0.178	0.203	0.216	0.151	0.151	0.149	0.143	0.146
20	0.150	0.141	0.195	0.228	0.261	0.140	0.140	0.151	0.155	0.153
21	0.133	0.120	0.194	0.271	0.320	0.121	0.121	0.131	0.129	0.130
22	0.202	0.190	0.301	0.370	0.419	0.193	0.193	0.196	0.184	0.189
23	0.201	0.173	0.548	0.459	0.560	0.173	0.173	0.202	0.210	0.206
24	0.234	0.228	0.370	0.393	0.426	0.234	0.234	0.223	0.199	0.208
25	0.172	0.160	0.250	0.301	0.349	0.160	0.160	0.171	0.172	0.172
26	0.164	0.148	0.269	0.300	0.359	0.146	0.146	0.167	0.177	0.173
27	0.185	0.173	0.248	0.297	0.340	0.173	0.173	0.185	0.188	0.186
28	0.183	0.173	0.248	0.299	0.336	0.175	0.175	0.180	0.176	0.177
29	0.205	0.198	0.283	0.353	0.387	0.202	0.202	0.197	0.178	0.185
30	0.245	0.240	0.380	0.409	0.439	0.247	0.247	0.232	0.202	0.214
31	0.138	0.123	0.237	0.322	0.380	0.126	0.126	0.133	0.125	0.128
32	0.313	0.294	0.574	0.420	0.481	0.290	0.290	0.321	0.345	0.335
33	0.141	0.122	0.242	0.332	0.403	0.122	0.122	0.140	0.142	0.141
34	0.181	0.159	0.270	0.350	0.427	0.156	0.156	0.186	0.202	0.195
35	0.409	0.418	0.536	0.449	0.429	0.426	0.426	0.395	0.359	0.373
36	0.607	0.617	0.563	0.500	0.462	0.617	0.617	0.609	0.610	0.610

Table 19 Economy Wide Skilled Labor Payment Share for 30 GTAP Regions

Region	Weighted Share	Simple Mean	Region	Weighted Share	Simple Mean
AUS	42.4%	31.3%	USA	40.7%	32.4%
NZL	36.4%	24.9%	MEX	30.8%	20.0%
JPN	38.4%	35.0%	CAM	29.0%	18.7%
KOR	28.9%	22.1%	ARG	28.4%	21.9%
IDN	26.8%	18.1%	BRA	34.6%	19.3%
MYS	26.8%	19.6%	CHL	30.1%	19.6%
PHL	26.6%	18.2%	RSM	29.3%	18.7%
SGP	34.8%	28.4%	E_U	40.1%	33.8%
THA	27.3%	18.9%	EU3	38.5%	33.0%
CHN	20.4%	17.9%	EFT	42.4%	36.8%
HKG	42.7%	30.2%	CEA	25.6%	19.0%
TWN	39.8%	24.7%	FSU	32.2%	19.0%
IDI	22.2%	17.9%	MEA	34.0%	19.1%
RAS	23.6%	17.9%	SSA	27.0%	18.0%
CAN	28.7%	24.0%	ROW	30.5%	18.4%

Sources: ILO tables of GTAP version 3 and table 24; edited by author
Note: The global weighted skilled labor payment share is 37.9%

Table 20 Implied Wage Ratio of Skilled to Unskilled for Some v3 GTAP regions

Region	Total	Professions	Manager	Skilled total	Skilled Body Count Share	Payment share (predicted)	S/U Wage Ratio (pred')	Payment share (Actual)	S/U Wage Ratio (Actual)
USA	1.19E+08	20644000	14775000	35419000	29.73%	40.90%	1.64	40.70%	1.62
CAN	13592900	2318000	1702000	4020000	29.57%	34.80%	1.27	28.70%	0.96
MEX	30534083	2958256	562047	3520303	11.53%	30.70%	3.40	/	/
JPN	64360000	7550000	2590000	10140000	15.76%	40.60%	3.65	38.4%	3.33
HKG	2738300	249200	134400	383600	14.01%	33.70%	3.12	42.7%	4.57
KOR	18921000	1570000	328000	1898000	10.03%	32.50%	4.32	28.9%	3.65
SGP	1576151	303711	156017	459728	29.17%	34.50%	1.28	/	/
AUS	7933400	869700	1063600	1933300	24.37%	38.10%	1.91	42.40%	2.28
NZL	1466400	188300	183700	372000	25.37%	36.60%	1.70	/	/
PHL	23917000	1392000	284000	1676000	7.01%	26.70%	4.83	/	/
MYS	6175800	455800	128000	583800	9.45%	26.80%	3.51	/	/
THA	23684480	696361	437695	1134056	4.79%	27.30%	7.47	/	/
IDN	62457138	2151213	97548	2248761	3.60%	26.70%	9.75	/	/
CHN	5.22E+08	26457518	8130787	34588305	6.63%	20.50%	3.63	/	/
BRA	42271526	2773886	679160	3453046	8.17%	34.60%	5.95	/	/
CHl	4773310	379560	177040	556600	11.66%	30.10%	3.26	/	/

Source: ILO, labor92.dat file and table 26 above. Edited by author.
Note: The Canadian IO table neglects to cover most of the public service, which is the most skilled labor intensive sector. This explains the odd outcomes for Canada.

Table 21 Distribution of main workers by industry and occupation in India (*1,000)

Occupational Classification / Industry	0-14	2	High-skilled	Low-skilled	Total
Agriculture, Forestry, Fishing and Hunting	62	1	63	152987	153050
Mining and Quarrying	21	20	41	1237	1278
Manufacturing Household Industry	5	33	38	7673	7711
Manufacturing Other than Household Industry	322	428	750	16687	17437
Trade and Commerce	128	246	374	3346	3720
Transport, Storage and Communication	412	857	1269	18935	20204
Other Services	6094	780	6874	12243	19117
Total	7044	2365	9409	213108	222517

Source: Manpower profile India, Institute of applied manpower research yearbook 1996, table 3.2.15, edited by author

Table 22 Compensation of employees in India (Bln. rupees)

Sectors	1980	1985	1981 est	implied earnings (rupees)
Agriculture, hunting, forestry and fishing	97.27	156.5	109.11	712.9
Mining and quarrying	10.6	18.92	12.26	9596.2
Manufacturing	77.62	156.17	93.33	3711.2
Construction	44.82	96.48	55.15	14825.8
Trade and transport	60.25	127.53	73.7	3648.1
Private and government services	115.41	242.77	140.88	7369.4
Total	405.97	798.37	484.45	2177.1

Source: National Accounts Statistics: Main aggregates and detailed tables, 1993, United Nations, edited by author

Table 23 The India labor split data in 1981 using a wage ratio of 2.37

GTAP Sectors	Skilled	Average Earnings	Unskilled	Average Earnings	Final Matrix Labor Payment		Total Industry Sum	High Skilled Payment Ratio
					skilled	unskilled		
1-14	63	1689	152987	713	0.11	109.00	109.11	0.001
15-18	41	21778	1237	9189	0.89	11.37	12.26	0.073
19-45	788	8434	24360	3558	6.65	86.68	93.33	0.071
46	374	30882	3346	13030	11.55	43.60	55.15	0.209
47	1269	7960	18935	3359	10.10	63.60	73.7	0.137
48-49	6874	11701	12243	4937	80.43	60.45	140.88	0.571
Total	9409	11662	213108	1758	109.73	374.70	484.43	0.227

Source: av. earnings is based on Sectoral based earnings from table 11 and on information from Union Bank of Switzerland (information for Bombay)

Table 24 The regression coefficients of non-transformed model (MHP = f(TER, GDPC)) for v4 GTAP database

Sector	Constant	Tertiary(1)	GDPC(2)	Sector	Constant	Tertiary(1)	GDPC(2)
1	0.0100	0.0255	0.0008	26	0.1207	-0.0142	0.0089**
2	0.0100	0.0255	0.0008	27	0.1415	-0.0523	0.0057**
3	0.0100	0.0255	0.0008	28	0.1212	0.0101	0.0032
4	0.0100	0.0255	0.0008	29	0.1360	-0.0401	0.0050
5	0.0100	0.0255	0.0008	30	0.1144	-0.0363	0.0074**
6	0.0100	0.0255	0.0008	31	0.1554	-0.0050	0.0090**
7	0.0100	0.0255	0.0008	32	0.1771	-0.1113	0.0147**
8	0.0100	0.0255	0.0008	33	0.1648	0.0511	0.0080**
9	0.0100	0.0255	0.0008	34	0.1484	-0.0429	0.0075**
10	0.0100	0.0255	0.0008	35	0.1535	-0.0825	0.0084**
11	0.0100	0.0255	0.0008	36	0.1606	-0.0449	0.0070**
12	0.0100	0.0255	0.0008	37	0.1502	-0.0169	0.0067**
13	0.0100	0.0255	0.0008	38	0.1497	0.0305	0.0075*
14	0.0100	0.0255	0.0008	39	0.1497	0.0305	0.0075*
15	0.1115	-0.1171*	0.0110**	40	0.1665	0.0704	0.0081**
16	0.1507	0.0273	0.0098	41	0.1665	0.0704	0.0081**
17	0.1089	0.0239	0.0121	42	0.1097	-0.0244	0.0092**
18	0.1235	-0.0152	0.0084**	43	0.3449	-0.1285	0.0065
19	0.1666	-0.1092**	0.0081**	44	0.3449	-0.1285	0.0065
20	0.1666	-0.1092**	0.0081**	45	0.3449	-0.1285	0.0065
21	0.1778	-0.0113	0.0050	46	0.1556	-0.0699	0.0088**
22	0.1580	-0.1158**	0.0086**	47	0.1882	-0.1184	0.0099**
23	0.1643	-0.0446	0.0067**	48	0.4014	0.1272	-0.0022
24	0.1778	-0.0113	0.0050	49	0.6021	0.0309	-0.0048
25	0.1778	-0.0113	0.0050	50	N/A	N/A	N/A

Note: (1) Tertiary data is measured as the years of tertiary education of average people
(2) The unit of GDPC data is thousands of US dollar.
(3) India data included.

Table 25 The Results of skill labor payment shares for GTAP Version 4

Region\Sector	pdr	wht	gro	v_f	osd	c_b	pfb	ocr	ctl	oap
AUS	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
NZL	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
JPN	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
KOR	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
IDN	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MYS	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
PHL	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
SGP	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
THA	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
VNM	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
CHN	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
HKG	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
TWN	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
IND	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
LKA	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
RAS	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
CAN	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078	0.078
USA	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
MEX	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
CAM	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
VEN	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
COL	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
RAP	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
ARG	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
BRA	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
CHL	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
URY	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
RSM	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
GBR	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
DEU	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
DNK	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
SWE	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063
FIN	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
REU	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
EFT	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
CEA	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
FSU	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
TUR	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
RME	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
MAR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
RNF	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
SAF	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
RSA	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
RSS	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
ROW	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 25 The Results of skill labor payment shares for GTAP Version 4 (Con'd)

Region\ sector	rmk	wol	for	fsh	col	oil	gas	omn	cmt	omt
AUS	0.052	0.052	0.052	0.052	0.192	0.398	0.398	0.239	0.253	0.253
NZL	0.034	0.034	0.034	0.034	0.165	0.285	0.267	0.212	0.192	0.192
JPN	0.015	0.015	0.015	0.015	0.41	0.41	0.41	0.41	0.31	0.31
KOR	0.005	0.005	0.005	0.005	0.145	0.236	0.208	0.152	0.243	0.243
IDN	0.001	0.001	0.001	0.001	0.261	0.261	0.12	0.261	0.115	0.115
MYS	0.013	0.013	0.013	0.013	0.13	0.184	0.149	0.146	0.177	0.177
PHL	0.009	0.009	0.009	0.009	0.015	0.182	0.139	0.115	0.073	0.073
SGP	0.039	0.039	0.039	0.039	0.266	0.333	0.329	0.265	0.275	0.275
THA	0.001	0.001	0.001	0.001	0.094	0.178	0.14	0.133	0.145	0.145
VNM	0.007	0.007	0.007	0.007	0.105	0.153	0.111	0.122	0.16	0.16
CHN	0.008	0.008	0.008	0.008	0.107	0.155	0.114	0.124	0.162	0.162
HKG	0.058	0.058	0.058	0.058	0.221	0.221	0.221	0.221	0.327	0.327
TWN	0.03	0.03	0.03	0.03	0.087	0.244	0.244	0.218	0.245	0.245
IND	0.009	0.009	0.009	0.009	0.094	0.157	0.116	0.122	0.149	0.149
LKA	0.008	0.008	0.008	0.008	0.104	0.158	0.117	0.125	0.159	0.159
RAS	0.009	0.009	0.009	0.009	0.092	0.158	0.116	0.122	0.148	0.148
CAN	0.078	0.078	0.078	0.078	0.268	0.268	0.268	0.268	0.18	0.18
USA	0.071	0.071	0.071	0.071	0.141	0.431	0.431	0.283	0.141	0.141
MEX	0.017	0.017	0.017	0.017	0.106	0.198	0.163	0.148	0.153	0.153
CAM	0.013	0.013	0.013	0.013	0.094	0.174	0.135	0.131	0.147	0.147
VEN	0.018	0.018	0.018	0.018	0.074	0.195	0.158	0.138	0.125	0.125
COL	0.013	0.013	0.013	0.013	0.083	0.173	0.134	0.128	0.137	0.137
RAP	0.016	0.016	0.016	0.016	0.055	0.178	0.136	0.123	0.11	0.11
ARG	0.027	0.027	0.027	0.027	0.098	0.238	0.209	0.168	0.139	0.139
BRA	0.034	0.034	0.034	0.034	0.102	0.185	0.148	0.139	0.141	0.141
CHL	0.017	0.017	0.017	0.017	0.094	0.193	0.156	0.142	0.143	0.143
URY	0.02	0.02	0.02	0.02	0.077	0.204	0.168	0.143	0.126	0.126
RSM	0.011	0.011	0.011	0.011	0.095	0.169	0.129	0.129	0.148	0.148
GBR	0.042	0.042	0.042	0.042	0.256	0.341	0.338	0.267	0.265	0.265
DEU	0.054	0.054	0.054	0.054	0.313	0.408	0.419	0.32	0.305	0.305
DNK	0.059	0.059	0.059	0.059	0.343	0.438	0.455	0.344	0.327	0.327
SWE	0.063	0.063	0.063	0.063	0.341	0.452	0.472	0.352	0.323	0.323
FIN	0.05	0.05	0.05	0.05	0.257	0.379	0.381	0.289	0.259	0.259
REU	0.047	0.047	0.047	0.047	0.295	0.665	0.665	0.323	0.263	0.263
EFT	0.065	0.065	0.065	0.065	0.396	0.473	0.5	0.379	0.37	0.37
CEA	0.017	0.017	0.017	0.017	0.066	0.186	0.147	0.131	0.119	0.119
FSU	0.017	0.017	0.017	0.017	0.067	0.186	0.148	0.131	0.119	0.119
TUR	0.014	0.014	0.014	0.014	0.112	0.183	0.147	0.141	0.162	0.162
RME	0.015	0.015	0.015	0.015	0.088	0.183	0.145	0.135	0.14	0.14
MAR	0.01	0.01	0.01	0.01	0.103	0.165	0.126	0.129	0.156	0.156
RNF	0.014	0.014	0.014	0.014	0.102	0.18	0.142	0.137	0.153	0.153
SAF	0.013	0.013	0.013	0.013	0.123	0.182	0.146	0.143	0.171	0.171
RSA	0.008	0.008	0.008	0.008	0.111	0.157	0.116	0.126	0.165	0.165
RSS	0.008	0.008	0.008	0.008	0.11	0.157	0.116	0.126	0.164	0.164
ROW	0.01	0.01	0.01	0.01	0.109	0.165	0.126	0.13	0.162	0.162

Table 25 The Results of skill labor payment shares for GTAP Version 4 (Con'd)

Region\ sector	vol	mil	pcr	sgr	ofd	b_t	tex	wap	lea	lum
AUS	0.253	0.253	0.253	0.253	0.253	0.253	0.273	0.274	0.274	0.194
NZL	0.229	0.185	0.214	0.229	0.229	0.215	0.176	0.165	0.169	0.178
JPN	0.31	0.31	0.31	0.31	0.31	0.39	0.272	0.153	0.153	0.351
KOR	0.254	0.202	0.268	0.254	0.254	0.213	0.163	0.162	0.124	0.174
IDN	0.115	0.115	0.115	0.115	0.115	0.115	0.155	0.123	0.155	0.117
MYS	0.191	0.17	0.178	0.191	0.191	0.144	0.152	0.131	0.147	0.132
PHL	0.167	0.061	0.124	0.167	0.167	0.11	0.099	0.13	0.105	0.085
SGP	0.264	0.272	0.269	0.264	0.264	0.273	0.225	0.182	0.21	0.233
THA	0.182	0.137	0.16	0.182	0.182	0.13	0.135	0.129	0.133	0.115
VNM	0.176	0.152	0.16	0.176	0.176	0.118	0.139	0.121	0.135	0.112
CHN	0.177	0.154	0.162	0.177	0.177	0.12	0.14	0.121	0.136	0.113
HKG	0.327	0.327	0.327	0.327	0.327	0.327	0.304	0.26	0.4	0.263
TWN	0.343	0.212	0.234	0.343	0.343	0.187	0.242	0.144	0.179	0.214
IND	0.175	0.141	0.156	0.175	0.175	0.118	0.134	0.122	0.131	0.109
LKA	0.177	0.15	0.161	0.177	0.177	0.121	0.139	0.122	0.135	0.113
RAS	0.175	0.139	0.156	0.175	0.175	0.118	0.133	0.122	0.131	0.108
CAN	0.18	0.18	0.18	0.18	0.18	0.182	0.119	0.161	0.145	0.151
USA	0.271	0.141	0.239	0.271	0.271	0.324	0.178	0.216	0.2	0.226
MEX	0.19	0.145	0.17	0.19	0.19	0.146	0.142	0.136	0.14	0.127
CAM	0.18	0.138	0.159	0.18	0.18	0.128	0.135	0.128	0.133	0.114
VEN	0.183	0.115	0.154	0.183	0.183	0.135	0.127	0.135	0.128	0.113
COL	0.178	0.128	0.154	0.178	0.178	0.125	0.13	0.127	0.129	0.11
RAP	0.174	0.1	0.142	0.174	0.174	0.119	0.117	0.129	0.119	0.099
ARG	0.201	0.129	0.174	0.201	0.201	0.168	0.141	0.149	0.141	0.136
BRA	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141
CHL	0.186	0.134	0.163	0.186	0.186	0.139	0.136	0.134	0.135	0.12
URY	0.186	0.116	0.157	0.186	0.186	0.141	0.129	0.138	0.13	0.117
RSM	0.179	0.139	0.159	0.179	0.179	0.125	0.135	0.126	0.133	0.113
GBR	0.265	0.261	0.267	0.265	0.265	0.276	0.222	0.184	0.208	0.232
DEU	0.297	0.302	0.306	0.297	0.297	0.332	0.252	0.207	0.234	0.276
DNK	0.312	0.325	0.325	0.312	0.312	0.359	0.268	0.217	0.248	0.297
SWE	0.316	0.32	0.327	0.316	0.316	0.367	0.268	0.222	0.249	0.301
FIN	0.277	0.255	0.274	0.277	0.277	0.298	0.224	0.197	0.212	0.244
REU	0.239	0.248	0.279	0.239	0.239	0.269	0.211	0.178	0.195	0.194
EFT	0.334	0.369	0.357	0.334	0.334	0.396	0.295	0.229	0.271	0.33
CEA	0.179	0.109	0.149	0.179	0.179	0.127	0.123	0.132	0.124	0.107
FSU	0.179	0.109	0.149	0.179	0.179	0.128	0.123	0.132	0.124	0.107
TUR	0.187	0.153	0.17	0.187	0.187	0.139	0.144	0.131	0.14	0.124
RME	0.182	0.13	0.158	0.182	0.182	0.132	0.133	0.131	0.132	0.115
MAR	0.18	0.148	0.162	0.18	0.18	0.125	0.139	0.125	0.135	0.115
RNF	0.184	0.144	0.164	0.184	0.184	0.134	0.139	0.13	0.136	0.119
SAF	0.189	0.163	0.174	0.189	0.189	0.141	0.149	0.131	0.144	0.128
RSA	0.178	0.157	0.164	0.178	0.178	0.123	0.142	0.122	0.137	0.115
RSS	0.178	0.156	0.163	0.178	0.178	0.122	0.141	0.122	0.137	0.115
ROW	0.181	0.153	0.164	0.181	0.181	0.127	0.141	0.125	0.137	0.117

Table 25 The Results of skill labor payment shares for GTAP Version 4 (Con'd)

Region\ sector	ppp	p_c	crp	nmm	i_s	nfm	fmp	mvh	otn	ele
AUS	0.295	0.454	0.397	0.248	0.289	0.289	0.258	0.245	0.245	0.39
NZL	0.256	0.279	0.29	0.209	0.199	0.214	0.217	0.257	0.257	0.305
JPN	0.415	0.376	0.37	0.378	0.368	0.378	0.361	0.4	0.4	0.382
KOR	0.296	0.201	0.281	0.21	0.206	0.224	0.221	0.231	0.231	0.269
IDN	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239	0.239
MYS	0.18	0.208	0.193	0.165	0.169	0.176	0.167	0.175	0.175	0.197
PHL	0.15	0.09	0.209	0.113	0.085	0.123	0.137	0.178	0.178	0.229
SGP	0.314	0.397	0.324	0.267	0.275	0.269	0.263	0.292	0.292	0.332
THA	0.167	0.169	0.193	0.147	0.142	0.158	0.155	0.171	0.171	0.201
VNM	0.153	0.172	0.165	0.145	0.149	0.158	0.148	0.15	0.15	0.168
CHN	0.155	0.175	0.167	0.147	0.151	0.159	0.15	0.151	0.151	0.17
HKG	0.419	0.575	0.393	0.352	0.315	0.315	0.315	0.451	0.451	0.451
TWN	0.199	0.204	0.262	0.212	0.172	0.23	0.221	0.268	0.268	0.322
IND	0.153	0.162	0.171	0.142	0.141	0.153	0.147	0.154	0.154	0.176
LKA	0.156	0.173	0.171	0.147	0.149	0.158	0.15	0.154	0.154	0.174
RAS	0.153	0.161	0.172	0.141	0.14	0.153	0.147	0.154	0.154	0.178
CAN	0.3	0.271	0.352	0.19	0.165	0.165	0.208	0.302	0.302	0.37
USA	0.355	0.356	0.439	0.252	0.206	0.244	0.278	0.387	0.387	0.478
MEX	0.183	0.189	0.211	0.159	0.152	0.168	0.167	0.187	0.187	0.221
CAM	0.164	0.168	0.188	0.146	0.142	0.157	0.154	0.167	0.167	0.195
VEN	0.173	0.155	0.213	0.143	0.129	0.153	0.157	0.186	0.186	0.226
COL	0.161	0.157	0.189	0.142	0.134	0.152	0.151	0.168	0.168	0.198
RAP	0.157	0.129	0.198	0.13	0.114	0.14	0.145	0.172	0.172	0.212
ARG	0.208	0.194	0.253	0.166	0.148	0.173	0.181	0.221	0.221	0.27
BRA	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141
CHL	0.177	0.174	0.208	0.152	0.143	0.161	0.161	0.183	0.183	0.218
URY	0.18	0.161	0.222	0.147	0.131	0.156	0.162	0.193	0.193	0.236
RSM	0.161	0.167	0.183	0.145	0.142	0.156	0.152	0.163	0.163	0.19
GBR	0.317	0.391	0.334	0.266	0.268	0.267	0.264	0.3	0.3	0.344
DEU	0.376	0.471	0.394	0.31	0.312	0.307	0.305	0.353	0.353	0.407
DNK	0.404	0.512	0.419	0.331	0.336	0.327	0.325	0.376	0.376	0.433
SWE	0.413	0.515	0.435	0.334	0.335	0.329	0.331	0.389	0.389	0.451
FIN	0.343	0.404	0.372	0.276	0.271	0.275	0.279	0.331	0.331	0.388
REU	0.301	0.548	0.37	0.25	0.269	0.248	0.248	0.283	0.283	0.38
EFT	0.441	0.579	0.447	0.365	0.376	0.359	0.353	0.404	0.404	0.459
CEA	0.166	0.144	0.205	0.138	0.123	0.147	0.152	0.179	0.179	0.218
FSU	0.166	0.144	0.205	0.138	0.123	0.148	0.152	0.179	0.179	0.219
TUR	0.175	0.19	0.195	0.157	0.156	0.167	0.162	0.175	0.175	0.201
RME	0.169	0.165	0.199	0.146	0.138	0.157	0.156	0.176	0.176	0.208
MAR	0.161	0.175	0.178	0.148	0.148	0.159	0.153	0.16	0.16	0.183
RNF	0.17	0.178	0.193	0.152	0.148	0.162	0.158	0.172	0.172	0.201
SAF	0.177	0.2	0.192	0.162	0.163	0.172	0.165	0.173	0.173	0.197
RSA	0.157	0.18	0.168	0.149	0.154	0.161	0.151	0.153	0.153	0.171
RSS	0.157	0.178	0.169	0.149	0.153	0.161	0.151	0.153	0.153	0.171
ROW	0.162	0.18	0.177	0.151	0.152	0.162	0.154	0.16	0.16	0.181

Table 25 The Results of skill labor payment shares for GTAP Version 4 (Con'd)

Region\ sector	ome	omf	ely	gdt	wtr	cns	t_t	osp	osg	dwe
AUS	0.39	0.263	0.365	0.365	0.365	0.254	0.281	0.483	0.654	0
NZL	0.305	0.202	0.342	0.342	0.342	0.214	0.229	0.456	0.566	0
JPN	0.382	0.345	0.417	0.417	0.417	0.421	0.387	0.407	0.365	0
KOR	0.269	0.185	0.152	0.152	0.152	0.167	0.206	0.352	0.473	0
IDN	0.239	0.065	0.493	0.493	0.493	0.154	0.084	0.32	0.553	0
MYS	0.197	0.134	0.353	0.353	0.353	0.174	0.204	0.41	0.593	0
PHL	0.229	0.091	0.249	0.249	0.249	0.101	0.091	0.514	0.633	0
SGP	0.332	0.265	0.413	0.413	0.413	0.286	0.323	0.402	0.525	0
THA	0.201	0.117	0.323	0.323	0.323	0.15	0.169	0.438	0.606	0
VNM	0.168	0.107	0.344	0.344	0.344	0.153	0.183	0.408	0.606	0
CHN	0.17	0.109	0.345	0.345	0.345	0.154	0.185	0.408	0.605	0
HKG	0.451	0.352	0.472	0.472	0.472	0.27	0.428	0.451	0.682	0
TWN	0.322	0.226	0.391	0.391	0.391	0.216	0.335	0.369	0.775	0
IND	0.176	0.106	0.332	0.332	0.332	0.146	0.171	0.422	0.609	0
LKA	0.174	0.11	0.341	0.341	0.341	0.153	0.181	0.413	0.606	0
RAS	0.178	0.106	0.33	0.33	0.33	0.145	0.17	0.424	0.61	0
CAN	0.37	0.207	0.257	0.257	0.257	0.193	0.195	0.381	0.641	0
USA	0.478	0.285	0.332	0.332	0.332	0.251	0.207	0.628	0.494	0
MEX	0.221	0.133	0.326	0.326	0.326	0.161	0.179	0.443	0.599	0
CAM	0.195	0.115	0.325	0.325	0.325	0.149	0.17	0.434	0.607	0
VEN	0.226	0.12	0.298	0.298	0.298	0.14	0.148	0.47	0.611	0
COL	0.198	0.111	0.316	0.316	0.316	0.143	0.16	0.444	0.61	0
RAP	0.212	0.103	0.288	0.288	0.288	0.125	0.131	0.474	0.62	0
ARG	0.27	0.152	0.301	0.301	0.301	0.163	0.167	0.482	0.596	0
BRA	0.141	0.141	0.239	0.239	0.239	0.176	0.159	0.529	0.529	0
CHL	0.218	0.126	0.317	0.317	0.317	0.153	0.168	0.45	0.604	0
URY	0.236	0.126	0.297	0.297	0.297	0.144	0.15	0.474	0.608	0
RSM	0.19	0.113	0.328	0.328	0.328	0.149	0.171	0.43	0.607	0
GBR	0.344	0.266	0.4	0.4	0.4	0.281	0.313	0.418	0.527	0
DEU	0.407	0.323	0.423	0.423	0.423	0.329	0.361	0.419	0.498	0
DNK	0.433	0.351	0.437	0.437	0.437	0.353	0.388	0.414	0.483	0
SWE	0.451	0.358	0.429	0.429	0.429	0.355	0.384	0.428	0.482	0
FIN	0.388	0.287	0.385	0.385	0.385	0.289	0.31	0.446	0.521	0
REU	0.38	0.237	0.574	0.574	0.574	0.242	0.27	0.536	0.563	0
EFT	0.459	0.39	0.47	0.47	0.47	0.393	0.437	0.393	0.46	0
CEA	0.218	0.112	0.295	0.295	0.295	0.134	0.142	0.47	0.614	0
FSU	0.219	0.112	0.295	0.295	0.295	0.134	0.142	0.47	0.614	0
TUR	0.201	0.127	0.337	0.337	0.337	0.162	0.187	0.425	0.599	0
RME	0.208	0.118	0.316	0.316	0.316	0.147	0.163	0.448	0.607	0
MAR	0.183	0.114	0.337	0.337	0.337	0.154	0.18	0.42	0.605	0
RNF	0.201	0.121	0.33	0.33	0.33	0.155	0.177	0.432	0.603	0
SAF	0.197	0.13	0.347	0.347	0.347	0.169	0.197	0.415	0.596	0
RSA	0.171	0.112	0.348	0.348	0.348	0.157	0.188	0.406	0.603	0
RSS	0.171	0.111	0.346	0.346	0.346	0.156	0.187	0.407	0.604	0
ROW	0.181	0.116	0.342	0.342	0.342	0.157	0.185	0.414	0.603	0

Table 26 Implied Wage Ratio of Skilled to Unskilled for Selected GTAP Version 4 regions

Region	Total	Professions	Manager	Skilled total	Skilled Body Count Share	Payment share	S/U Wage Ratio
USA	119149000	20644000	14775000	35419000	29.73%	39.22%	1.53
CAN	13592900	2318000	1702000	4020000	29.57%	27.55%	0.91
MEX	30534083	2958256	562047	3520303	11.53%	27.47%	2.91
JPN	64360000	7550000	2590000	10140000	15.76%	36.39%	3.06
HKG	2738300	249200	134400	383600	14.01%	42.16%	4.47
KOR	18921000	1570000	328000	1898000	10.03%	26.56%	3.24
SGP	1576151	303711	156017	459728	29.17%	33.25%	1.21
AUS	7933400	869700	1063600	1933300	24.37%	40.14%	2.08
NZL	1466400	188300	183700	372000	25.37%	32.72%	1.43
PHL	23917000	1392000	284000	1676000	7.01%	22.51%	3.86
MYS	6175800	455800	128000	583800	9.45%	24.23%	3.06
THA	23684480	696361	437695	1134056	4.79%	24.89%	6.59
IDN	62457138	2151213	97548	2248761	3.60%	15.53%	4.92
CHN	521505618	26457518	8130787	34588305	6.63%	17.49%	2.98
BRA	42271526	2773886	679160	3453046	8.17%	31.25%	5.11
CHl	4773310	379560	177040	556600	11.66%	27.81%	2.92
DNK	2902212	637576	115280	752856	25.94%	38.73%	1.80
DEU	51692478	9052864	1673680	10726544	20.75%	34.87%	2.05
GBR	23440500	4137780	2311700	6449480	27.51%	36.78%	1.53
SWE	4430000	1450000	0	1450000	32.73%	37.01%	1.21
TUR	19491948	1015554	344200	1359754	6.98%	24.68%	4.37
VEN	6769251	843290	252773	1096063	16.19%	26.85%	1.90
COL	2819500	333552	62750	396302	14.06%	27.52%	2.32
SAF	5789797	402173	264342	666515	11.51%	32.03%	3.62
LKA	5158965	460010	137080	597090	11.57%	21.87%	2.14

Source: GTAP version 4 (pre-release)

Appendix: Country Details for Other Regions

1. United States

The split of payments to labor is estimated for the years of 1992 and 1970. The data are from the 1992 Current Population Survey (CPS) and the 1970 Census of Population. The specific sources are the data file of Person Records, taken from the 1992 CPS as provided by the ANU Social Science Data Archives (SSDA), and the US Department of Commerce, Bureau of the Census (1972a and 1972b).

The data from 1992 CPS includes the industry codes and recodes (A-IND and A-DTIND), detailed occupations (A-DTOCC) and total yearly earnings (ERN-VAL), as described in US Bureau of the Census (1992), and covers a sample of 79260 non-zero observations. A 62 sector by 45 occupation matrix is obtained by summing up the item ERN-VAL by industry and by occupation. Since the occupations in the item A-DTOCC are similar to the ILO standard, it is not difficult to aggregate on those to the 62 by 2 matrix. The similarity of the industry classification then makes it a straight forward matter to further aggregate to the desired 37 by 2 matrix. Then, from the item A-DTOCC the number of farm operators and managers can be observed. Our criterion for separating out the farm labor in developed countries is that they are those without certified post-secondary education. In the absence of human capital data for farmers and farm workers in the United States, the proportions of total earnings by farm labor in the eight agricultural subsectors (Table 2) are be obtained for 1992 from the assumption that the farm labor accounts for about 45% of all payments. This is just under the proportion for Australia, for which we have consulted human capital data (see below).

For 1970 the data sources indicated above provide the industry number of males and females and their mean yearly earnings by occupation. Thus, the matrix of total industry earnings by occupation (combined males and females) is readily calculated. Thereafter, the approach is the same as for 1992. This time, however, non-farm labor account for only 40% of the total farm operators and managers in agriculture. Also, because the 1970 CPS used a much more aggregated industry classification, there are now only data for agriculture, mining, and the food (manufacturing) industry as a whole. To disaggregate up to the 37 industries required, the 1992 earning ratios of the subsectors to the corresponding aggregated sectors were used.

2. Canada

The estimation for Canada is based on average yearly earnings and numbers of employees by occupation for the economy as a whole from the 1986 Census (Statistics Canada 1989). Because industry-level labor statistics are not available from this source, it is assumed that the proportions of earnings by industry for each occupation are the same in US and Canada. Due to the similarity of the occupational classifications used in Canada and the US, the total earnings of employees by occupation as (as in the item A-DTOCC of US 1992 CPS) can be calculated for the economy as a whole. Imposing the US industry split for each occupational group yields the required 37 by 2 matrix, subsequent extensions to which are the same as for the US.

3. Australia

Three estimates have been made, for 1981, 1986 and 1991. For 1986-87 a similar task has already been completed for the database of the ORANI model of the Australian economy (Kenderes and Strzelecki 1992). The estimation is therefore straight forward, from a 113 by 8 matrix of payments to labor, with the eight types of labor defined consistently with the ILO classification. Note that the number of farmers and agricultural managers are included in the first professional category. Therefore, the separation of payments to farm labor adopts the US (CPS) result that 55% professional workers in the agricultural industries are farmers and agricultural managers. In 1992, about 50% of all managers and administrators (not just in agriculture) in Australia had no post-school qualification (ABS 1993). This proportion was then used to split farm labor away from this group, so that about 30% of 'professional' workers in the agricultural industries are reclassified as farm laborers.

For 1981 and 1991, the variables of industry, occupation and individual income have been used. The method of estimation is the same as for the US in 1992. For 1981 and 1991, respectively, 161 by 267 and 48 by 60 matrices were obtained. For consistency between 1981 and 1991, the 161 by 267 matrix for 1991 was firstly aggregated to the classifications used in 1981, to a 48 by 60 matrix. Then both were transformed to the required 37 by 2. Further disaggregation of payments to professional, production and farm labor in the agricultural subsectors was based on the assumption that non-farm labor account for 35% and 45% of total farmers and agricultural managers in 1981 and 1991, respectively.

4. The European Union

The main sources are Eurostat (1991 and 1992). These give 1988 values for hourly and monthly gross earnings and worker hours per year. They also include a breakdown of workers and payments between "manual" and "nonmanual" workers in construction, mining, manufacturing, energy and water industries. Manual workers comprise all employees engaged on manual work under contract of employment, express or implied, within the enterprise. Non-manual workers are all salaried persons who are not included in the definition of manual workers. The data covers only eight countries, namely Belgium, Denmark, Germany, France, Ireland, Italy, Luxembourg, and Portugal. Based on the original data, it is easy to obtain the matrix of yearly earnings of manual and non-manual workers across industries that are according to the General Industrial Classification of Economic Activities within the European Communities (NACE) for the EU as a whole. The use of a SALTER-NACE concordance transfers this to a 25 by 2 matrix, wherein the number of industries is 25 because there is no data for agriculture, trade and transport, and services.

This outcome is hardly acceptable since the classification of manual and non-manual workers is quite different from definition of professional and production workers defined earlier. For an approximate correction, the Australian data is taken as "typical" and used as a model for adjustments. Since both the professional-production and manual-nonmanual dichotomies can be derived from the Australian data, proportional differences can be derived. For each industry, these proportional corrections are applied to the EU data, yielding approximate professional-production splits. Corresponding splits for the eight agricultural industries, as between professional, production and farm workers, are approximated based on the data for Australia in 1986. For the other sectors not available in the Eurostat data (trade and transport, and other services), payments to all labor are subdivided by using the data on employee numbers from Table 2C in the ILO Yearbook of Labor Statistics and statistics on gross annual incomes by occupation from Union bank of Switzerland (1994). The latter has data for many countries including ten from the EU, namely Belgium, Denmark, Germany, Greece, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

5. Japan

The case of Japan is complicated not only by data limitations but also by the strong dependence of wages on sex, lengths of service and age. The first decile, first quartile, median, third quartile and ninth decile wages, average (yearly) wages, number of employees for male and female across industries were extracted from wage surveys in 1970 and 1992 (Ministry of Labor of Japan 1970 and 1992). Then the average wages of professional and production workers (Wprof and Wprod) are defined as follows:

Male: Wprof = (3rd quartile wage + 9th decile wage)/2
Wprod = (1st quartile wage + median wage)/2
Female: Wprof = 9 decile wage
Wprod = median wage

This roughly reflects the frequency of wages for the few aggregate sectors for which complete data are available.

The following system of equations is then solved for the number of full-time equivalent male and female workers in each industry:

$$Lprof + Lprod = L \quad (1)$$
$$Wprof * Lprof + Wprod * Lprod = Wav * L \quad (2)$$

Where L, Lprof and Lprod are the total number of employees, professional and production employees, respectively. Wav is average wage. The total wage bill for professional and production workers can therefore be deduced. Then it is not difficult to change this result to obtain the final required matrix (29 by 2 in this case because the source does not provide data for the agricultural sector).

An alternative approach is to assume that all females are production workers in the industries in which Wprof of females is lower than or not much different from Wprod of males. This assumption leads to a final result which is more in the line with the other developed countries and so the latter result is adopted.

6. Taiwan

The data source for the all sectors other than agriculture is Directorate-General of Budget, Accounting and Statistics, Executive Yuan (1990 and 1991). The data are available by industry and include average monthly earnings and the number of employees in 1979, 1989 and 1990. Included are salary-earners and wage workers in mining and quarrying, manufacturing, electricity, gas and water, and construction. Supervisory and technical employees and non-supervisory employees are included for commerce, transport, storage and communication, financing, insurance and real estate, community, social and personal services. The 1990-data are only available through July and so do not include annual averages as for the 1979 and 1989 data, but they also include the number of assistants, who are considered salary earners, and their average earnings. We assume that professional workers include supervisory and technical employees and that salary earners are included but not assistants. Production workers include non-supervisory employees or wage workers and assistants. We further assume that the ratios of total earnings of assistants to total earnings of salary earners are constant over time at their 1990 levels. It is then not difficult to calculate the

matrices of payments to professional and production workers in 1979 and 1989 and then to construct 29 by 2 matrices.

The 29 industries exclude the eight GTAP agricultural groups. The data source for agriculture as a whole is Department of Agriculture and Forestry, Taiwan Provincial Government (1990) which gives the number of farmers by educational attainment and also the total number of other employees in agriculture in 1980 and 1989. Professional workers are those farmers who finished middle school and/or had some post-school qualification (university/college/vocational school). Farm laborers are separated as farmers who have not completed middle school. The category "other employees" is then split between professional, production and farm workers in proportion with the split of all other workers. The earning proportions of three types of agricultural workers can be estimated by choosing the appropriate ratios of the average earnings of professional and production workers to farm workers. This completes the required 37 by 3 matrix.

7. South Korea

Only 1991 data are available for average earnings and number of employees for "operative workers" and "office workers". Operatives are the workers on production lines or auxiliary to them and who are engaging in essential manual work. Office workers include all workers other than operatives, who are engaged in technical, managerial, professional or clerical work. They include routine office workers and their helpers. The industry groups for which the data are available include mining and manufacturing industries (National Statistical Office 1993). It was necessary to flesh out these data by imposing patterns drawn from the data for Taiwan. Operative and office workers are regarded as wage workers and salary earners, respectively. Thus, professional workers include office workers but not assistants. Production workers include "operative workers" and assistants. Farm workers are not separated due to the absence of corresponding data for the agricultural sector. The ratios mentioned for mining and manufacturing in Taiwan are used for splitting total earnings across industries. The split of payments among types of workers in agriculture also follows the proportions obtained for Taiwan. And for the four services sectors (33-36 in the GTAP classification of Table 2) the splits are obtained by using employment statistics from the ILO Yearbook of Labor Statistics, combined with income data from Union Bank of Switzerland (1994), as in the case of the EU.

8. Brazil

Although no national data were obtained for Brazil, the combined resources of the ILO Yearbook of Labor Statistics and Union Bank of Switzerland (1994) are sufficient for an approximate professional-production split for most industries to be made for 1992. They are not sufficient, however, to split out payments to farm workers in agriculture. This separation is based on the statistics for Taiwan. Neither do they cover the mining industries. And because the data for manufacturing do not distinguish component industries, the same proportions are applied across all manufacturing and mining industries.

9. Indonesia

The estimation is based on average monthly wages and numbers of workers by industry and by education level extracted from 1992 Sakernas Survey. There are 10 education levels. The levels of 1 to 5 are lower secondary, 6 is upper-secondary, 7 and 8 are high upper-secondary and 9 and 10 are tertiary and university levels. We had first to define professional and production workers in these terms and then to concord the industry groups for which the data were supplied with the GTAP classification. In the first variant , professional workers are those who have upper secondary education or higher. Production workers are those who have less than upper secondary education. In a second approach, employees with high upper-secondary or better are regarded as professional workers. This second approach appears to give a more reasonable result in comparison, for example, with Taiwan. From the Indonesian data we could only separate the number and payments to professional and other workers ("other" including farm labor). One possible correction would be to assume there are no farm workers in the agricultural industries. Most agricultural workers in developing countries are farmers. Another would be to use the proportions of payments to production and farm workers in Taiwan to estimate the distribution of payments over three types of workers in agriculture.

10. The Philippines and Thailand

For these developing countries no classification of workers by industry and occupation seemed available. Instead, we resorted to secondary sources based on human capital surveys. For the Philippines, we used the database of the APEX model and for Thailand the database of the PARA CGE model. These databases already split payments to skilled and unskilled labor by industry. The only major step is to concord the industrial classification used with that of GTAP.

In the case of Philippines, skilled workers are those who finished high school or at least have some college education, and unskilled workers are those who did not complete high school. For Thailand, it is assumed that labor employed on a daily wage basis is unskilled, labor employed on a monthly wage rate or longer term basis is considered as skilled labor, and the agricultural sector employs only farm workers. Concerns remain about the consistency of this approach with that we have taken for other countries. It seems inappropriate, for example, to assume no skilled labor or slightly educated workers are employed in the Thai rural sector. And, for manufacturing in both the Philippines and Thailand, the skill splitting criteria chosen by the builders of the two source databases yield what seem to be too high a proportion of workers in the skilled category.