Estimation Of Labor Demand Elasticity For The RMSM-LP: Revised Minimum Standard Model For Labor And Poverty Module

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INTRODUCTION

The RMSM-LP (Revised Minimum Standard Model for Labor and Poverty) is a Microsoft Excel-based simulation package for facilitating the forecasting, monitoring and analysis of financial flows of developing countries developed by the World Bank. It models the demand side of the economy by using an economy wide consistent flow-of-funds framework in which different agents are identified. More precisely, the basic model includes the National Accounts; Balance of payments; general Government; Monetary survey and a rest of the economy account. In addition to the above-mentioned sectors, the model forecasts detailed trade accounts and foreign debt flows and stocks. As such it can be used to produce a comprehensive outlook for a developing economies.

To be able to calibrate RMSM-LP module, we need to provide labor demand elasticity of wage and output for two heterogeneous labor groups (skilled and unskilled). However, in reality, reliable labor data is unavailable or do not have sufficient observations for the efficient estimation of labor demand elasticity for many developing countries. For this reason, (1) we do a literature survey to find acceptable ranges of wage and output elasticity for the labor demand and (2) provide some labor database accessible for economists and (3) provide actual estimates of wage and output elasticity of labor demand using aggregated data of manufacturing and agricultural sector for two regions (Africa and Latin America).

Finally, based on survey and actual estimates, we provide an acceptable range of elasticity for the proper calibration of RMSM-LP module.

DATA SOURCES OF EMPLOYMENT, WAGE, AND OUTPUT

Data Sources

We can get labor data from three different sources. First, Martin Rama and Raquel Artecona, 1999, " A Database of Labor Market Indicators across Countries". This database covers most of the countries and report five years average figures to increase the reliability of the data from 1945-49. While this has a reputation because of quality of the data, limited number of observation is one shortfall.

Second, the World Bank regional database (SIMA) covers most of the developing countries for most of labor data (including some disaggregated labor data). However, this database has many missing observations and is insufficient for country specific research.

Third, IMF's IFS CD-Rom is very helpful for country specific analysis since it provides time series annual data for employment, output and wages (disaggregated data in unavailable).

Extraction Of Data

(1). Martin Rama and Raquel Artecona's Labor Database:
Researcher should contact one of them personally to obtain the data.

(2). The World Bank SIMA:
The data can be easily downloadable from Bank intranet in Excel format.

Here are some tips for the first users:

- First: go to the World Bank intranet and select Data shortcuts from full-down menu
- Second: select SIMA query from the menu
- Third: Double click QUERY in the box to activate the extraction process
- Fourth: Select database (e.g., Regional Africa or others depending on your target)
- Fifth: Select target countries
- Six: Click series and select series (e.g. employment of agriculture as a % of total employment, Monthly wages of agricultural sector, value added as a % of total GDP)
- Seven: Click periods and select periods (e.g., 1980-1995)
- Eight: Click show data, this will show you requested data in Excel format
- Nine, Click File and double click export data from full-down menu
- Ten, Select Excel and assign a file name for data file you extracted.

LITERATURE REVIEW

In this section we report survey of literature on estimates of elasticity of labor demand that are grouped by industry, educational level, occupation, region, and countries.

Wage Elasticity Of Labor Demand

Most of the studies are focused on two countries, i.e., United States and United Kingdom. For the United States, Heckman and Sedlacek (1985) report the estimate of manufacturing sector as –0.49 and that of non-manufacturing sector as –0.93 and Franz and Konig (1986) report the estimate as –0.96 using the manufacturing sector data. Also a study of early period of the manufacturing sectors by Hsing (1989) report his estimate of –0.70 for the period of 1953 to 1978. However, Nadiri (1996) report the smallest estimate of –0.12 for manufacturing sector using trans-log production function.

For the United Kingdom, Harris (1985) report the estimate of elasticity of labor demand as low as –0.21 for the manufacturing sector using the data covering from 1968 to 1981 But Layard and Nickell (1986) report the large estimate of –0.93 for the all industries using the data covering the period of 1954-1983. Following study of Andrew (1987) report estimate of –0.51 for the sample of aggregate data and Wadhwani (1987) report the estimate of –0.38 using manufacturing sector data for the period of 1962 to 1981.

Kollreuter (1980) investigated West Germany's manufacturing sector and report the estimate of a little smaller –0.20 while Pencave and Holmlund (1988) report a little higher estimate of –0.75 for the Sweden using the data for the period of 1950 to 1983. Harris (1990) investigated New Zealand and report the estimates of quite low –0.24 for the aggregate data for 1965 to 1987. Symons and Layard (1984) investigated for the five OECD countries manufacturing sector for the period of 1956 to 1980 and report the estimate of very high –1.54.

Finally, Begg et al. (1989) investigated aggregated data of United Kingdom and Japan and report estimate of –0.40 and –0.45 respectively. From this survey we can conclude that the maximum (absolute value) estimated elasticity is –1.54 and the minimum estimate is –0.12.

Output Elasticity Of Labor Demand

Most reported studies are for the United States. Nadiri and Mamuneas (1996) report estimate of 0.36 and Shapiro (1986) provides the highest value of 1.00. But Estevao (1996) reports much smaller interval estimates of 0.2 to 0.22 and Munnell (1990) report the value of 0.59.

Two studies of United Kingdom by Feldstein (1967) and Lesli and White (1980) report the output elasticity of labor demand in England as 0.77-0.90 and 0.64 respectively.

Roberts and Skoufias (1997) investigated manufacturing sector of Columbia and report the estimate of skilled labor as 0.733 and that of unskilled labor as 0.661 while Pessino (1997) report that for Argentina as 0.25. Lim (1976) investigate Malaysia and report the interval estimates of 0.45 to 0.67 and the World Bank report the estimate of Taiwan, using the agricultural sector data, as 0.38.

Based on this survey we can conclude that the output elasticity of labor demand varies between 0.2 to 1.0. Hamermesh (1993) has shown that different functional forms are not sensitive for the estimates and argue sample mean value of the estimate is 0.75 and most probable range of estimates between 0.15 and 0.75. Finally he argues that value of estimate decrease as the skill of labor increases. Box 1 in the appendix summarizes various production functions utilized in the literature.

PANEL ESTIMATION

Data

Data are collected from two different sources. First, we use " A Database of Labor Market Indicators across Countries" by Martin Rama and Raquel Artecona (1999) and we utilized the World Bank Database: SIMA. SIMA data set covers 11 Latin American Countries and those include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, Peru, Uruguay, Venezuela.

Panel Estimation

Functional form is given as equation (1).

$$Log(labor^{D})_{i,t} = a_0 + a_1 Log(Wage)_{i,t} + a_2 Log(Output)_{i,t} + \varepsilon_{i,t} \quad \textbf{(1)}$$

where, $labor^D$ is labor demand, a_1 is wage elasticity and a_2 is output elasticity of labor demand.

Labor Demand Elasticity in Latin America

We use fixed effect estimation, random effect estimation, and White (1980)'s heteroscedasticity consistent estimation methods to estimate labor demand elasticity for Latin America as a whole. The results are reported in Table 1.

Table 1. Labor Demand Elasticity of Latin America: Manufacturing Sector

	Fixed Effect	**Random Effect**	**White's Estimation**
Constant	---------------	4.97 (0.46)**	4.80 (0.79)**
Wage	-0.20 (0.08)*	-0.45 (0.07)**	-0.78 (0.12)**
Output	0.30 (0.07)**	0.57 (0.04)**	0.87 (0.04)**
Adjusted R-squared	0.45	0.88	0.95
No. of Observations	33	33	33

Note: Panel of 11 countries with 11 observations are used (many missing values)
Double asterisks denote that estimates are significant at 1 percent critical level
And single asterisk at 5 percent critical level.

The estimation shows that elasticity of wage lies between - 0.20 and –0.78 and output elasticity lie between 0.3 to 0.87. All estimates are significant as is the case with wage elasticity. Actual estimation results are consistent with literature survey in previous chapter.

Labor Demand Elasticity in Africa

First, we estimated labor demand elasticity of manufacturing sector and estimation results are reported in table 2. For the manufacturing sector, wage elasticity hover from –0.2 to –0.71 and that of output hover between 0.32 to 0.92.

Table 2. Labor Demand Elasticity of Africa: Manufacturing Sector

	Fixed Effect	Random Effect	White Estimation
Constant	---------------	1.54 (0.78)	-1.76 (0.48)**
Wage	-0.20 (0.21)	-0.63 (0.15)**	-0.72 (0.09)**
Output	0.32 (0.07)**	0.62 (0.05)**	0.92 (0.04)**
Adjusted R-squared	0.25	0.58	0.95
No. of Observations	96	96	33

Note: Panel of 12 countries with each of 16 observations are used (many missing values).
Double asterisks denote that estimates are significant at 1 percent critical level
And single asterisk at 5 percent critical level.

All estimates are significant except the wage elasticity of fixed effect model. Next, we estimated elasticity of labor demand for agricultural sector and estimation results are reported in Table 5. For the agricultural sector, wage elasticities hover from –0.44 to –0.88 and that of output hover between 0.64 to 0.72. All estimates are significant at 1 percent critical level.

Table 3. Labor Demand Elasticity of Africa: Agricultural Sector

	Fixed Effect	Random Effect	White Estimation
Constant	---------------	4.97 (0.46)**	1.06 (0.77)
Wage	-0.45 (0.21)*	-0.45 (0.07)**	-0.87 (0.07)**
Output	0.64 (0.08)**	0.57 (0.04)**	0.72 (0.04)**
Adjusted R-squared	0.45	0.88	0.89
No. of Observations	76	33	33

Note: Panel of 11 countries with 16 observations are used (many missing values).
Double asterisks denote that estimates are significant at 1 percent critical level
And single asterisk at 5 percent critical level.

When we compare the absolute value of agricultural sector with that of manufacturing sector, estimates of elasticity of manufacturing sector has higher value than that of agricultural sector.

CONCLUSION

Based on literature survey and actual estimation, recommended range of labor demand elasticity for the calibration of RMSM-X-LP module can be summarized as follows.

First, for the estimate of manufacturing sector (proxy for urban labor), we would recommend the values between –0.20 to -0.9 for wage elasticity of labor demand and 0.3 to 0.9 for the output elasticity of labor demand. Second, for the estimate of agricultural sector (proxy for rural labor), we would recommend the value between –0.10 to -0.9 for wage elasticity of labor demand and 0.2 to 0.9 for the output elasticity of labor demand.

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Appendix:

Box 1. **Production Function**

<table>
<tr><td colspan="2">For the analysis of heterogeneous labor, Cobb-Douglas or CES forms are inappropriate. Both functions assume that elasticity of substitution is constant or one. However, elasticity of substitution is affected by dis-aggregation of labor group and this could cause interactions of between two different labor inputs). One possible simplifying assumption is that migration between two groups of labor is insignificant. We can use Leontief or Translog form but those two approaches need data on all factor prices and quantities</td></tr>
<tr><td>Cobb-Douglas</td><td>$Y = \prod X_i^{\beta_i}, \ \ \Sigma\ \beta_i = 1 if\ CRS,$
$where, \beta_i\ is\ from\ Ln Y = \beta_0 + \beta_1 Ln Ls + \beta_2 Ln K,$
$\eta_{ii} = (1-\beta_i),\ \eta_{ii} = -(1-s)\sigma_{ii}, s = wL/Y$</td></tr>
<tr><td>CES</td><td>$Y = [\sum_i \beta_i X_i]^{b/\rho},\ b = 1 if\ \ CRS$</td></tr>
<tr><td>Generalized Leontief</td><td>$Y = \sum\sum b_{ij} X_i^{0.5} X_j^{0.5},\ w_i = b_{ij} + \sum_j b_{ij}[X_j / X_i]^{0.5}, i = 1,...,n.$
$\varepsilon_{ij} = (b_{ij} - w_i)/2w_i$</td></tr>
<tr><td>Translog</td><td>$Ln Y_{nt} = \alpha_{0n} + \sum \alpha_{in} Ln X_{\text{int}} + 0.5 \sum_i \sum_j \beta_{ijn} Ln X_{\text{int}} Ln X_{jnt}$
$= \alpha_{0n} + \alpha_{1n} Ln L_{sk,nt} + \alpha_{2n} Ln L_{un,nt} + \alpha_{3n} Ln K_{nt}$
$+ 0.5 \beta_{11} (Ln L_{sk,nt})^2 + 0.5 \beta_{22} (Ln L_{un,nt})^2 + 0.5 \beta_{33} (Ln K_{nt})$
$+ 0.5 \beta_{12,nt} (Ln L_{sk,nt} \times Ln L_{un,nt} + Ln L_{un,nt} \times Ln L_{sk,nt})$
$+ 0.5 \beta_{13,nt} (Ln L_{sk,nt} \times Ln K_{nt} + Ln K_{nt} \times Ln L_{sk,nt})$
$+ 0.5 \beta_{23,nt} (Ln L_{un,nt} \times Ln K_{nt} + Ln K_{nt} \times Ln L_{un,nt})$
$where,\ Ln L_{sk,nt}$: *Log of output per unit of skilled labor in country n, at time t*
$Ln L_{un,nt}$: *Log of output per unit of unskilled labor in country n, at time t*
$Ln K_{nt}$: *Log of output per unit of capital in country n, at time t*
$\alpha_{in,} \beta_{ijn}$: *parameters of the production function*
$Assumptions:\ \sum \alpha_{in} = 1; \beta_{33n} = \sum_i^3 \sum_j^3 \beta_{ijn}; \beta_{13jn} = -\sum_j^3 \beta_{ijn}.$</td></tr>
<tr><td>Elasticity of Substitution</td><td>$s_i = \alpha_i + \sum_j \beta_{ijn} Ln X_i,\ \ i = 1, 2, ...N\ and\ \beta_{ijn} = \beta_{jin}$</td></tr>
<tr><td>Factor Demand Elasticity</td><td>$\varepsilon_{ii} = (\beta_{ii} - s_i^2 - s_i)/s_i$</td></tr>
</table>