Technical Note on
the Indonesian Labour Market

ESTIMATING EMPLOYMENT ELASTICITY FOR THE INDONESIAN ECONOMY

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PREFACE

This technical note has been produced under an ILO project (INS/99/007) entitled *Assistance for making Economic Recovery Employment-Friendly*. The project is funded by the ILO and carried out within the cross-sectoral framework of the United Nations Support Facility for Indonesian Recovery (UNSFIR).

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The study basically draws the following major conclusions:

a) The notion of employment elasticity, despite its critics, represents a convenient way of summarising the employment intensity of economic growth. It is in the spirit of so-called *Okun's Law* in industrialised countries that has been helpful in identifying growth thresholds at which employment creation becomes significant.

b) There is, however, no clearly articulated official position in Indonesia on either the data sources or the methodology that ought to be used for estimating employment elasticity.

c) The estimates of employment elasticity can be derived readily from province-level employment/GDP data for the 1997-1996 period using both econometric and non-econometric methods. The estimates vary from a low of 0.49 (non-econometric method) to a high of 0.66 (OLS method).

d) Given the range of elasticity estimates, the growth thresholds at which employment creation reaches the point of absorbing new entrants to the labour force (approximately 2 million jobs annually) varies between 3.47 per cent to 4.68 per cent.

It is hoped that this technical note will help the Government of Indonesia – through the Ministry of Manpower - to systematically engage with the professional community to reach a consensus on the most appropriate method of estimating – and interpreting - employment elasticity. Such an approach will enable the government to seek improvements in its methodology from professional peers and at the same time enable it to gain legitimacy from the broader community on the dissemination of labour market statistics.

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1. Introduction

One indicator widely used for analysing the operation of the labour market is employment elasticity. The latter measures the percentage changes in employment induced by changes in GDP. Hence, the elasticity of employment seeks to capture the responsiveness of the labour market to changes in macroeconomic conditions (as represented by GDP growth).

The concept appears to be popular in policy-making circles in Indonesia. For example, a widely cited statistic is that every one per cent growth in GDP leads to the creation of 400,000 jobs. This led a recent ILO Mission to Indonesia to conclude that the economy would have to grow at 5 per cent to absorb new entrants to the labour force (ILO, 1999), but even such a growth rate would not be able to cope with the backlog of the unemployed and underemployed.

Although relatively easy to compute, the use of the notion of employment elasticity, both for labour market analysis and policy-making purposes, is vulnerable to a number of methodological complexities. This technical note suggests that while these complexities cannot be fully reconciled, there is considerable scope for improvement in the way in which employment elasticity is computed, interpreted and disseminated in policy-making circles.

There are several ways of estimating employment elasticity – ranging from the simplest to the relatively complex. The Indonesian government – through the Ministry of Manpower – has not publicised the way in which it arrives at the estimates. Informal discussions held with the Ministry of Manpower suggest that officials appear to display a predilection to opt for the simplest method.[2] Unfortunately, simplicity does not deliver reliability. The analysis offered here shows that the aggregate employment elasticity is sensitive to the method of measurement as well as the time period over which the measurement is carried out. A key implication of these findings is that the Ministry of Manpower ought to acknowledge these complications openly and engage systematically with the professional community to reach a consensus on the most appropriate method of estimating – and interpreting - employment elasticity. The Ministry can seek inspiration from the fact that at least one government agency – the Central Board of Statistics (BPS) – now engages in a frank, open public discussion on how poverty is measured. Such openness has allowed BPS to seek improvements in its methodology from professional peers and has effectively enabled the organisation to defuse criticism stemming from past practices of secrecy.[3]

This technical note is organised as follows. Section two offers a brief, but critical, introduction to the notion of employment elasticity. Section three elaborates the different methods of estimating employment elasticity. These methods include (a) the descriptive approach using aggregate data; (b) Ordinary Least Square (OLS)

[2] Based on a meeting with officials of Barenbang, Depnaker (Ministry of Manpower), Jakarta, 15 March 2000.

[3] A good example is a recent seminar hosted jointly by the BPS and the World Bank entitled 'Poverty measurement in Indonesia, 1999'. It was held in Jakarta (President Hotel) on May 16, 2000. Prior to that event, BPS staff participated extensively in a series of seminars hosted by BAPPENAS (the National Development Planning Agency). Large numbers of stakeholders were present in those seminars.

regression using pooled province-level data with a 'minimalist' specification; (c) GLS 'random effect' regression using pooled province-level data which only account for sectoral GDP; (d) GLS 'random effect' regression using pooled province-level data where the independent variables include both nation-wide GDP and sectoral GDP. An allowance is also made to take account of the distinct economic structures of Java and the Outer Islands. This is done by incorporating dummy variables to represent the broad regional economies within Indonesia. Section four presents the key findings based on the above methods. Section five briefly discusses the estimation of employment elasticity within the manufacturing sector using the industrial survey data. Finally Section six makes recommendations based on a comparison of the different methods.

2. The concept of employment elasticity: a critical discussion

There are a number of criticisms that one can make against the notion of employment elasticity. First, there is the issue of the two-way relationship between employment and output. From the perspective of an economy-wide production function, the use of labour and complementary factors of production generates national output or GDP. Hence, the faster the growth of labour, *ceteris paribus*, the faster the growth of output. Hence, the notion of employment elasticity focuses only on the demand side of the relationship (with GDP acting as a representation for aggregate demand) and ignores the supply side (the output-creating effect of labour utilisation).

Second, even if it is valid to focus primarily, or only, on the demand side of the employment-GDP relationship, the notion of employment elasticity is valid for a given state of technology and knowledge. As technology changes and knowledge about 'best-practice' production processes change, it can make a given percentage growth of GDP more or less employment intensive. Furthermore, the notion of employment elasticity is 'endogenous' to the policy regime. A given policy regime could be more or less conducive to the growth of employment. For example, existing policy initiatives could encourage labour-using technology or they could impart a capital bias in production processes. The clear implication is that the elasticity of employment is not really an 'exogenous' variable. It carries the complex imprint of the 'natural forces' of the market economy as well as the historical configurations of existing policies. Disentangling the two effects can be a complex task.

The third complexity in the measurement of employment elasticity is specific to the Indonesian case. It is argued that the impact of GDP on employment is not symmetrical. Implicit within the indicator (of employment elasticity) is the assumption that economic growth will promote employment while economic contraction will result in unemployment. In Indonesia, the argument goes, the latter is not necessarily the case because of the so-called 'unemployment as luxury' hypothesis. In the absence of any comprehensive unemployment benefits, unemployment during an economic contraction in Indonesia becomes a luxury that only those with adequate non-labour income can afford. As the 1997 crisis has shown, people respond to a major recession by re-allocating their labour services to the agricultural sector and the informal sector rather than remaining 'openly unemployed'. This means that in an economic downturn the use of any employment elasticity coefficient will overstate the impact on unemployment.

An economy-wide employment elasticity is also unable to distinguish between the impact on employment of changes in sectoral GDP and total GDP. This point is not trivial. Consider, for example, the case of the agricultural sector. In any growing economy experiencing structural change, workers will shift out of the agricultural sector to manufacturing and services, while at the same time demand will be created for jobs through the expansion of the agricultural sector itself. Thus, it will be necessary to disentangle two effects: a direct effect on job creation working through the channel of sectoral GDP; an indirect 'substitution' effect (the movement of people between sectors) as the economy as a whole expands (as reflected in the growth of overall GDP). Any estimation procedure should thus be able to identify the net effect of economic growth on sectoral employment.

How should one react to the prevailing criticisms of the concept of employment elasticity? It is possible to adopt a nihilistic stance and suggest that the concept is so vulnerable to various methodological complexities that it is not worth pursuing as a tool that can assist policy-makers. This paper eschews such nihilism. There are two reasons for this. First, the existence of a relatively stable employment-GDP relationship – the so-called *Okun's Law* – in industrialised countries has been found to be useful in identifying growth thresholds at which employment creation becomes significant (Kelly, 2000: 23).[4] Second, it is possible to respond to some of the perceived methodological problems in a manner that will enhance the capability of the Indonesian government to use the notion of employment elasticity creatively for policy-making – or at least monitoring - purposes.

To start with, some of the usual criticisms directed against the concept of employment elasticity essentially recognise the fact that one ought to distinguish between a movement along a given employment-GDP curve and a shift of the curve. Thus, at any one point, the estimated employment elasticity will measure the slope of the curve. However, the slope and intercept of the curve will also change depending upon the behaviour of the 'shift' parameters. In this case, the parameters are represented by such dynamic factors as changes in technology, new knowledge about work practices and production processes and changes in policy regimes. Given that such shift parameters cannot be readily captured and fed into the computation of the elasticity of employment, it is necessary to update the estimates on a regular basis. Such a procedure will also alert the government to any significant changes in the employment creating potential of the economy and the need for policy action to the extent that such action is deemed desirable and feasible. This procedure is illustrated in this paper by using different time periods for estimating employment elasticity.

[4] See also Padalino and Vivarelli (1997) for a detailed study of the relationship between employment and GDP growth in the G-7countries using data between 1960 and 1994. While admitting the '…possibility of a breakdown of a growth/employment link in the past several years (1993-94 to 1996)', the authors note that there is '…no historical tendency for a weaker employment response to growth. On the contrary, the opposite trend emerges for most of the G-7 countries' (Padalino and Vivarelli, 1997: 211).

As far as disentangling the effects of sectoral GDP and total GDP on employment is concerned, this paper tackles the issue directly by generating estimates that are sensitive to this distinction. In addition, the paper suggests the use of a variety of methods and the utilisation of different data sources to compute the relevant numbers. This in turn ends up as a sensitivity analysis of the robustness of the estimation procedures.

3. Methodology and data sources

The discussion will proceed on the premise that one is dealing with the estimation of an economy-wide employment elasticity. This premise will be subsequently relaxed. The relevant formula is:

$$e = \frac{\Delta L / L}{\Delta Y / Y} \qquad (1)$$

where L stands for employment while Y denotes GDP for the economy as a whole. The numerator can be interpreted as the percent change of employment, while the denominator refers to the percent change of income, that is, the growth rate of GDP. The elasticity 0 is thus interpreted as the per cent change of employment for every one per cent change of GDP.

As it stands, the elasticity formula seems very simple and easy to apply. If one has employment and GDP data for two periods, then estimating the employment elasticity becomes a 'back-of-the-envelope' exercise. It should be noted further that with equation (1) one can only measure the *arc elasticity*, meaning that the elasticity computed is between two different points in time, rather than *point elasticity*. It appears that it is this simple – or descriptive method - that has been used by the Ministry of Manpower to estimate employment elasticity and also used by the ILO Employment Mission to Indonesia that was conducted in April last year (ILO, 1999).

An alternative estimation method involves a double-log linear equation relating employment and GDP. The basic form of the equation is as follows

$$\ln L = b_0 + b_1 \ln Y \qquad (2)$$

Variables L and Y are defined as before, and ln stands for the natural logarithm of the relevant variable. Here, the regression coefficient b_1 serves as the employment elasticity. In other words,

$$b_1 = \frac{d \ln L}{d \ln Y} = \frac{dL / L}{dY / Y} \qquad (3)$$

Thus b_1 is the analogue to the above simple elasticity 0. This form of estimation generates point elasticity, that is, an elasticity that measures the percentage change in the numbers employed if GDP changes infinitesimally close to zero.

An advantage with this second method of estimation, that is, the regression technique, is that it allows one to control the 'beta coefficients' with other variables. To illustrate the point, consider the general form of the above equation (2):

$$\ln L = f(\ln Y, Z) \qquad (4)$$

where Z can be all other variables that affect the employment-GDP relationship, that is, they are 'shift' parameters. In equation (2), the variable Z is assumed to be non-existent.

What could be subsumed under Z? Theoretically speaking, it could be any variable that could conceivably affect the employment variable. In practice, there are several possibilities. A set of dummy variables is one possibility. One may expect that several regions within Indonesia, such as Java, may have different elasticity from the rest of the region, because regional economies within Indonesia may have sufficiently different economic structures. For example, Java is more urbanised and industrialised than the Outer Islands. One may also include dummies for time periods, or other contextual variables that were discussed in section 2. Unfortunately, it is not easy to generate policy-relevant variables or proxies for changes in technology. More importantly, the estimation of equation 4 in an Indonesian context really requires the use of province-level data for which the use of proxies for policy-relevant variables that could affect employment is even more difficult. Hence, the subsequent estimates that incorporate the Z variable focus on regional dummies.

When one considers employment elasticity at the sectoral level, then the equation (4) becomes

$$\ln L_i = f(\ln Y_i, Z) \qquad (5)$$

This means that sectoral GDP (*Yi*) and other variables affect employment in sector-i. Within the sectoral framework, it is possible to interpret the Z variable as incorporating the effect of total GDP (*Y*) on sectoral employment. Thus, changes in employment will be related to changes in both *Yi* and *Y*.

Having provided a brief sketch of the different ways of specifying employment elasticity, some comments are necessary on data sources. Labour force data are obtainable from the publications of the Central Board of Statistics (BPS). The source of the data is the annual labour force survey (or SAKERNAS) with the following exceptions: years ending with zero (decadal observations) are based on population censuses, and years ending with five are from the intercensal population surveys. The standard definition of employment in an Indonesian context is defined as people aged 15 years and above who worked during the previous week of the survey period.[5] However, when dealing with industrial origin classification, this data is not

[5] Before 1998 the BPS used the age of 10 as the benchmark. In 1998, BPS changed the benchmark to the age of 15.

readily available. The readily available data is the one using 10 years of age as the benchmark.

The period covered in this technical note is between 1977 to 1996.[6] The crisis years (1997-1999) have been deliberately omitted in order to avoid confounding influences of the extreme turbulence that characterised the Indonesian economy during that period. Several years, however, are missing. They are 1979, 1981, 1983 and 1984 where no survey or censuses were conducted. Furthermore, in 1986, 1987 and 1988, the BPS changed the nine-sector classification to five-sector categorisation. Therefore, in carrying out the estimations, the following adjustments are done: 'service' covers transportation, financial and public service sectors; and 'other' comprises mining and quarrying, electricity, gas and water supply, and construction.[7]

The data on the gross domestic regional product (GDRP) are also available from the BPS. For this study, all the GDP data are all converted to the 1993 constant price.

4. Results

This section will present results of various alternative methods in estimating the elasticity of employment. First, the standard formula that enables the estimation of *arc elasticity* will be employed. This will be followed by the presentation of results based on econometric estimates.

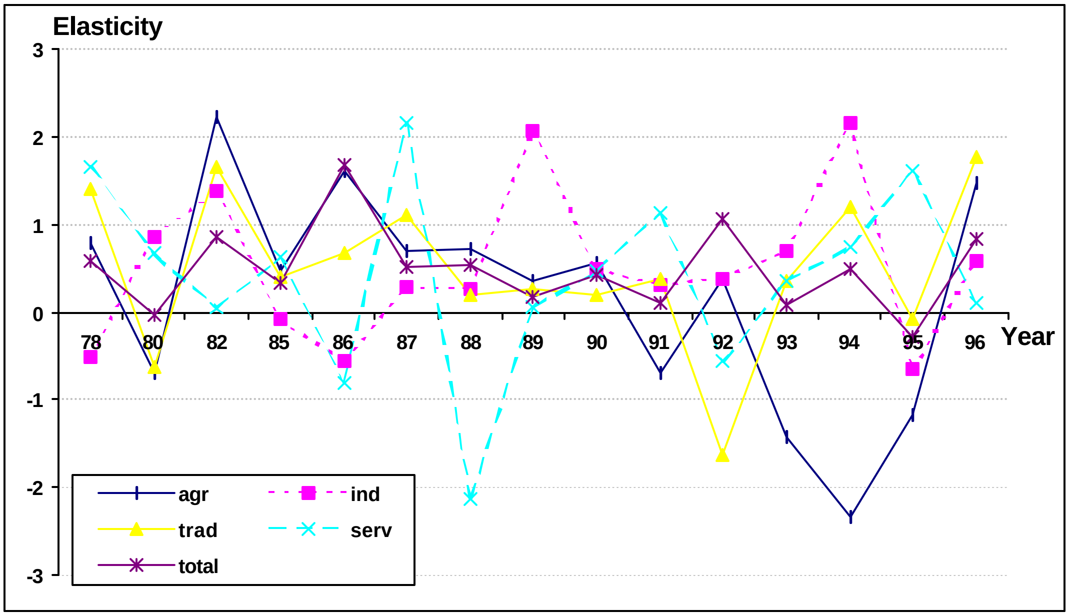
4.1. The 'descriptive' method of computing arc elasticity of employment

The annual employment elasticities for each of five major sectors using equation (1) are shown Figure 1. It can be seen from Figure 1 below that the employment elasticity fluctuates a great deal. Some sectors even experience negative elasticity.

[6] The 1977 data should be used cautiously as the survey conducted at that year is not representative for all Indonesian areas. In several provinces, especially in eastern part of Indonesia the data is only collected for the capital city of the province.

[7] The authors acknowledge that the adjustments are arbitrary, but alternative adjustments will be equally arbitrary.

Figure 1
Employment elasticity of major sectors using descriptive method, 1978-1996



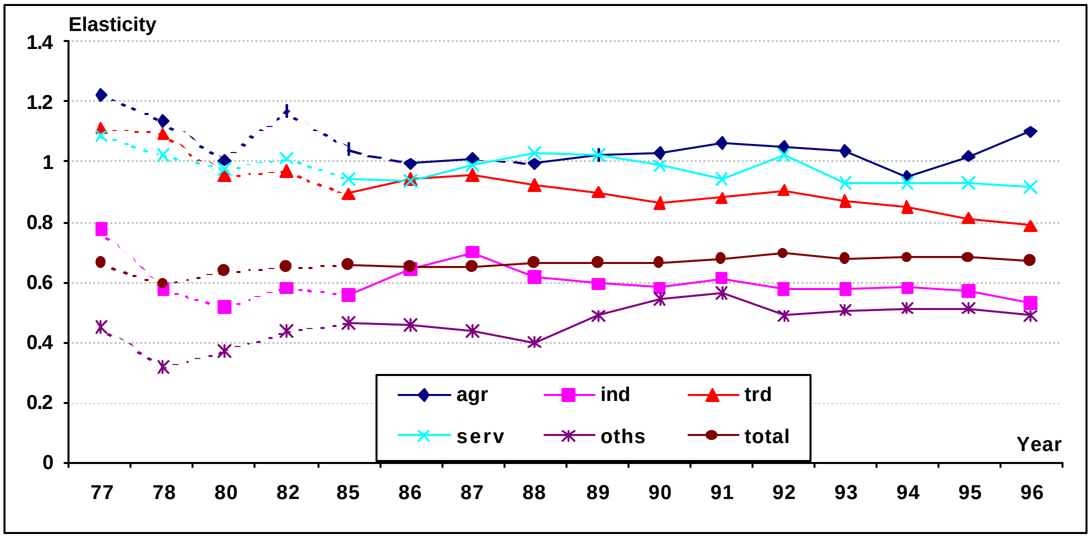
Source: Appendix 1.
Note: 'Other' sector is excluded as it shows too great a variation.

Clearly, the above trend of employment elasticity will be hard to use for policy formulations or even for monitoring purposes. All sectors show great fluctuations from year to year. Hence, it is difficult to analyse the sectoral composition of the employment elasticity. The 'other' sector is not depicted here as the fluctuations are too wide. This is possibly due to the fact that the sector represents a pool of highly differentiated activities. As mentioned earlier, 'other' comprise mining and quarrying, electricity, gas and water supply, and construction sectors.

4.2. Econometric estimates of employment elasticity: results based on OLS

A different method of producing a more stable series of sectoral employment elasticity will be elaborated below. The method involves an estimation of equation (2), one for each year and each sector. The regression will be fitted using provincial data. Hence each regression will consist of 26 cross-sectional observations. The OLS method is employed to estimate the coefficients. In other words, we are estimating coefficients b_1 from the equation $\ln L_i = b_0 + b_1 \ln Y_i$ where L is employment and Y is GDP, and subscript i denotes region. Results are shown in Figure 2 below.

Figure 2
Employment elasticity of major sector using OLS regression, 1977-1996



Source: Appendix 2

One advantage with this method is that the 1977 employment elasticity can still be estimated. This is different from the previous method where the 1978 observations are used to estimate the 1977 employment elasticity. An important difference from the previous method is that the estimates turn out to be much more stable. It is now possible to infer that the overall employment elasticity for Indonesia during the 1977-1996 period is around 0.6 to 0.7 as this has been stable since the end of 1970s.

Agriculture seems to be a sector that has an employment elasticity in excess of unity for the whole period of analysis. In other words, one per cent growth in agricultural GDP leads to more than one per cent growth in employment in the sector. In the late 1970s, there seemed to be a significant decline of the elasticity followed by a sharp increase in 1982. During the second half of 1980s, the elasticity seemed to be stable. In the early 1990s, it tended to decline reaching a trough in 1994 when the elasticity was below one. In 1995 and 1996, the elasticity was on the upswing again. On the other hand, the employment elasticity in the trade sector seems to be in constant decline during the period of analysis. This could be related to the fact that this sector is the home of the bulk of the informal sector. Performing 'the employer of last resort', the sector receives workers that cannot be absorbed by the formal sector. In this sense, it is understandable that the growing number of workers in this sector (combined with a fixed capital stock) is the cause of declining employment elasticity. The same argument applies to the service sector, especially since 1992. Taking aside the year 1977, the industry sector showed relatively stable employment elasticity for the whole period. However, a closer inspection suggests that the employment elasticity was on an upswing pattern before 1990 and on a declining trend after that.

Table 1 below presents a comparison of the two methods – that is, the descriptive method that leads to the estimation of *arc elasticity* and the OLS method that generates the 'beta' coefficients. As can be seen the two differ a great deal. Similarities are apparent only for the industry and 'other' sectors, while the agricultural sector differs considerably. In estimating the average, the standard deviation is shown in parentheses. The table shows that sectoral averages obtained by the OLS regressions have lower standard of deviation, and hence higher reliability, compared to those obtained by the simple formula.

The right panel of Table 1 presents the annual overall employment elasticity for the 1977-1996 period. Again, it can be seen that the OLS regression gives a more stable series rather than the descriptive method. Using the latter, the annual employment elasticity fluctuates greatly with some years indicating negative magnitudes. Furthermore, the economy-wide employment elasticity obtained by the OLS regression method is significantly higher compared with the descriptive method (0.66 vs 0.49).

Table 1.
The sectoral and annual average employment elasticity, 1977-1996

Sectoral average		
Sectors	**Descriptive method: arc elasticity**	**OLS Regression**
Agriculture	0.19 (1.23)	1.05 (0.07)
Industry	0.51 (0.85)	0.60 (0.06)
Trade	0.48 (0.89)	0.92 (0.09)
Services	0.41 (1.07)	0.98 (0.05)
Other	0.58 (10.05)	0.46 (0.06)
All sectors	0.49 (0.49)	0.66 (0.02)

Economy-wide annual average		
	Descriptive method: arc elasticity	**OLS Regression**
1977	--	0.66
1978	0.58	0.59
1980	-0.04	0.64
1982	0.86	0.65
1985	0.33	0.66
1986	1.67	0.65
1987	0.52	0.65
1988	0.54	0.67
1989	0.17	0.66
1990	0.42	0.67
1991	0.11	0.67
1992	1.05	0.70
1993	0.07	0.67
1994	0.48	0.68
1995	-0.29	0.68
1996	0.83	0.67
All year	0.48	0.66

Source: Appendix 1 and 2.
Note: Standard of deviation in parentheses.

From a policy perspective, the above result has important implications. Human resource planning – which relies on employment elasticities - is typically carried out within a medium- and long-term framework, rather than within short-term horizons. Accordingly, the volatile nature of employment elasticity as depicted in Figure 1 would make it difficult for such a planning exercise to be carried out. Not only is it difficult to see trends, but is also hard to evaluate the effects of past policies. Therefore, in relation to planning purposes, the regression technique appears to be more appropriate than the formula based on the descriptive approach.

4.3. Pooling time-series and cross-section data

Statistically speaking, a more efficient estimate is obtainable when one pools the cross section and time series data together. The additional efficiency comes from larger number of observations available for the estimation process. The larger number of observations also makes it possible to introduce other relevant variables into the model specification, for example as shown in equation (4). Also, it reduces the possibility of correlations among independent variables.

The *random effect* model is used to obtain efficient estimates of the employment elasticity as OLS is no longer an acceptable estimator when pooled data is used. The random effect is a GLS method essentially taking into account the existence of three sources of errors in the regression equation. They are the time-related error, cross-section-related error, and 'white noise'.[8]

Regression specifications used in this sub-section would be a linear form of equation (4). Appendix 3 presents the complete regression results of this specification with attempts to differentiate Java and off-Java regions. Three different time periods are used: the first uses all existing years, the second uses 1985 as the starting year, and the third uses 1990 as the starting year. For each of the data set, two models are used. Model 1 is the simplest model only containing the log of GDP on the right hand side of the equation. In other words, it is $\ln L = b_0 + b_1 \ln Y$ where L is employment and Y is GDP. Accordingly, the coefficient of the log of GDP is the employment elasticity. Model 2 adds a dummy variable for Java region. The dummy enters the model as one affecting the intercept and also as an interacting variable. In so doing, not only the intercept but also the gradient (or the slope) varies between Java and off-Java regions. The model takes the form of

$$\ln L = b_0 + b_1 \ln Y + d_1 D + d_2 (D * \ln Y)$$

where D is a dummy variable taking a value of 1 for Java provinces and 0 elsewhere. Therefore,

Equation for off-Java region is:	$\ln L = b_0 + b_1 \ln Y$
Equation for Java region is:	$\ln L = (b_0 + d_1) + (b_1 + d_2) \ln Y$.

[8] For more a technical exposition about the random-effect GLS estimator, see Greene (1999).

It follows that the employment elasticity for off-Java region is b_1, and that for Java region is $(b_1 + d_2)$. Excerpts from Appendix 3 are shown in Table 2 below. In the table the employment elasticity (the coefficient for the logarithm of income, i.e., b_1) is shown together with the coefficient that would change the elasticity for Java region, that is, d_2.

Regression estimates reported in Table 2 seem statistically plausible. Likewise, the employment elasticity obtained by adding the dummy variable for Java is also statistically significant. The exception is only that for the agricultural sector using 1990-1996 data set, which at face value appears unreasonable.

The coefficient of determination is also at a reasonable level for all regressions. The lowest is apparent for the 'other' sector. This is to be expected, as the 'other' sector is basically a pool of highly differentiated activities. As mentioned earlier, the 'other' sector comprises mining and quarrying, electricity, gas and water supply, and construction sectors. With the inclusion of the dummy variable, however, the coefficient of determination for this sector increases to above 50 per cent. The rest of the sectors show relatively more convincing coefficients of determination. For the service sector, the model can even explain as high as 85 per cent of variations in the dependent variable.

The Java effect is only positive for the agricultural sector, while all other sectors show negative effects. Positive effects are also apparent for the 'other' sector, but they are statistically insignificant. That means that in terms of employment, any additional growth of GDP would generate greater labour absorption if the income-generating activities occurred outside Java.

Table 2.
Employment elasticity using pooled provincial time-series data and regional 'dummies'

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
AGRICULTURE						
Employment elasticity	0.83**	0.78**	0.35**	0.32**	0.36**	0.11
Plus dummy Java		0.22		0.29**		0.86**
INDUSTRY						
Employment elasticity	0.54**	0.54**	0.65**	0.64**	0.70**	0.65**
Plus dummy Java		-0.09		-0.12		-0.15
TRADE						
Employment elasticity	0.78**	0.82**	0.78**	0.83**	0.87**	0.94**
Plus dummy Java		-0.34**		-0.40**		-0.46**
SERVICES						
Employment elasticity	0.72**	0.74**	0.81**	0.82**	0.85**	0.85**
Plus dummy Java		-0.23		-0.23**		-0.26**
OTHER						
Employment elasticity	0.66**	0.60**	0.18**	0.12**	0.73**	0.65**
Plus dummy Java		0.06		0.24		-0.12
ALL SECTORS						
Employment elasticity	0.57**	0.60**	0.41**	0.44**	0.35**	0.38**
Plus dummy Java		-0.24**		-0.17**		-0.18**

Source: Appendix 3
Note: ** significant at 5% * significant at 10%

Table 3 uses the elasticities reported in Tables 1 and 2 to illustrate the impact on the number of jobs created per 1 per cent change in sectoral GDP. As can be seen, there are substantial differences in the projected number of jobs created by sector, depending on the values used for corresponding elasticities. For example, in the case of agriculture, using the elasticity parameter derived from the descriptive method yields approximately 74 thousand jobs created (per 1 per cent change in agricultural GDP), while 411 thousand jobs are created if the elasticity parameter derived from the OLS method is used. These are conspicuous differences that policy makers simply cannot ignore. In other words, it is important to agree on what the appropriate method of calculating the employment elasticity ought to be, given that the implications for projecting employment growth are so dramatic.

Table 3
Number of additional jobs created with a 1% increase in sectoral GDP (in thousand)

	Descriptive Method	Average of OLS regressions	Pooling data sets (GLS random effect method)	
	Without regional dummy	Without regional dummy	Without regional dummy	With regional dummy
Agriculture	74.37	411.02	324.90	305.33
Agriculture Java	--	--	--	194.16
Industry	50.59	59.51	53.56	53.56
Industry Java	--	--	--	32.92
Trade	80.57	154.43	130.93	137.65
Trade Java	--	--	--	87.52
Services	70.12	167.61	123.14	126.56
Services Java	--	--	--	56.35
Other	25.17	19.96	28.64	26.04
Other Java	--	--	--	17.47
All sectors	427.73	576.13	497.57	523.75
All sectors Java	--	--	--	185.94

Note: This table relies on elasticities reported in Tables 1 and 2
The projections are based on 1998 employment levels.

As a means of concluding this section, it would be useful to illustrate the national growth rate required to absorb the inflow of new entrants to the workforce (approximately two million per year based on recent estimates. Obviously, a unique answer to this question is not possible because the required growth rate is sensitive to the particular employment elasticity used. As can be seen in Table 4, the required growth rate varies from 4.68 per cent to 3.47 per cent. Are these growth rates achievable in the medium-term?

The predictions by the government are that the economy is expected to grow in the 3-4 per cent range in 2000, while the medium-term forecast is that the economy will grow in the 5-6 per cent range. Thus, what one can conclude is that in the short run the pressure of slow growth on the labour market is likely to be quite significant, given that the predicted growth rate may fall just below the range required to absorb new entrants to the labour force.

Table 4
Required growth rate to absorb new entrants to the workforce (% per annum)

Method	Employment elasticity	No. of additional jobs created with 1 per cent income growth	Required growth rate
Descriptive method	0.49	427,730	4.68
Simple OLS regression	0.66	576,130	3.47
Pooled provincial time-series data			
- without regional dummy	0.57	497,570	4.02
- with regional dummy (simple average)	0.54	469,800	4.26

Note: New entrants to the workforce are estimated to be approximately 2 million people per year.

4.4. Pooling time-series and cross-section data: distinguishing between the employment effects of growth in sectoral GDP and overall GDP

The term employment elasticity has two possible meanings. The first is the change in employment due to the change in the corresponding sectoral GDP. The second interpretation is the change in employment due to the change in GDP for the economy as a whole. The two types of GDP determine the employment elasticity simultaneously, and not separately. This will be examined in this subsection. For that purpose, we will use the following model specification

$$\ln L_{ip} = b_0 + b_1 \ln Y_{ip} + b_2 \ln Y_p$$

where all variables are defined as before, subscripts *i* denotes sector and *p* denotes province. Therefore, each sectoral regression will contain not only the corresponding sectoral GDP but also the overall provincial GDP.

Estimation results of each sectoral regression are shown in Table 5 below. In general, the equations seem to perform quite well. Also the employment elasticity with respect to sectoral income are all statistically significant at 95 per cent confidence interval, except for the 'other' sector. The latter even suggests a negative elasticity coefficient, arguably because of the highly differentiated nature of this sector. Another unexpected result is the employment elasticity with respect to total GDP for the service sector that bears the 'wrong' sign and is statistically insignificant.

Table 5.
Employment elasticity using pooled provincial time-series data: distinguishing between the employment effects of growth in sectoral GDP and total GDP

	Data sets		
	1977-96	**1985-96**	**1990-96**
AGRICULTURE			
From sectoral income	1.2281**	0.7154**	0.8428**
From total income	-0.3614**	-0.3211**	-0.4490**
INDUSTRY			
From sectoral income	0.4056*	-0.1223	0.2490
From total income	0.2506**	1.2532**	0.6751**
TRADE			
From sectoral income	1.0085**	0.3325**	0.5138**
From total income	-0.2735**	0.5406**	0.4847**
SERVICES			
From sectoral income	0.7538**	0.3786**	0.329**
From total income	-0.0340	0.4301**	0.5201**
OTHER			
From sectoral income	-0.1641*	-0.4775**	-0.3141**
From total income	1.1393**	1.1424**	1.3957**

Source: Appendix 4
Note: ** significant at 5% * significant at 10%

The employment elasticity with respect to total GDP or income provides an interesting insight. First of all, the employment elasticity with respect to the total income for the agricultural sector appears to be negative. That means higher total income will lead to lower agricultural employment. This, in essence, is in line with the structural change theory proposed by Chenery and Syrquin (1970). Overall, the above results suggest that increases in agricultural income will have two counteracting influences on agricultural employment. On one hand, the expansion of the agricultural sector will boost employment in the sector, but on the other hand, the expansion of the economy as a whole decreases employment in the sector as workers reallocate their services to non-agricultural activities.

On the other hand, the coefficients of employment elasticity with respect to total income for industry bears a positive sign. This implies that the net employment creating capacity is higher for industry, since both the sectoral effects and the overall effects are additive. Again, this result agrees with the structural change theory.[9]

[9] Experiments using the dummy variable for Java, as used in the previous subsection, do not produce statistically significant estimates for the dummies.

A point worth noting is that the elasticity estimates are sensitive to the time periods over which the computations are made. For example, in the case of services, the estimated sectoral elasticity is 0.74 for the 1977-1996 period, but drops to 0.32 for the 1990-1996 subperiod. It is difficult to say whether this represents a genuine drop in the employment creating potential of the service sector or whether it is a statistical artifact as the trends in the subperiods are not statistically significant.

Table 6 uses the elasticities reported in Table 5 to work out the impact on the number of jobs created for every 1 per cent change in both sectoral and total GDP. The novelty of Table 6 lies in the final column that shows the net employment creating capacity of each sector. As can be seen, the job losses induced by structural change are highest in agriculture, while industry is a net gainer from the process of the reallocation of employment from the agricultural sector.

Table 6
Number of additional jobs created with a 1% increase in sectoral GDP and total GDP (in thousand)

	Source of income	Number of additional jobs	Net effect
Agriculture	Sectoral income	480.73	339.26
	Total income	-141.47	
Industry	Sectoral income	40.23	65.09
	Total income	24.86	
Trade	Sectoral income	169.29	123.38
	Total income	-45.91	
Services	Sectoral income	128.92	123.11
	Total income	-5.81	
Other	Sectoral income	-7.12	42.32
	Total income	49.44	

Note: This table relies on elasticities reported in Table 4.
The projections are based on 1998 employment levels.

5. Estimating employment elasticity: use of alternative data

The previous discussion on estimating the employment elasticity is based on the use of aggregate labour data collected through the labour surveys or censuses. Another alternative source of data is available, namely the industrial establishment-level surveys. However, data from this survey, that is, the survey of medium and large enterprises conducted by the BPS, would only be appropriate to estimate employment elasticity for the medium- and large-scale firms in the manufacturing sector. Nevertheless, they serve as a useful complement to this exercise because they provide some insights into the employment creating potential of medium- and large-scale firms. An example of such estimation as conducted by a UNIDO study is shown in Table 7 below.

The employment elasticity in Table 7 is calculated using the previously discussed descriptive method in section 3. The result, as one may guess, is quite volatile in nature, and is quite similar to the previously noted findings. The employment elasticity for the food manufacturing sector for the 1985-1988 period is 1.1 but that for the 1988-1993 period drops to a mere 0.2. For the medium and large enterprise in general, the above table suggests an employment elasticity of 0.5 during the 1985-1997 period. This is essentially similar to the employment elasticity for the industry sector during the 1977-1996, that is, 0.51 (please refer to Table 1).

Table 7
The employment elasticity from medium and large enterprise survey (three-digit ISIC classifications): descriptive method

	Period of analysis			
	1985-1988	**1988-1993**	**1993-1997**	**1985-1997**
All medium & large manuf.	**0.8**	**0.6**	**0.3**	**0.5**
Food manuf. (31)	1.1	0.2	0.2	0.3
Textile manuf. (321)	0.7	0.5	0.1	0.4
Garment manuf. (322)	0.8	0.5	-0.6	0.7
Furniture manuf. (332)	0.8	0.9	0.4	0.8
Electrical goods (383)	-0.2	0.6	0.4	0.6
Transport equip. (384)	0.4	0.2	0.4	0.3
Metal industry (38)	0.4	0.5	0.4	0.5
Footwear manuf. (324)	1.3	0.9	1.1	1.0

Source: Dhanani (2000)

Given the availability of the data, it would be possible to estimate the employment elasticity using the previously elaborated econometric techniques. If the survey data were available for several periods of time then pooling the time series, cross-industry data would allow one to carry out an estimation exercise with pooled data sets.

An immediate advantage of using such a survey data is that it would be possible to compute the elasticity of employment at a very detailed level within manufacturing. The above table shows the employment elasticity for three-digit ISIC classifications. The reliability of calculating the elasticity for a very disaggregated level, say for five-digit ISIC, would depend on the number of observations (that is, firms surveyed) available for that ISIC.

6. Conclusions and recommendations

There are several conclusions that one can draw from the above discussions. First, the descriptive method entailed in computing employment elasticity produces significant volatility. For policy-making and monitoring purposes, such volatility engenders some complications. On the other hand, as shown in Table 1, the use of econometric technique provides a much more stable pattern. More importantly, they enable one to ascertain whether the numbers generated are statistically significant or not.

Second, pooling provincial and time-series data provides greater flexibility in estimating the employment elasticity. One advantage is that it enlarges the data set thus engendering more efficiency in estimation. Also, it enables the exploration of alternative specifications of the regression model. However, in the presence of pooled data, simple OLS is no longer acceptable. The random effect GLS method, as used in this technical note, provides an efficient and consistent estimator under such circumstances.

Third, some regularities are apparent despite the use of different methods. Agriculture seems to have the highest employment elasticity at the sectoral level. This is followed by trade, services and industry sectors. The 'other' sector occasionally shows irregular outcomes. As argued before, this may be due to the highly differentiated content of the 'other' sector.

Fourth, the analysis of employment elasticity was expanded by incorporating regional 'dummies' and by attempts to disentangle the effects on employment due to the growth of sectoral GDP and due to the overall expansion of the economy. When these extensions are done, the findings provide insights into the various configurations of employment elasticity. For example, the use of 'dummy' variables to represent the distinct economic structures of Java and the Outer Islands suggest that the employment creating potential of GDP growth is apparently higher for the Outer Islands rather than Java (the exception is the agricultural sector in Java). As far as distinguishing between the employment effects of the growth of sectoral GDP and overall GDP is concerned, the apparently high employment elasticity of the agricultural sector diminishes because of 'substitution effects'. In other words, while the growth of the agricultural GDP expands employment within agriculture, the growth of the economy as a whole leads to a decline in employment in the latter as labour services are reallocated to off-farm activities. This is, of course, a basic tenet of structural change theory. In the case of the industrial sector, the effects are 'additive', that is, growth of sectoral GDP and overall GDP both add to employment growth.

Fifth, it is evident that the employment elasticity is changing overtime. All of the methods suggest this. Whether one uses the descriptive method or econometric technique, the elasticity of employment is in a state of flux. Therefore, it would be appropriate to keep updating the estimation exercises so as to include the latest situation in the computation.

Sixth, in addition to the use of labour survey data, other survey data can be utilised to estimate the employment elasticity. The medium and large-scale establishment data can be used to calculate employment elasticity in the manufacturing sector as a whole. Such a data set allows one to obtain employment elasticities at a disaggregated level within manufacturing.

Finally, the national growth rate that is required to absorb new entrants to the workforce (approximately 2 million per year) varies between 4.68 to 3.47 per cent. These variations are due to the different employment elasticities that are used in the calculations. While these growth rates may be achievable in the medium term, in the short term the pressure of slow growth on the labour market is likely to be quite significant. The latest forecasts from the government and international agencies suggest that for the year 2000 (and perhaps even for the year 2001) the predicted growth rate may fall just below the range required to absorb new entrants to the labour force.

Based on the above analysis and conclusions, several recommendations follow.

- First, the government should eschew the use of the descriptive method and rely more extensively on the use of appropriate econometric techniques in estimating the employment elasticity. This could be the OLS method if only province-level observations at a particular point in time is used, or this could be the random effect GLS method if pooling of province-level and time-series data is desired to enlarge the data. Within this framework, attempts should be made to distinguish between the employment effects of changes in sectoral GDP and overall GDP as well as between Java and the Outer Islands.

- Second, as the employment elasticity is evidently changing over time, it would be useful for the institution in charge of releasing the elasticity to keep updating its database. Frequent updating is necessary to appreciate the dynamics of the labour market.

- Third, it is advisable that the estimation of employment elasticity also be done using other alternative sources of data, in addition to the standard use of labour surveys. The technical note has shown the possibility of using the industrial establishment survey data to estimate the employment elasticity for the manufacturing sector.

- Finally, as emphasised in the introduction to this note, the government ought to engage systematically with the professional community to reach a consensus on the most appropriate method of estimating – and interpreting - employment elasticity. Such an approach will enable the government to seek improvements in its methodology from professional peers and at the same time enable it to gain legitimacy from the broader community on the dissemination of labour market statistics.

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Appendix 1
Employment elasticity of major sectors using simple formula on aggregate national data, 1978-1996

	Agriculture	Industry	Trade	Services	Other	Total
1978	0.79	-0.52	1.40	1.65	-0.66	0.58
1980	-0.71	0.86	-0.64	0.66	-16.35	-0.04
1982	2.21	1.37	1.66	0.05	1.31	0.86
1985	0.46	-0.09	0.40	0.62	0.17	0.33
1986	1.61	-0.56	0.67	-0.80	31.34	1.67
1987	0.68	0.28	1.11	2.16	-9.79	0.52
1988	0.72	0.27	0.19	-2.12	-1.55	0.54
1989	0.34	2.07	0.27	0.05	-6.46	0.17
1990	0.57	0.48	0.19	0.47	1.80	0.42
1991	-0.69	0.31	0.36	1.13	2.31	0.11
1992	0.38	0.38	-1.63	-0.57	0.01	1.05
1993	-1.42	0.69	0.35	0.35	2.72	0.07
1994	-2.34	2.14	1.20	0.74	3.50	0.48
1995	-1.18	-0.65	-0.07	1.60	0.03	-0.29
1996	1.47	0.58	1.76	0.11	0.27	0.83
Average	**0.19**	**0.51**	**0.48**	**0.41**	**0.58**	**0.48**

Appendix 2
Employment elasticity of major sectors using simple OLS regression on annual provincial data, 1977-1996

	Agriculture	Industry	Trade	Services	Other	All Sector
1977	1.22	0.77	1.11	1.09	0.45	0.66
1978	1.14	0.57	1.10	1.03	0.32	0.59
1980	1.00	0.52	0.95	0.98	0.37	0.64
1982	1.17	0.58	0.97	1.01	0.44	0.65
1985	1.05	0.55	0.90	0.94	0.46	0.66
1986	1.00	0.64	0.94	0.94	0.46	0.65
1987	1.01	0.70	0.96	0.99	0.44	0.65
1988	0.99	0.62	0.93	1.03	0.40	0.67
1989	1.02	0.60	0.90	1.03	0.49	0.66
1990	1.03	0.58	0.87	0.99	0.55	0.67
1991	1.07	0.61	0.88	0.94	0.56	0.67
1992	1.05	0.57	0.91	1.02	0.49	0.70
1993	1.04	0.57	0.87	0.93	0.51	0.67
1994	0.95	0.58	0.85	0.93	0.51	0.68
1995	1.02	0.57	0.81	0.93	0.51	0.68
1996	1.10	0.53	0.79	0.92	0.49	0.67
Average	**1.05**	**0.60**	**0.92**	**0.98**	**0.46**	**0.66**

Appendix 3
Estimation results of pooling provincial time-series regression

AGRICULTURE

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	7.736**	8.0856**	11.1649**	11.3230**	11.0903**	12.7619**
Ln employment	0.8315**	0.7780**	0.3508**	0.3183**	0.3598**	0.1150
Dummy Java		-1.6049		-1.8814**		-6.1842**
Ln e * Djava		0.2249		0.2930**		0.8574**
R-squared	0.6480	0.6749	0.7819	0.7982	0.8157	0.7881

Note: ** significant at 5% * significant at 10%

INDUSTRY

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	8.0464**	7.8237**	7.3051**	7.1766**	7.0008**	7.1585**
Ln employment	0.5407**	0.5356**	0.6535**	0.6433**	0.7044**	0.6555**
Dummy Java		2.0289**		2.0374**		2.2359**
Ln e * DJava		-0.0859		-0.1202		-0.1529
R-squared	0.5343	0.6491	0.5453	0.6490	0.5529	0.6507

Note: ** significant at 5% * significant at 10%

TRADE

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	6.9494**	6.5515**	6.9661**	6.5269**	6.3063**	5.7970**
Ln employment	0.7803**	0.8233**	0.7782**	0.8283**	0.8748**	0.9434**
Dummy Java		3.4413**		3.8732**		4.1981**
Ln e * DJava		-0.3423**		-0.3951**		-0.4638**
R-squared	0.7905	0.8177	0.8091	0.8331	0.8311	0.8365

Note: ** significant at 5% * significant at 10%

SERVICES

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	7.1650**	6.9407**	6.5140**	6.3822**	6.2929**	6.1946**
Ln employment	0.7248**	0.7386**	0.8140**	0.82027**	0.8451**	0.8490**
Dummy Java		2.6282**		2.5270**		2.6801**
Ln e * DJava		-0.2267		-0.2347**		-0.2587**
R-squared	0.8575	0.8660	0.8702	0.8762	0.8787	0.8810

Note: ** significant at 5% * significant at 10%

OTHER

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	6.6602**	6.8289**	9.9866**	10.0370**	6.2340**	6.5183**
Ln employment	0.6639**	0.6004**	0.1773**	0.1152**	0.7227**	0.6489**
Dummy Java		0.7559		-0.0508		2.0819
Ln e * DJava		0.0619		0.2443		-0.1175
R-squared	0.3516	0.5162	0.3581	0.6107	0.3980	0.5952

Note: ** significant at 5% * significant at 10%

ALL SECTORS

	Data sets					
	1977-96		1985-96		1990-96	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	9.3900**	9.0049**	10.7333**	10.3497**	11.3305**	10.8866**
Ln employment	0.5660**	0.5953**	0.4144**	0.4389**	0.3468**	0.3759**
Dummy Java		3.1320**		2.5902**		2.8745**
Ln e * DJava		-0.2442**		-0.1678**		-0.1847**
R-squared	0.5445	0.5973	0.6215	0.6692	0.6490	0.6640

Note: ** significant at 5% * significant at 10%

Appendix 4
Estimation results of pooling provincial time-series regression: employment effects of changes in sectoral and total GDP

AGRICULTURE

	Data sets		
	1977-96	**1985-96**	**1990-96**
Constant	8.0321**	11.3546**	11.5612**
Ln sectoral income	1.2281**	0.7154**	0.8428**
Ln total income	-0.3614**	-0.3211**	-0.4490**
R-squared	0.7178	0.8292	0.7671

Note: ** significant at 5% * significant at 10%

INDUSTRY

	Data sets		
	1977-96	**1985-96**	**1990-96**
Constant	6.7673**	1.5433*	4.1783**
Ln sectoral income	0.4056*	-0.1223	0.2490
Ln total income	0.2506**	1.2532**	0.6751**
R-squared	0.5474	0.6265	

Note: ** significant at 5% * significant at 10%

TRADE

	Data sets		
	1977-96	**1985-96**	**1990-96**
Constant **Ln sectoral income**	7.7901** 1.0085**	5.2669** 0.3325**	4.5140** 0.5138**
Ln total income	-0.2735**	0.5406**	0.4847**
R-squared	0.8005	0.7581	0.8003

Note: ** significant at 5% * significant at 10%

SERVICES

	Data sets		
	1977-96	**1985-96**	**1990-96**
Constant	7.2486**	5.9565**	5.5294**
Ln sectoral income	0.7538**	0.3786**	0.329**
Ln total income	-0.0340	0.4301**	0.5201**
R-squared	0.8576	0.8368	0.8402

Note: ** significant at 5% * significant at 10%

OTHER

	Data sets		
	1977-96	**1985-96**	**1990-96**
Constant	2.3453**	4.4664**	1.0318
Ln sectoral income	-0.1641*	-0.4775**	-0.3141**
Ln total income	1.1393**	1.1424**	1.3957**
R-squared	0.6759	0.7754	0.8098

Note: ** significant at 5% * significant at 10%