
**Quality of Employment
Growth in Singapore
1983-96**

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**Economics Department
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**QUALITY OF
EMPLOYMENT GROWTH
IN SINGAPORE
1983-96**

BY

**DOMESTIC ECONOMY DIVISION*
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MONETARY AUTHORITY OF SINGAPORE**

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QUALITY OF EMPLOYMENT GROWTH IN SINGAPORE, 1983-96

	<u>Content</u>	<u>Page</u>
	Executive Summary	i-iii
1.	Introduction	1
2.	Employment Gains by Industry and Occupation: Towards a Services-based Economy	3
3.	Employment Gains by Earnings Group: Towards a Higher Quality Workforce	6
4.	Employment Growth and Educational Attainment	11
5.	Conclusion	17
	Appendix: Employment by Industry-Occupation Cells and Gross Median Wages	18
	References	19

Executive Summary

1. Singapore has experienced a healthy rate of job growth over the years, with unemployment maintained at a low 2% in recent years. However, of greater significance to a resource-constrained economy like Singapore is the quality of such employment growth. As the economy undergoes economic restructuring, there is considerable displacement and replacement of jobs both within and between industries as companies progress up the value-added chain or relocate elsewhere.

2. This paper examines the quality of employment gains between 1983 and 1996 in terms of job earnings for an employment matrix of 6 industrial and 6 occupational categories. The resultant 36 occupation-industry cells are arrayed in order of their gross median wages averaged over 1991-95. They are then grouped into three earnings groups – highest, middle and lowest – with each group accounting for about one-third of total employment in 1990. The analysis is largely based on data from the *Labour Force Survey* which covers households only and excludes workers living on sites and commuting daily to and from Malaysia. It also excludes the agriculture & fishing, quarrying, and the electricity, gas & water industries, as well as industries and occupations that are not classified. Jobs in the 36 occupation-industry cells accounted for about 90% of total employment in 1990.¹

3. From an industry viewpoint, the financial and business services industry accounted for the largest share (28%) of total jobs created between 1983-96, a vastly disproportionate increase given its share of employment (8.6%) in 1983. In contrast, the manufacturing industry – the largest employer – only accounted for a modest 12% of employment gains, and saw its share of employment declining from 30% in 1983 to 24% in 1996. Underpinned by strong employment growth in the financial and business services, the services industry as a whole – which also comprises commerce, transport and communications, and community and social services – experienced an increase in its share of employment from 62% to 69% over the period. These trends towards a more service-oriented economy are consistent with developments in the other Newly Industrialized Economies (NIEs) and the more advanced economies.

4. From an occupational perspective, the managerial and professional categories accounted for a disproportionate share of employment growth. These occupational categories accounted for three-quarters of total employment gains between 1983 to 1996, compared to their combined employment share of 22% in 1983. In contrast, growth in the production and related worker occupational categories was negligible.

¹ The analysis will be biased towards findings of better job quality only to the extent that the excluded workers are lower-skilled ones and that their number has increased during the period. However, estimates which conservatively assumed that all the excluded workers were unskilled ones showed the bias to be insignificant, and would not alter the findings of this paper.

5. Analysed by earnings groups, three distinct phases of employment growth can be identified over the 1983-96 period: the **consolidation phase** (1983-86), the **extensive growth phase** (1986-91) and the **intensive growth phase** (1991-96). The consolidation phase was characterised by a decline in overall employment as the economy went into a recession in 1985, led by substantial job losses in the two lower earnings groups. During the extensive growth phase, robust employment gains were experienced across all three earnings groups as the economy recovered and gathered momentum. In the intensive growth phase, there was a shift towards higher quality jobs, as the highest-earnings group saw large employment gains while the lowest-earnings group experienced substantial job losses.

6. Indeed, over the entire period, the highest-earnings group experienced the fastest growth rate of 6% p.a., and accounted for three-quarters of Singapore's overall employment gains. The managerial and professional occupational categories mentioned above comprised the bulk of the highest-earnings group, and accounted for virtually all the employment gains. Of these, two-thirds went to managers and professionals in the services industry, led by financial and business services. Managerial and professional employment in manufacturing also grew strongly, accounting for about a quarter of the job increase in the highest-earnings group over the period, even though manufacturing employment as a whole grew by much less. Although there was a wide dispersion in earnings within the highest-earnings group, employment growth was evenly distributed within the group, not skewed towards either the upper or lower end of the earnings scale.

7. With employment growth largely concentrated in the highest-earnings group, employment in the middle-earnings group experienced modest growth of only 1.7% p.a., mostly in the clerical and service & sales jobs in the services industry. The lowest earnings group saw hardly any growth, and has experienced a trend decline in employment since 1991. This has been the result of substantial job losses in the manufacturing industry, comprising primarily production and related workers. That the manufacturing industry has been adding managerial and professional jobs while at the same time shedding production and related jobs is indicative of its restructuring towards more capital-intensive and higher-skilled activities.

8. In line with the rising quality of employment, the aggregate skill level of the labour force has improved. The proportion of skilled labour – defined as workers with at least post-secondary education – doubled from 15% in 1983 to 31% in 1996. In contrast, the ratio of unskilled labour – those with at most lower-secondary education – declined from 54% to 39% during this period. The improvement in workers' educational level was broad-based across all industries, with the manufacturing industry experiencing the largest improvement.

9. A good part of the improvement in the economy's aggregate skill level was due to the so-called *within or occupational mix effect* (90%) rather than

the *between* or *industry shift effect* (10%). **Occupational mix effect** arises from the substitution of more educationally qualified workers for less qualified ones within individual industries due to: (a) developments in the *supply* of better educated workers and the concomitant decline in their relative cost; and/or (b) the introduction of *skills-biased* technological progress. **Industry shift effect** stems from changes in the patterns of demand or the structure of the economy, which result in the higher-skilled industries experiencing greater-than-average employment growth compared to the lower-skilled industries.

10. The **industry shift effect** was concentrated almost entirely in the financial and business services industry, an industry with rising employment share and higher skill requirement. In contrast, the contribution from the manufacturing industry was negative, as the industry experienced a trend decline in its employment share over the period. On the other hand, with increasing proportions of skilled workers over the last 13 years, all industries contributed positively to the **occupational mix effect**. In particular, the manufacturing industry accounted for about one-third of the overall occupational mix effect.

11. With both its **positive** contribution to the occupational mix effect and **negative** contribution to the industry shift effect, the manufacturing industry makes for an interesting case study. Between 1983 and 1996, both value-added and capital stock in the manufacturing industry grew at roughly similar rates which were well in excess of its employment growth. The substantial increase in capital-labour ratio, or capital deepening, in the manufacturing industry reflected its shift to more capital-intensive, labour-saving production techniques and activities. These activities were also increasingly skills-biased, requiring greater use of skilled workers than unskilled workers. Indeed, since 1991, there has been an absolute decline in the number of lower skilled manufacturing workers.

1 Introduction

1.1 Between 1983 and 1996, the Singapore economy grew by 7.7% per year. During the same period, total employment increased by about half a million to 1.75 million, equivalent to an annual growth rate of 2.6%.¹ This healthy rate of job growth has provided gainful employment for most Singaporeans, with the unemployment rate at a low 2% in recent years.

1.2 However, of greater significance for a resource-constrained economy like Singapore is the quality of such employment growth. With continuous economic restructuring, there has been considerable displacement and replacement of jobs both within and between industries as companies move up the value-added chain or relocate elsewhere. For example, in the manufacturing industry, jobs in the professional, technician and associate professional occupation, presumably high-quality ones, were added even as jobs in the production and related worker occupation, presumably low quality type, were shed. Also, the bulk of the job gains between 1983 and 1996 accrued to the services industries, which are traditionally but otherwise mistakenly considered to be low-paying ones. Are these employment trends consistent with the shift towards a high-skilled, knowledge-intensive economy?

1.3 Occupational and industrial classifications of jobs have often been used as proxies for job quality. However, analyses of job quality based only on occupational or industry data separately can provide a limited, and possibly distorted, picture of employment growth. In this paper, we examine the quality of employment gains between 1983 and 1996 in terms of job earnings for an employment matrix of 6 industrial and 6 occupational categories. The resultant 36 occupation-industry cells are arrayed in order of their median wages averaged over 1991-95. They are then grouped into three earnings groups – **highest**, **middle** and **lowest** – with each group accounting for about one-third of total employment in 1990. We adopt a broadly similar framework to that in Ilg (1996).

1.4 Our analysis is largely based on data from the *Labour Force Survey* compiled by the Ministry of Labour (MOL). The survey covers households only and excludes workers living on sites and commuting daily to and from Malaysia. In our study, we also exclude the agriculture & fishing, quarrying, and the electricity, gas & water industries, as well as industries and occupations that are not classified. Jobs in the 36 occupation-industry cells covered in our study sample accounted for about 90% of total employment in 1990. Only to the extent that these excluded workers are lower-skilled ones and that their number has increased during the period will the analysis be biased towards findings of better quality in employment growth. However, estimates which conservatively assumed that all the excluded workers were unskilled ones showed the bias to be insignificant, and would not in any way alter the findings of this paper.

¹ Source: Ministry of Labour, *Report on the Labour Force Survey of Singapore*, various issues.

1.5 This paper is organised as follows. Section 2 first discusses Singapore's employment growth over 1983-96 by industry and occupation. Section 3 then examines the quality and distribution of the employment growth in terms of three different earnings groups. Three distinct phases of employment growth can be identified: the **consolidation phase** (1983-86), the **extensive growth phase** (1986-91) and the **intensive growth phase** (1991-96). Section 4 relates the quality of employment gains to the educational level of the labour force. It also decomposes changes in aggregate skill level of the economy into an **occupational mix effect** and an **industry shift effect**, and discusses their proximate causes. Finally, Section 5 concludes.

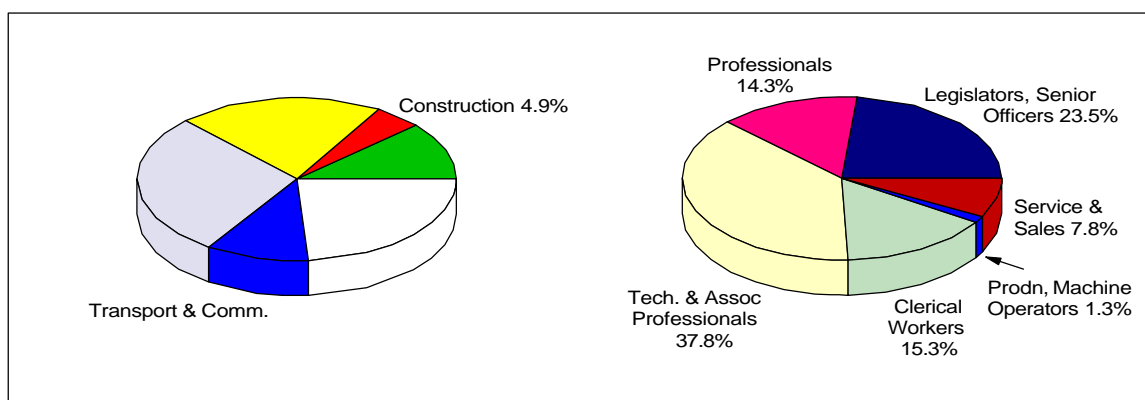
2 Employment Gains by Industry and Occupation: Towards A Services-based Economy

2.1 Table 2.1 presents the level and growth of employment, and Chart 2.1 the composition of employment gains, between 1983 and 1996 broken down by industry and occupation.

Table 2.1
Employment, 1983 and 1996

Industry and Occupation	Employment		Growth (% p.a.)
	1983	1996	
Industry			
Total	1162603	1675900	2.9
Manufacturing	347453	406317	1.2
Construction	89905	114900	1.9
Commerce	283761	405869	2.8
Transport, Storage & Communications	141260	195335	2.5
Finance, Insurance, Real Estate & Biz	100082	246040	7.2
Community, Social & Personal Services	200142	307439	3.4
Occupation			
Total	1162603	1675900	2.9
Legislators, Administrators & Managers	93753	214298	6.6
Professionals	54157	127529	6.8
Technicians & Associate Professionals	110452	304607	8.1
Clerical Workers	182995	261651	2.8
Service & Sales Workers	189943	229983	1.5
Production & Related Workers	531303	537832	0.1

Chart 2.1
Composition of Employment Gains, 1983-96



2.2 **By Industry:** From an industry viewpoint, the services sector, which comprises commerce, transport & communications, financial & business services, and community & social services, accounted for more than four-fifths of total employment gains. The financial & business services industry, in particular, contributed some 146,000 jobs, or about 28% of the total. This represents a vastly disproportionate increase, given that its share of employment in 1983 - at 8.6% - was less than one-tenth. The contribution to employment gains of the other services industries was broadly commensurate with their employment shares.

2.3 By contrast, the manufacturing industry – the largest employer in Singapore – saw only a modest increase in jobs of 59,000, or about 12% of the total. As a result, the share of manufacturing employment declined from 30% in 1983 to 24% in 1996. (Chart 2.2.) Concomitantly, the share of services employment rose from 62% to 69%, due almost entirely to the 6% point increase in the employment share of financial & business services. These trends toward an increasing share of employment in the services sector are consistent with developments in the other Newly Industrialized Economies (NIEs) and more advanced economies. (Chart 2.3.) In the advanced economies, this phenomenon, often termed "de-industrialisation", has been found to be due largely to the relatively higher productivity growth of the manufacturing industry vis-à-vis the services industry (Rowthorn and Ramaswamy [1997]). It is a natural consequence of the industrial dynamism in a mature economy, and should not be viewed negatively.

2.4 **By Occupation:** From an occupational perspective, employment growth in the (a) legislative, administrative and managerial; (b) professional; and (c) technician and associate professional categories contributed three-quarters of the net employment gains between 1983 and 1996. This is again vastly out of proportion in relation to their combined employment share of 22% in 1983. Nonetheless, these occupations are, in the order listed, high-paying ones and their growth suggests an increasing shift towards higher-skilled and value-added activities. In contrast, growth in the production and related worker occupational category was almost negligible.

Chart 2.2
Industry Shares of Employment, 1983-96

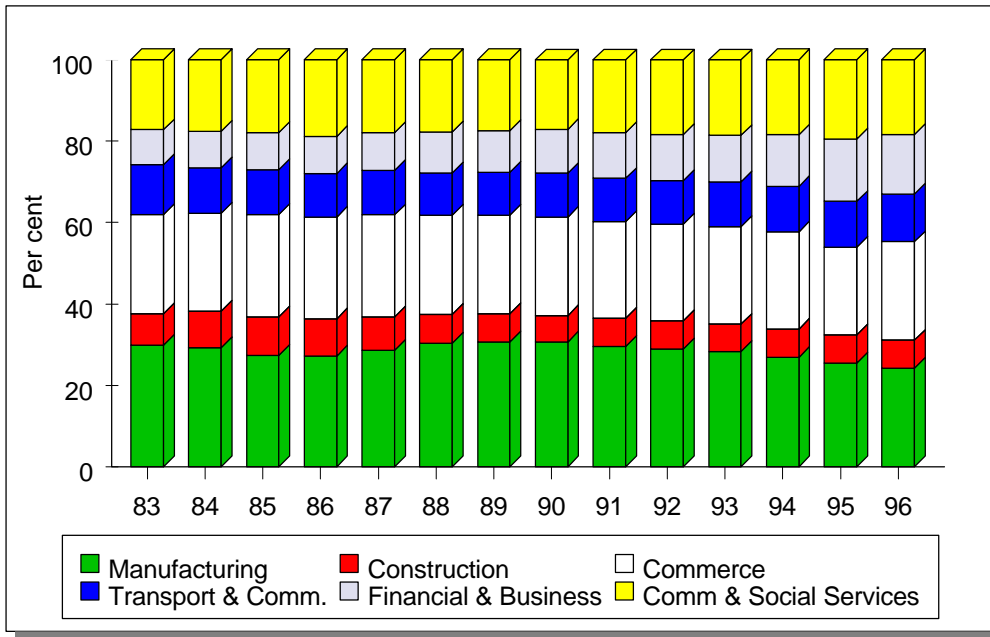
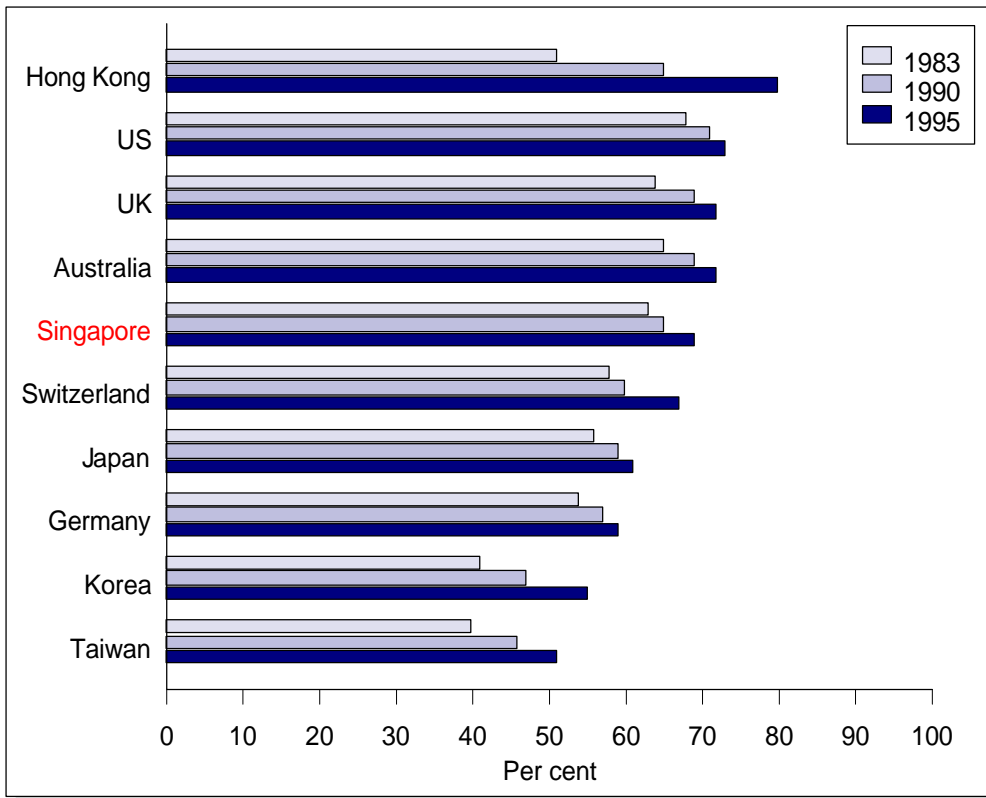


Chart 2.3
Shares of Services Employment in the Economy:
A Cross-Country Comparison



Source: OECD (1996) and national sources.

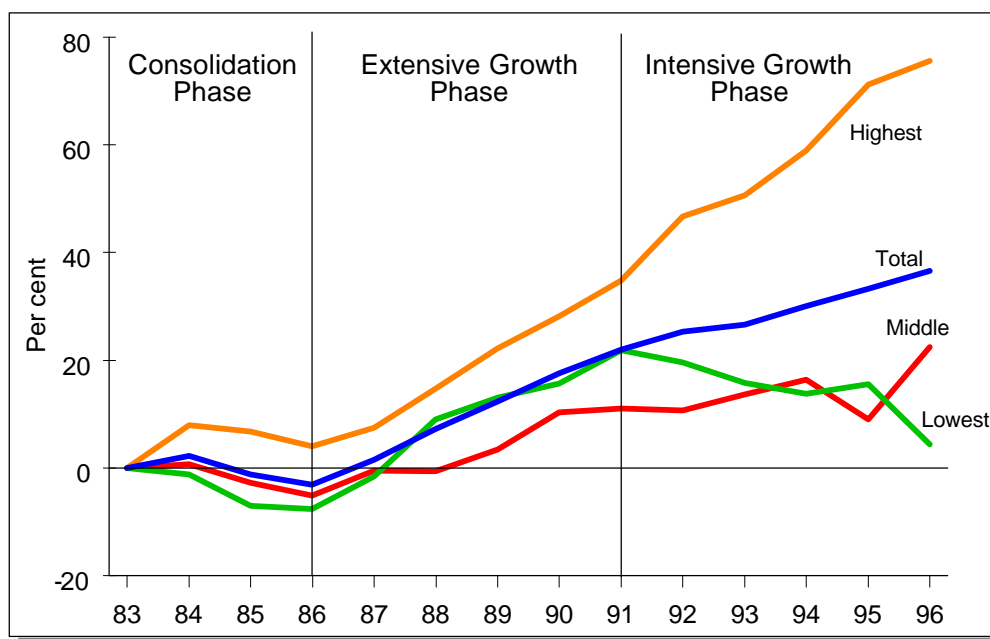
3 Employment Gains by Earnings Groups: Towards A Higher Quality Workforce

3.1 Table 3.1 and Chart 3.1 display the employment growth trends of the 36 industry-occupation categories clustered into three groups: highest-, middle- and lowest-earnings groups. (The Appendix provides a more detailed breakdown of the 36 industry-occupation cells.) Over the 1983-96 period, three distinct phases of employment growth can be identified: the *consolidation phase* (1983-86), the *extensive growth phase* (1986-91) and the *intensive growth phase* (1991-96).

Table 3.1
Employment Gains by Earnings Groups and Occupation, 1983-96

Occupation	Employment		Change in Employment, 1983-96	
	1983	1996	Number	% of Sub-Total
Highest-Earnings Group				
Legislators, Administrators & Managers	93753	214298	120545	31.3%
Professionals	54157	127529	73372	19.1%
Technicians & Associate Professionals	110452	304607	194155	50.4%
Service & Sales Workers	6970	13002	6032	1.6%
Production & Related Workers	75024	65795	-9229	-2.4%
Sub-Total	340356	725231	384875	100.0%
Middle-Earnings Group				
Clerical Workers	182995	261651	78656	70.4%
Service & Sales Workers	180600	206102	25502	22.8%
Production & Related Workers	81117	88633	7516	6.7%
Sub-Total	444712	556386	111674	100.0%
Lowest-Earnings Group				
Service & Sales Workers	2373	10879	8506	50.8%
Production & Related Workers	375162	383404	8242	49.2%
Sub-Total	377535	394283	16748	100.0%

Chart 3.1
Cumulative Employment Growth by Earnings Groups, 1983-96



3.2 The **consolidation phase** was characterised by a decline in overall employment as the economy went into a recession in 1985. During the period, GDP growth averaged a low 4.3% p.a. and overall employment declined by 1% p.a. Modest job growth in the highest-earnings group could not make up for the substantial job losses in the two lower earnings groups. During the **extensive growth phase**, employment grew by a robust 5.1% p.a., reflecting the strong GDP growth of 9.4% p.a. following the economic recovery in 1987. Healthy employment gains were experienced across all three earnings groups. In the **intensive growth phase**, with GDP growth at 8.6% p.a., there was a moderation in employment growth accompanied by a shift towards higher quality jobs. Overall employment growth was sustained at 3.0% p.a., with most of the job gains concentrated in the highest-earnings group. The lowest-earnings group, on the other hand, experienced a decline in employment during this period.

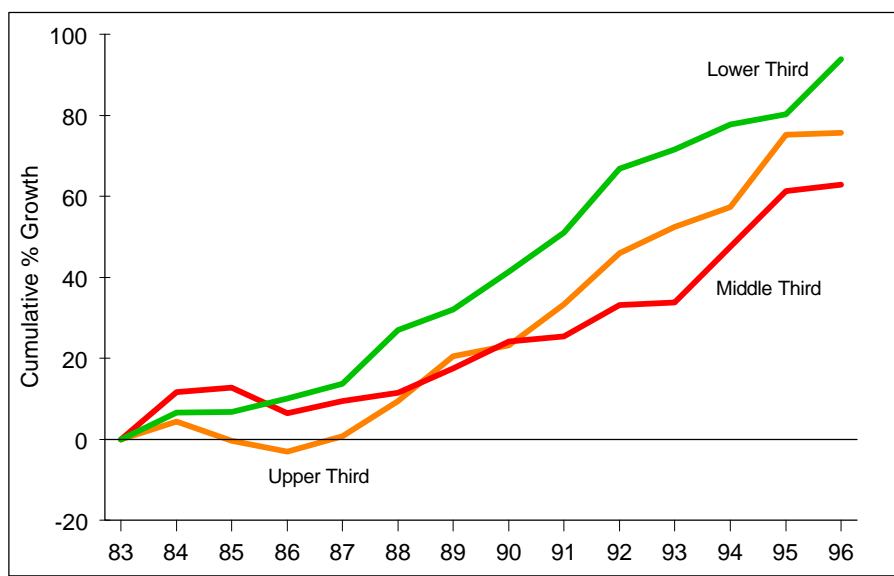
3.3 **Highest-earnings group:** Jobs in the three managerial and professional occupational categories comprise the bulk of the jobs in the highest-earnings group. They experienced the fastest growth rate of 7.3% p.a. during 1983-96, compared to 2.9% p.a. overall, and accounted for all the employment gains in the highest-earnings group. In turn, jobs in the highest-earnings group, which grew by 6.0% p.a., contributed three-quarters of Singapore's overall employment gains. The gross median wage, averaged over 1991-95, of the highest-earnings group was \$2,292, about twice the \$1,085 gross median wage of the other two earnings groups combined. The substantial job gains in the highest-earnings group thus imply that there had been a large shift in workers' earnings in the economy over 1983-96.

3.4 Managers and professionals in the services industry alone accounted for two-thirds of the job increase in the highest-earnings group, with financial & business services contributing 28%, and commerce, and community & social services another 16% each. Managerial and professional employment in manufacturing also grew strongly, by 97,000 or about a quarter of the job increase in the highest-earnings group over the period, even though manufacturing employment as a whole grew by much less.

3.5 The highest-earnings group, however, comprises 20 industry-occupation cells with gross median wages (averaged over 1991-95) ranging from a low of \$1,688 to a high of \$5,146, a difference of \$3,458. This compares with the much smaller dispersion in gross median wages of \$832 to \$1,405, a difference of \$573, for the 16 industry-occupation cells in the middle- and lowest-earnings groups combined. Gross median wages at the lower end of the highest-earnings group are more akin to those of the middle-earnings group than those at the top of the highest-earnings group.

3.6 To assess whether employment growth was evenly distributed across industry-occupation cells in the highest-earnings group, or only concentrated in either its lower or upper end, the group was further divided into three equal sub-groups. As Chart 3.2 shows, employment growth was fairly balanced among the three sub-groups. From the top down, the three sub-groups experienced annual employment growth of 6.0%, 5.0% and 7.5% respectively. They also each accounted for about one-third of the employment gains in the highest-earnings group.

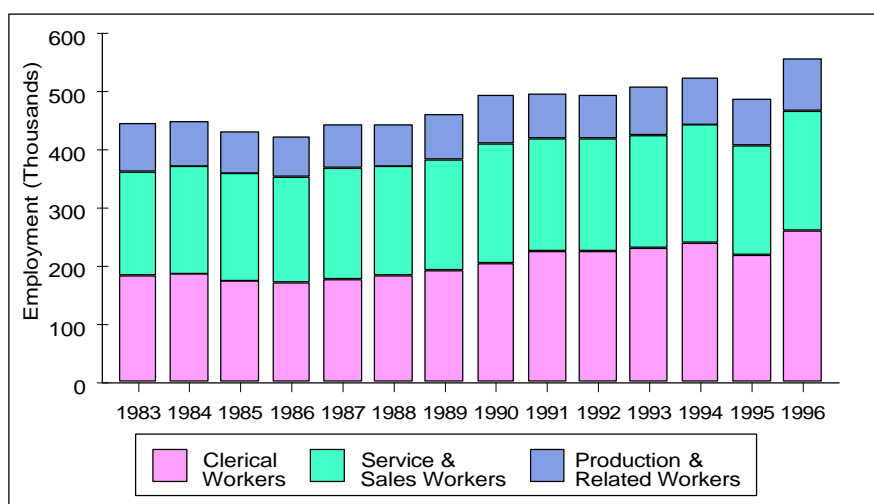
Chart 3.2
Distribution of Employment Growth in the Highest Earnings Group, 1983-96



3.7 **Middle-earnings group:** Employment in the middle-earnings group, made up mostly of clerical, and service & sales workers, experienced modest

growth of 1.7% p.a. over 1983-96. (See Chart 3.3.) Clerical jobs accounted for 70% of the increase while service & sales jobs made up another 23%. Growth was led by the services sector, with commerce accounting for 43%, and financial & business services and transport & communications another 18% each. Service & sales jobs in the commerce industry alone accounted for about one-third of the employment gains in the middle-earnings group.

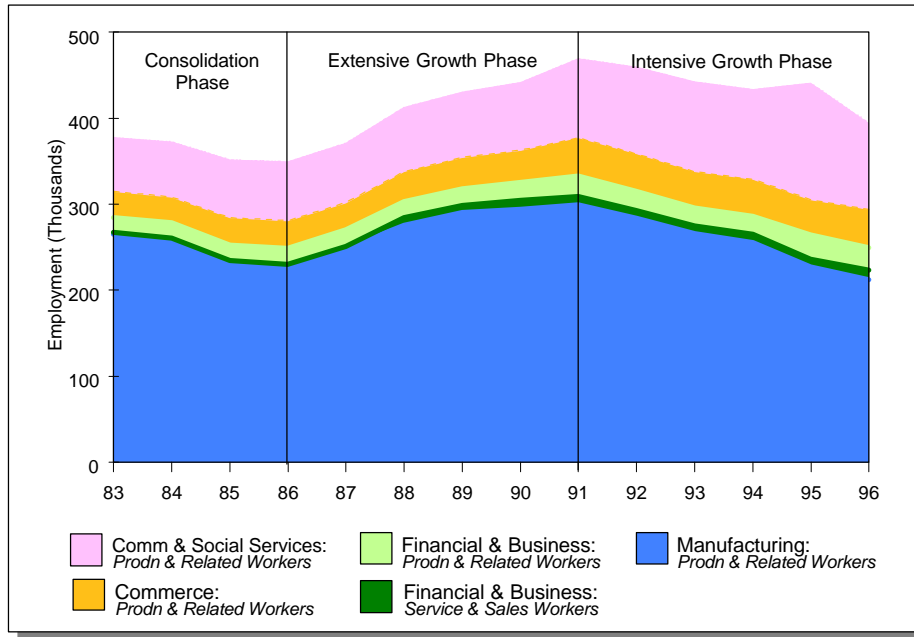
Chart 3.3
Occupational Trends in the Middle-Earnings Group, 1983-96



3.8 **Lowest-earnings group:** Employment in the lowest-earnings group, comprising almost entirely production and related jobs, barely experienced any growth over the 13-year period between 1983 and 1996. In fact, there has been a trend decline in employment in this group since 1991. Modest job gains in the other industries could hardly make up for the substantial job losses in the manufacturing industry (see Chart 3.4). That the manufacturing industry has been adding managerial and professional jobs while at the same time shedding production and related jobs is indicative of its restructuring towards more capital-intensive and higher-skilled activities.

3.9 As Chart 3.4 also illustrates, the employment trends in the lowest-earnings group during the three phases of employment growth – consolidation, extensive growth and intensive growth – are most clearly accentuated. They show the extent to which the employment and employability of lower-skilled labour, such as production and related workers, are vulnerable to the vicissitudes of the business cycles and, as will be shown in the next section, the introduction of skills-biased technology.

Chart 3.4
Employment by Industry-Occupation Cells in the Lowest Earnings Group



4 Employment Growth and Educational Attainment

4.1 Consistent with the rising quality of employment, there has been an improvement in the aggregate skill level of the labour force in the economy. Chart 4.1 presents the composition of the labour force in terms of the highest educational level attained. The proportion of skilled labour, defined as those workers with at least post-secondary education, doubled from 15% in 1983 to 31% in 1996. This mirrored the decline in the proportion of unskilled labour, defined as those with at most lower-secondary education, from 54% to 39%. The proportion of workers with secondary education - at about 30% - has remained largely unchanged throughout the period. The rise in educational level of the workforce extended across all industries. (Chart 4.2.) Manufacturing, in particular, experienced the most rapid increase.

Chart 4.1
Composition of the Labour Force by Educational Level, 1983-96

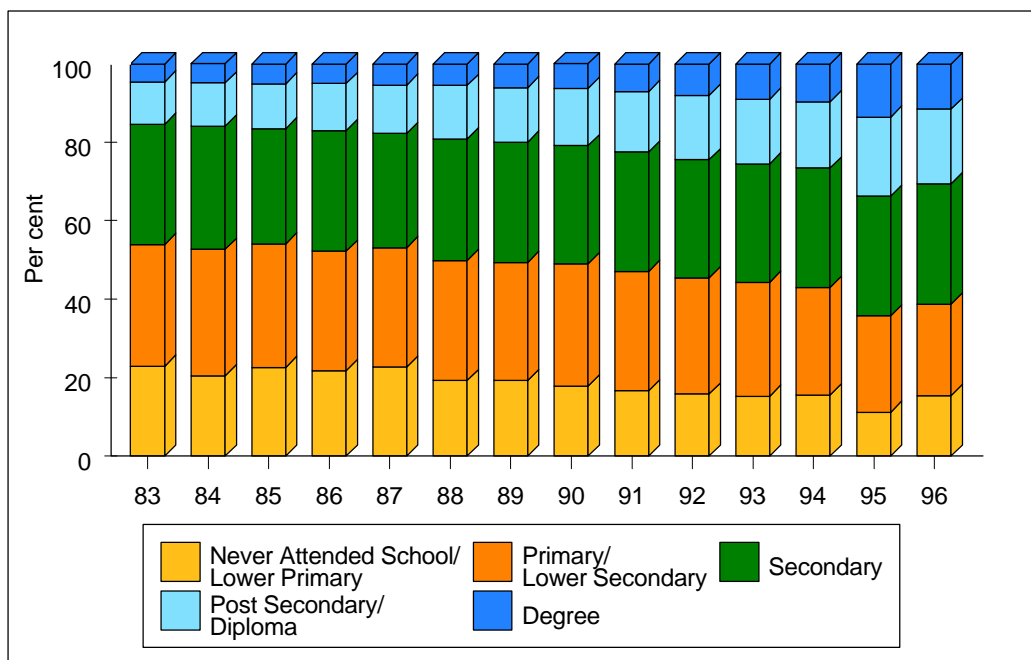
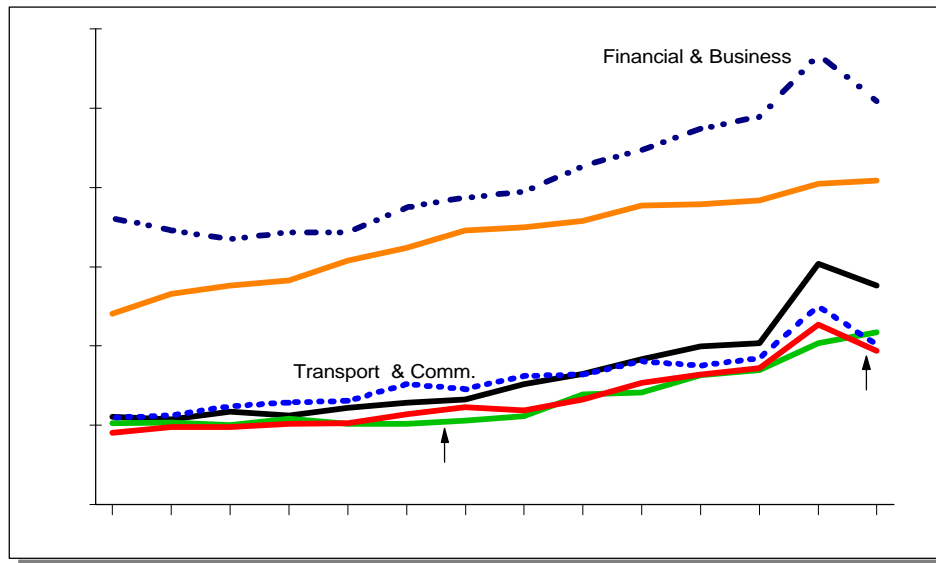


Chart 4.2
Proportion of Skilled Workers by Industry, 1983-96



4.2 Changes in the aggregate skill level of the economy result from both changes in the skill levels of individual industries (through changes in occupational mix) and shifts in employment across industries with different skill requirements. The first effect, known as the *within* or *occupational mix effect*, arises from the substitution of more educationally qualified workers for less qualified ones within individual industries. The second effect, known as *between* or *industry shift effect*, stems from changes in the patterns of demand or the structure of the economy, which result in the higher-skilled industries experiencing greater-than-average employment growth compared to the lower-skilled industries.

4.3 We can formally decompose the change in aggregate skill level of the economy into an industry shift effect and an occupational mix effect as follows. Let S be the ratio of skilled workers in the economy. If L^s and L^u denote skilled and unskilled workers respectively, and i and t the industry and time respectively, then:

$$(1) \quad S_t = \frac{L_t^s}{L_t^s + L_t^u} = \frac{\sum_i L_{i,t}^s}{L_t}$$

4.4 Re-arranging the terms in Equation (1) and denoting $E_{i,t}$ as the share of employment in industry i at time t , therefore:

$$(2) \quad S_t = \sum_i \frac{L_{i,t}^s}{L_{i,t}} \cdot \frac{L_{i,t}}{L_t} = \sum_i S_{i,t} \cdot E_{i,t}$$

4.5 Equation (2) expresses the ratio of skilled workers in the economy as a weighted average of the proportions of skilled workers in the various industries, using as weights their respective employment shares. Differentiating the equation with respect to time to obtain instantaneous changes, we get:

$$(3) \quad \frac{dS_t}{dt} = \sum_i \left\{ S_{i,t} \cdot \frac{dE_{i,t}}{dt} + E_{i,t} \cdot \frac{dS_{i,t}}{dt} \right\}$$

4.6 Since our data are for discrete time periods, we use the discrete form of Equation (3) as follows:

$$(4) \quad \Delta S_t = \sum_i (\bar{S}_{i,t} \cdot \Delta E_{i,t} + \bar{E}_{i,t} \cdot \Delta S_{i,t})$$

where the Δ sign and the overhead bar denote taking the difference and average of a variable, respectively, over time periods t and $(t-1)$. Equation (4) provides an exact decomposition. The first term on the right-hand-side of the equation captures the industry shift effect and the second term the occupational mix effect.

4.7 The results of the decomposition, presented in Table 4.1 and geometrically illustrated in Chart 4.3, reveal that the shift in aggregate skill level was overwhelmingly dominated by the occupational mix effect.

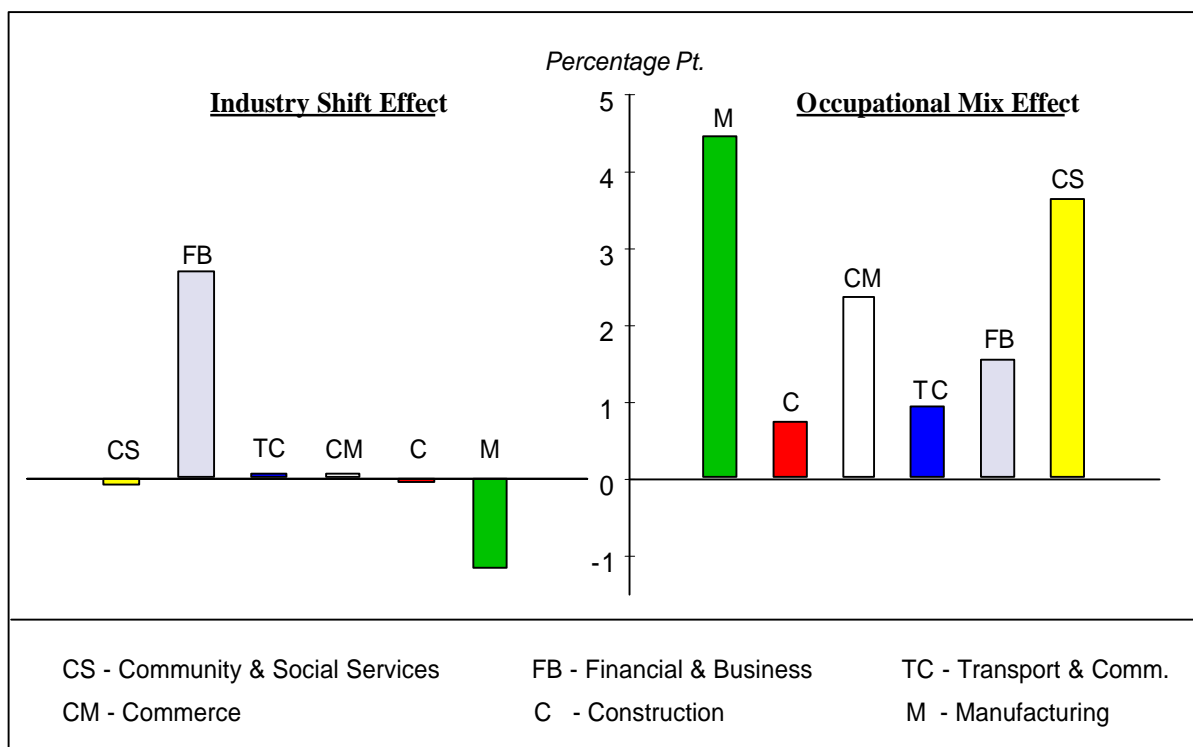
4.8 The **industry shift effect** accounted for only 10% of the increase in aggregate skill level of the labour force over 1983-96. It was concentrated almost entirely in the financial & business services industry, an industry with rising employment share and higher skill requirement. In contrast, the contribution from the manufacturing industry was negative, as the industry experienced a trend decline in its employment share over the period.

Table 4.1
Decomposition of the Change in Aggregate Skill Level, 1983-96

Industry	Change in Skill Level and Contributions from Industry	Decomposition	
		Occupational Mix Effect	Industry Shift Effect
Manufacturing	3.3	4.5	-1.2
Construction	0.7	0.8	-0.1
Commerce	2.4	2.4	0.1
Transport & Communications	1.0	0.9	0.1
Financial & Business Services	4.2	1.6	2.6
Community & Social Services	3.5	3.6	-0.1
TOTAL	15.3	13.7	1.5

% Points

Chart 4.3
Decomposition of the Change in Aggregate Skill Level, 1983-96



4.9 The **occupational mix effect**, on the other hand, accounted for 90% of the increase in aggregate skill level of the economy, with all the industries contributing positively to the effect. In particular, the manufacturing industry accounted for about one-third of the overall occupational mix effect, the largest contribution. This was followed by community & social services, and commerce.

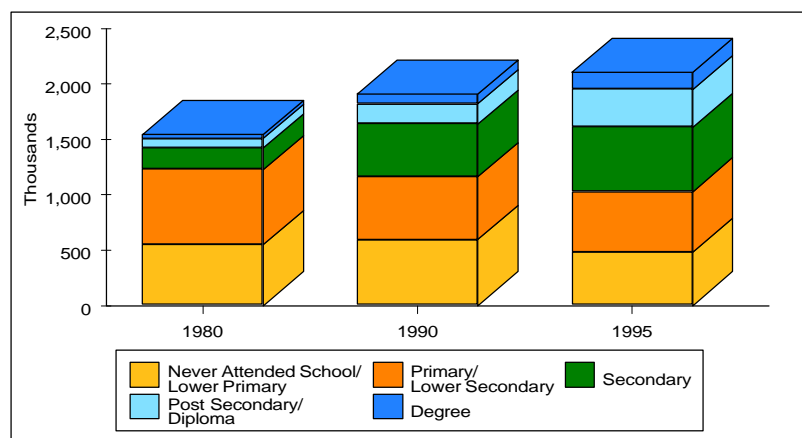
4.10 The predominance of the occupational mix effect deserves further examination. The substitution of more educationally qualified workers for less qualified ones within individual industries could be due to: (a) developments in the *supply* of better educated workers and the concomitant decline in their relative cost; and/or (b) the introduction of *skills-biased* technological progress.

4.11 The supply of better-educated workers in the population has indeed increased (see Chart 4.4). Between 1980 and 1995, the number of Singapore residents with at least a post-secondary education grew at about 10% p.a.² This resulted in their proportion in the population rising three-fold, from about 8% to 24%. At the same time, the proportion of the population with less than secondary education declined from about 80% to 49%. These developments were accompanied by a decline in the relative cost of better-educated workers. For

² Source: Department of Statistics (1980, 1990)

example, the average income of a worker with tertiary education relative to that of one with at most primary education declined from 5.9 in 1980 to 3.5 in 1990.³

Chart 4.4
Population by Educational Attainment, 1980, 1990 and 1995



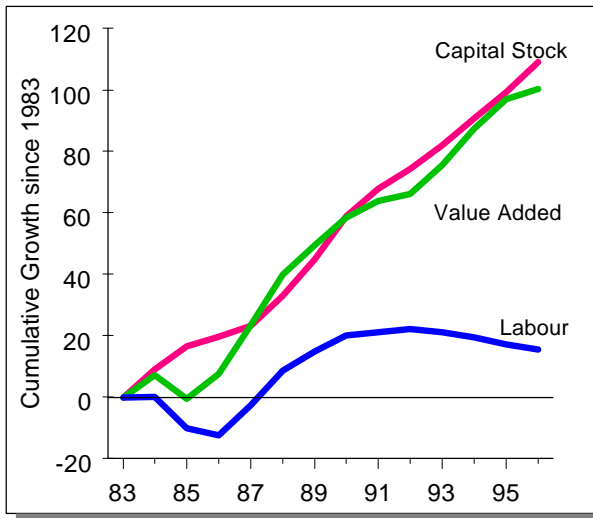
4.12 However, the significance of technological progress biased in favour of higher skilled workers at the expense of lower skilled workers cannot be underestimated. The manufacturing industry, with both its **positive** contribution to the occupational mix effect and **negative** contribution to the industry shift effect, makes for an interesting case study.

4.13 Between 1983 and 1996, both value-added and capital stock in the manufacturing industry grew at roughly similar annual rates of 8.0% and 8.8% respectively. These rates were well in excess of the 1.2% p.a. growth of manufacturing employment. (Chart 4.5 a.) As a result, there had been a substantial increase in capital-labour ratio, or capital deepening, in the manufacturing industry, reflecting its shift to more capital-intensive, labour-saving production techniques and activities. There was also evidence of capital-skill complementarity. Skilled labour in the manufacturing industry increased at 8.6% p.a., roughly the same growth rate as capital stock, even as the lower-skilled labour experienced a slight decline. (Chart 4.5 b.) Studies have shown that the technology that is embodied in new capital equipment is increasingly skills-biased, requiring greater use of skilled labour than unskilled labour (See, for example, Berman, Bound and Griliches [1993] for the US and Wong [1993] for Singapore). Indeed, since 1991, there has been an absolute decline in the number of lower-skilled manufacturing workers.

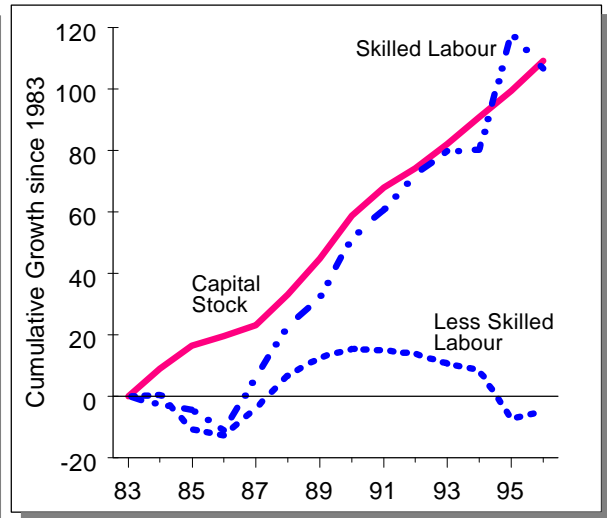
³ Data on average income are from the 1980 and 1990 Censuses of Population.

**Chart 4.5
Comparative Growth in the Manufacturing Industry**

(a) Value-Added, Capital and Labour



(b) Capital, Skilled and Unskilled Labour



5 Conclusion

5.1 The increase in employment between 1983 and 1996, numbering 513,000, was concentrated in the services industry, particularly financial and business services. The larger share of employment growth in the services industry had led to an increase in its share of employment in the economy, consistent with developments in the NIEs and other more advanced economies.

5.2 Job growth was also concentrated in three high-paying occupational categories: (a) legislative, administrative and managerial; (b) professional; and (c) technician and associate professional. Indeed, the three occupations formed the bulk of the upper-third earnings group of the economy. Job growth in this highest-earnings group was larger than the other two earnings groups – middle and lowest – by a margin of 3-to-1. That is, for every job added to the two lower earnings groups, there were three jobs added to the highest earnings group. In fact, the lowest-earnings group, which comprised primarily production and related jobs, experienced barely any employment growth.

5.3 In line with the rising quality of employment, the aggregate skill level of the labour force has also improved. A good part of the improvement in the aggregate skill level was due to **occupational mix effect** (90%), as more educationally qualified workers were substituted for less qualified ones within industries, rather than **industry shift effect** (10%), which stemmed from changes in the patterns of demand or the structure of the economy. Evidence from the manufacturing industry suggests that there had been a shift to more capital-intensive, labour-saving production techniques and activities. These activities were also increasingly skills-biased, requiring greater use of skilled workers than unskilled workers.

Appendix
Employment by Industry-Occupation Cells and Gross Median Wages

Occupation	Industry	Employment		Change in Employment, 1983-96		Gross Median Wages, 1991-95
		1983	1996	Number	% p.a.	
HIGHEST EARNINGS GROUP						
Legislators, Snr Offs & Mgrs	Fin, Ins, Real Est & Business	8,531	31,444	22,913	10.6%	5,146
Legislators, Snr Offs & Mgrs	Manufacturing	17,767	44,819	27,052	7.4%	4,428
Legislators, Snr Offs & Mgrs	Comm, Social & PS	2,202	11,214	9,012	13.3%	4,010
Legislators, Snr Offs & Mgrs	Tpt, Storage & Comm	5,388	17,697	12,309	9.6%	3,929
Legislators, Snr Offs & Mgrs	Construction	2,544	21,162	18,618	17.7%	3,890
Legislators, Snr Offs & Mgrs	Commerce	57,321	87,962	30,641	3.3%	3,475
Professionals	Tpt, Storage & Comm	2,758	5,030	2,272	4.7%	3,310
Professionals	Comm, Social & PS	27,303	45,006	17,703	3.9%	2,821
Professionals	Fin, Ins, Real Est & Business	9,514	33,009	23,495	10.0%	2,752
Professionals	Manufacturing	9,429	29,619	20,190	9.2%	2,699
Professionals	Construction	2,587	7,153	4,566	8.1%	2,658
Professionals	Commerce	2,566	7,712	5,146	8.8%	2,599
Tech, & Assoc Prof	Tpt, Storage & Comm	17,404	31,258	13,854	4.6%	2,292
Tech, & Assoc Prof	Fin, Ins, Real Est & Business	19,991	81,591	61,600	11.4%	2,166
Prod, Machine Operators & Cleaners	Construction	75,024	65,795	-9,229	-1.0%	1,934
Tech, & Assoc Prof	Construction	3,464	10,693	7,229	9.1%	1,902
Tech, & Assoc Prof	Manufacturing	16,206	66,316	50,110	11.4%	1,876
Tech, & Assoc Prof	Commerce	11,866	36,548	24,682	9.0%	1,845
Tech, & Assoc Prof	Comm, Social & PS	41,521	78,201	36,680	5.0%	1,729
Service & Sales Workers	Tpt, Storage & Comm	6,970	13,002	6,032	4.9%	1,688
Sub-Total		340,356	725,231	384,875	6.0%	
MIDDLE EARNINGS GROUP						
Prod, Machine Operators & Cleaners	Tpt, Storage & Comm	81,117	88,633	7,516	0.7%	1,405
Clerical Workers	Tpt, Storage & Comm	27,623	39,715	12,092	2.8%	1,311
Service & Sales Workers	Manufacturing	4,041	3,502	-539	-1.1%	1,297
Clerical Workers	Manufacturing	34,893	49,514	14,621	2.7%	1,237
Clerical Workers	Construction	5,901	9,538	3,637	3.8%	1,220
Service & Sales Workers	Commerce	137,647	169,106	31,459	1.6%	1,193
Clerical Workers	Commerce	43,274	60,206	16,932	2.6%	1,189
Clerical Workers	Fin, Ins, Real Est & Business	42,868	62,963	20,095	3.0%	1,176
Service & Sales Workers	Construction	385	559	174	2.9%	1,141
Clerical Workers	Comm, Social & PS	28,436	39,715	11,279	2.6%	1,085
Service & Sales Workers	Comm, Social & PS	38,527	32,935	-5,592	-1.2%	1,042
Sub-Total		444,712	556,386	111,674	1.7%	
LOWEST EARNINGS GROUP						
Prod, Machine Operators & Cleaners	Fin, Ins, Real Est & Business	16,805	26,154	9,349	3.5%	1,027
Prod, Machine Operators & Cleaners	Commerce	31,087	44,335	13,248	2.8%	1,024
Prod, Machine Operators & Cleaners	Manufacturing	265,117	212,547	-52,570	-1.7%	978
Service & Sales Workers	Fin, Ins, Real Est & Business	2,373	10,879	8,506	12.4%	918
Prod, Machine Operators & Cleaners	Comm, Social & PS	62,153	100,368	38,215	3.8%	832
Sub-Total		377,535	394,283	16,748	0.3%	
GRAND TOTAL		1,162,603	1,675,900	513,297	2.9%	

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