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Labour Productivity in the Canadian Tourism Sector

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Executive Summary

- The primary objective of this study is to calculate labour productivity for the tourism sector using the National Tourism Indicators (NTI) and the Human Resource Module of the Tourism Satellite Account (TSA-HRM), and to estimate an econometric model of labour productivity. Using the HRM data we are able to determine to what extent demographic characteristics of the labour force impact labour productivity.

- Despite the relatively small sample of 66 observations we found quantitative relationships that have also been established in productivity literature. Many are statistically significant and fairly robust over alternative model specifications. At the very least, these results appear to validate the data contained in the HRM.

- Labour productivity is found to increase with the capital labour ratio, the proportion of part-time hours, the share of hours supplied by women, the proportion of immigrant workers, and by the proportion of the most experienced workers.

- There are substantial differences in the level of labour productivity across industries. Transportation, which has highest capital labour ratio, also has the highest labour productivity.

- A separate econometric study of the combined accommodation and food and beverage services industry that uses provincial data over a ten year period finds significant differences in labour productivity between provinces.

- The second study also finds a positive relationship between labour productivity and investment in information and communications technology, public investment per capita, and human capital.

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1.0 Introduction

Funded by the Canadian Tourism Human Resource Council (CTHRC), Statistics Canada published a report in 2009 that describes the data set known as the Human Resource Module (HRM) of the Tourism Satellite Account (TSA). From an industry perspective, the data are drawn from six tourism industry groups defined at the three and four digit level of the North American Industry Classification System (NAICS). These groupings cover 29 individual tourism industries, that is, "industries whose output is consumed in large part by tourists." The annual data are aggregated to the national level and cover the period 1997 to 2007. The HRM presents a descriptive analysis of the key variables: hours of work by women, men, and immigrants; the mix of part-time and full-time hours and jobs; as well as information on wages. The report (Statistics Canada, 2009, p. 19) concludes:

> The HRM provides a rich source of information for the planning and analysis of tourism employment in Canada. The linking of the HRM with other tourism databases such as the CTSA and the NTI, allows for even greater analysis. Variables such as labour productivity (GDP divided by hours worked) can now be calculated.

The primary objective of the present study is to take up this suggestion by integrating the information available in the National Tourism Indicators (NTI) and the HRM. Specifically, we calculate labour productivity from the industry GDP data available in the NTI and the hours of labour data reported in the HRM. By estimating an econometric model of labour productivity, we are able to determine to what extent characteristics of the labour force have an impact on labour productivity.

The combination of 6 industries and 11 years provides 66 observations, which is a rather small sample for an exercise of this type. Nevertheless, we do find quantitative relationships that have been established in the productivity literature. Many are statistically significant and fairly robust over alternative model specifications. At the very least, these results appear to validate the data contained in the HRM.

Section 2 of this report presents our theoretical model and surveys some recent literature that is relevant to this study. Section 3 presents our analysis of tourism productivity using the NTI and the HRM. Section 4 reports the results of a separate investigation of productivity in the combined accommodation and food and beverage services industry in ten provinces. Labour force information for this study is drawn from the Labour Force Survey. We are able to include some variables that the literature suggests are important to labour productivity, in particular investment in public capital, the stock of information and communications technology and measures of human capital. Again, the sample size of 100 observations is relatively small and so while the results are sensible and encouraging the statistical reliability of the parameter estimates is correspondingly modest.

2.0 Context and Theoretical Framework

The production of marketable goods and services naturally entails the use of inputs such as labour, land, capital equipment and material inputs. Through the combined use of human labour and capital equipment the production process 'adds value' to raw materials as they are transformed into a saleable product or service. It is this transformation that constitutes the output of the production process. The concept of productivity measures the effectiveness of capital and labour in production. Labour productivity is the ratio of the value of output to the quantity of labour used in production. It is increases in labour productivity that allow for improvements in economic well-being as well as enhanced competitiveness of a firm, industry or country.

Changes in labour productivity can come from a variety of sources and there is a large amount of empirical literature devoted to quantifying the origin of labour productivity and its improvements. Clearly the quantity of physical capital that is available to each worker - the capital labour ratio - is a contributing factor. Improvements in the quality and quantity of capital over time enhance labour productivity. But, not all labour is identical. Better educated, better trained and more experienced workers are more productive. This notion is captured in the concept of human capital. Labour also differs in other ways: some workers are hired on a full-time basis; others work part-time hours; some workers are native born, others are immigrants; some are male; and some are female. The labour market experiences of these different types of workers are not necessarily identical and this may be reflected in different hourly wage rates. Whether the wages paid to a particular type of worker truly reflects their productivity has been the subject of considerable research.

The production of goods and services takes place within a geographical area as well as a legal, social and political environment. These factors can have a measureable effect on labour productivity. The political, legal and social environment has been referred to as 'social capital' and this has been shown to explain a large share of the differences in labour productivity between countries. Governments invest in public infrastructure such as roads, water systems, ports and the like. The physical capital embodied in public infrastructure has been shown to have a positive effect on labour productivity in private industry.

The primary objective of this study is to relate the information available in the Human Resource Module of the Tourism Satellite Account to a measure of labour productivity in six tourism industries. Labour productivity, measured by the ratio of industry GDP to hours of labour input, is the variable we endeavour to explain. In econometric terms, it is our dependent variable. It is helpful to use some notation to explain the theoretical context of the study. The production function describes the relationship between inputs and output, Y:

$$Y_{it} = A_{it} L_{it}^{1-\beta} K_{it}^{\beta} \qquad (1)$$

where i = 1,…6 is an industry index and t = 1997,…2007 is a time index.

L is labour input measured in hours of work and K is the physical capital stock (buildings, machinery, equipment and vehicles.) The term denoted by A is known as the Solow residual which is determined by demographic variables including the age structure of the labour force, the gender ratio, the proportion of immigrant workers, and the proportion of part-time hours.

$$A_{i,t} = E_{i,t} S_{i,t}^{\gamma} M_{i,t}^{\delta} F_{i,t}^{\rho} P_{i,t}^{\mu} \qquad (2)$$

where E allows for disembodied technical progress, S is the age structure of the workforce, M is the proportion of hours provided by immigrants, F is the proportion of hours provided by females and P is the proportion of part-time hours. The combination of equations (1) and (2) gives the following equation to be estimated, where all variables are in natural logarithms:

$$y_{it} - l_{it} = \theta_i + \theta_t + \gamma s_{it} + \delta m_{it} + \rho f_{it} + \mu p_{it} + \beta(k_{it} - l_{it}) \qquad (3)$$

In equation (3), $LogE_{i,t} = \theta_i + \theta_t$, θ_i is the industrial fixed effect and θ_t is the time fixed effect.

Typically, labour productivity is related to human capital in the form of educational attainment. However, the HRM does not include information on education and training. This could bias results and we will comment on this later in the report.

In a second empirical study we use provincial data for the combined accommodation and food and beverage services industries. This not only allows us to look at the provincial dimension but also permits us to include some information on education that is available in the labour force survey. In addition, we are able to include information on public investment and private investment in information and communications technology.

In the following subsection, we present brief overviews of the recent literature on productivity analysis that are of particular interest to the present study

2.1 Labour productivity and ICT

In the productivity literature, there has been great interest in the effect of the technological revolution in information and communications technology (ICT). ICT is collectively defined as computer and telecommunications technologies. ICT convergence has given rise to technologies such as the internet, videoconferencing, groupware, intranets, and third-generation cell phones. ICT enables organizations to be more flexible in the way they are structured and in the way they work. Certainly, the workplace whether an office or the shop floor, has changed dramatically since the introduction of desktop computers, networks and robots.

Sharpe (2006) studied the relationship between ICT and productivity in the Canadian economy. He analyzed ICT investment and capital stock per worker for the Canadian economy as well as 20 industries as defined in the North American Industry Classification System (NAICS) between 1980 and 2005. In general, ICT has had a positive impact on productivity growth in Canada and the United States since the mid-1990s. However, in this study (Sharpe, 2006, p. 33) noted that the relationship between ICT investment and productivity growth is complicated and depends on the way productivity is measured:

> …Labour productivity is defined as the ratio of real output, measured as either value added or gross output, to labour input, measured as either hours worked or persons employed.
>
> Total factor productivity (TFP) is defined as the ratio of output to all inputs used in the production process.
>
> In addition to the positive impact of ICT investment on labour productivity growth through the higher ICT capital intensity channel, ICT investment and capital stock can directly contribute to TFP growth and thereby to labour productivity growth. Thus, part of the contribution of ICT investment and capital to labour productivity growth is picked up by higher ICT capital intensity and part by technological progress to TFP growth. Unfortunately, there is no simple methodology to capture the total effect of ICT investment on labour productivity. Estimates of the contribution of ICT investment to TFP growth, and hence labour productivity growth, should be considered as very approximate in nature and as likely underestimating the true contribution of ICT to labour productivity growth as ICT investments are the carriers or manifestation of technological progress, the ultimate driver of labour productivity growth.

At the same time Sharpe (2006, p. 34) points to limitations on the basic growth accounting framework for the estimation of the impact of ICT investment on labour productivity growth:

> First, the impact of ICT investment on labour productivity growth may not occur the same period in which the investment takes place due to lags…. Second, the benefits of ICT investment on firm performance may go well beyond productivity increases and include quality improvements in products and services produced….Third, ICT investments may be so small in magnitude that they have minimal effect on the capital stock, but represent such technological breakthroughs that they raise productivity significantly….Fourth,..ICT may indeed have important productivity-enhancing effects; they also may have non-trivial productivity-reducing effects, either directly or indirectly.

Nevertheless his key conclusion is that ICT has been the driving force behind the acceleration of productivity growth in Canada and the United States since 1996 and he suggests that the potential of ICT has not been fully exploited and that this type of investment will continue to contribute to productivity growth in the future.

2.2 Labour productivity, human capital and demography

There is a vast literature on the effect of human capital in earnings and productivity. An important strand of this research focuses on the individual. What is the rate of return to a person who invests in education? How do hourly wages and earnings vary with educational attainment and years of experience? This notion is typically captured by the age profile of wages or earnings of individuals – that is, the path of wages/earnings over the working life of an individual. In competitive markets for labour, economic theory predicts that wages equal the marginal productivity of labour. More precisely, the hourly wage paid by a profit-maximising firm operating in competitive markets equals the contribution to output of one extra hour of labour input. Following this line of thought, the productivity of individuals can be measured by their wages or earnings. However, there are a number of reasons why wages may differ from marginal productivity. For example, discrimination against women or visible minorities could result in wages falling below marginal productivity. Industries dominated by monopolies can afford to pay their workers more than those workers would earn in a competitive industry.

Kotlikoff (1988, p. 1) offers some compelling reasons why variations in productivity over the life-cycle are so important:

> Understanding how productivity varies with age is important for a variety of reasons. A decline in productivity with age implies that aging societies must increasingly depend on the labor supply of the young and middle age. It also means that policies designed to keep the elderly in the work force, while potentially good for the elderly, may decrease overall productivity. A third implication is that, absent government intervention, employers may not be willing to hire the elderly for the same compensation as younger workers. Labor economists are particularly interested in the relationship of productivity and age because it can help test alternative theories of the labor market.

To that we can add: as the average age of the labour force increases, some industries in the tourism sector that tend to rely on relatively scarce younger workers could find it increasingly difficult to attract and retain employees from that age group.

Kotlikoff examined over 300,000 records of employee data for a particular company over the period 1969 to 1983. He found (Kotlikoff, 1988, p. 1) that "... productivity falls with age. For young workers, compensation (earnings plus pension accrual) is below productivity and for older workers compensation exceeds productivity. For several worker groups the discrepancy between compensation and productivity is very substantial. In addition to confirming some features of contract theory, the results lend support to the bonding models of Becker and Stigler and Lazear which suggest that firms use the age-earnings profile as an incentive device."

Hellerstein *et al* (1999) also uses establishment data to estimate marginal productivity differentials among different types of workers. They then compare these productivity differentials to estimated relative wages. Among the findings are, (1) the higher pay of prime-aged workers (aged 35-54) and older workers (aged 55 +) is reflected in higher point estimates of their relative marginal products, and (2) for the most part, the lower relative earnings of women are not reflected in lower relative marginal products.

Both of these studies find that the productivity of the most senior workers falls below that of prime age workers. But they also find that wages do not necessarily match marginal productivity. In particular, Hellerstein finds that women are paid less than their marginal product while Kotlikoff claims older workers are paid more than their marginal product.

A significant portion of the literature on earnings profiles uses large surveys that are administered over long periods of time. Beaudry *et al* (2000) estimate earnings profiles for Canadian males and females using annual Surveys of Consumer Finance (1971-1993) to follow age cohorts through time. For males whose highest level of education is a high school diploma, weekly earnings rise relatively slowly over time to about age 40 or slightly younger, gaining about 20-25% over initial earnings. Weekly earnings then flatten out before declining somewhat. For those with a university degree, earnings increase much more quickly with age as on the job experience complements the human capital embodied in the years of formal education. By age 40, earnings have almost doubled for these more highly educated workers. Earnings for most cohorts peak in the workers' early 40s and then decline somewhat. These findings suggest that for males, productivity peaks in the middle years. The picture for females is complicated by the effect of years spent rearing children. Earnings for women with a high school diploma are noticeably flat while there is some growth for women with a degree, which is sustained throughout the working lifespan – there is only weak evidence that earnings decline in later years.

Heckman *et al* (2008) use U.S. census data from 1940 to 2000 to estimate annual earnings for white and for black males. Before 1960, earnings profiles rise with age (experience) before flattening out and remaining fairly flat. More recent surveys show earnings peaking well before retirement. Furthermore, since the 1980 census, the decline in annual earnings was considerable for older workers.

Given these systematic findings on earnings profiles that are derived from the lifetime earnings of individuals or the experience of age cohorts over time, it is not surprising that economists have attempted to explain inter-regional and cross-country differences in economic growth by differences in the demographic characteristics of populations.

Gomez and Hernandez de Cos (2006) used a sample of 144 countries observed over a fifty year period, 1950 to 2000, to examine the role of the age structure of the population as a determinant of economic growth. They note that a decline in the birth rate is likely to stimulate economic growth by reducing the dependency ratio, increasing labour market participation and possibly household saving. A second channel comes through the effect of a maturing labour force on productivity. They argue that, "labour force participation and productivity peak sometime during the prime working ages of 35 and 54 when the balance between formal education and experiential human capital reaches its optimum.[1]" As a result economies that

[1] Gomez and Hernandez de Cos (2006, p. 5)

have a relatively large share of prime age workers should be more productive. Their key empirical findings are that demographically mature countries are significantly better off in terms of GDP per capita than non-mature counterparts and that demographic maturation has contributed to over half of the increase in global per capita GDP averaged across countries since 1960. They also suggest that inter-country differences in rates of maturation have contributed to rising economic inequality.

Feyrer (2007) analyzes data from 87 countries over ten years and finds that changes in workforce demographics have a strong and significant correlation with the growth rate of productivity. Changes in the proportion of workers between the ages of 40 and 49 seem to be associated with productivity growth. To illustrate the implications of his results Feyrer (2007, p. 100) calculates that a 5% increase in the size of this cohort over a ten-year period is associated with a 1%–2% higher productivity growth in each year of the decade.

Bhatta and Lobo (2000) find that differences in human capital and the age structure of the labour force explain a high proportion of inter-state differences in Gross State Product (GSP) within the United States. Interestingly they find that differences in the proportion of workers with academic qualifications below a university degree account for more of the differences in GSP than variations in the proportion of people with university degrees. In the same vein, Hirte and Brunow (2008) find that inter-regional productivity differences in the Germany are in part explainable by differences in human capital.

Taken together, these studies suggest that within the Canadian tourism sector, variations in labour productivity across industries and over time may in part be explained by differences in educational attainment and the age structure of the labour force.

2.3 Labour productivity and immigrant workers

In 2007, the accommodation and food and beverage services industries together accounted for 68% of the jobs in the tourism sector (that is, in the six industries that comprise this sector – see Table 3.2). The labour force working in these two industries includes a significant number of immigrants who contributed about 28% of the total hours worked in 2007. Immigrants to Canada admitted through the economic class tend to be well educated and well trained. The very fact that they have taken the enormous step of leaving their home country to settle in a new land implies immigrants are generally ambitious and hard working. Yet studies of how well immigrants adjust to the Canadian labour market show that earnings are lower than for the comparably educated Canadian born, and estimates of how quickly, if at all, immigrants catch up to their native counterparts vary. Part of the explanation for lower earnings for immigrants could be that foreign credentials, work experience and formal education do not yield the same economic return in Canada that they would have done if such experience and education had been undertaken in Canada. It is also possible that some immigrants need time to develop the language skills that are effective in the Canadian labour market.

Baker and Benjamin (1994) compared the experience of Canadian immigrants that arrived in the 1970s with earlier cohorts. They conclude (Baker and Benjamin, 1994, p. 400):

> We have painted a fairly pessimistic picture of the immigrant experience in the Canadian labor market. Entry earnings are falling across successive immigrant cohorts, while their rates of assimilation are uniformly small. Recent immigrants start with earnings up to 20% lower than their predecessors and have assimilated at a very modest pace in their first years in Canada. If their future assimilation matches that of earlier cohorts, convergence with natives may be unattainable.

A more recent study by Aydemir and Skuterud (2005) that employs Canadian census data shows that the entry earnings of recent cohorts of immigrants relative to the Canadian born have continued to deteriorate. They claim that about a third of the decline can be attributed to compositional shifts in language ability and region of birth. They find no deterioration in the economic returns to foreign education but a marked decline in the return to foreign labour market experience.

Hum and Simpson (2004) used longitudinal data in the form of the Survey of Labour Income and Dynamics (SLID) to look at the labour market experience of Canadian immigrants and reported rather similar pessimistic conclusions as reached ten years earlier by Baker and Benjamin. They find (Hum and Simpson, 2007 p. 129) "our instrumental variable estimates which allow for unobservable fixed effects suggest that immigrants never catch up to otherwise comparable native born workers."

As noted above the HRM of the TSA records the proportion of hours supplied by immigrant workers. In a later section we report on estimates of how this proportion affects overall labour productivity.

2.4 Labour productivity and infrastructure

The productivity and growth literature distinguishes between social infrastructure and public infrastructure. The first concept was introduced by Hall and Jones (1999) in their influential paper entitled *"Why do some countries produce so much more output per worker than others?"* To Hall and Jones, social infrastructure includes legal and social institutions and government policies that work to equate private and social returns to investment. If private returns are low due to high taxation, crime, bribery, the inability to enforce contracts etc. then investment will be lower than otherwise, with growth and productivity correspondingly lower while unproductive rent-seeking will be all the greater. Hall and Jones argue that differences in social infrastructure go a long way towards explaining differences in labour productivity across countries.

The concept of public infrastructure refers to public investment in physical capital such as roads, bridges, tunnels, ports and airport runways. That such investment in public capital contributes to the aggregate economy's productive capacity has been demonstrated in a number of empirical studies. Fernald (1999) answered a question that had troubled this literature – what is the direction of causation? Do highly productive economies enjoy a large stock of public capital because they are rich? Or does the existence of public capital causally affect the economy's aggregate level of productivity? Fernald examined the history of the largest component of US public investment, namely roads. He concluded that vehicle-intensive industries benefitted from investments in roads. This was especially true immediately after the interstate system was established in the 1950s and 1960s. Subsequent investment in roads was found to be beneficial but not unusually productive. Destefanis and Sena (2005) examine Italian regional data to study the relationship between public infrastructure and total factor productivity. They are also concerned with the direction of causality and conclude that it flows from public infrastructure to total factor productivity. More recently, Bronzini and Piselli (2009) returned to Italian regional data to re-examine this link but using a model that includes investment in R&D and human capital as well as public infrastructure. They argue it is necessary to examine simultaneously how all three types of investment impact total factor productivity in order to distinguish their separate effects and avoid attributing to one the contributions of others. They find that public infrastructure does Granger-cause total factor productivity while the converse is not true. Moreover, by using a spatial model they find that public infrastructure in a given region has positive spill-over effects on productivity in neighbouring regions.

The Statistics Canada report by Harchaoui *et al* (2003a) provides an informative description of Canada's public infrastructure over time and by level of government. It is useful to note what is *not* included in this concept: the physical investments that support education and health are excluded, as is the capital owned by government enterprises. Public infrastructure does include roads, ports, runways, bridges, sewer systems, waterways, irrigation systems and parks. In 2002 the total stock of public infrastructure was valued at $227.5 billion, which amounted to 20% of Canada's total business physical capital. By level of government, the largest share was held by local governments (48.1%), followed by provincial governments (34.3%), leaving 17.6% in the hands of the federal government. In a separate paper Harchaouri and Tarkhani (2003b, p. -ii-) measure the contribution of Canadian public capital to productivity and conclude:

> Public capital contributed for about 18% of the overall business sector multifactor productivity growth over the 1961-2000 period. This is somewhat lower than the figures reported in the literature. However, the magnitudes of the contribution of public capital to productivity growth vary significantly across industries, with the largest impact occurring in transportation, trade and utilities.

In our second statistical study we analyze labour productivity in the accommodation and food and beverages services industries over time and by province. Since public infrastructure data are available by province we are able to include this variable in our model.

2.5 Labour productivity and part-time workers

In situations in which demand fluctuates greatly by time of day or day of the week it is likely that firms will find it profitable to hire more part-time employees since it is costly to satisfy a highly variable demand for labour by relying exclusively on full-time workers (for example by using overtime or scheduling short shifts). Owen (1978) investigates this hypothesis. By comparing employment practices across industries, he finds a positive correlation between fluctuations in demand and the proportion of employees that work part-time.

Nelen *at al* (2009) used a matched employer-employee dataset of Dutch pharmacies to investigate the productivity of pharmacy assistants. Output of each establishment (pharmacy) is measured by the number of filled prescriptions. The authors conclude that firms with a high share of part-time employment are more productive then firms with a high share of full-time employment and that the measured differences in productivity levels are significant both statistically and quantitatively. Other implications of their results are that given a certain level of on the job experience (with the current employer), older workers are less productive than younger ones. It is suggested that younger workers may have more up-to-date knowledge and may be more motivated. Conversely, amongst workers of a given age, those with more years of experience at their current employer are more productive than workers of the same age but with shorter job tenure.

3.0 Productivity Analysis: The Human Resource Module of the TSA

The Human Resource Module of the Canadian Tourism Satellite Account provides detailed demographic data on the labour force working in six tourism industries. Table 3.1 summarizes the dimensions of these data.

Table 3.1
Dimensions of the Human Resource Module of the TSA

Industry Groups[2]	Labour Force Characteristics	Job Information
Air Transport	Employed/Self-Employed	Number of Jobs
Other Transport	Full/Part-Time	Total hours worked
Accommodation	Male/Female	Total wages/salaries
Food and Beverage Services	Immigrant Status	Average annual hours
Recreation and Entertainment	Age Ranges (4)	Average annual wage/salary
Travel Services		Average hourly wage

As shown in the Table 3.1 above, the HRM provides labour market data on the number of jobs, hours worked, job status, and employment earnings according to the gender, age group and immigrant status of workers in six tourism industries. The available data cover the eleven-year period 1997-2007. Our ultimate objective is to examine the relationship between these labour market variables and labour productivity (GDP per hour of work.) For this purpose, we have 66 observations – a relatively small sample for an econometric exercise of this type. The results are presented and discussed towards the end of this section.

[2] The components of each of these aggregate industry groups are listed in Appendix C.

A detailed analysis of the 2007 HRM data has been published by Statistics Canada (2009). Here, we begin with a brief overview of the data available in the HRM by looking at the selected statistics presented in Table 3.2.

Table 3.2
Summary Statistics from the HRM, 2007

Industry	Share of Hours by Type of Worker by industry*					Wage/Hr
	Jobs*	Females	Immig.	Full-time	Age 15-24	
Air Transport	0.033	0.353	0.222	0.876	0.075	$30.49
Other Transport	0.092	0.213	0.236	0.892	0.036	$25.43
Accommodation	0.142	0.578	0.279	0.863	0.172	$15.77
Food and Beverage Services	0.534	0.563	0.282	0.729	0.362	$12.39
Recreation, Entertainment	0.171	0.467	0.152	0.782	0.210	$19.23
Travel Services	0.028	0.677	0.333	0.925	0.089	$21.24

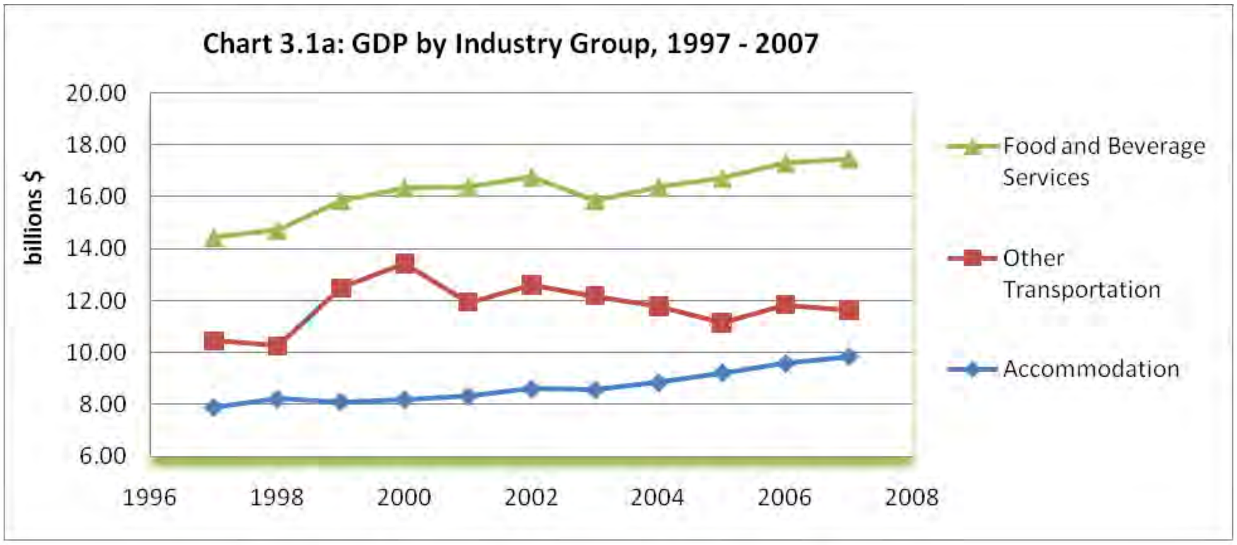
*Share of Jobs by Industry: industry share of all jobs in 6 tourism industries (column sum = 1.0)

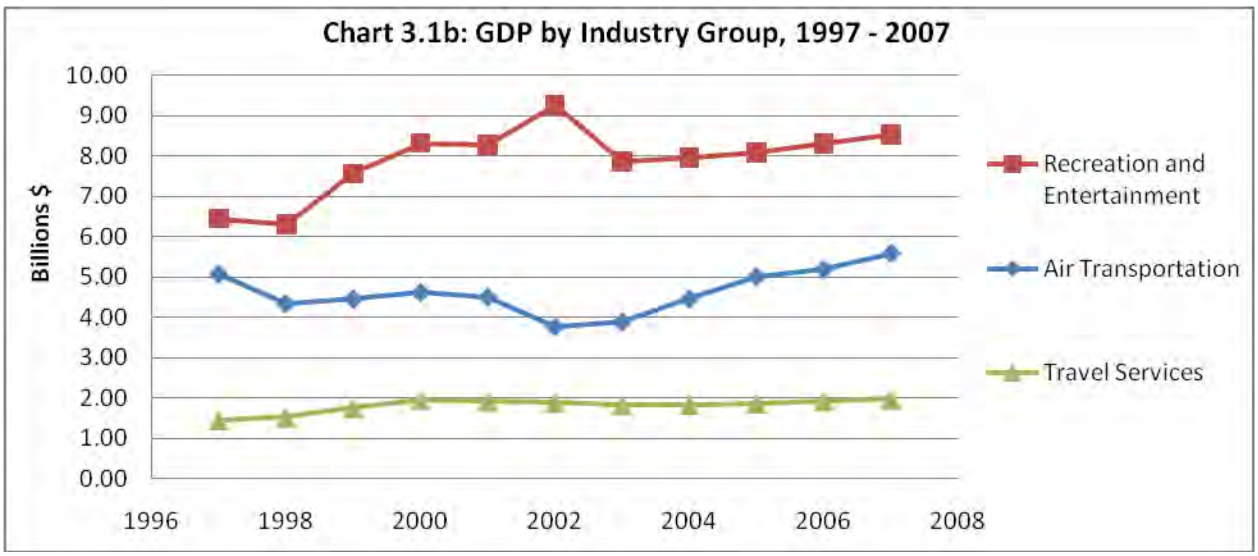
In 2007, the total number of jobs in the six tourism industries amounted to 1.65 million of which 114,417 (7%) were self-employed. More than half of these jobs were found in the food and beverage services industry which employed a larger than average share of women. This industry relies heavily on younger workers (36.2% of all hours are worked by employees aged under 25) and is relatively more reliant on part-time workers (who account for 27.1% of all hours worked) and immigrants (28.2% of hours worked.) The food and beverage services industry paid the lowest average hourly wage of the six industries.

Chart 3.1a presents the time series of total industry GDP for three of the six industries and shows that GDP is largest in food and beverage services. These data are taken from the National Tourism Indicators and consequently the GDP estimates plotted in Charts 3.1a and 3.1b specifically reflect tourism demand[3].

The share of tourism demand in total industry output or supply varies considerably by industry. The Tourism Satellite Account reports that in 2002 tourism GDP was highest for travel services (92%) and accommodations (66%). On the other hand, the tourism share is relatively low in those service industries that rely principally on 'local' demand that is, not demand by visitors and tourists. These are the food and beverage services and the recreation and entertainment industries for which tourism demand is 17% and 22% of the total, respectively. When averaged over all six industries, tourism demand accounts for 34% of total industry demand.

[3] According to Human Resource Module of Tourism Satellite Account, tourism demand is defined as the spending by Canadian and non-resident visitors on domestically produced commodities. This spending has a direct impact on a wide range of industries, some more so than others.





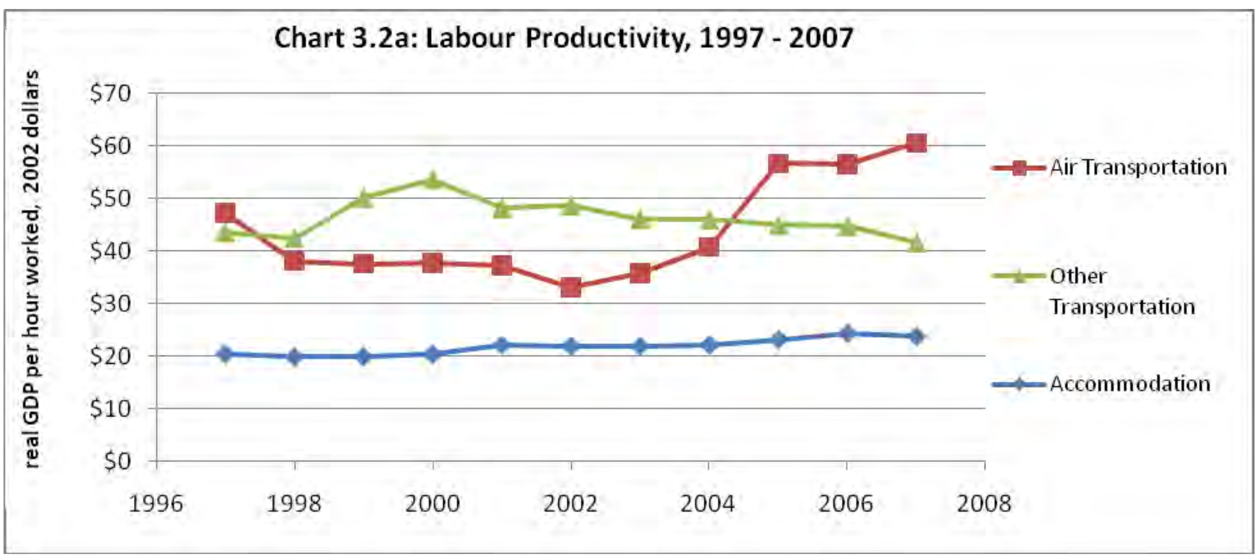
The data recorded in the Human Resource Module of the Tourism Satellite Account refers to measures relevant to the total industry. Hence, the total number of jobs in all six industries that were referred to earlier is a measure of total industry employment. In other words, the 1.65 million jobs in the six tourism industries cannot all be attributed to tourism demand. Statistics Canada (2009) refers to these 1.65 million jobs as a feature of 'tourism supply' and estimates that 525,000 of these jobs (about 32%) can be attributed to tourism demand. It is the 525,000 jobs that are defined as 'employment generated by tourism'.[4]

In order to integrate the industry GDP data of the National Tourism Indicators with the data available in the Human Resource Module, these two datasets need to be made compatible. Essentially, we need to estimate the hours of work in the HRM that is attributable to tourism

[4] 'Employment generated by tourism' understates the number of jobs that could potentially be attributable to tourism demand since non-tourism industries are excluded from the calculations.

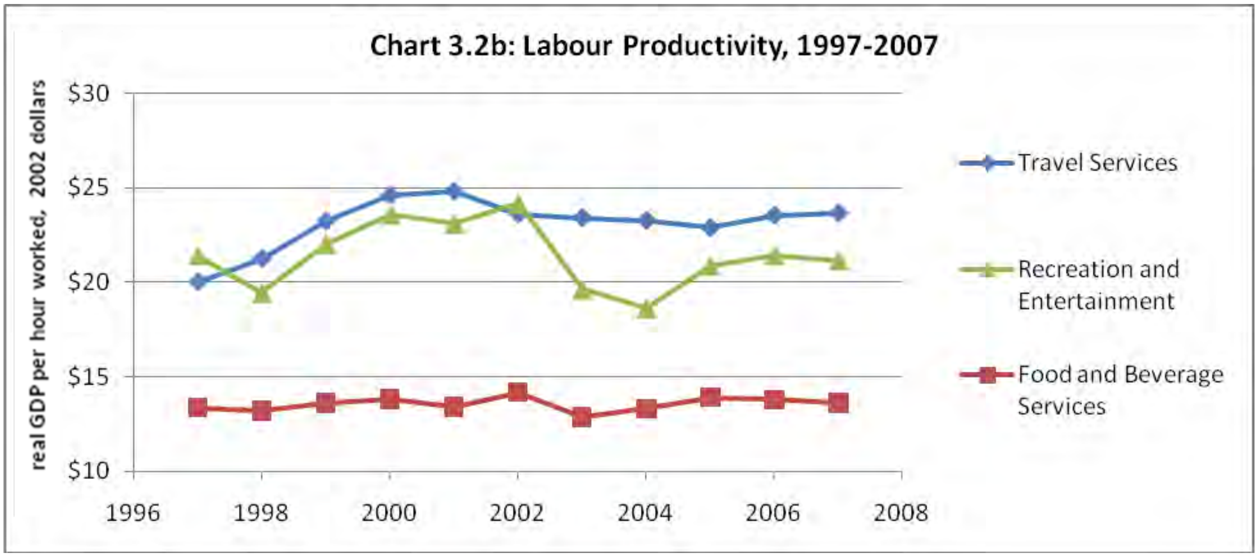
demand. To do so, we make use of the weights available in the Tourism Satellite Account. The TSA was produced every two years between 1996 and 2002 inclusive. As an example, consider accommodation. The published tourism shares of total industry GDP attributable to tourism demand for accommodation (in 1996, 1998, 2000 and 2002) are 65.0%, 64.4%, 65.9% and 66.4% These are fairly stable with a hint of a slight increase over time. For some industries, the tourism share in 1996 was well below the share in later years. Air transportation, for example, has these shares: 61.6%, 77.3%, 77.9% and 78.7%. From these proportions we need to estimate annual tourism shares for each of six industries for the years 1997-2007 (these are the years for which HRM data are available.) Our interpretation of the air transportation shares is that 1996 is an outlier while the three subsequent shares are stable. Based on this description, we decided to estimate the 1997 share by averaging the observed shares in 1996 (61.6%) and 1998 (77.3%) For the years 1998, 2000 and 2002 we used the published shares and for the remaining years for which we do not have official estimates (1999, 2001, 2003-2007) we used the average of the (very similar) shares in 1998, 2000 and 2002. We applied the same method to all six industries.

Having calculated tourism share for all six industries for the years 1997 to 2007 we then calculated the industry GDP. The ratio of industry GDP to the hours of work is our measure of labour productivity. The results of these calculations are plotted in Charts 3.2a and 3.2b. Note that the vertical axis measures real GDP per hour worked in constant 2002 dollars.

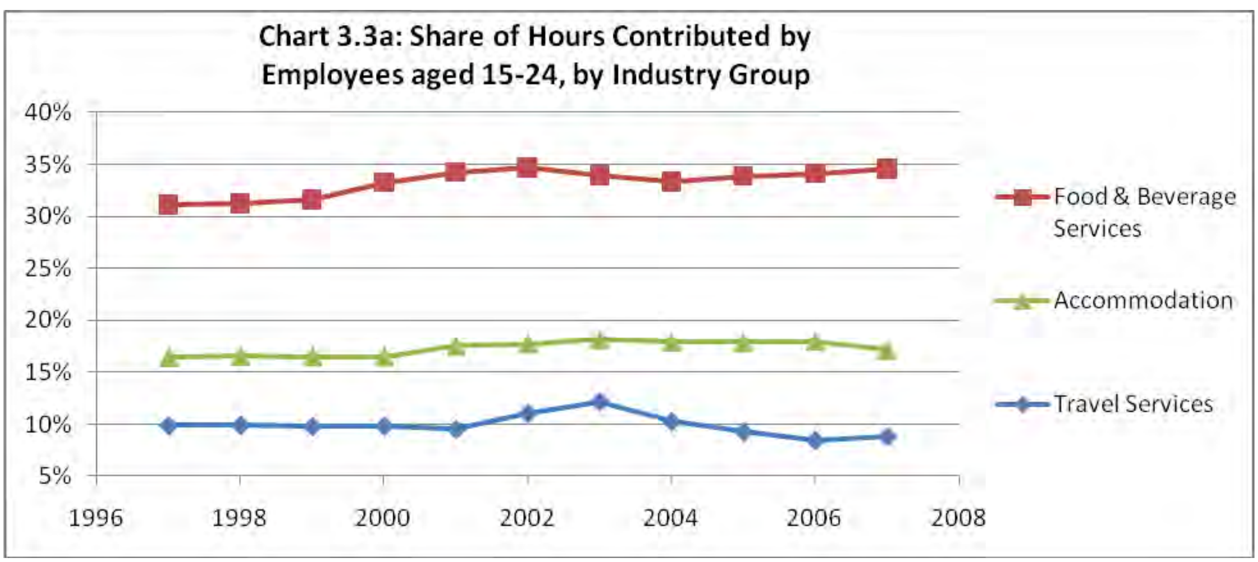


Labour productivity is highest in the transportation industries which not only employ older, well educated workers, but also use a great deal of physical capital. Output per hour is much the same in accommodation, travel services and recreation and entertainment with annual data varying between $20 and $30 per hour. Output per hour is lowest in the food and beverage services industry.

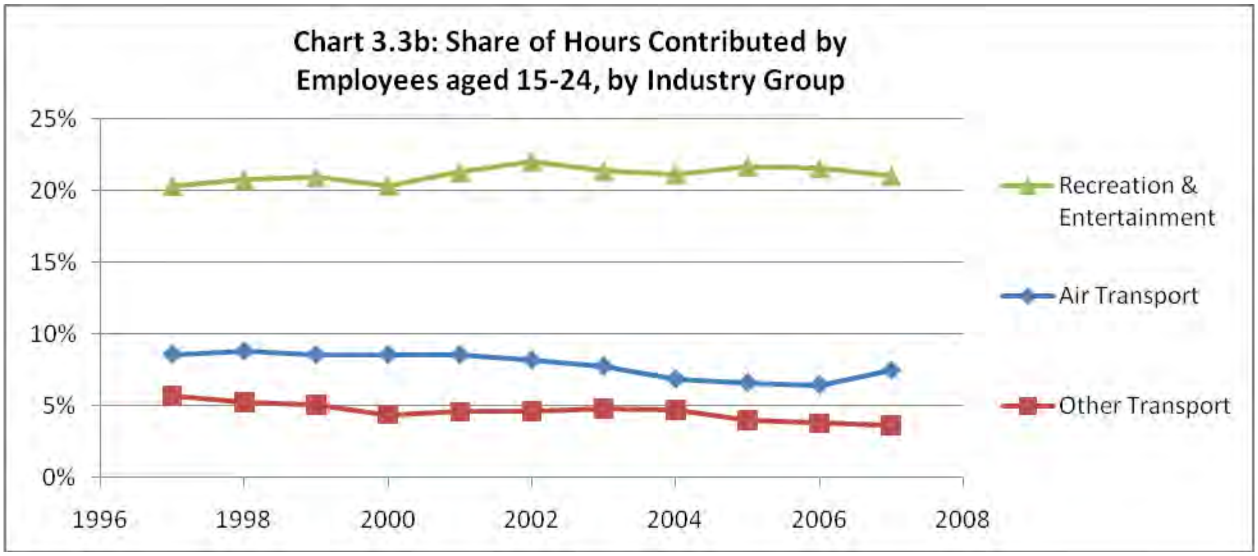
The series displayed in Charts 3.2a and 3.2b are the dependent variables in the regression analysis that will be reported later in this section. But first, we take a look at the time series paths followed by the explanatory variables. All but one of these variables is drawn from the HRM of the TSA. To construct each industry's capital labour ratio we used data from the Statistics Canada's Economic Accounts (see Appendix B for details.)



Charts 3.3a and 3.3b show the share of hours contributed by employees aged between 15 and 24 years. Clearly, the food and beverage services industry relies most heavily on this age group and the level of dependence rose over the period covered by the data.



As seen in Chart 3.3b, transportation industries make relatively little use of this youngest group of workers and indeed the shares have declined somewhat over time.

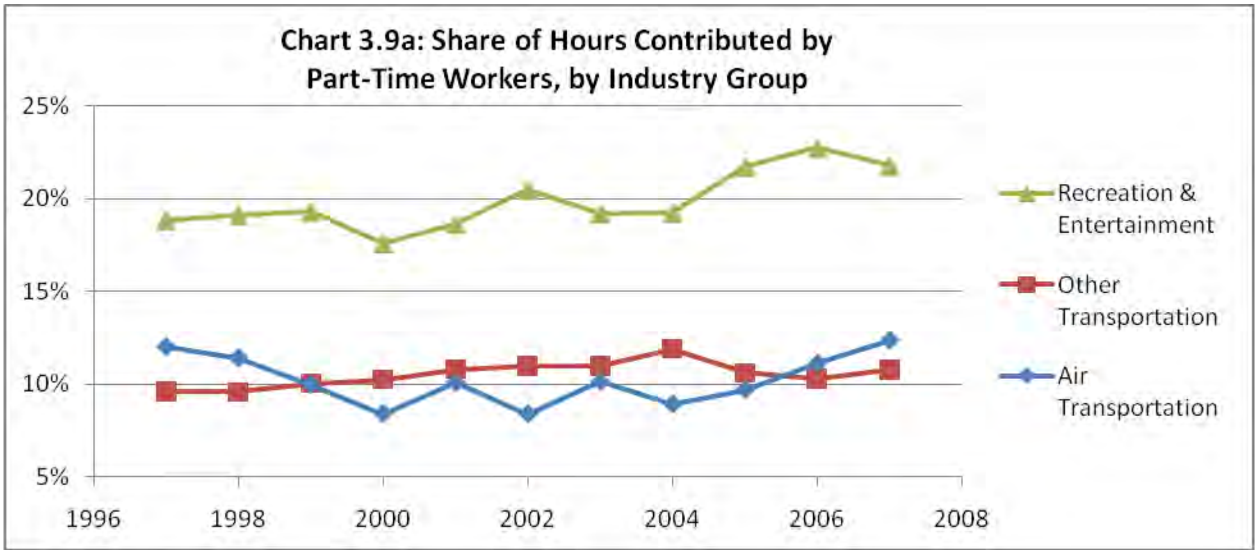


The remaining age charts are available in Appendix A. A feature common to all industries is that the share of mature workers has increased over time. Alone amongst the six industries, food and beverage services has seen an increase in the shares of both the oldest and youngest workers, with a concomitant decline in the share of workers aged 25 to 44. As noted earlier, the empirical literature suggests strongly that an increase in the share of prime age workers is associated with increases in productivity. Note however, that the oldest age category in the HRM is 45 years and older which means that prime age workers are combined with the oldest workers whose productivity is generally shown to be somewhat lower.

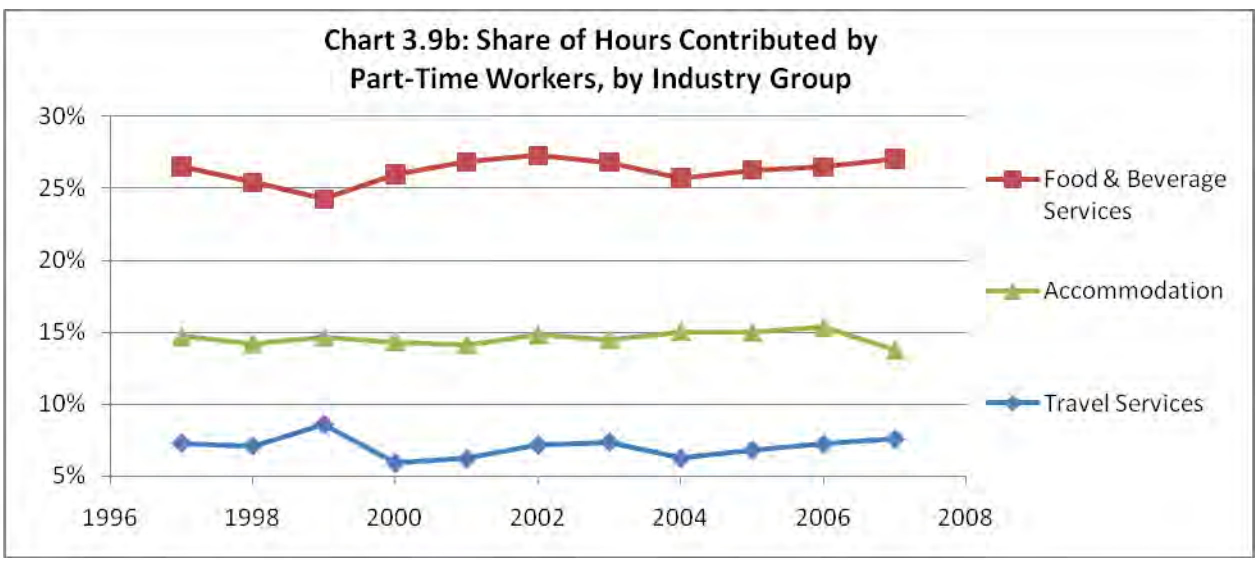
When the share of hours supplied by female workers is plotted, the biggest differences are found between industries rather than within industries over time (see Appendix A). The industries with the largest share of female hours are, in declining order, travel services, accommodation, food and beverage services, other transportation, recreation and entertainment, and air transportation. There are some variations over time; in 5 of 6 industries the share of hours supplied by women was higher in 2007 than in 1997.

In the same vein, five out of six industries have seen the share of hours supplied by immigrants increase between 1997 and 2007. Growth has been greatest in other transportation and in food and beverage services. Again, differences between industries are quite pronounced with over 30% of hours supplied by immigrants in travel services and around 15% in recreation and entertainment.

For five of six industries, the share of hours provided by part-time workers has remained relatively stable over time. Only recreation and entertainment has shown any appreciable positive trend (chart 3.9a). Again, there are noticeable differences between industries.



The highest shares of part-time hours are in the food and beverages and recreation and entertainment industries with part-time hours accounting for in excess of 20% of total hours (chart 3.9b). About 15% of hours in accommodation are supplied by part-time workers while the share drops to 10% in the transportation industries and well below 10% in travel services.



Finally, Charts 3.10a and 3.10b show the time series of capital per unit of labour which is measured by the real value of the capital stock per hour of labour input.

Chart 3.10a: Capital Stock per Hour of Labour Input, by Industry Group

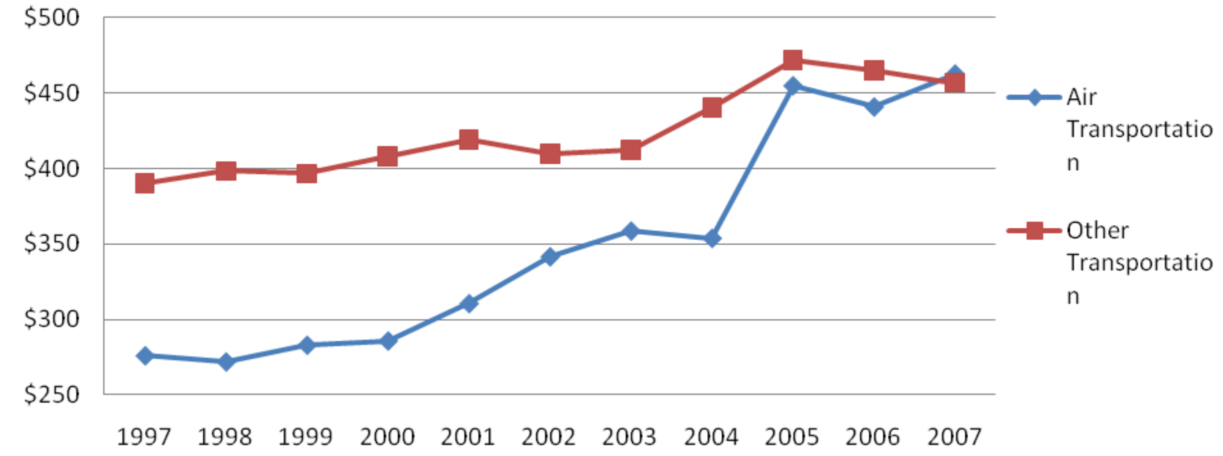
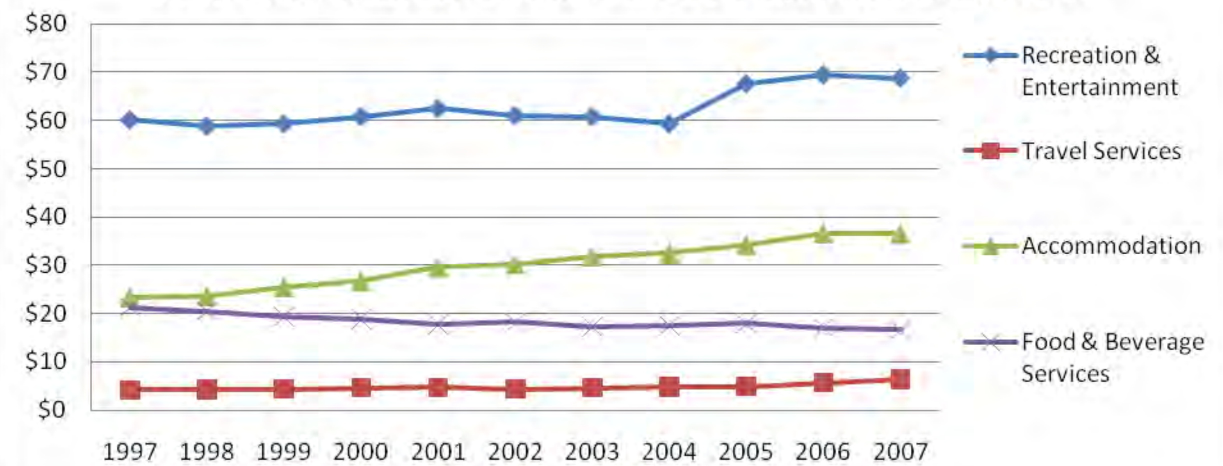


Chart 3.10b: Capital Stock per Hour of Labour Input, by Industry Group



The transportation industries are clearly much more capital intensive than the other four, having a capital labour ratio an order of magnitude larger. Capital per labour unit has also increased over time in the transportation sector but shows no net increase in two of the other four industries. Recreation and entertainment recorded a small jump in capital per unit of labour in 2005. Accommodation is the exception, and like transportation, it shows a positive trend in capital per unit of labour.

3.1 Estimating a Model of Labour Productivity - Regression Results

In this section we present the results of estimating a model of labour productivity. The dependent variable is labour productivity (lnGDPH) measured annually over the period 1997 to 2007 for each of six tourism industries. Consequently, there are 11x6 = 66 observations available at the present time. This is a small sample by any standard and one cannot expect to estimate a vast number of coefficients with any precision with such a sample. Despite the small sample size, the results appear to be plausible, robust across model specifications and broadly consistent with the published literature.

Since the productivity levels differ considerably across industries, one might anticipate that it would be appropriate to take account of heteroskedasticity. That is to say, it is likely that the error variances differ across industries and possibly over time. We therefore employ Feasible Generalized Least Squares (FGLS) in STATA as our method of estimation. Accounting for heteroskedasticity should make the estimation procedure more effective. Further efficiency gains are offered by FGLS through the estimation of the inter-industry error covariances. Some mild autocorrelation is detected in the residuals and this also is accounted for in the estimation procedure. Variables other than the industry and time dummy variables are measured in natural logarithms.

Table 3.3 presents estimation results for a model that includes the following explanatory variables:

- Capital per unit of labour (lnCAPH);
- the proportion of part-time hours (lnPPT);
- the proportion of hours supplied by women (lnPFEM);
- the proportion of hours supplied by immigrants (lnPIMMIG);
- variables that measure the age composition of the labour force (lnp_15-24, lnp_25-34 and lnp_35-44); and,
- industry dummy variables (air transport(Dat), other transports(Dot), accommodation(Das), recreation and entertainment(Der) and food and beverage services(Dfb)).

Since we have six industries, we have included a constant and five industry dummy variables. No dummy variable is included for the travel services industry, so this industry effectively becomes the benchmark against which the other industries are compared. Similarly, we have omitted the share of hours supplied by the most mature workers (aged 45 and older) so again these workers become the base case relative to whom the other age groups are compared.

The positive coefficient on capital is consistent with economic theory and indicates that a 10% increase in capital per labour input increases average labour productivity by about 7.5%. The coefficient on the share of part-time hours is also positive and statistically significantly different from zero. This is consistent with the results reported by Owen (1978) and Nelen *et al* (2009) who find empirical support for the claim that part-time workers raise labour productivity by allowing for variations in labour input that match variations in demand. The coefficient of 0.2 implies that at the sample mean, a 10% increase in part-time hours has the effect of raising labour productivity by 2%.

TABLE 3.3 Feasible Generalized Least Squares			
lnGDPH	**Coefficient**	**Standard Error**	**z**
lnCAPH	.7495005	.0834412	8.98
lnPPT	.2099934	.0699325	3.00
lnPFEM	2.424095	.321744	7.53
lnPIMMIG	1.037693	.3530836	2.94
lnp_15-24	-.1079746	.0996757	-1.08
lnp_25-34	.5397011	.1537509	3.51
lnp_35-44	.7113887	.1206986	5.89
Dat	-.6489061	.3616435	-1.79
Dot	-1.156676	.300216	-3.85
Das	-.6516635	.1512994	-4.31
Dfb	-.6053118	.18678	-3.24
Der	-.1024958	.3005343	-0.34
_cons	5.880383	.7549053	7.79

An increase in the proportion of women is also associated with an increase in labour productivity and while the standard error is small, the coefficient itself is large. The coefficient of 2.4 implies that a 1% increase in the proportion of women is associated with an almost 2.4% increase in labour productivity. Certainly the proportion of women employed in tourism industries has increased over time as it has in other industries. How might we interpret the finding that an increase in the proportion of women working in an industry raises labour productivity? It would probably come as no surprise to academics such as Judy Rosener of the Merage School of Business at the University of California, Irvine. Rosener (2007, 1997 and 1990) argues that inherently female characteristics (consensus-seeking leadership, an emphasis on collaboration, less power-obsessed) are increasingly valuable in the workplace. This view is not necessarily limited to feminist researchers in business. The Economist recently quoted Niall FitzGerald, chairman of Reuters and former head of Unilever "Women have different ways of achieving results and leadership qualities that are becoming more important as organisations become less hierarchical."[5]

An alternative explanation focuses on our statistical model's inability to take into account the investment in human capital. The HRM of the TSA does not contain any information on the educational achievements of workers. The productivity literature shows very clearly that human capital is a key factor in determining wages and productivity. The exclusion of an important variable from a statistical model can result in other proxy variables assuming the role of the omitted variable. In the present case, it could be that the proportion of women in a workforce is a proxy for average educational achievement. Parsons and McMullen (2009) report on trends in university education between 1992 and 2007 using Canada's Post-secondary Student Information System – an annual survey of university graduation data. In 1992 universities in Canada graduated 28% more females than males. Over the next 15 years,

[5] Economist, January 2nd, 2010 pp. 48

women dramatically and consistently increased their participation in university education. In every province and in all subject areas except mathematics and computer science, the growth in the number of women graduates far exceeded that of male graduates. In BC and Alberta combined, female graduates more than doubled while numbers of male graduates increased by less than 60%. In Manitoba, male graduates barely increased in these 15 years, but the number of women who graduated grew by over 30%. The result was that in 2007, Canadian universities graduated 148,000 women and 95,000 men - a margin in favour of women of some 56%. It is exceedingly likely that an industry that hires more women is also hiring employees with a higher level of educational achievement, which corresponds with a higher level of productivity. We believe this is the most plausible explanation for the statistically significant and positive coefficient on the proportion of women in the labour force.

The positive coefficient on the proportion of immigrants in the labour force implies that immigrant workers enhance productivity. It is impossible to say precisely how this effect may come about but it is not necessarily inconsistent with the literature on immigrant workers' wages. As we have seen, that literature finds immigrant wages are low relative to the wages of native born Canadians with similar characteristics. It is conceivable that in general the wages of immigrants understate their productivity (measured by output per hour worked) just as Hellerstein *et al* (1999) found that women are paid less than their marginal product while Kotlikoff (1988) claims older workers are paid more than their marginal product.

There is a vast literature on how the age composition of the labour force affects productivity. In particular, it is well established that productivity increases when the share of prime age workers increases. Prime age is typically cited to be somewhere in the age interval of 40 to 50 years. The coefficients reported in Table 3.3 are consistent with this literature. The youngest workers are associated with the lowest levels of productivity (although the small negative coefficient is not statistically significantly different from zero.) The coefficients on the proportions of workers aged 25-34 and 35-44 are positive and statistically different from zero, implying that these workers are more productive than the most mature workers (45 years and older) with the 35-44 year old group having the highest levels of labour productivity. We might have expected the younger workers, 25-34, to be somewhat less productive than the prime age workers, but as we noted previously, the most mature group also includes the oldest workers whose productivity is also generally found to be below that of prime age workers.

The coefficients on the industry dummy variables are negative, which implies that output per hour of work is highest in the benchmark industry (Travel Services) once other variables are taken into account, namely the level of capital per unit of labour and the labour force variables from the HRM.

Table 3.4 reports the estimation results for a model that includes time dummy variables (excluding 2001, which is the reference year) along with all the variables included in the previous specification. Given the small sample size, it is extremely encouraging that many coefficients are robust when the time dummy variables are included. This increases our confidence that the estimated coefficients are supported by the data and not sensitive to changes in model specification. It may be useful to clarify the role of the industry and time dummy variables in Table 3.4. The inclusion of industry dummy variables allows for differences in labour productivity across industries. But these industry differences are averages over time, that is, the estimated inter-industry differences do not vary over time. Similarly, the time dummy variables allow for labour productivity variations over time – but these year-to-year variations are necessarily the same for every industry.   It is the other variables (capital and labour force characteristics) that allow for or explain variations in labour productivity that are more complex than time-invariant inter-industry differences and industry-invariant differences over time.

First, consider the variables whose coefficients are essentially unchanged when the time dummy variables are included. These are: the proportion of part-time hours, the proportion of hours supplied by women and by immigrants and the share of hours supplied by workers in the 25-34 and 35-44 age groups. It's reasonable to say that coefficients on these variables are fairly robust. The coefficient on capital per worker remains positive and statistically significantly different from zero while shrinking to a more plausible numerical value. In an augmented Cobb-Douglas technology such as the model used here, the capital coefficient should reflect the share of total output that goes to capital (as opposed to labour). The estimate in Table 3.4 implies a capital share of 45%

Interestingly, the inclusion of the time dummy variables changes the estimates of the coefficients on the industry dummy variables, some of which are positive and statistically significantly different from zero in the model reported in Table 3.4. Taking into account all the other variables in the model, the latest results imply that even accounting for differences in capital per worker, the transportation industries and recreation and entertainment have the highest levels of labour productivity.

The time coefficients themselves measure the changes in labour productivity over time, having allowed for the effects of the other variables. So, for example, to the extent that the labour force is maturing and capital per worker is increasing there is a concomitant increase in labour productivity over time. The time coefficients do not 'double count' these contributions, rather they measure changes over time that the other variables cannot explain. The time coefficients essentially provide estimates of the growth of annual labour productivity that comes about from unidentified sources (that is, sources not identified by this particular model).   Moreover, the time coefficients can be identified directly as growth rates relative to the base year, 2001. Consider, for example, the coefficient on D07, which is 0.188. This implies, after the effects of the other variables are accounted for, labour productivity increased 18.8% between 2001 and 2007. On the other hand, labour productivity was about 2.4% higher in 2003 than it was in 2001. The negative coefficients on years prior to 2001 indicate to what extent productivity was below the level in 2001. Thus, the coefficient of -0.063 for 1997 suggests labour productivity that year was some 6% below the level in 2001. Over the entire period covered by the sample, labour productivity, as measured by the time dummy variable coefficients, is estimated to have grown a total of approximately 25.5% or about (25.5/10)% = 2.55% per year.[6]

TABLE 3.4			
lnGDPH	**Coefficient**	**Standard Error**	**z**
lnCAPH	.4522691	.0772865	5.85
lnPPT	.2048805	.0695109	2.95
lnPFEM	2.193879	.3466467	6.33
lnPIMMIG	1.508875	.3212611	4.70
lnp_15-24	.09302	.0957425	0.97
lnp_25-34	.8695609	.1490953	5.83
lnp_35-44	1.231753	.1753339	7.03
Dat	.6740857	.3175416	2.12
Dot	.7082341	.2836211	2.50
Das	-.0329798	.1465314	-0.23
Dfb	-.1772496	.1865381	-0.95
Der	.9304888	.2824404	3.29
D97	-.063891	.0208053	-3.07
D98	-.1300924	.0181881	-7.15
D99	-.0677193	.0144062	-4.70
D00	-.0113547	.0087231	-1.30
D02	.051129	.0087201	5.86
D03	.0244768	.012713	1.93
D04	.0668877	.0145183	4.61
D05	.151536	.0206358	7.34
D06	.1775435	.0247998	7.16
D07	.1882659	.0247785	7.60
_cons	8.266914	.7638416	10.82

4.0 Productivity Analysis of Accommodation and Food and Beverage Services

Variations in labour productivity between provinces can only be studied at a level of aggregation for which such data are available. As far as the tourism sector is concerned the only meaningful provincial data available is the combined accommodation and food and beverage services industries. According to the Tourism Satellite Account, the proportion of industry output (supply) that is consumed by tourists (tourism demand) was about 34.0% in 2002. This is a weighted average of tourism demand in accommodation (66.4%) and food and beverage services (17.3%). The ratio of industry GDP to the total hours of labour supplied is the measure of labour productivity that is used in the following analysis. The data are available

[6] A more precise calculation shows that the results imply an average compound rate of growth of labour productivity equal to 2.66%

annually for all ten Canadian provinces between 1998 and 2007 inclusive, which gives a cross-section time-series sample of 100 observations.

In this study, characteristics of the labour force are taken from the Labour Force Survey (LFS) which provides data for this specific industry. Unlike the HRM of the TSA, the LFS records the highest level of educational achievement as well as other demographic details such as age. However, in the LFS there are just three age categories. Consequently, we use the proportion of workers who are between 15-24 years of age and between 25-54 years of age. These age categories are represented in the model as dummy variables. The omitted group of mature workers therefore serves as the benchmark against which the others are measured. Three variables representing capital intensity are included in the model. CapH is the value of physical capital per hour of labour input. ICTH refers specifically to information and communications technology per unit of labour input. Finally, the real value of public investment within the province is included. This variable is expressed in per capita terms by dividing the real value of public investment by the provincial population. Public investment includes public expenditures for the construction and renovation of government buildings, expenditures for infrastructure, and expenditures for machinery and equipment. Public investment in infrastructure is the largest component of total public investment. Public investment in infrastructure ranges from communication towers, electric power construction, waterways and canals, bridges, parking lots, sewage systems, waste disposal facilities, historical sites to roads and highways.

Labour force characteristics are represented by: the proportion of female workers (lnPFEM); the proportion of part-time employees (lnPPT); the proportion of workers in the 15-24 (lnp_15-24) and 25-54 (lnp_25-54) age categories; the proportion of workers with a post-secondary certificate or degree (lnPOSTSEC); and, the proportion of immigrant workers (lnPIMMIG). All variables are in the natural logarithmic form. The method of estimation is Feasible Generalised Least Squares (FGLS.)

TABLE 4.1

lnGDPH	Coefficient	Standard Error	z
lnCAPH	.1609736	.0063098	25.51
lnICTH	.1141661	.0073781	15.47
lnPUBK	.0611254	.0036104	16.93
lnPFEM	-.2356253	.017903	-13.16
lnPPT	.0459987	.0145024	3.17
lnIMMIG	.0066472	.0005145	12.92
lnp_15-24	.1002458	.0286508	3.50
lnp_25-34	.2003514	.0296902	6.75
InPOSTSEC	.0375266	.0051219	7.33
_cons	2.068832	.0653767	31.64

The first set of results are reported in Table 4.1 All three capital intensity variables have positive and statistically significant coefficients, which is what we would expect from economic theory and the empirical literature. According to these results, information and communications technology and public investment are very effective in boosting labour productivity in the accommodation and food and beverage industry. The proportion of part-time hours has a positive coefficient, which consistent with the results obtained with the HRM data analysis. However, here we find the proportion of females is associated with lower average productivity. As in the HRM study, the proportion of immigrants in the labour force is positively related to average labour productivity.

Investment in human capital through the acquisition of a university degree or a post-secondary certificate is seen to raise labour productivity significantly. A ten percentage point increase in the proportion of the province's labour force that holds a post-secondary certificate or a university degree is associated with a 0.4% increase in labour productivity.

TABLE 4.2			
lnGDPH	**Coefficient**	**Standard Error**	**z**
lnCAPH	.2167042	.0128431	16.87
lnICTH	.0653809	.0023107	28.30
lnPUBK	.0446121	.0038984	11.44
lnPFEM	-.0944173	.0131038	-7.21
lnPPT	.0719741	.0068098	10.57
lnIMMIG	.0059414	.000518	11.47
lnp_15-24	.0706664	.0128092	5.52
lnp_25-34	.1435161	.0242343	5.92
InPOSTSEC	.0613599	.0075585	8.12
Nova	-.0372649	.0101509	-3.67
BC	.0647365	.0117445	5.51
QUEBEC	-.035101	.018888	-1.86
ONTARIO	-.06947	.0198872	-3.49
_cons	2.068212	.0298819	69.21

The results reported in Table 4.2 include provincial dummy variables. We have excluded provincial dummy variables that were shown to have coefficients not statistically different from zero. The omitted provinces are therefore judged to have similar levels of labour productivity, after taking into account inter-provincial differences in the variables included in the model (such as capital intensity and characteristics of the labour force). Of the included provinces, only B.C. is shown to have higher labour productivity than the omitted group – Newfoundland and Labrador - while productivity is lower in Nova Scotia, Ontario and Quebec. Not surprisingly the inclusion of the provincial dummy variables has an impact on some of the other coefficients. However, many remain statistically significantly different from zero.

TABLE 4.3			
lnGDPH	**Coefficient**	**Standard Error**	**z**
lnCAPH	.2310159	.0283932	8.14
lnICTH	.0942393	.0143338	6.57
lnPUBK	.0436675	.0129	3.39
lnPFEM	-.2064355	.0360245	-5.73
lnPPT	.0950443	.0279035	3.41
lnIMMIG	.0429262	.0094568	4.54
lnp_15-24	.0248123	.0353882	0.70
lnp_25-34	.0296781	.0588347	0.50
InPOSTSEC	.0846241	.0206819	4.09
D98	.0523565	.0054016	9.69
D99	.0427	.006152	6.94
D00	.0631213	.0036147	17.46
D01	.0438102	.0032328	13.55
D02	.0277374	.0024764	11.20
D04	.0084202	.0017653	4.77
D05	.0114797	.0035235	3.26
D06	.0073924	.0052575	1.41
D07	.0919952	.0168308	5.47
SASK	-.0704121	.0190247	-3.70
PEI	-.0719074	.0231635	-3.10
NOVA	-.0686716	.0138493	-4.96
QUEBEC	-.128532	.0363501	-3.54
ONTARIO	-.189264	.0342021	-5.53
_cons	2.046833	.1161814	17.62

A third specification is reported in Table 4.3 where time dummy variables are included for all years except 2003 which becomes the reference year against which the others can be evaluated. The year 1998 is represented by D98 and so on. Again, most of the previously statistically significant coefficients are robust to the inclusion of time dummy variables, the age group variables excepted. The coefficients on the time dummy variables represent percentage differences in labour productivity relative to the base year, which is arbitrarily set to 2003.

According to these results, productivity was at a low point in 2003. It had risen 9% by 2007 and was apparently 5% higher in 1998 than in 2003. These results imply that over the entire sample period there was no net change in labour productivity beyond what is accounted for by investment in physical and human capital. In the six-industry HRM study the time dummy variables did detect a positive trend in productivity (averaged over all six industries) over and above what can be explained by the other variables. The two sets of results imply that the accommodation and food and beverage services industries probably did not contribute much to that trend – productivity increases then presumably have its source in the other industries.

5.0 Conclusions

This paper has presented two related statistical studies. The first addresses the challenge of determining to what extent the labour force characteristics of workers in the six tourism industries identified in the HRM of the TSA contribute to labour productivity in those industries. We refer to this as the HRM study. There is a vast literature on the connections between demographic factors and productivity and this paper attempts to summarize the key findings that are relevant to the present study. In the main, the lessons from the broader literature are borne out here. Labour productivity is found to increase with the capital labour ratio, the proportion of part-time hours employed, the share of hours supplied both women and immigrants and with the share of prime-age workers. The fact that a relatively small sample of 66 observations yielded statistically significant results that broadly accord with the established literature is in itself an encouraging result provides a validation of the data contained in the HRM.

At first glance it may seem odd that productivity increases with the proportion of women in the labour force. Our preferred explanation is that in this particular study being a woman is a proxy for being somewhat better educated so the economic returns to being female are really the economic returns to education. The HRM does not contain any information on educational attainment and yet it is well established that wages and productivity are higher for better educated workers. It has also been established that the proportion of Canadian university graduates who are female has increased noticeably over the past few decades so hiring females implies hiring people who on average have a higher educational attainment.

The positive effect of the proportion of immigrants on productivity is not so easily explained by the evidence available in this study although it is possible to speculate. The research literature shows that immigrants earn less than the Canadian born with similar characteristics and that the returns to education and labour market experience that have been accumulated outside Canada command a smaller premium than if those components of human capital had been developed in Canada. But this study did not focus on wages and earnings; rather the variable of interest is on productivity, that is, labour's contribution to the value of production. Immigrants are selected and tend to have relatively high levels of education. One may speculate that as a group, immigrants tend to be highly motivated. While we present no direct evidence here, it could be that these characteristics are reflected in high levels of productivity (even if not in wage levels).

Finally the HRM study finds that there has been some 'disembodied' productivity growth. That is, growth that is not explained by the demographic factors or the quantity of capital per worker. The estimates are averaged over all six industries. In the second empirical study, we found that this trend was not apparent in accommodation and food and beverage services, so its source is presumably to be found in the other four industries.

The second study addresses productivity in the combined accommodation and food and beverage services industries – we refer to this as the AFB study. The combined industry is sufficiently large for data to be available on a provincial basis so we are able to analyse productivity changes over a ten year period within ten provinces, giving a sample of 100 observations. In the AFB study, data are drawn from a wide range of sources. In particular, we use information on the educational achievement of workers and find that higher levels of education are associated with higher productivity – but being female in this industry does not raise productivity when education is controlled for. It is interesting that the two studies are otherwise in broad agreement. Productivity is found to increase with capital per worker, the proportion of immigrants, the proportion of part-time workers and the proportion of workers who are close in age to the so-called prime age group for whom productivity is greatest.

The AFB study also incorporated provincial public investment per capita and industry investment in information and communications technology per hour of labour input. Both of these forms of capital were found to have a positive effect on labour productivity, which is consistent with the broader literature.

In principle, it should be possible to compare levels of productivity across provinces and to do this we included so-called provincial dummy variables. The statistical results are mixed in that there is some shifting depending on whether or not time dummy variables are also included. It must be recognized that with 100 observations, not all questions will be answered by the data with robust and highly precise numerical estimates. Looking at the results as a whole, it would seem that after accounting for the effects of the included variables, Ontario, Quebec and Nova Scotia appear to have lower levels of labour productivity. However it is important to note that these dummy variables are measuring residual productivity differences after other effects have been accounted for (say from capital per worker and average levels of education).

6.0 Recommendations & Future Work

We believe that in this paper we have undertaken a thorough investigation of the extent to which the data available in the HRM of the TSA can be used to explain levels of labour productivity in six tourism industries. It is always possible to measure variables slightly differently and to look for others that might be included in the analysis. However, we believe there is little scope for any useful advances in this direction. Even if promising variables could be identified, the small sample size itself makes it unlikely that they could be accommodated in a statistical model. Further analysis of these data will likely have to wait until more data become available, as they will with the passage of time.

The second of our studies, which focused on the combined accommodation and food and beverage services industries benefitted from a slightly larger sample size, but nevertheless 100 observations still constitutes a relatively small data set. So again, it is unlikely that with the currently available data we will be able to find fruitful avenues of further research.

Instead, we suggest that further work on productivity in tourism industries should look at other sources of data and in particular the Workplace and Employee Survey (WES). Statistics Canada's own description of this unique data set is as follows[7]:

> The survey aims to shed light on the relationships among competitiveness, innovation, technology use and human resource management on the employer side and technology use, training, job stability and earnings on the employee side. The survey is unique in that employers and employees are linked at the micro data level; employees are selected from within sampled workplaces. Thus, information from both the supply and demand sides of the labour market is available to enrich studies on either side of the market.
>
> To create the best conditions for growth in the knowledge-based economy, governments need to fine-tune their policies on education, training, innovation, labour adjustment, workplace practices, industrial relations and industry development. The results from the survey will help clarify many of these issues and will assist in policy development.
>
> The Workplace and Employee Survey offers potential users several unique innovations: chief among these is the link between events occurring in workplaces and the outcomes for workers. In addition, being longitudinal, it allows for a clearer understanding of changes over time.

As noted in the survey section, in the broader productivity literature there has been considerable interest in assessing the contribution of ICT to productivity growth. The purpose of the proposed research would be to examine the relationship between the use of information and communications technology (ICT) and investment in education and training that is relevant to ICT with levels of productivity at the firm level specifically within the Canadian tourism sector. We are not aware of any studies, let alone Canadian studies, that specifically address the tourism sector. Having reviewed this proposal, Statistics Canada staff members have determined that a sufficiently large sample exists for the study to be undertaken. The most significant challenge will be finding a cost effective way to select the appropriate sample and to conduct the research.

6.1 Recommendations

The HRM contains a great deal of interesting information on the characteristics of workers in tourism industries with one obvious omission, namely any measure of educational achievement. Given the demonstrated importance of human capital for labour productivity, we recommend that this dimension be added to the data base.

While recognizing that data is costly to acquire, we nevertheless would support the development of the HRM in the provincial dimension.

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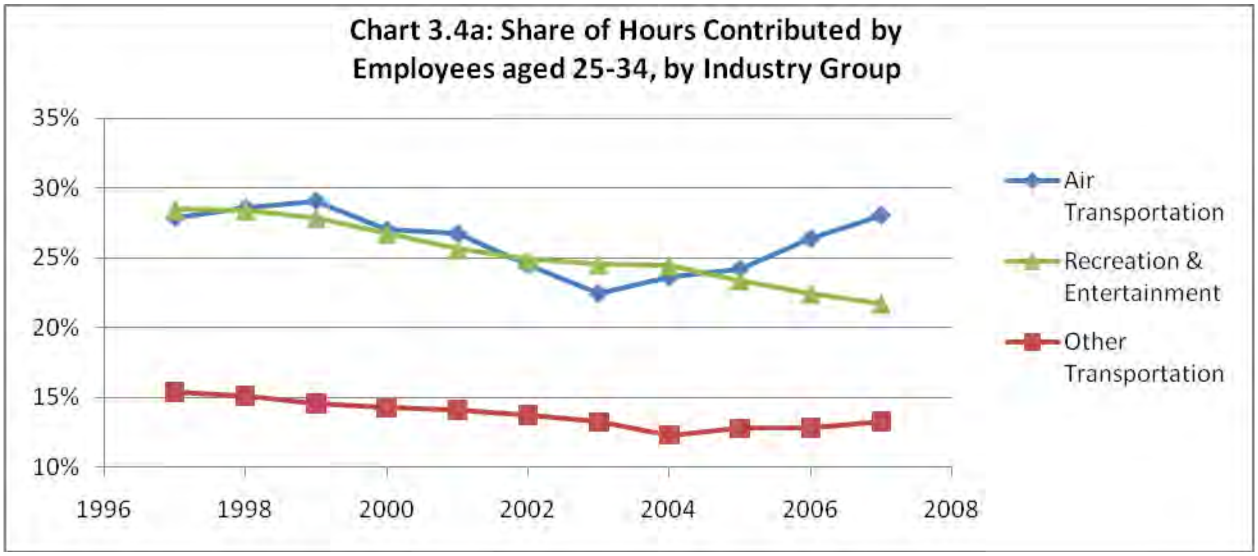
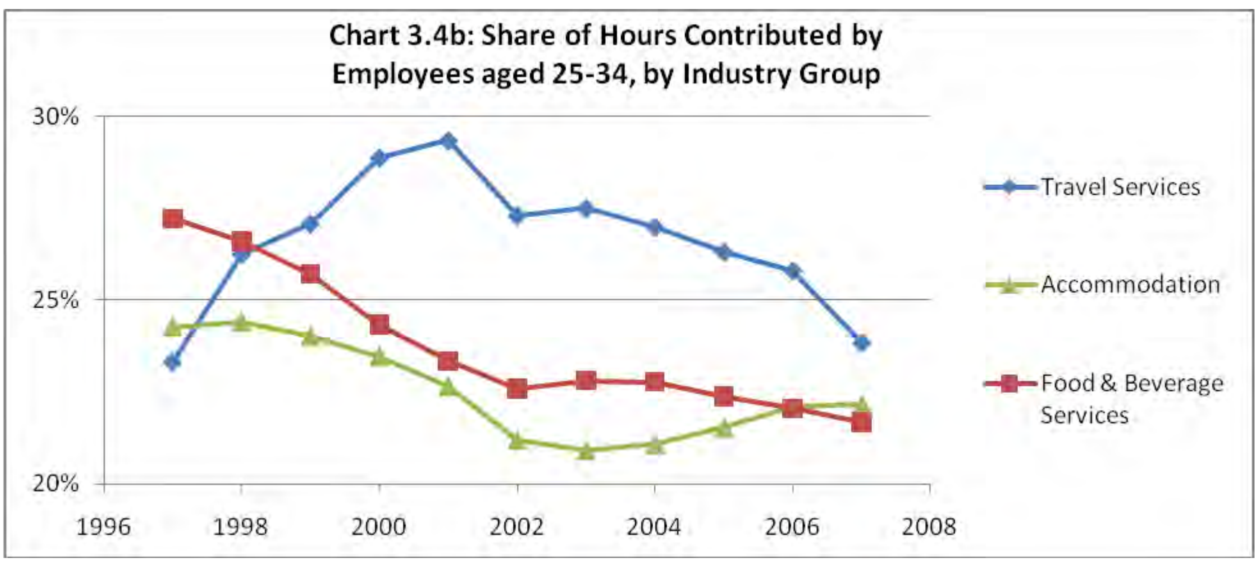
[7] Information on WES is available at this site http://www.statcan.gc.ca/imdb-bmdi/indexW-eng.htm

Further work on productivity in tourism industries in Canada would be most fruitful if it is based on alternative data sources and we have suggested that the WES is the ideal candidate. It is firm level data that surveys both employees and employers. It has a focus on investment in training and in ICT. Such a study would shed considerable light on the potential of ICT and related training to raise productivity in this service industry.

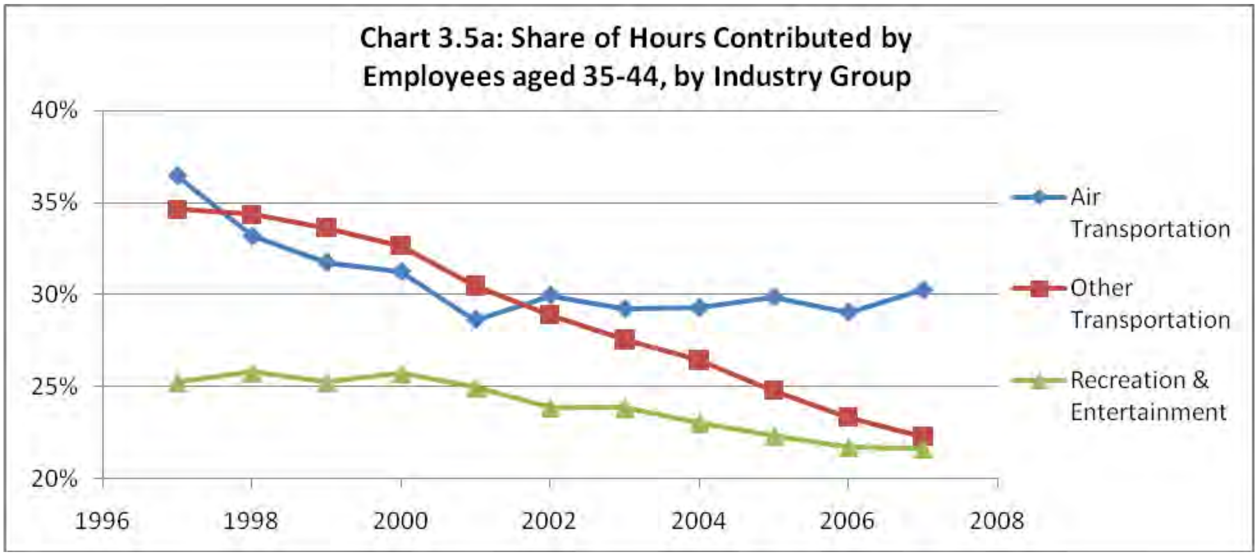
Appendix A – Supplemental Graphs

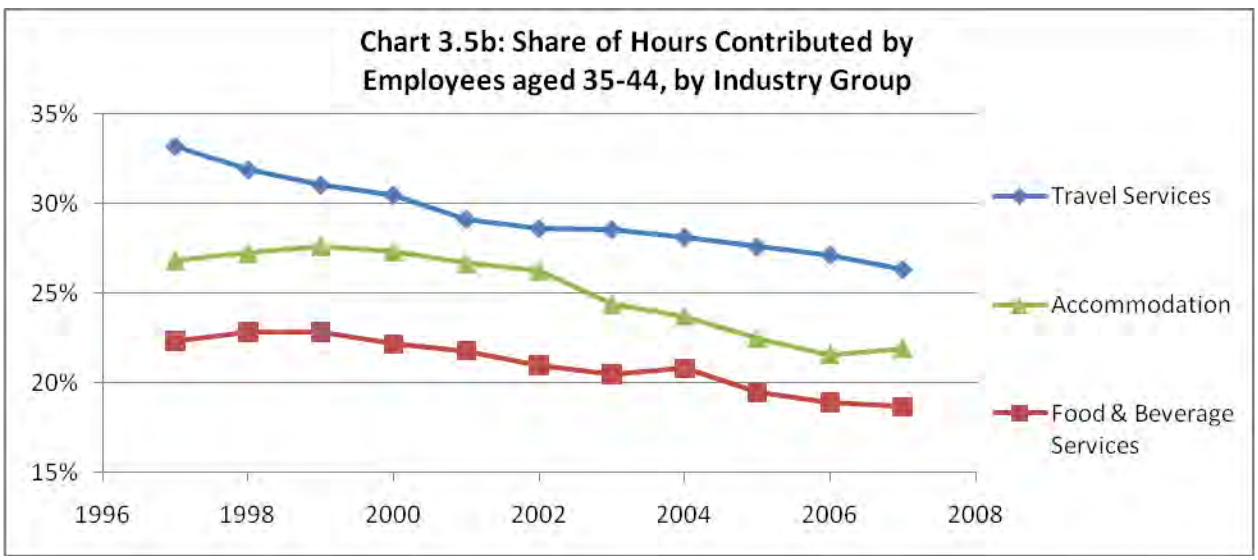
Charts 3.4a and 3.4b show the share of total hours supplied by workers aged 25-34:



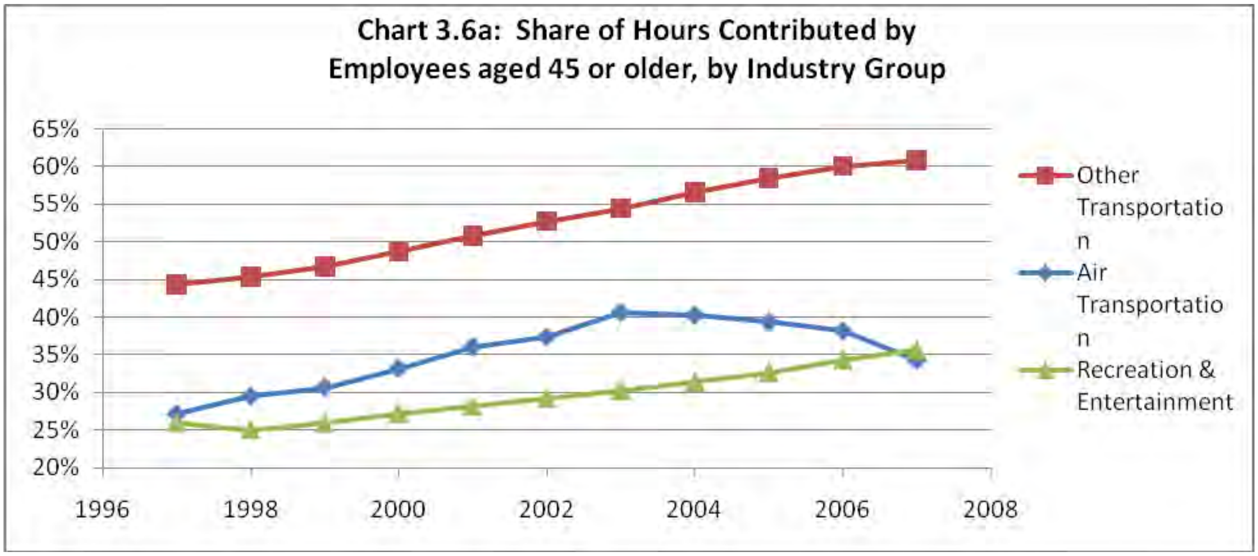


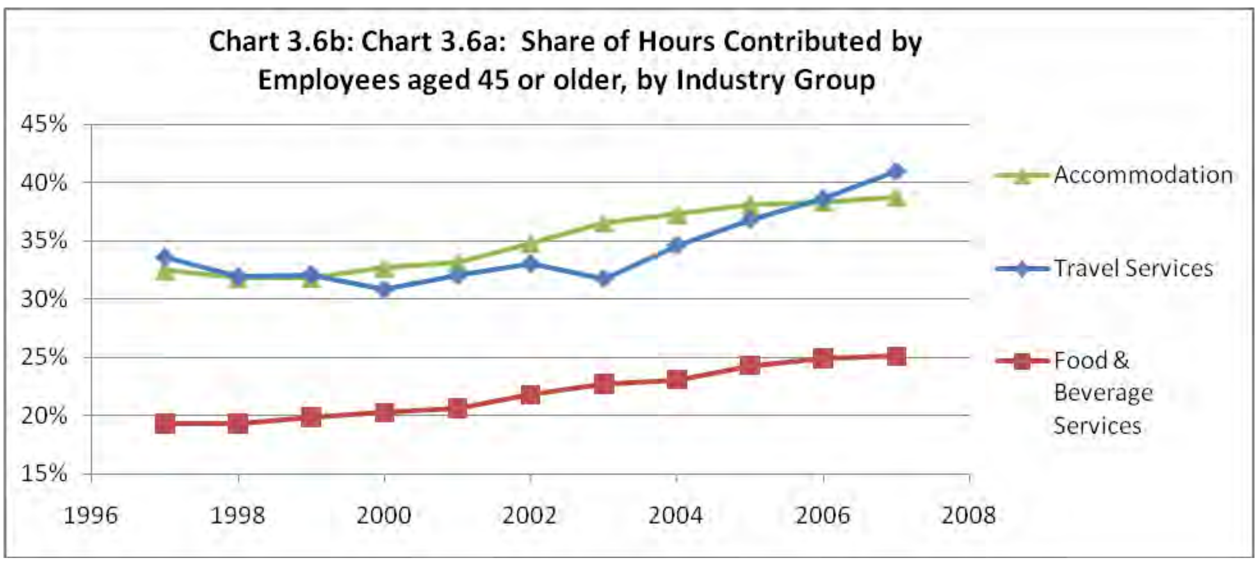
Charts 3.5a and 3.5b show the share of total hours supplied by workers aged 35-44:



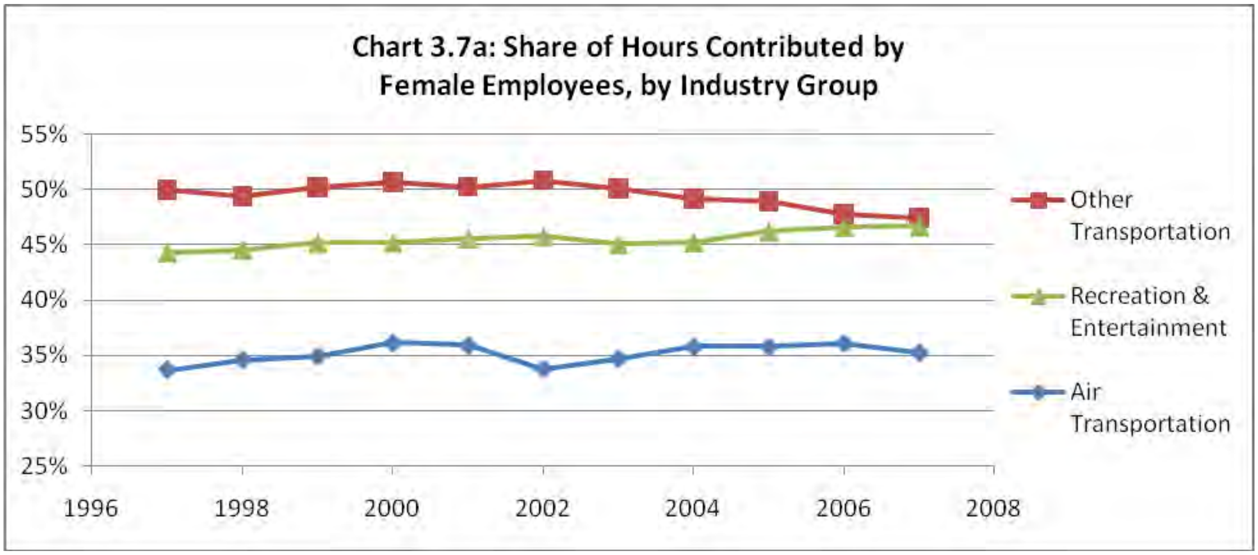


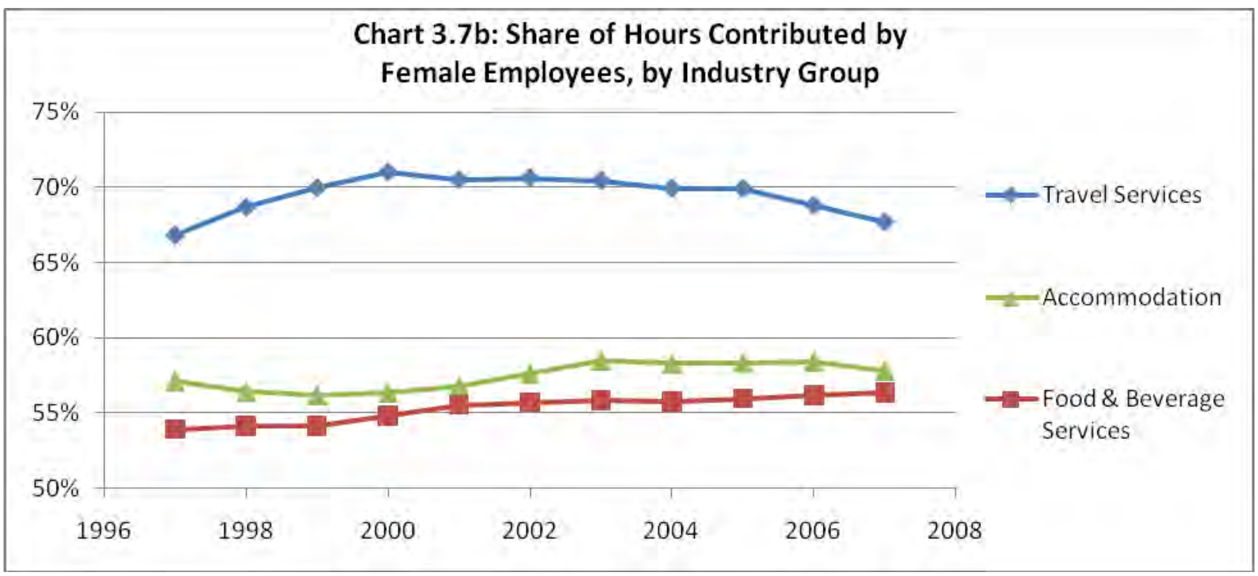
Charts 3.6a and 3.6b show the share of total hours supplied by workers age 45 or older:



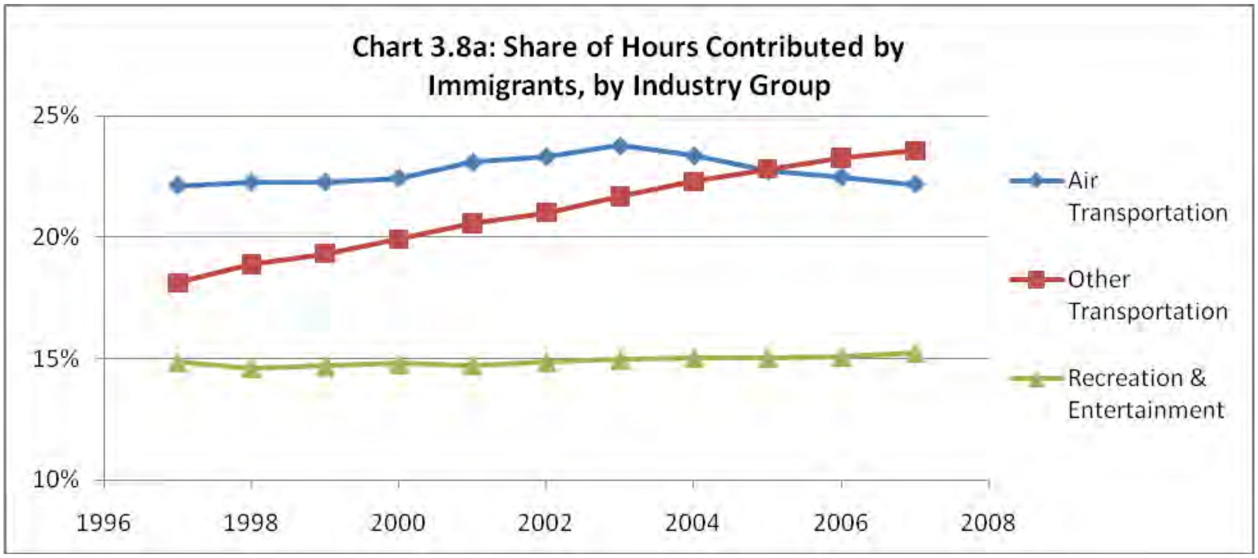


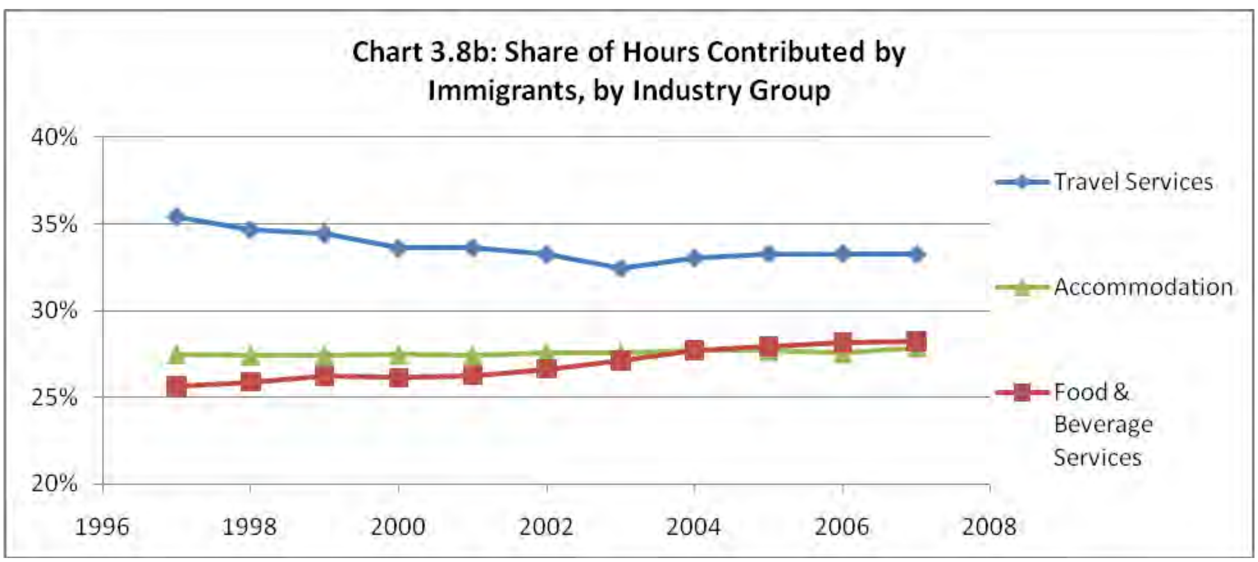
Charts 3.7a and 3.7b show the share of total hours supplied by women:





Charts 3.8a and 3.8b show the share of total hours supplied by immigrants:





Appendix B - Data Sources and Analytical Methods

Data Sources used in the Human Resource Module (HRM) Model

The HRM model uses annual data for all of Canada, which is the only frequency and geographical definition that is available. The six tourism/hospitality industries are defined within the Canadian Tourism Satellite Account: air transportation, other transportation, accommodation, food and beverage services, recreation and entertainment, and travel services. This dataset contains 66 observations from six national level tourism/hospitality industry groups for the period 1997 to 2007. Four data sources are used to create this model's cross-sectional time-series data set. The dependent variable, labour productivity is real industry GDP per hour worked. Annual real industry GDP for six tourism industries is provided by Statistics Canada's Productivity Accounts. The hours of work supplied to each of the six industries is provided by the Human Resource Module (HRM) of the TSA. The method of reconciling the tourism demand-oriented GDP data and the tourism supply-oriented HRM data is explained in detail in the main body of this report – it uses information in the TSA. Labour force characteristics, such as age, gender, immigrant status, and the role of part-time workers are also provided by Human Resource Module of Tourism Satellite Account. Age groups in the HRM model are aggregated by Statistics Canada as follows: 15-24 years old, 25-34 years old, 35-44 years old and 45 years old and up. The model uses the end-of-year gross capital stock in chained (2002) dollars which is provided by Statistics Canada's Economic Accounts for each of the six industries. The capital intensity variable is computed as the real capital stock divided by hours worked. Table A1 provides a summary of the data sources for the HRM study.

Table A1: HRM Model Variables and Their Data Sources

Source	Variable	CANSIM Series
Tourism Account, National Tourism Indicators	tourism GDP, tourism demand, tourism supply	3870001, 3870002, 3870010
Tourism Satellite Account	share of tourism GDP in tourism/hospitality industries	
Human Resource Module of Tourism Satellite Account	number of hours-worked and jobs and workforce characteristics in tourism/hospitality industries: type of jobs, gender, immigrant status, and age	
Flows and Stocks of Fixed Non-Resident Capital	capital stock	310002
Input-output Account	Industry GDP	3810015

Data Sources used in the Accommodation, Food and Beverage Services (AFB) Model

The AFB model uses annual data for a single combined industry. The advantage of using a combined industry, namely Accommodation, Food and Beverage Services, is that the data have a provincial dimension. The dataset contains 100 observations from Canada's 10 provinces for the period: 1998 to 2007. Six data sources are used to create this study's cross-sectional time-series data set. A summary of the data sources is provided in Table A2. The dependent variable is labour productivity measured by real GDP per hour worked. Real GDP is drawn from the provincial Input-Output Accounts and the number of hours is taken from Statistics Canada's Productivity Accounts. The Labour Force Survey (LFS) provides information on work force characteristics such as age, gender and the level of education. The age groups available in the LFS are: 15- 25 years old, between the ages of 25 and 54, and over age 55. The role of immigrants in provincial production is not available as a direct measure. We have constructed a proxy using information from the HRM (which provides hours supplied by immigrants at the national level) and data on immigrant populations available from provincial Mobility and Migration surveys.

The AFB model makes uses information on three types of physical capital. Two of these are measures that are available for the specific industry under consideration and are divided by hours of labour supplied to this industry. Thus, the total capital stock is provided by provincial Economic Accounts and the input of information and communication technologies (ICT) is obtained from the provincial Input-Output Accounts – both measures are specific to the Accommodation, Food and Beverage Services industry. Public investment is a proxy for infrastructure investment and is drawn from provincial Income-Expenditure Accounts. It supports all industries, not just the AFB industry. Public investment per capita is computed as the ratio of real provincial infrastructure investment to the provincial population, which of course is not industry specific. The GDP deflator is obtained from the provincial Economic Accounts and is used to deflate ICT input and public investment.

Table A2: AFB Model Variables and Their Data Sources

Source	Variable	CANSIM Series
Private and Public Investment, Construction, Machinery and Equipment/Capital Expenditure	public investment	320002
Flows and Stocks of Fixed Non-Resident Capital	capital stock	310002
Input-Output Account	information and communication technology input, provincial level GDP, GDP deflator	3800056, 3810013, 3790025
Productivity Account	Number of hours-worked	3830010
Mobility and Migration	International immigrants	510011
Labour Force Survey	Provincial level workforce characteristics: gender, type of jobs, education, age	2820008
Estimates of Total Population, Canada, Provinces and Territories	Provincial population	510005

Statistical Methods for both the HRM and AFB Models

In order to estimate the two models' parameters we used the statistical program STATA and in particular the Feasible Generalized Least Squares procedure which is applicable to panel data sets such as the ones used here. We test and make adjustments for heteroskedasticity and autocorrelation. The estimation procedure should provide consistent parameter estimates. Detailed statistical output is available on request.

Appendix C: Tourism industries in the HRM

North American Industry Classification System (NAICS) 2002

1. Air transportation
4811 – Scheduled air transport
4812 – Non-scheduled air transport

2. All other transportation industries
4821 – Rail transportation
4831 – Deep sea, Coastal and Great Lakes water transportation
4832 – Inland water transportation
4851 – Urban transit systems
4852 – Interurban and rural bus transportation
4853 – Taxi and limousine service
4854 – School and employee bus transportation
4855 – Charter bus industry
4859 – Other transit and group passenger transportation
4871 – Scenic and sightseeing transportation, land
4872 – Scenic and sightseeing transportation, water
4879 – Scenic and sightseeing transportation, other
5321 – Automotive equipment rental and leasing

3. Accommodation
7211 – Traveller accommodation
7212 – RV (recreational vehicle) parks and campgrounds

4. Food and beverage services
7221 – Full-service restaurants
7222 – Limited-service eating places
7224 – Drinking places (alcoholic beverages)

5. Recreation and entertainment
51213 – Motion picture and video exhibition
7111 – Performing arts companies
7112 – Spectator sports
7115 – Independent artists, writers and performers
7121 – Heritage institutions
7131 – Amusement parks and arcades
7132 – Gambling industries
7139 – Other amusement and recreation industries

6. Travel services
5615 – Travel arrangement and reservation services

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