The Long View: Labour Productivity, Labour Income and Living Standards in Canada

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Over long periods of time, productivity is the single most important determinant of a nation's living standard or its level of real income.

(Harris 2002, 166)

Thus, trends in productivity are the key determinants of long-run trends in both absolute and relative living standards. The fall-off in real income growth in Canada and other developed economies since 1973 is a direct result of slower productivity growth.

(Sharpe, this volume)

INTRODUCTION

Higher productivity growth is generally believed to result in higher real income and thereby raised living standards. This is supported by the cross-country comparison reported in Harris (2002, Figure 1), which shows a strong correlation between labour productivity and real wages across countries. Casual observation of Table 1 suggests that labour productivity (GDP per hour worked) and the aggregate real wage (labour income per hour worked) in Canada have moved together since the mid-1950s.[1] This is reflected in annual growth rates averaged over several years. Labour productivity growth averaged 1.87 percent over the period 1956-2001, while average real wage growth was only slightly lower at 1.84 percent.[2] On this basis, the Canadian experience over the past 46 years appears to support the conventional wisdom that advances in labour productivity eventually get reflected in real wage gains at the aggregate level.

Recent developments in Canada, however, bring into question the stability of the relationship. Chart 1 shows that labour productivity and the aggregate real wage diverged in the

TABLE 1

Labour Productivity and the Aggregate Real Wage (Average Annual Growth Rates)

Period	Labour Productivity (GDP per hour worked)	Aggregate Real Wage (Labour income per hour worked)
1957–2001	1.87	1.84
1957-1973	2.81	2.95
1974-1993	1.19	1.18
1994-2001	1.56	1.11

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CHART 1

Labour Productivity, the Aggregate Real Wage and Real GDP Per Capita

aggregate real wage: labour income per hour

labour productivity: GDP per hour worked

real GDP per capita
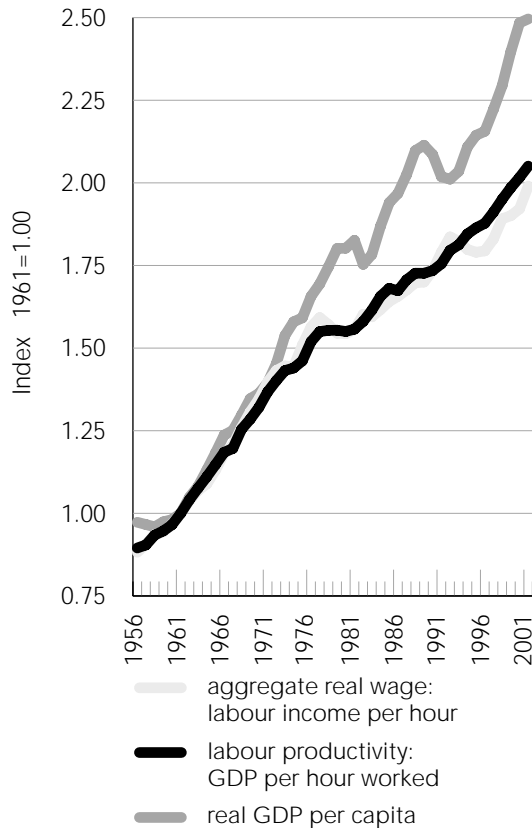
mid-1990s. Labour productivity growth has averaged 1.56 percent since 1994, while the aggregate real wage grew by an average rate of only 1.11 percent. Thus, advances in labour productivity (GDP per hour worked) over the past eight years have exceeded real wage gains (labour income per hour worked) by a substantial margin. This implies that labour income has declined as a proportion of GDP, suggesting that workers have not received the full benefits of labour productivity gains.

This paper examines the developments outlined above from a historical perspective and considers the implications for living standards. The following section examines shifts in labour and non-labour income shares of

GDP over the period 1926-2001. The next section discusses the implications for living standards of shifts between labour and non-labour income shares. The final section draws a few policy conclusions from the analysis.

A NATIONAL ACCOUNTING PERSPECTIVE ON HISTORICAL TRENDS

The measure of labour productivity referred to above is defined as GDP per hour worked, while the aggregate real wage is labour income per hour worked. The two measures have the same denominator — hours worked. The ratio of the two measures — the aggregate real wage/labour productivity — is therefore equivalent to labour income/GDP. We focus on labour income as a percentage of GDP mainly because data on hours worked are available beginning in 1956 only, whereas labour income and GDP are available back to 1926. This is also convenient from an accounting perspective, because it enables us to analyse shifts in labour income versus other components of national income.

Labour Income

It is generally believed that real wage gains can be sustained over the long run only if supported by advances in labour productivity (other things being equal). The standard neoclassical model predicts that labour productivity growth (increases in the marginal product of labour) will be reflected in real wage growth (increases in the marginal cost of labour) in the long run.[3] In other words, labour productivity and the aggregate real wage should move together over long periods. Or, equivalently, the labour income share of GDP should tend to revert to its mean.

Before examining this prediction, let us draw attention to a few issues that arise in measuring labour income. The bottom line in Chart 2 shows that wages and salaries[4] increased from under 45 percent of GDP in 1926 to over 55 percent in the mid-1970s. The upward trend largely reflects migration of workers from farms and unincorporated businesses (UBs) into the paid labour force. Chart 3 shows that farm and UB income declined from about 19 percent of GDP in the mid-1940s to about 5 percent in the 1980s. While the agricultural sector continued its decline through to 2001, the income share of the UB sector rose by two percentage points beginning in the early 1980s, largely due to an increase in self-employment. These developments have tended to offset one another, such that the farm and UB income share of GDP has been stable since the early 1980s (see Chart 4).

We modify labour income to take into account changes in the share of farm and UB income as follows: We first calculate the average share of wages, salaries and supplementary labour income as a percentage of GDP less farm and UB income (57 percent over the period 1926-2001).[5] We then apply the constant proportion to divide farm and UB income into a labour and non-labour income component.[6] This section of the paper focuses on before-tax measures of household and corporate income. We consider the implications of changes in taxes less transfers to persons for living standards in the following section.

Chart 2 illustrates the definition of labour income defined above as a percentage of GDP over the period 1926-2001. The series exhibits large, persistent deviations from its historical mean, lasting over a decade during some episodes. For example, the labour income share of GDP was below its mean throughout the 15-year period

CHART 2

Labour Income as a Proportion of GDP / NDP
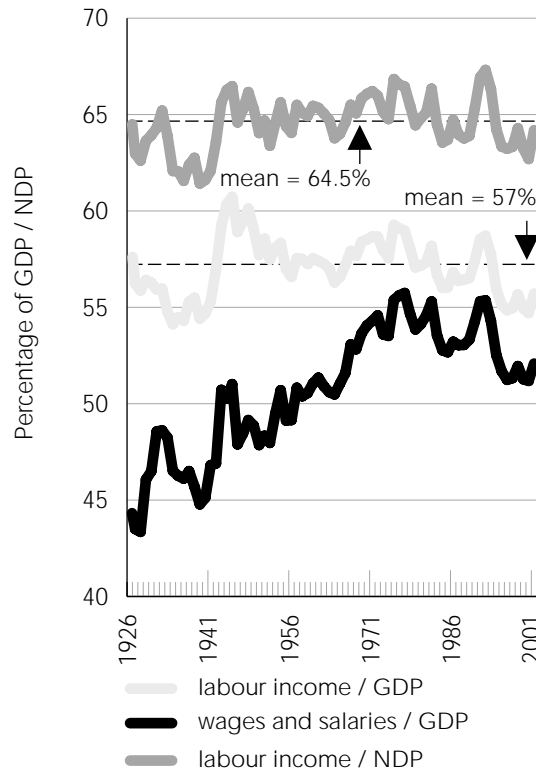
1927-41 and above its mean throughout the 12-year period 1966-77.

More rigorous econometric methods can be used to test whether the labour income share of GDP has tended to revert to its mean over the historical period. A Chow test provides evidence of a shift in the mean in 1994 at the 6-percent level of significance.[7] There is little evidence of a shift, however, when we test for a structural shift at an unknown breakpoint — one cannot reject the null hypothesis of a constant mean even at the 10-percent level of significance. Similarly, unit root tests provide weak evidence that the labour income share of GDP is mean-stationary. This finding contrasts with the results obtained by Hostland (1996). The conflict can be reconciled by the fact that the unit root tests are

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CHART 3

Farm and Unincorporated Business Income
as a Percentage of GDP

farm & unincorporated
business income

farm income
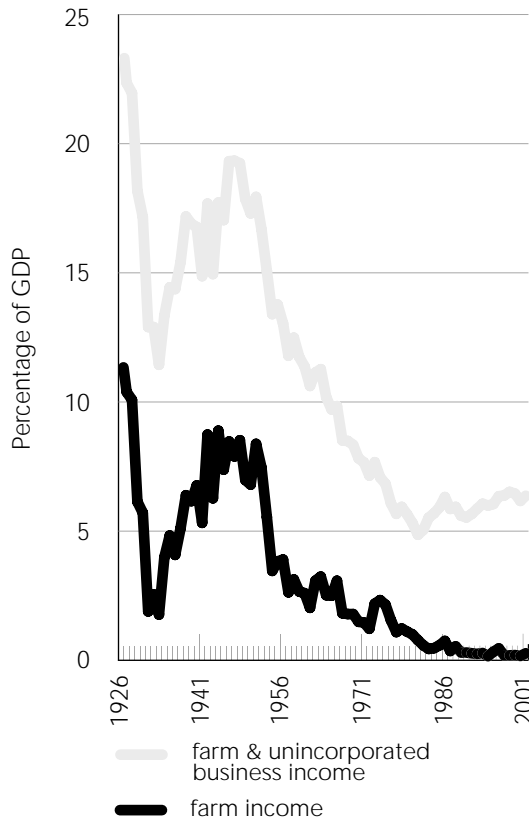
conducted over different sample periods. One can reject the unit root hypothesis at the 1-percent level over the period 1950-94, which corroborates the results reported in Hostland. The evidence in support of mean-stationarity diminishes, however, when the sample period is extended to 2001. One can reject the unit root hypothesis at only the 7-percent level over the period 1950-2001. These results indicate that the decline in the labour income share in 1994 brings into question its tendency to revert to its mean over time. Hence, we conclude that formal statistical tests are inconclusive about whether one can expect the labour income share of GDP to revert to its mean in the future.

Non-Labour Income

Labour income is but one source of household income. Many households receive income from interest and investment earnings. Moreover, retained earnings by corporations are a potential source of income for those households that hold equity (either directly or indirectly, in mutual funds and pension plans). One must also take into account the non-labour component of income earned by farms and UBs. In order to maintain consistency with the before-tax measure of labour income examined above, we include corporate profits before taxes in non-labour income.

Chart 4 illustrates the following three components of non-labour income as percentages of GDP:
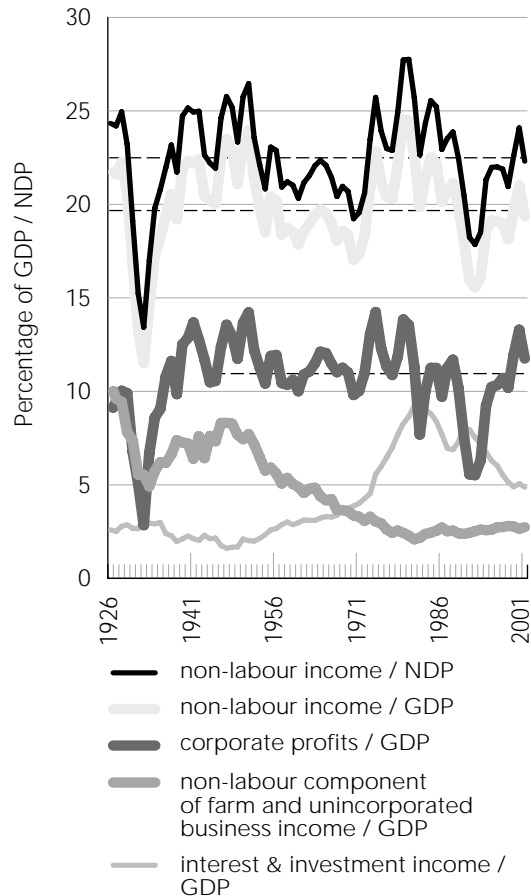> corporate profits before taxes
> interest and investment earnings
> the non-labour component of farm and UB income

Corporate profits as a percentage of GDP declined substantially during the Great Depression in the 1930s and again during the recession in the early 1990s. There was a strong rebound in the mid-1990s, raising corporate profits to an average level of 11 percent of GDP over the period 1995-2001, which is equal to its historical average over the post-war period. The decline in the labour income share of GDP in 1994 therefore cannot be attributed to a rise in corporate profits. Interest and investment income increased from 4 percent of GDP in the early 1970s to a peak of 10 percent in 1982, and then subsequently declined to an average of 5 percent over the four-year period 1998-2001.

Chart 4 shows that many of the shifts in the components of non-labour income have tended to offset one another. Non-labour income exhibited a tendency to revert

CHART 4

Non-Labour Income as a Percentage of
GDP / NDP

- non-labour income / NDP
- non-labour income / GDP
- corporate profits / GDP
- non-labour component
  of farm and unincorporated
  business income / GDP
- interest & investment income /
  GDP

to its mean of about 20 percent of GDP over the period 1926 to 2001. This is supported by unit root tests, which indicate that the non-labour income share of GDP is mean-stationary.[8] The non-labour income share of GDP nonetheless exhibits large, persistent deviations from its mean, some lasting several years.

Other Components of National Income

We now examine components of national income that are not included in the measures of labour and non-labour income examined above. We focus on the following four main components, depicted in Chart 5:
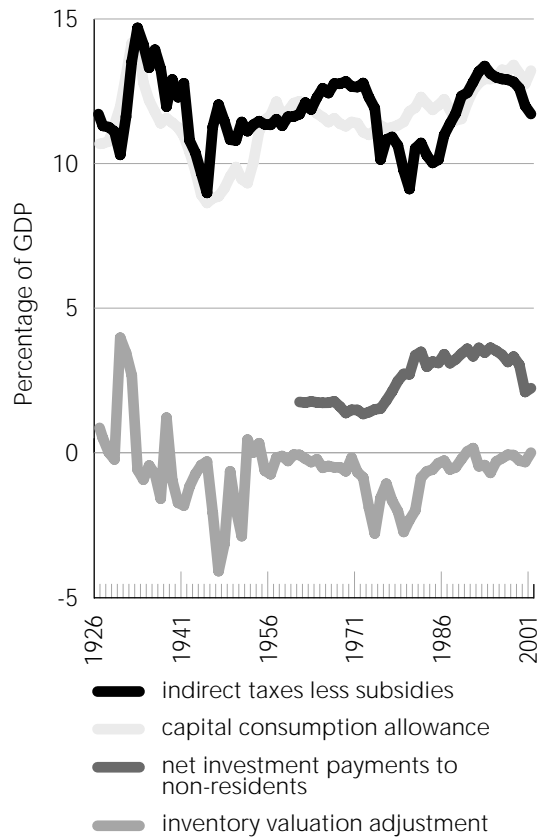
> inventory valuation adjustment (IVA)
> net investment payments to non-residents
> indirect taxes less subsidies
> capital consumption allowances (CCA)

Chart 5 shows that there were sizeable fluctuations in each of these components over the historical period. The IVA share of GDP fluctuated substantially during the inflationary episodes in the 1970s. Net investment payments to non-residents increased from 1.5 percent of GDP in the mid-1970s to 3.5 percent in the early 1990s. Both of these components have shown little change over the past decade, however. Indirect taxes increased considerably from a low of 9.1 percent in 1980 to a peak of 13.4 percent in 1993, before declining to 11.7 percent in 2001. Indirect taxes therefore cannot account for the decline in the labour share of GDP in 1994.[9]

Changes in the CCA income share of GDP play a key role in our analysis. To illustrate, Charts 2 and 4 show labour and non-labour income shares of Net Domestic Product (NDP), defined as GDP less CCA. Both labour income and non-labour income exhibit much smaller fluctuations as shares of NDP versus GDP. Moreover, labour income as a percentage of NDP is only slightly below its historical mean in the 1990s. This indicates that the decline in labour's share of GDP in 1994 can be largely attributed to an increase in CCA. This is supported by formal statistical tests. For example, unit root tests provide strong evidence that the labour income and non-labour income shares of NDP are mean-stationary.

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CHART 5
Other Components of National Income

Percentage of GDP

- indirect taxes less subsidies
- capital consumption allowance
- net investment payments to non-residents
- inventory valuation adjustment

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IMPLICATIONS FOR LIVING STANDARDS

We now address the methodological question of whether labour productivity growth in excess of real wage growth necessarily curtails the advancement of living standards.

Consider the case where there is a shift between labour and non-labour income. Since the household sector as a whole owns UBs and corporate equity, income from interest and investments, farms and UBs, and corporate retained earnings augment household wealth. Since not all households have these assets, there can be important implications for the distribution of wealth across house-

holds. The overall effects on living standards are unclear.

Now consider the implications of shifts between labour income and the "other income" components of GDP, namely CCA, IVA and net investment payments to non-residents. An increase in any of these income components clearly reduces household wealth. In particular, the gradual increase in CCA as a percentage of GDP after the 1970s implies that a growing proportion of national income is needed to replace depreciating capital, and hence less income is available to households and corporations for a given level of production. For this reason, NDP (GDP less CCA) per capita is a better measure of living standards than the more conventional GDP per capita measure. Similarly, the reduction in net payments to foreigners as a percentage of GDP since the mid-1990s implies that proportionally more income is retained by domestic households. One should also take this into account when measuring advances in living standards.

Taxes and Living Standards

Chart 6 shows that tax revenues from all sources less transfers to persons[10] increased from 20 percent of GDP in the mid-1980s to an average level of 25 percent over the period 1997-2001. This implies a five-percentage-point reduction in after-tax income as a percentage of GDP. The implications of an increase in the overall tax burden for living standards is complicated by several factors.

Taxes are used to fund fiscal expenditures, which benefit households and businesses. There is strong public support for public expenditures in many areas, health care and education being prime examples. Moreover, public investments in developing physical infrastructure (airports, roads, water, sewerage, public transportation,

CHART 6

The Tax Burden (Total Taxes less Transfers
as a Percentage of GDP)

total tax revenue

taxes less transfers

transfers
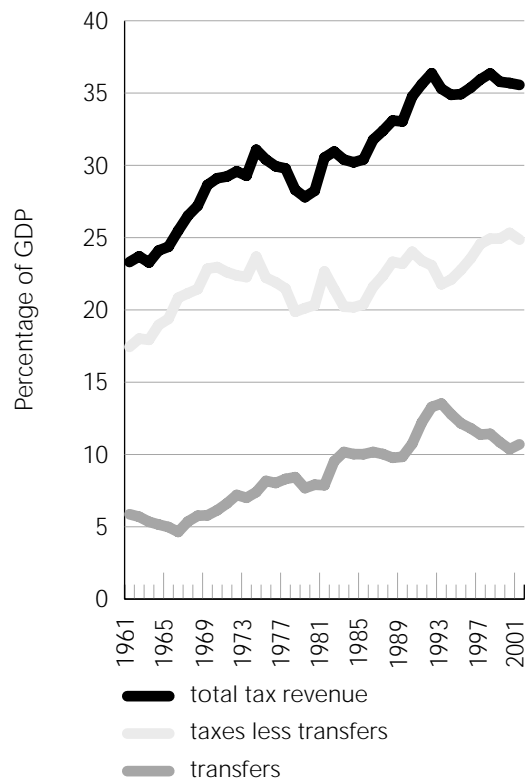
etc.) can boost productivity. Productivity growth can also be enhanced by public investments in research and innovation. On the other hand, high marginal tax rates reduce incentives to work, save and invest, which act to reduce labour supply, capital accumulation and productivity growth. High marginal tax rates can also raise compliance costs associated with tax evasion and avoidance (resulting in more activity in the underground economy, for example). In order to assess the implications of a rising tax burden for living standards, one must weigh the benefits derived from public expenditures against the distortion costs incurred by having to raise tax revenues.

The intertemporal nature of public debt also plays an important role in these calcula-

tions. Net public debt increased substantially, from 14 percent of GDP in 1974 to 88 percent in the mid-1990s.[11] From a simple accounting perspective, this reflects a growing fiscal imbalance with expenditures on program spending and debt-service costs exceeding total tax revenues. Net public debt declined to 66 percent of GDP in 2000, a decline of 22.5 percentage points over five years. Higher tax revenues and lower program spending were needed to cover the rising debt-service costs and reduce the debt burden to a sustainable level. The build-up in net public debt from the mid-1970s to the mid-1990s and subsequent decline had an important influence on intertemporal allocation of after-tax incomes. The implications for household wealth are unclear, however, because an increase in net public debt implies higher future tax liabilities.

Changes made to the Canada Pension Plan (CPP) in the mid-1990s are a good example of this. Increases in CPP contributions were introduced to reduce future unfunded liabilities of the plan. In addition, the "pay-as-you-go" funding scheme was modified to include partial funding. These changes have implications for the intertemporal allocation of CPP contributions for individuals, and for intergenerational equity as well, but do not affect household wealth at the aggregate level. The increase in CPP contributions has reduced after-tax incomes, but the implications for national living standards are ambiguous.

The national-income accounting framework also falls short in measuring advances in living standards in other important dimensions. For instance, capital gains earned on real and financial assets are not captured by the national accounts. As a consequence, the above analysis does not include the substantial increase in household wealth arising from the dramatic rise in

equity prices in the late 1990s. Similarly, the analysis does not take into account capital gains associated with the effect of unanticipated changes in inflation on the real value of outstanding long-term bonds. In short, the definition of non-labour income outlined above provides an incomplete measure of household wealth.

The analysis also fails to take into account changes in relative consumer versus producer prices that affect the real purchasing power of households. A decrease in consumer prices relative to producer prices implies that households can consume more in real terms for a given level of production. Chart 7 shows that the Consumer Price Index (CPI) declined rel-ative to the GDP price deflator from the early 1930s to the late 1970s, raising the real pur-chasing power of households. The CPI has subsequently increased relative to the GDP price deflator, eroding the real purchasing power of households. These relative price changes reflect several underlying factors such as movements in the relative price of traded versus non-traded goods. In particular, the depreciation of the Canada-US exchange rate beginning in the mid-1970s raised the prices of imported goods, which make up a larger component of the CPI than the GDP price deflator. It is worth pointing out here that productivity advances abroad can lead to lower import prices and thereby raise the real pur-chasing power of domestic consumers. For example, technological innovations in the pro-duction of semiconductors in the United States over the past decade have led to dra-matic reductions in the real price of informa-tion and communication technology (ICT) equipment in Canada. This is an example of productivity advances abroad raising the domestic standard of living but having no direct effect on the producer real wage.[12]

CHART 7
Consumer vs. Producer Price Level
(CPI / GDP Price Deflator)

It should also be noted that the measure of labour productivity examined above is defined as GDP per hour worked, whereas advances in living standards are typically meas-ured as GDP per capita. Changes in hours worked per capita therefore lead to a divergence between labour productivity and living stan-dards. Chart 8 shows that hours worked per capita increased throughout the 1960s and 1970s. This reflects changes in demographic factors, as well as labour market developments. Maturing of the baby boom generation over this period raised the working-age component of the population. There was a dramatic increase in the participation of women in the labour force at the same time. These trends were par-tially offset by a decrease in average weekly hours worked during the 1960s, along with an increase in the unemployment rate in the 1970s. Large cyclical fluctuations in the unem-

CHART 8
Average Annual Hours Worked Per Capita
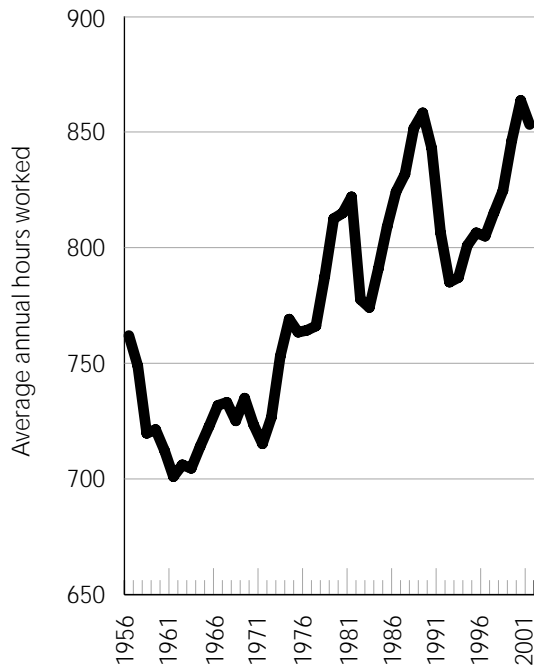
ployment rate throughout the 1980s and 1990s also had a major influence. Overall, the upward trend in hours worked per capita since the 1970s has raised living standards in excess of advances in labour productivity. This is illustrated in Chart 1, which compares indices of GDP per capita versus GDP per hour worked. GDP per capita grew at an average annual rate of 2.0 percent over the period 1971-2001, while GDP per hour worked grew at an average annual rate of only 1.4 percent.

CONCLUSIONS

Our analysis of national income shares indicates that the decline in the labour income share in 1994 can be largely attributed to an increase in capital consumption allowances (CCA). Casual observation and formal statisti-

cal tests indicate that labour income and non-labour income shares of NDP (GDP less CCA) tended to revert to their respective means over the historical period 1926-2001. Deviations can last for periods of several years, however. Hence, one can expect labour productivity growth and real wage gains to diverge for several years at a time.

The implications for living standards are unclear, however. Shifts between labour and non-labour income have little if any effect on household wealth at the aggregate level. The implications of changes in taxes and transfers for persons for living standards are complicated by several factors. Both before-tax and after-tax measures of income can give a misleading impression of advances in living standards. Analysing shifts in national income shares can provide valuable insights into underlying economic developments but does not provide reliable measures of advances in living standards over time or across countries. Several important aspects of living standards are not captured by the national income accounts, including changes in capital gains, relative consumer versus producer prices, and hours worked per capita. Moreover, the national income framework is not amenable to addressing issues such as the distribution of income, which often play a prominent role in assessing policy options.

We conclude that policy-makers should not be concerned with the recent divergence between labour productivity growth and real wage gains. This is not to imply that labour productivity is unimportant for policy analysis. On the contrary, real wage gains can only be sustained by advances in labour productivity, other things being equal. Labour productivity growth has been the chief source of advances in living standards over the historical period (Harris 2002; Sharpe, this volume).

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Looking to the future, we cannot count on further increases in hours worked per capita to raise living standards. There is little scope for a continued rise in the labour force participation of women. Moreover, impending demographic trends will act to reduce the working-age component of the population and put downward pressure on labour force participation rates as the baby boom generation retires over the next few decades. Advances in labour productivity will be needed just to maintain living standards.

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On a final note, we want to stress that NDP per capita provides only a rough measure of our standard of living. Economic progress has several more dimensions. We believe that policy analysis should be based on more meaningful measures of economic progress that take into account changes in household consumption, wealth and the distribution of income. Recent developments by Osberg and Sharpe (2001, 2002) and Sharpe (2002) on measuring "economic well-being" using these kinds of indicators represent a step in this direction. Further analysis along these lines will result in better measures of economic progress over time and across countries, and thereby provide a more reliable basis for policy decisions.

NOTES

The views expressed in this paper are those of the authors and not those of the Department of Finance. The authors would like to thank Pierre Fortin, Craig Riddell and Andrew Sharpe for several valuable comments.

1   This paper focuses on labour productivity and labour income in the total economy (the business and government sectors combined). Labour *income* can be more accurately described as labour *compensation*, because it includes wages, salaries and supplementary labour income. We also focus on the *producer* real wage so that labour income is deflated using the GDP price deflator. The implications of changes in consumer versus producer prices are considered later in the paper. A detailed description of the data is available upon request.

2   The statistics reported in the text and in Table 1 are calculated by averaging annual growth rates. Similar results are obtained by calculating compounded growth rates.

3   This relationship can be derived in the short run using a Cobb-Douglas production function with perfect competition in product and factor markets. The relationship can be derived in the long run under much more general assumptions.

4   More precisely, wages, salaries and supplementary labour income.

5   Average of (wages, salaries and supplementary labour income) / (GDP - farm and UB income).

6   Labour income = wages, salaries and supplementary labour income + 0.57 (farm and UB income).

7   Detailed results obtained from all statistical tests are available upon request.

8   These results are available upon request.

9   Since the components of national income sum to one, by definition, the decline in the labour and non-labour income share of GDP in the early 1990s is equivalent to the increase in the "other income components" listed above.

10   Direct taxes include taxes paid on labour and investment income, corporate income and capital gains, as well as contributions to the Employment Insurance (EI) program and the Canada and Quebec Pension Plans (CPP/QPP). Indirect taxes include taxes on production and imports. Transfers include all transfers made to persons and businesses.

11   This refers to net debt at the federal, provincial and local levels combined on a national accounts basis.

12   The relative consumer/producer price decline would be reflected in a divergence between the consumer real wage and the producer real wage.

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