A Historical Perspective on Labour Productivity, Labour Income and Living Standards in Canada

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– *Abstract* –

Recent advances in labour productivity (GDP per hour worked) in Canada have exceeded real wage gains (labour income per hour worked) by a considerable margin. This implies that labour income has declined as a proportion of GDP. We provide insights into these recent developments by examining labour and non-labour income shares of GDP over the historical period 1926-2001. We find that the labour income share of GDP has tended to revert to its mean over the historical period 1926-2001, implying that labour productivity and the aggregate real wage have tended to move together in the long run. Deviations can last for several years, however. Developments in the 1990s are not unprecedented from a historical perspective.

Labour productivity growth in excess of real wage gains does not necessarily curtail the advancement of living standards. For example, shifts between labour and non-labour income have little (if any) effect on household wealth at the aggregate level. The decline in the labour income share of GDP in the early 1990s can be largely attributed to an increase in capital depreciation as a percentage of GDP. This implies that less income has been available to households and corporations for a given level of production.

We argue that analysing shifts in national income shares does not provide reliable measures of advances in living standards over time or across countries. We recommend conducting policy analysis with more meaningful measures of economic progress that take into account changes in household consumption, wealth, and the distribution of income.

 "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 (1999, p. 3)

"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 (2002b, p. 3)

1. Introduction

Higher productivity growth is generally believed to result in higher real income and thereby raise living standards. This is supported by the cross-country comparison reported by in Harris (1999, Chart 1), which shows a strong correlation between labour productivity and real wages across countries. Casual observation of Figure 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 1.85 per cent over the period 1956-2001, while average real wage growth was only slightly lower at 1.80 per cent.[2] Moreover, the productivity slowdown in the early 1970s and the subsequent recovery in about 1997 are reflected in changes in average growth rates of the aggregate real wage (see Table 1 below). 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.

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[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 explicitly later in the paper. A detailed description of the data is available upon request.

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	1.85%	1.80%
1957-1973	2.77%	2.94%
1974-1996	1.26%	1.06%
1997-2001	1.60%	1.40%

Recent developments in Canada, however, bring into question the stability of the relationship. Figure 1 shows that labour productivity and the aggregate real wage diverged in the mid-1990s. Since 1993 labour productivity growth averaged 1.36 per cent, while the aggregate real wage grew by an average rate of only 0.66 per cent. Advances in labour productivity (GDP per hour worked) over the past nine 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 of the paper examines shifts in labour and non-labour income shares of GDP over the period 1926-2001. Section 3 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.

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[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.

2. 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. Both 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 only available beginning in 1956, 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 only be sustained over the long run if supported by advances in labour productivity (other things 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 of time. Or equivalently, the labour income share of GDP should tend to revert to its mean.

Before examining this prediction, let us first draw attention to a few issues that arise in measuring labour income. The bottom line in Figure 2 shows that wages and salaries[4] increased from under 45 per cent of GDP in 1926 to over 55 per cent in the mid-1970s. The upward trend largely reflects migration of workers from farms and unincorporated businesses into the paid labour force. Figure 3 shows that farm and unincorporated business income declined from about 19 per cent of GDP in the mid-1940s to about 6 per cent in the 1990s.

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[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.

We adjust for this by decomposing farm and unincorporated business (UB) income into a labour and non-labour component 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.[5] The average share is 0.57 per cent over the period 1926-2001. We then apply the constant proportion − 0.57 per cent − 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.

Figure 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 1927-1941 and above its mean throughout the 12-year period 1966-77. The decline in the mid-1990s is not unprecedented from a historical perspective. A similar episode occurred during the Great Depression in the 1930s.

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 0.06 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 0.10 level of significance. Similarly, unit root tests provide weak evidence that the labour income share of GDP is mean-stationary. The results obtained by Hostland (1996) indicate that the labour income share of GDP is mean-stationary over the period 1947Q2-1995Q3. The evidence is much weaker, however, when the sample period is extended to 1926-2001. To sum up, we conclude that formal statistical tests are inconclusive about whether one can expect the labour income share of GDP to revert to its mean over time.

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[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.

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 provide a potential source of income to 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 unincorporated businesses. In order to maintain consistency with the before-tax measure of labour income examined above, non-labour income includes corporate profits before taxes.

Figure 4 illustrates the following three components of non-labour income as percentages of GDP:

1.   interest and investment earnings;

2.   profits before taxes; and

3.   the non-labour component of farm and unincorporated business income.

There have been sizable shifts in each of the three components listed above. Interest and investment income increased from 4 per cent of GDP in the early 1970s to a peak of 10 per cent in 1982, and then subsequently declined to an average of 5 per cent over the past four years (1998-2001). Many of the shifts tended to offset one another, however. Casual observation of Figure 5 suggests that non-labour income has exhibited a tendency to revert to its mean of 19.8 per cent 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] As in the case of the labour income share of GDP, the non-labour income share exhibits large, persistent deviations from it mean, which last several years.

Note that there is no evidence of an upward shift in the non-labour income share of GDP in 1994 that could account for the downward shift in the labour income share. The non-labour income share of GDP declined by 4.3 percentage points between 1989 and 1992, but then quickly recovered. A different story emerges when labour income and

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[8] These results are available upon request.

non-labour income are aggregated.[9] The bottom line in Figure 5 shows that the labour and non-labour income share of GDP declined by 2.7 percentage points below its historical mean over the period 1989 to 1992. It has recovered partially over the past few years, but still remains 2.0 percentage points below its historical mean in 2001.

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 Figure 6:

1. inventory valuation adjustment (IVA);
2. net investment payments to non-residents;
3. indirect taxes less subsidies; and
4. capital consumption allowances (CCA).

Figure 6 shows that there have been sizable 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 per cent of GDP in the mid-1970s to 3.5 per cent 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% in 1980 to a peak of 13.6% in 1993, before declining to 12.1% in 2001. Indirect taxes therefore made a small contribution to the decline in the labour and non-labour income shares of GDP in the early 1990s, but then acted to raise the labour and non-labour income shares of GDP over the period 1993-2001.[10]

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[9] The measure of labour and non-labour income used in this paper is similar to Fortin's (1999) definition of private disposable income, which he describes as "current income that is ready to be spent or saved and that ends up in personal and corporate hands after households and businesses have paid their taxes, received transfers from governments, and paid their bills to foreigners" (Fortin p. 4). The difference between the two measures can be traced to the treatment of taxes less transfers. This section of the paper focuses on "before-tax" measures of labour and non-labour income, whereas Fortin uses "after-tax" measures. In other words, Fortin subtracts taxes paid and adds transfers to income earned by households and businesses. We consider the implications of taxes and transfers to persons in the following section of the paper.

[10] 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.

To illustrate, we calculate labour and non-labour income as a percentage of Net Domestic Product (NDP), which is defined as GDP less CCA. The top line in Figure 5 shows that using NDP in place of GDP as the basis of comparison attenuates the decline in labour and non-labour income in the 1990s. It declined by only 1.6 percentage points below its historical mean in the early 1990s, and has almost completely recovered over the past few years rising to 0.7 of a percentage point below its historical mean in 2001. Furthermore, unit root tests provide strong evidence that the labour income and non-labour income shares of NDP are mean stationary.

3. Implications for Living Standards

Does labour productivity growth in excess of real wage growth necessarily curtail 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 unincorporated businesses and corporate equity, income from interest and investments, farm and unincorporated businesses, and corporate retained earnings augment household wealth. Since not all households hold equity, there are implications for the distribution of wealth across households. The implications for living standards are unclear.

In contrast, consider the case of a shift between labour income to the "other income" components of GDP, namely CCA, IVA and net investment payments to non-residents. A reduction in labour income along with an increase in any of these income components clearly reduces household wealth. For example, the gradual increase in CCA as a percentage of GDP since the 1970s implies a growing proportion of national income was needed to replace depreciating capital. Similarly, the reduction in net payments to foreigners as a percentage of GDP since the mid-1990s implies that proportionally more income was retained by domestic households.

Taxes and Living Standards

Figure 7 shows that tax revenues from all sources less transfers to persons[11] has increased from 20 per cent of GDP in the mid-1980s to an average level of 27.5 per cent

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[11] Direct taxes include taxes paid on labour and investment income, corporate income, capital gains, as well as contributions to the Employment Insurance (EI) program, and the Canada and Quebec Pension Plans

over the period 1997-2001. This implies a 7.5 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, roadways, water, sewage, public transportation, etc.) can boost productivity. Productivity growth can also be enhanced by public investments aimed to foster 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 calculations. Net public debt increased substantially from 14 per cent of GDP in 1974 to 88 per cent in the mid-1990s.[12] From a simple accounting perspective, this reflected a growing fiscal imbalance with total tax revenues exceeding expenditures on program spending and debt service costs. Net public debt declined to 66 per cent 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.

(CPP/QPP). Indirect taxes include taxes on production and imports. Transfers include all transfers made to persons and businesses.
[12] This refers to net debt at the federal, provincial and local levels combined on a national accounts basis.

Changes made to the Canada Pension Plan (CPP) in the mid-1990s provide 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. Figure 8 shows that the Consumer Price Index (CPI) declined relative to the GDP price deflator from the early 1930s to the late 1970s, raising the real purchasing 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 trade versus non-traded goods. In particular, the depreciation of the Canada-US exchange rate since 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 highlighting here that productivity advances abroad can lead to lower import prices and thereby raise the real purchasing power of domestic consumers. For example, technological innovations in the production of semiconductors in the US over the past

decade have led to dramatic reductions in the real price of ICT equipment in Canada. This is an example where productivity advances abroad raise our standard of living, but have no direct effect on the producer real wage.[13]

It is also important to note that the measure of labour productivity examined above is defined as GDP per hour worked, whereas advances in living standards are typically measured as GDP per capita. Changes in hours worked per capita therefore leads to a divergence between labour productivity and living standards. Figure 9 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 females in the labour force at the same time. These trends were partially 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 unemployment 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 Figure 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 per cent over the period 1971-2001, while GDP per hour worked grew at an average annual rate of only 1.4 per cent.

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

4. Conclusions

Formal statistical tests provide weak evidence that the labour income share of GDP has tended to revert to its mean over the historical period 1926-2001. Hence, it is not evident that labour productivity and the aggregate real wage have tended to move together in the long run. Deviations can last for several years. Mean reversion is supported by formal statistical tests, however, when we take into account changes in capital consumption allowances (CCA) as a proportion of GDP. In other words, labour productivity and the aggregate real wage tend to move together in the long run when output is measured using Net Domestic Product (NDP = GDP – CCA).

A decline in the labour income share of GDP does not necessarily curtail the advancement of living standards. For example, a shift between labour and non-labour income has little (if any) effect on household wealth at the aggregate level. The decline in the labour income share of GDP in the early 1990s can largely be attributed to an increase in capital consumption allowances (CCA) as a percentage of GDP. This implies that less income has been available to households and corporations for a given level of production. 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 about advances in living standards. In general, labour productivity growth in excess of real wage gains has ambiguous implications for living standards.

While analysing shifts in national income shares can provide valuable insights into underlying economic developments, the basic approach does not provide reliable measures of advances in living standards over time or across countries. Several important influences on 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 divergence between labour productivity and the aggregate real wage observed in the 1990s. This is not meant 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 equal. Labour productivity growth has been the chief source of advances in living standards over the historical period (Harris 1999 and Sharpe 2002b). 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 females. 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.

On a final note, we want to stress that GDP 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 Sharpe and Osberg (2001) and Sharpe (2002a) on measuring "economic well-being" using these kinds of indicators represent an important 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.

**Figure 1: Labour Productivity, the Aggregate Real Wage
and Real GDP per Capita**
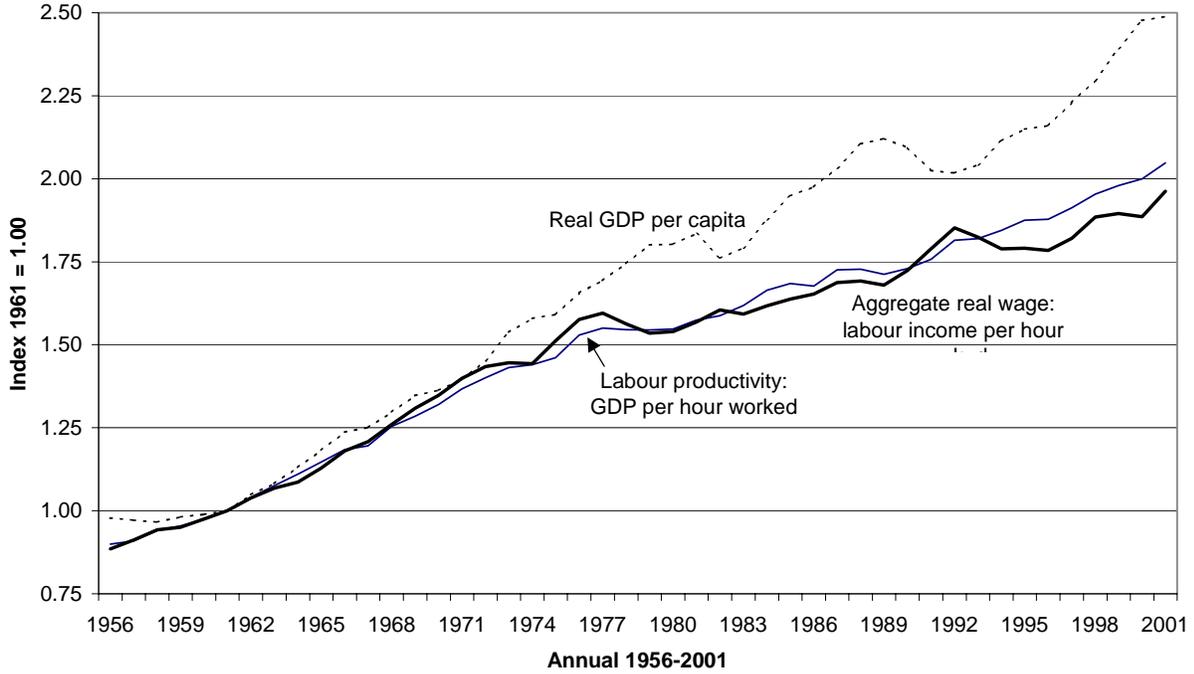
**Figure 2: Labour income as a proportion of GDP**
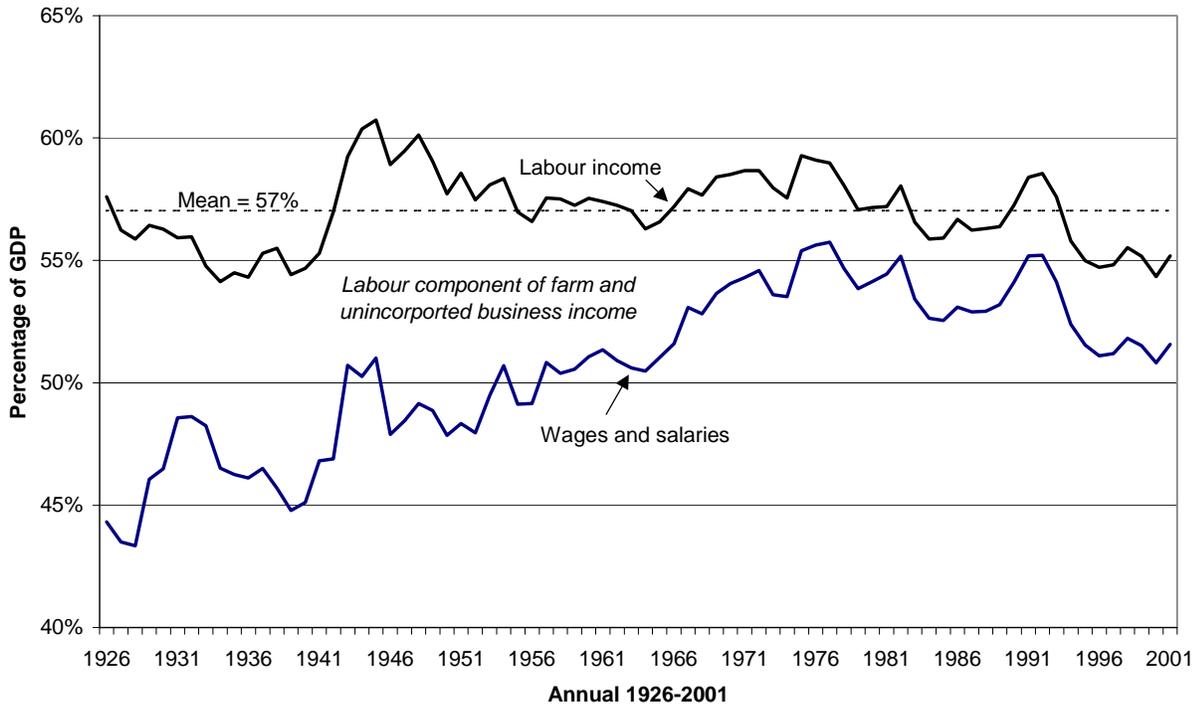
Figure 3: Farm and unincorporate business income as a percentage of GDP


Farm and unincorporated business income

Unincorporated business income

Farm income

Annual 1926-2001
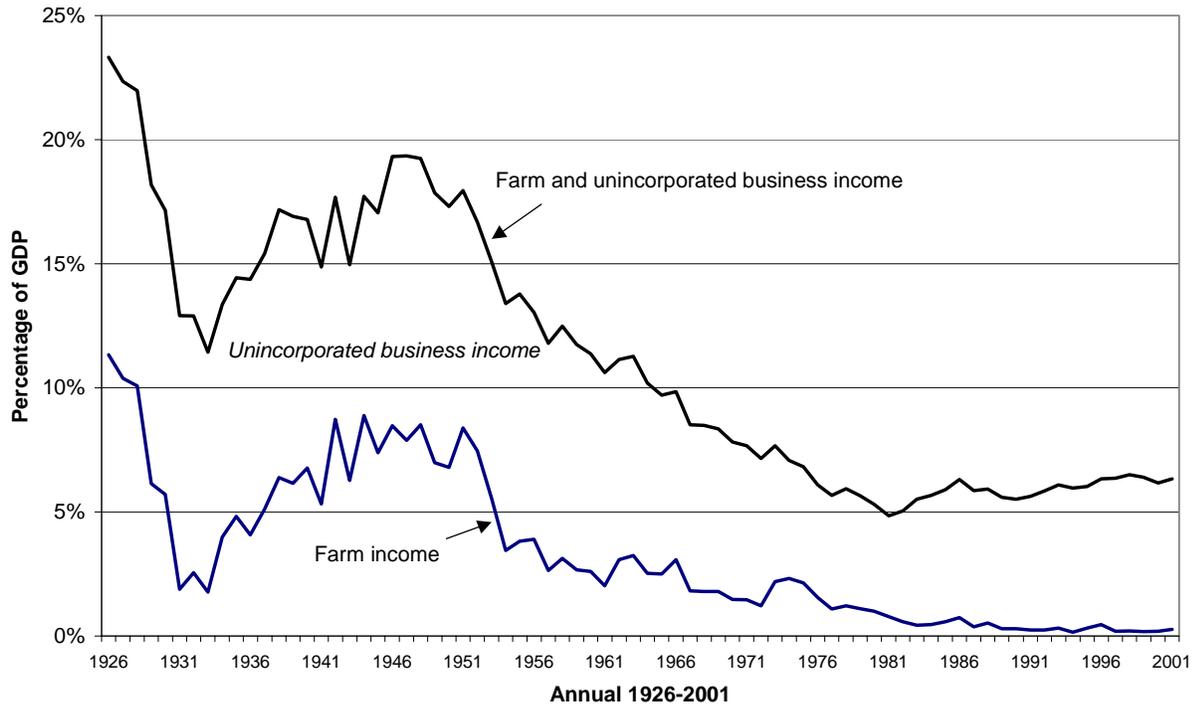
Figure 4: Non-labour income as a percentage of GDP

Non-labour income

Mean = 19.8%

Non-labour component of farm and unincorporated business

Profits before taxes

Interest and investment income

Annual 1926 - 2001
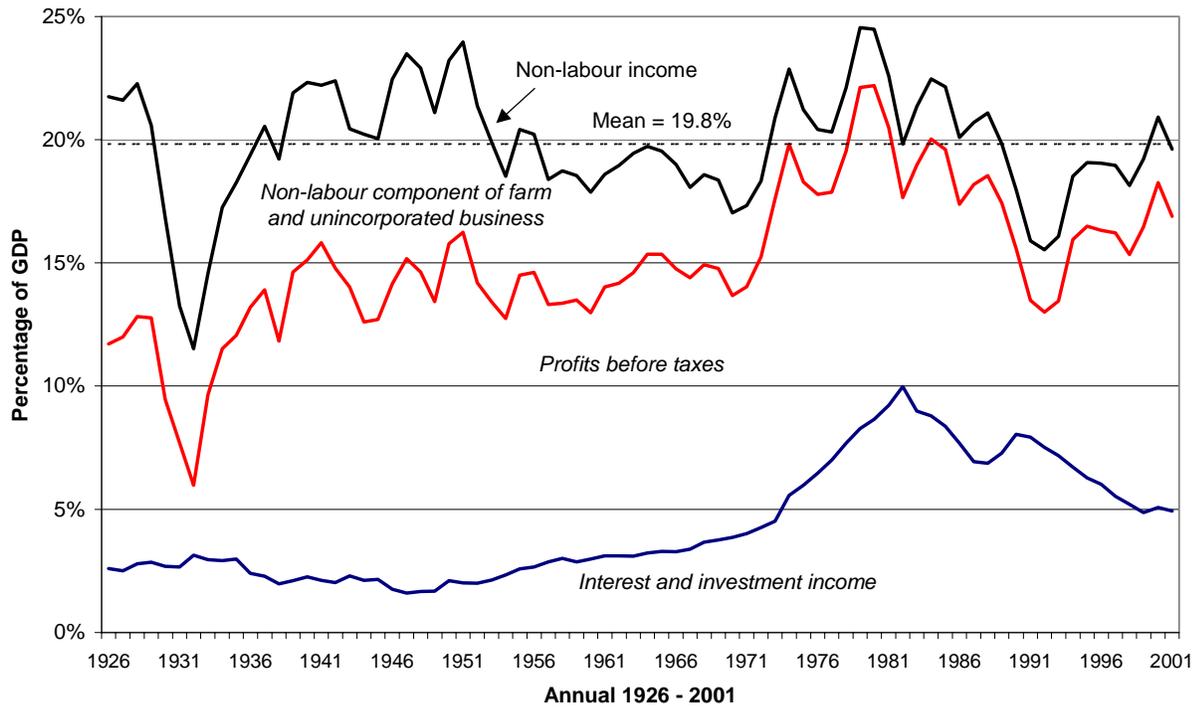
**Figure 5: Labour and non-labour income as a percentage of GDP versus NDP**
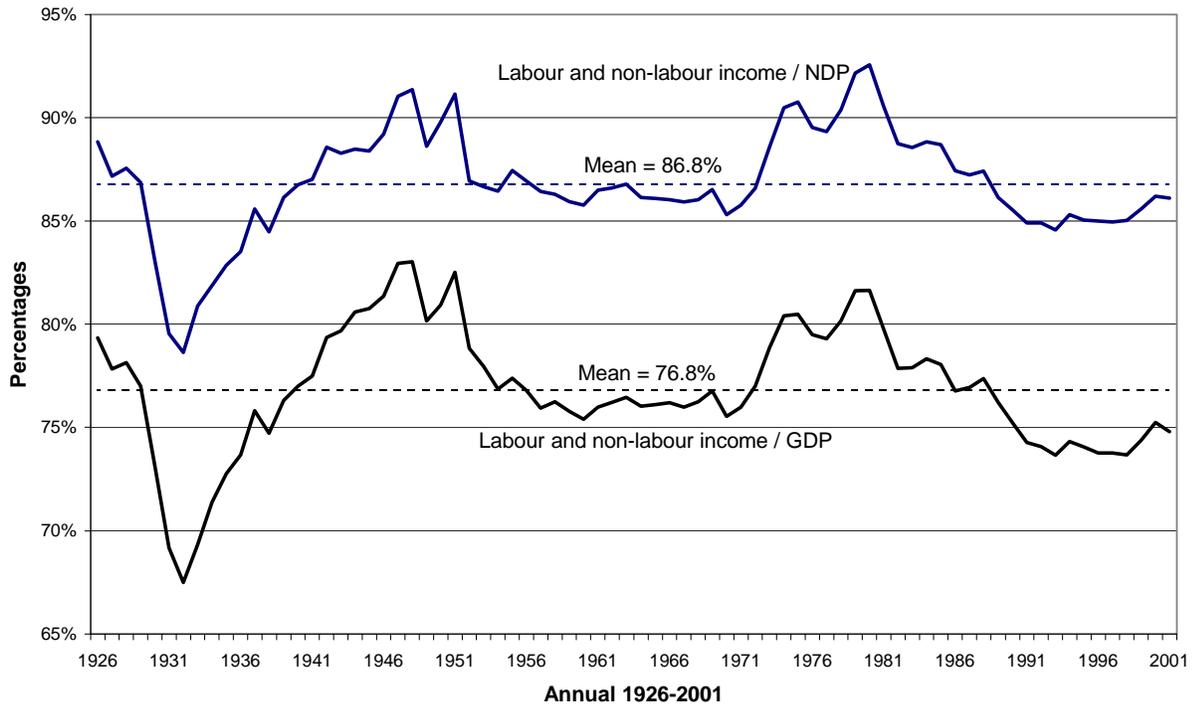
**Figure 6: Other Components of National Income**
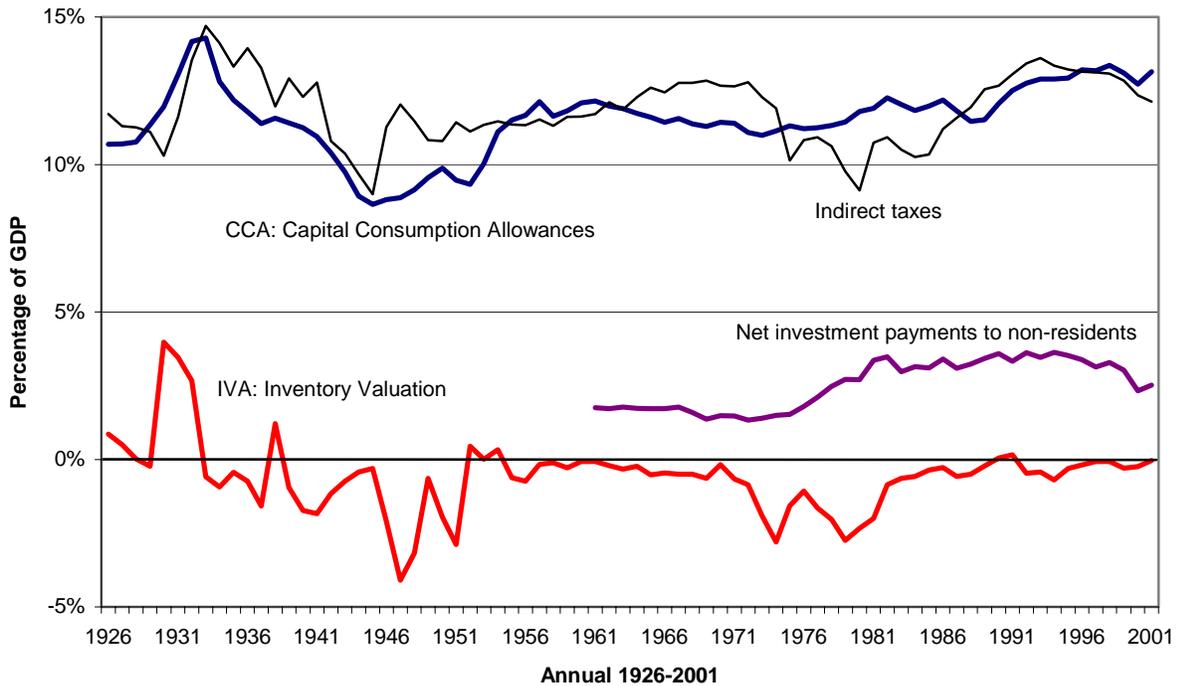
Figure 7: The Tax Burden
(Total taxes less transfers as a percentage of GDP.)
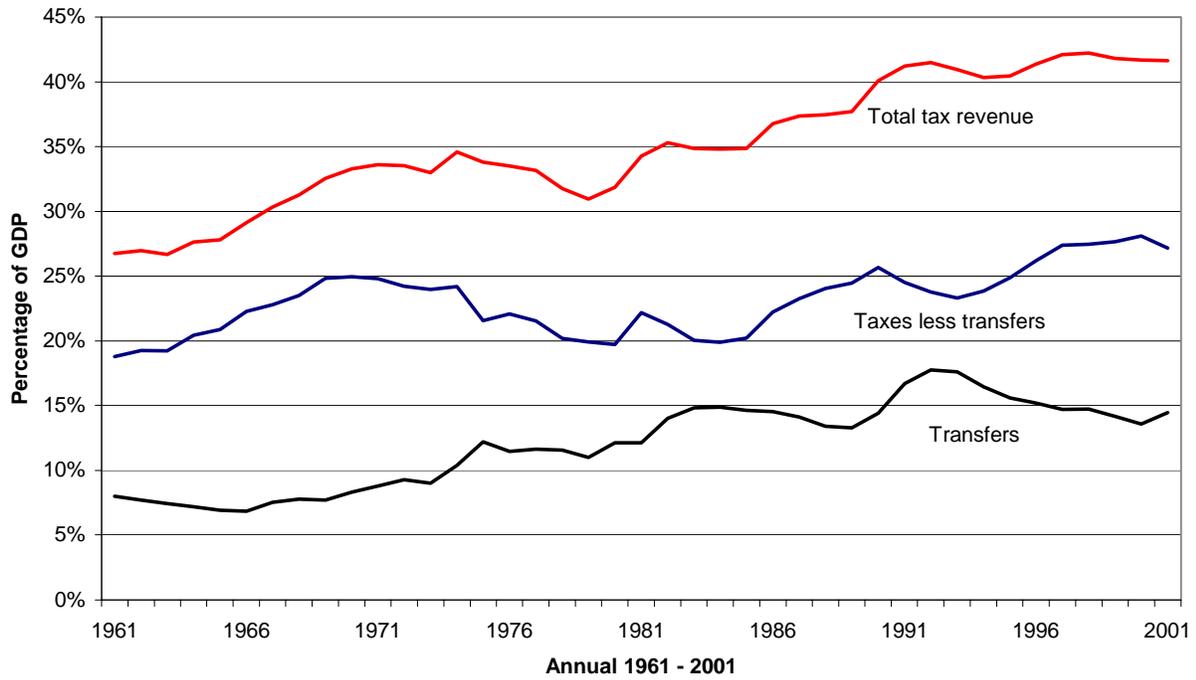
Figure 8: Consumer versus Producer Price Level
(CPI / GDP Price Deflator)
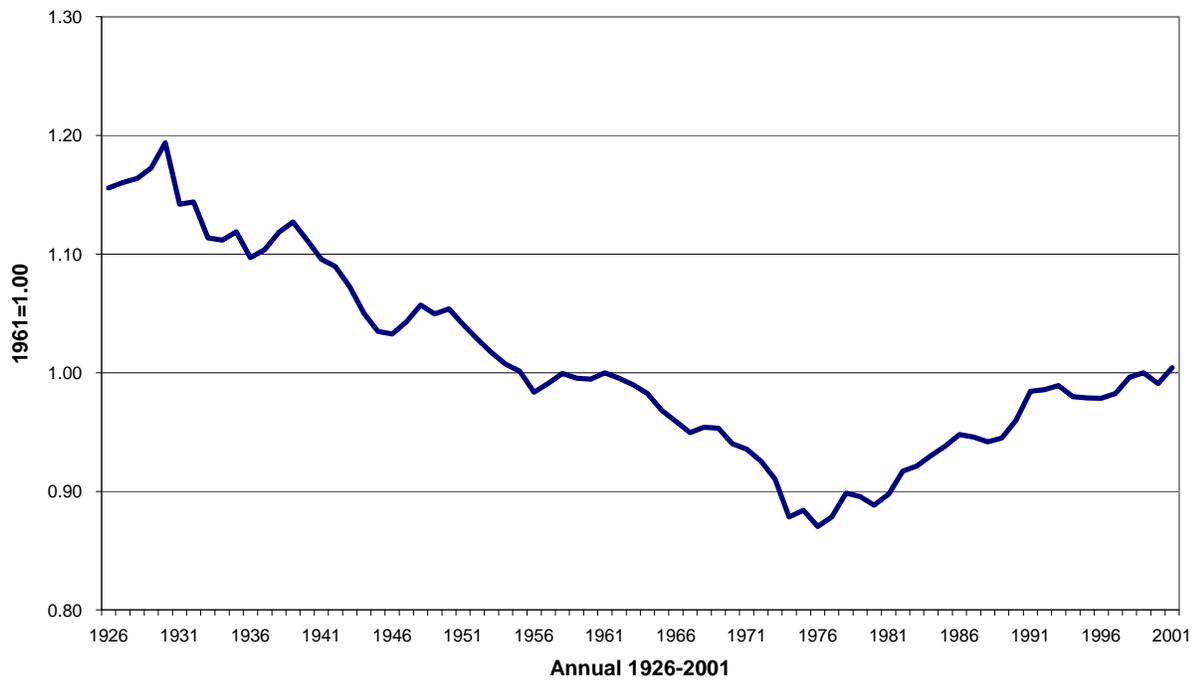
Figure 9: Average Annual Hours Worked per Capita
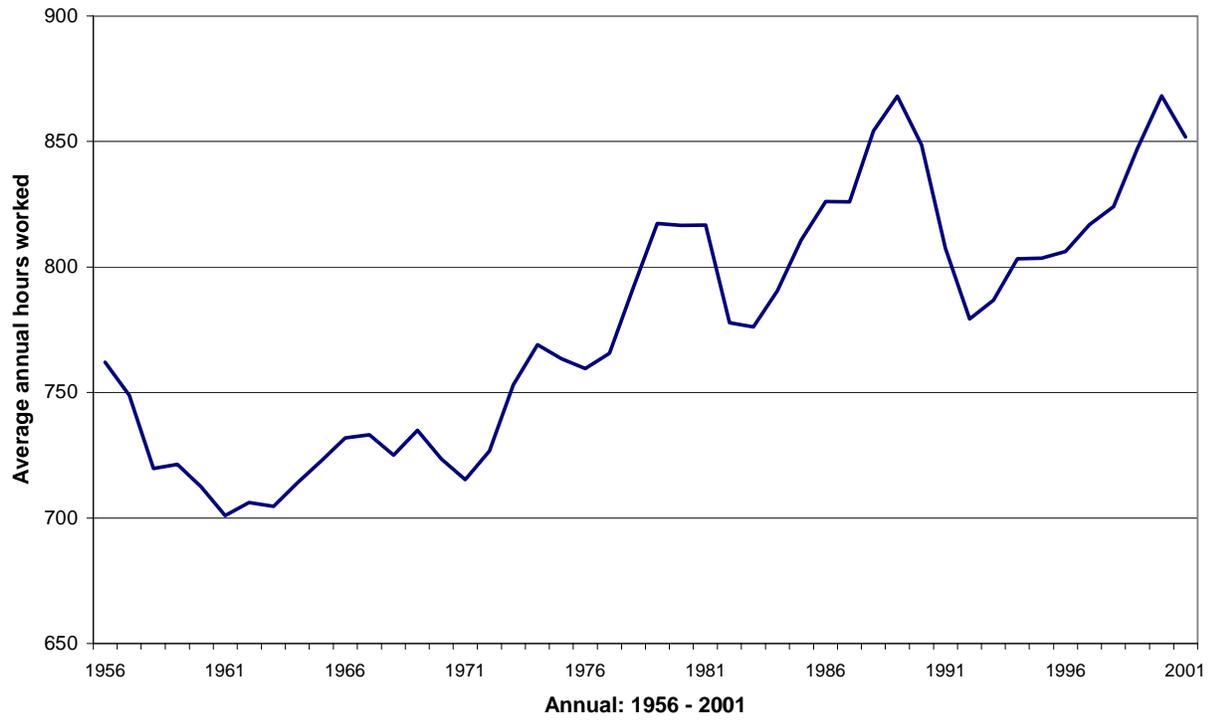
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