Pierre Duguay: Productivity, terms of trade and economic adjustment

Remarks by Mr Pierre Duguay, Deputy Governor of the Bank of Canada, to the Canadian Association for Business Economics, Kingston, Ontario, 28 August 2006.

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Good evening. It is a pleasure and an honour to speak to you this evening, at the start of a conference that has a long and distinguished tradition among Canadian business economists. I hope that my remarks will spur some fruitful discussion, and I look forward to your reflections tomorrow on Canada's "low-productivity conundrum."

The Bank of Canada is keenly interested in productivity -for a number of reasons. Productivity gains are a key determinant of growth in potential output and, hence, of Canada's sustainable pace of non-inflationary economic expansion. Productivity also affects marginal costs, a key driver of prices. And productivity differences across sectors and across countries have implications for the real exchange rate.[1]

More generally, increasing productivity is fundamental to raising living standards and therefore deserves the attention of policy-makers, business people, and citizens. And it seems fair to say that productivity will become even more important as the Canadian population ages and as China, India, and other emerging-market countries increase their presence in the world economy. At the same time, it's important to realize that the expansion of trade with these countries provides new opportunities for increases in productivity and real income.

I will touch on productivity in my remarks this evening, but I would like to focus on another issue that also has a direct bearing on our standard of living - namely, our terms of trade, that is, the prices we get for our exports relative to the prices we pay for our imports. When the prices of what we sell in world markets go up, or the prices of what we buy from the rest of the world go down, we are richer as a country. But changes in our terms of trade mean more than changes in real income and wealth. They also have significant implications for the allocation of resources within the economy. And our economic welfare depends, in large measure, on how well and how swiftly we adjust to such changes in economic circumstances. The past three and a half years have been marked by a significant improvement in Canada's terms of trade. This has also been a period of particularly intense adjustment. I want to talk about this adjustment process and the link to our standard of living.

I will begin by drawing attention to the distinction that must be made, in an open economy, between real income and real output. I will then review the adjustment of the Canadian economy to the recent sharp rise in our terms of trade and suggest some general implications for productivity and potential output. After this, I'll say a few words about the Bank of Canada's new economic model, ToTEM, and conclude with some comments on the Bank's outlook for the Canadian economy.

Productivity, terms of trade, and living standards

There is no doubt that advances in productivity underpin improvements in our standard of living. However, in an open economy, real income depends not only on the volume of output, but on the trading value of that output, that is, on the terms of trade. Moreover, domestic production is not the only source of income, and not all income from domestic production accrues to residents. The tendency to identify standard of living with real gross domestic product (GDP) per capita overlooks these important dimensions.

In my view, a better indicator of the standard of living would be gross national product (GNP) per capita deflated by domestic demand prices.[2] By focusing on GNP rather than GDP, this measure includes Canadians' earnings from abroad and excludes non-residents' income earned in Canada. By

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[1] See, for example, R. Lafrance and L.L. Schembri. 1999-2000. "The Exchange Rate, Productivity, and the Standard of Living." Bank of Canada Review (Winter) 17-28.

[2] A similar view has been put forward by U. Kohli. 2005. "Switzerland's growth deficit: A real problem - but only half as bad as it looks." Available at http://www.snb.ch/d/download/referate/ref_050304_koh.pdf.

deflating GNP by the price index for domestic purchases rather than by the GDP deflator - the price of domestic output - it captures the terms-of-trade effect.

It is instructive to compare this measure of real income with that of GDP per capita over the past 35 years (Chart 1). While the two measures move broadly in sync for most of this extended period, they have diverged since 2003. Since then, and for the first time in 25 years, real income per capita has grown consistently faster than real output per capita. From 2002 to 2005, the average annual growth of real income per capita was 3.6 per cent, compared with growth in real output per capita of 1.7 per cent. This gain in real income reflects an improvement both in our terms of trade and in the balance on cross-border investment income.

The substantial rise in real commodity prices since the beginning of 2003 and the reduced prices for imported consumer goods from emerging-market economies have resulted in a significant improvement in our terms of trade, and generated large gains in real income.[3] These gains, which are reflected in higher prices for domestic output relative to those for domestic purchases, account for 1.6 percentage points of the 3.6 per cent annual growth in real income since 2002.

In addition, current-dollar GNP has grown more rapidly than current-dollar GDP since 1999, as foreign investment income accruing to Canadians has risen more than Canadian investment income accruing to non-residents. This factor has contributed 0.3 percentage points to average annual growth in real income since 2002. It reflects both the decline in Canada's net international indebtedness - the result of a stream of current account surpluses in recent years - and the effect of a stronger Canadian dollar on the servicing of U.S.-dollar-denominated debt.

The measure of real income advocated here - GNP divided by the domestic demand deflator - is more comprehensive, more intuitive, and easier to compute than the related concept of "command GDP," which has attracted some attention lately. Command GDP takes terms-of-trade changes into account by deflating current-dollar exports by the import price index (Chart 2). It equals real income only when the trade balance and the current account balance are both at zero.[4]

To be sure, real GDP has other drawbacks as a measure of living standards, and these drawbacks apply equally to the measure of real income derived from GNP. For example, both are measures of gross, rather than net, output or income - they don't make allowance for depreciation of capital or degradation of the environment. Furthermore, they ignore non-marketed services produced by public infrastructure, and make no allowance for the distribution of income among Canadians. But the point I want to highlight this evening is that improved terms of trade and a strengthened net foreign investment position have resulted in a significant - and easily measured - increase in the real per capita income of Canadians in the aggregate, and thus in our standard of living.

Of course, the income gains generated by an improvement in the terms of trade, particularly those associated with swings in commodity prices, may not be as durable as those generated by advances in productivity. But the income gains associated with declining import prices that come from the productivity gains achieved by our trading partners are no different than those generated by increases in domestic productivity. So, while accounting for the open-economy dimension doesn't diminish the importance of increased productivity to our standard of living, it does underscore that living standards are affected by a number of factors in addition to productivity gains, and that living standards benefit from increases in both domestic and foreign productivity.

I should add that these inadequacies of real GDP as a measure of real income do not in any way diminish its relevance to monetary policy. From a monetary policy perspective, real income matters primarily as a driver of *domestic* demand. But when it comes to assessing the pressures of *aggregate* demand on capacity - a key component of inflation dynamics - it is real GDP that matters.

I would now like to turn to how Canada has fared in adjusting to the recent terms-of-trade shock.

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[3] The trend decline in the relative price of imported machinery and equipment has also contributed to the rise in Canada's terms of trade, but this is not a recent development.

[4] Let gy, gq, and gz be growth in real income, real GDP, and command GDP, respectively; gPd, gPx, and gPm, the rates of increase in domestic demand, export, and import prices; X and M, nominal exports and imports, and dN, the change in net foreign investment income (N = GNP - GDP).

It follows that gy = gq (GDP/GNP) + (gPx - gPd) (X/GNP) - (gPm - gPd) (M/GNP) + dN/GNP
= gz (GDP/GNP) + (gPm - gPd) (X - M)/GNP + dN/GNP, since gz = gq + (gPx - gPm) X/GDP.

Adjusting to changes in the terms of trade

As I noted, the recent rise in Canada's terms of trade stems from two main sources: reduced prices for imports, especially from emerging-market countries such as China and India, and substantially higher prices for many of our commodity exports due to strong global demand, particularly from Asia. This improvement in our terms of trade may last for some time, if prices of commodities in futures markets are any indication. It has increased real wealth and income, and thus fuelled increased spending by consumers, governments, and businesses.

A further outcome has been a rapid and substantial appreciation of the Canadian dollar against the U.S. dollar and, indeed, against many other currencies. The stronger Canadian dollar has tempered the pressure of increased domestic spending on aggregate demand by dampening net exports, thus helping to keep overall supply and demand in balance, and inflation pressures in check. At the aggregate level, then, the flexible exchange rate has been playing its classic role of "shock absorber."

However, from a sectoral perspective, the sharp rise in the exchange rate has signalled the need for prompt adjustment. It has intensified the pressure on many manufacturers, who were already facing stiff competition from producers in emerging-market countries. It has reduced their export revenues and lowered the prices of competing imports, even as the prices of many raw material inputs were rising.

Large, sustained changes in the terms of trade - whether in a favourable or unfavourable direction - can cause stress and dislocation. They can lead to significant shifts in production and employment among sectors of the economy, resulting in a loss of jobs in some industries and growth in others. In macroeconomic terms, terms-of-trade shocks trigger a shift of resources to activities generating higher income. From that perspective, postponing adjustment would mean forgoing the potential income gains that the reallocation of resources can bring. Adjustment is always difficult - but it is vital to our economic prosperity.

Some observers regard the adjustment to the recent rise in Canada's terms of trade as a form of the "Dutch disease."[5] But from a macroeconomic point of view, the reallocation of resources is a sign of health, not disease - it is the sign of a vibrant, dynamic economy adjusting to significant shifts in demand by putting resources to their most profitable use.[6] To make the most of our opportunities as a trading nation, we need to adjust as quickly and effectively as possible to changes in global economic circumstances.

There are indications that Canadians are doing just that. With profitability especially strong in the energy and mining sectors, as well as in most sectors with low exposure to international trade, businesses and investors have been quick to seize the new opportunities presented by the improvement in our terms of trade. We've seen strong growth in capital spending and employment in these sectors. A surge in investment in machinery and equipment across the economy suggests that firms are taking advantage of the stronger exchange rate (which reduces the cost of imported machinery and equipment) to improve their productivity and enhance their competitiveness. Many manufacturers are taking advantage of lower-cost imported inputs or shifting their focus to higher-value-added production.

Labour is also adjusting to the terms-of-trade shock. The evidence shows that labour markets in Canada are relatively flexible, which helps the country adjust to labour-demand shocks.[7] While employment has decreased markedly in manufacturing since 2004, it has grown strongly in non-farm primary industries, in construction, and in other sectors that are driven by the strength in domestic demand - for example, finance, insurance, real estate, and health and education services. These developments have involved a sharp increase in net migration of labour to Alberta from other parts of the country. Employment growth in Ontario and Quebec has moderated a bit, but still averaged a relatively robust 1.3 per cent from July 2004 to July 2006.

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[5] The Economist coined this term in 1977 to describe the adverse effect that large-scale natural gas development in the North Sea had on Dutch manufacturing through a real appreciation of the guilder.

[6] An excellent general equilibrium analysis of booms in the resource sector can be found in W.M. Corden. 1994. "Booming Sector and Dutch Disease Economics: Survey and Consolidation." Oxford Economic Papers, New Series 36(3): 359-80.

[7] T. Bayoumi, B. Sutton, and A. Swiston. 2006. "Shocking Aspects of Canadian Labor Markets." IMF Working Paper No. 06/83.

Overall, the Canadian economy has been adjusting rather well, though not without pain, to a significant change in economic circumstances. However, the adjustment is not over yet, and challenges remain. There are still barriers to labour mobility and to interprovincial trade, and pressures are building on housing markets and infrastructure in regions of strong growth - most notably, Alberta. These are reflected in intensified labour shortages and differentiated pressures on wages and housing prices. Because governments receive a significant share of increased commodity-related revenues, they have the power to alleviate, but also to magnify, some of these pressures.

Let me now turn to the implications of a terms-of-trade shock for labour productivity and for potential output.

Implications for labour productivity and potential output

A change in the terms of trade can affect labour productivity through two main "channels": the exchange rate and the reallocation of resources across sectors.

The currency appreciation associated with an improvement in the terms of trade lowers the relative price of imported physical capital, particularly machinery and equipment, and encourages the substitution of capital for labour, which should contribute to higher labour productivity over time, other things being equal.

While the effect of the reallocation of resources on real income is always positive, its effect on aggregate labour productivity is less clear. For one thing, the rise in commodity prices can be expected to lower productivity in the primary sector, as higher-cost - that is, less-productive - activities become more profitable. On the other hand, the reallocation of capital and labour away from the production of manufactured goods toward the production of commodities should raise overall labour productivity, since labour productivity levels are higher in the more capital-intensive primary sector. As for the shift from tradables to non-tradables, no generalization is possible, since the non-tradable, services sector is very broad and very diverse, with some industries (like finance and wholesale trade) showing high productivity levels and others (like retail trade) showing much lower productivity levels. At any rate, these are long-run effects.

In the short run, the adjustment process can be expected to exert a transitory drag on productivity growth. For instance, workers with skills tied to a particular industry may require retraining in order to become fully functional in areas of the economy that are expanding. Once in new jobs, it may take them some time to develop the firm-specific skills often associated with productivity gains. Furthermore, investment in new machinery and equipment may involve new technology, which may necessitate retraining or reorganization of the workplace before the full productivity gains materialize.[8]

Now, to the extent that a terms-of-trade shock affects productivity growth, there will also be an effect on the growth of potential output. If I were to generalize about the likely effects of the current terms-of-trade shock on potential output through productivity, I would say that we would expect to see an increase in the long run, but a possible dampening in the short run, owing to transitional dislocation costs. The gain over time would come primarily from the "capital deepening" that results from changes in the relative costs of labour and capital and from increased exploration in the primary sector. While closed mines can be re-opened fairly quickly, regulatory requirements and the time it takes to build infrastructure mean that it can take more than a decade for a new mine to go from exploration to production. Thus, the rise in potential output from this latter source will occur slowly.

Modeling changes in the terms of trade

The Bank's interest in understanding how terms-of-trade movements play out in the economy is not new. For decades, the Bank of Canada has monitored the effect of swings in the terms of trade on real income and on the external value of the Canadian dollar. Over the years, we have built models to study how changes in the terms of trade and the subsequent economic adjustment affect the

[8] See, for example, D. Leung. 2004. "The Effect of Adjustment Costs and Organizational Change on Productivity in Canada: Evidence from Aggregate Data." Bank of Canada Working Paper No. 2004-1.

economy.[9] But it is only recently that Bank staff have formally incorporated a separate commodity sector into our main projection model, ToTEM.

In contrast to the Bank's previous model, which treated economic activity as a single aggregate,[10] ToTEM - which stands for Terms of Trade Economic Model - makes explicit the distinction between raw materials or commodities, and manufactured goods. This distinction is crucial for two reasons. First, commodity production represents a sizable proportion, some 11 per cent, of Canadian GDP,[11] and commodity exports account for nearly 45 per cent of the dollar value of our total exports. Second, the commodity sector and the manufacturing sector are characterized by different technologies and different competitive structures, which have important implications for the behaviour of inflation. For instance, the production of commodities is more capital-intensive and more price-inelastic than the production of other goods and services. Moreover, commodity prices are set in world markets, whereas manufactured goods are subject to product differentiation and to a greater degree of price-setting influence by firms.

In ToTEM, the key driver of consumer prices is the marginal cost of producing consumer goods. Consumer goods are produced using four inputs: labour, capital, an imported intermediate good, and commodities. In this framework, the marginal cost can be expressed as a function of labour costs (including the costs of hiring and training), as well as the price of imported intermediate goods, the price of commodity inputs, the price of investment goods, and the rate of capacity utilization.

ToTEM is a clear improvement over the previous model in its ability to capture the response of the Canadian economy and the Canadian dollar to changes in commodity prices. That's all I'll say about ToTEM for now. But this fall we'll be publishing an article in the *Bank of Canada Review* that will discuss this new model in some detail.

Let me now turn to the outlook for the Canadian economy as we at the Bank see it.

Outlook for the Canadian economy

The Canadian economy continues to adjust to major global developments. In the *Monetary Policy Report Update*, released last month, the Canadian economy was judged to be operating just above its production capacity and was projected to return to capacity by the end of 2008, reflecting some anticipated moderation in U.S. economic growth and the effects of past increases in interest rates and the exchange rate in Canada.

The level of the policy interest rate was judged, at the time, to be consistent with achieving the inflation target over the medium term. CPI inflation was expected to return to our 2 per cent target in the second half of 2007. Core inflation was projected to remain at 2 per cent throughout the projection period.

In our *Update*, we said that the upside risk to Canadian output and inflation related primarily to the momentum of household spending and housing prices. It was judged to be roughly offset by the risk that the U.S. economy would grow more slowly than expected, thus reducing demand for Canadian exports.

Information received since July suggests that real GDP growth for the second quarter may have been slightly weaker than anticipated in our *Update*. But the underlying trends in the economy appear to be in line with the broad thrust of our July projection in terms of both output and inflation.

Finally, with the recently released July CPI now showing the effect of the 1 per cent reduction in the GST, I would like to remind you that, in setting monetary policy, the Bank's approach continues to be to look through any direct impact on inflation from changes in indirect taxes. In this context, core CPI,

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[9] See, for example, T. Macklem. 1993. "Terms of Trade Disturbances and Fiscal Policy in a Small Open Economy." The Economic Journal 103: 916-36; also D. Longworth. 1980. "The terms of trade: The Canadian experience in the 1970s." Bank of Canada Review (January) 13-25.

[10] See S. Poloz, D. Rose, and R. Tetlow. 1994. "The Bank of Canada's New Quarterly Projection Model (QPM): An Introduction." Bank of Canada Review (Autumn) 23-38.

[11] Value added in agriculture, fishing and trapping, mining, and a number of resource-based manufacturing industries (wood products, paper and allied products, primary metal products, petroleum and coal products, and chemical products) as a percentage of GDP, in 1997 constant dollars.

which excludes the effect of changes in indirect taxes, is an important indicator of the underlying trend of inflation.

Conclusion

Allow me to conclude. As a trading nation in a global economy, Canada will continue to experience changes in its terms of trade. It is important to understand the effects of such changes, given their implications for both aggregate supply and aggregate demand, and for our standard of living.

Movements in our terms of trade present important challenges and opportunities for Canadian businesses, individuals, and governments. Although adjusting to economic change is never easy, *how* we respond to change has a real impact on our economic well-being. The speed with which we respond, the ways in which we deal with the challenges, and the extent to which we seize the opportunities, are all profoundly important.

Over the past few years, Canada has responded rather well to a dramatic change in its terms of trade. Sound monetary policy has helped in two ways. Low and stable inflation has provided an important element of certainty in a time of rapid change. And monetary policy has helped to facilitate adjustment by supporting aggregate demand to keep the economy near its full potential and inflation on target. A strong world economy has also helped, making the adjustment process somewhat easier. But much of the success of this far-reaching adjustment is also a testament to the flexibility of Canadian workers and businesses.

Chart 1: Real GDP and Real Income per Capita (1970 - 2005)

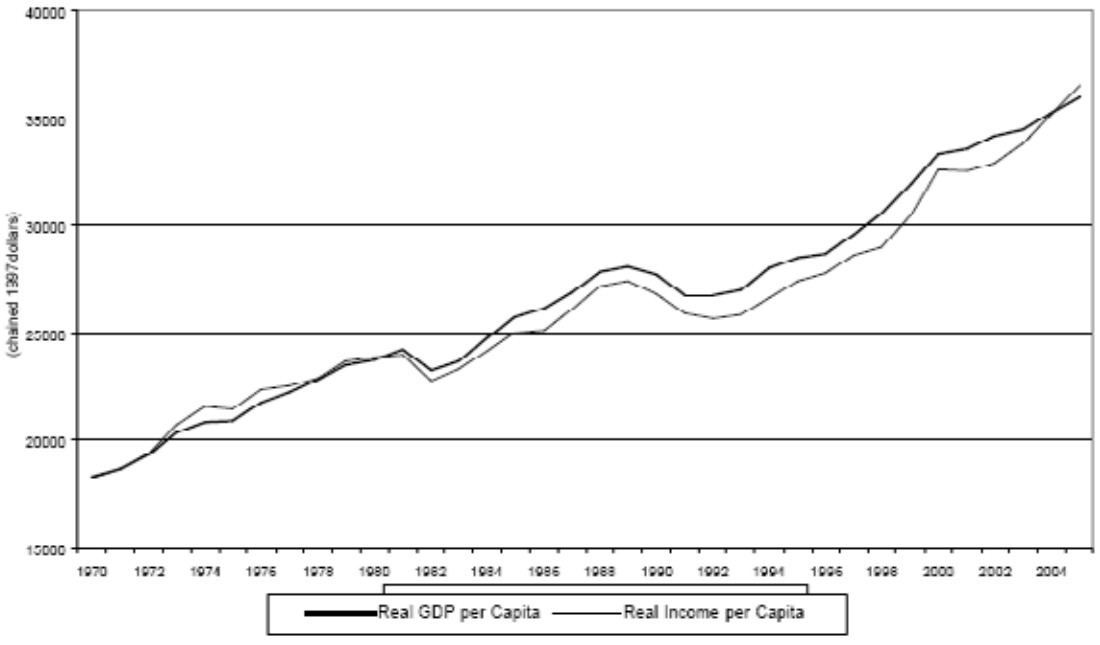

Chart 2: Real GDP, Command GDP, and Real Income per Capita (1970 - 2005)