



April 9, 2008

100th anniversary of the Canadian penny An opportunity to re-examine the usefulness of our coins and bank notes in circulation

Follow-up to the study "Should We Stop Using the Penny?"

SUMMARY

In February 2007, the study published by Desjardins Group's Economic Studies **concluded that the penny should be retired as quickly as possible**. The study sparked interest among Canadians, in the print and electronic media and even abroad. The innovative approach used, which involved estimating the costs for society as a whole by totalling the costs incurred by the different economic agents, was favourably received by experts. **The penny's 100th anniversary, on January 2**, prompted us to further our thinking in this regard, but also on all Canadian denominations (coins and bank notes).

Since our study was released, the Royal Canadian Mint (RCM) published its 2006 annual report in May 2007, which shows that **the production of coins in Canada rose sharply in 2006, i.e., from 1.5 to 2.2 billion pieces**. In our view, this dramatic surge in production reflects the fact that Canadians increasingly hoard low-denomination coins rather than use them to pay for their cash purchases. This is particularly true for the penny whose **annual production rose 51% in 2006, from 767 million to 1,160 million pieces**. Due to the hoarding phenomenon—**stockpiled coins that serve no productive purpose**—merchants and financial institutions routinely need new coins for the retail distribution system. In fact, due to the resulting strong "artificial" demand, the RCM must produce more Canadian coins and cannot free up some of its production capacity to produce more lucrative foreign coins.

Moreover, **rising prices will require changes to Canadian currency over the next two decades**. Indeed, small coins will become increasingly obsolete and new, larger denominations of both coins and bank notes will be needed to finance daily transactions. **As is typical of a modern economy, inflation, over time, tends to increase denomination value rather than quantity**.

Our analysis of the current situation in Canada leads us to suggest 3 major groups of changes: 1) **Promptly remove the one-cent coin** (it should have been done in the early 1980s). 2) A few years later, the government should consider making a series of joint, carefully thought out and planned changes. In our view, **it should begin by removing the five-cent coin and replacing the \$5 bill with a coin of the same value** (as was done in 1987 with the \$1 bill and in 1996 with the \$2 bill). **It could then introduce a new series of smaller and lighter low-denomination coins** (10 cents, 20 cents and 50 cents) as was done in New Zealand. The government could decide to keep the actual 10-cent coin, given its current small size. **Since removal of the nickel will then require rounding to the nearest 10 cents, the government could decide to replace the quarter with a 20-cent coin**. Lastly, **a new series of \$1, \$2 and \$5 coins could be introduced**. These coins should also be relatively lighter and smaller than their predecessors. 3) **Every five years, the government should also evaluate the merits of introducing a \$200 bill** taking into account the other means of payment (debit and credit cards, cheques, bank transfers, and eventually smart cards, etc.) and the potentially illegal activities associated with its use.

Lastly, through its Department of Finance, the government should be more proactive about preventing the proliferation of myths and misunderstandings on the topic. Too many people mistakenly believe that removing the penny will play in favour of merchants and increase inflation. However, in this age of productivity, **no action is unimportant that helps countries reduce costs and become more competitive internationally**.

Jean-Pierre Aubry
Economic Consultant

François Dupuis
Vice-President
and Chief Economist,
Economic Studies
Desjardins Group

Hendrix Vachon
Economist,
Economic Studies
Desjardins Group

514-281-2336 or 1 866 866-7000, ext. 2336
E-mail: desjardins.economics@desjardins.com

1. INTRODUCTION¹

In February 2007, a study on the one-cent coin conducted by Desjardins Group's Economic Studies **concluded that the penny should be removed from circulation in the short term.**² This study sparked interest among Canadians and in the print and electronic media, which published many articles and news stories on the topic across Canada. The study was so relevant that it even attracted the attention of other countries dealing with the same problem, i.e., low-denomination coins in circulation.

It bears mentioning that our methodology consisted in evaluating not only the costs for the federal government, but also for all the economic agents (merchants, consumers, financial institutions and the government). **Experts viewed this innovative approach favourably.** The federal Department of Finance did not contest our economic arguments or our estimate that the total cost of producing the penny is 1.5 cents in contrast to the Royal Canadian Mint (RCM), which states its direct costs in this regard are 0.8 cents per coin. The difference between the two figures can be explained by the fact that the RCM does not take into account indirect and fixed costs in its calculations. **It also bears mentioning that the small profit (positive seigniorage according to the RCM) or small loss (negative seigniorage in our view) that the government can realize has a minor effect on the total cost for society and no significant impact on the final decision to be made, i.e., remove the penny from circulation and round retail prices to the nearest five cents for cash purchases.**³

Given that **the penny celebrated its 100th anniversary on January 2**, we thought it was an opportune time not only to pursue our thinking about this coin but also about all the other Canadian denominations (coins and bank notes). As

prices and standard of living continue to rise, many changes to Canadian coins and bank notes in circulation will no doubt become necessary over the next two decades. In fact, the increasing obsolescence of small-value denominations will make these changes desirable. The models typically used by industrialized nations to manage their currencies will help governments to select the proper timing for the introduction of new coin and bank note denominations.

Following this introduction, we will begin this Economic Viewpoint by summarizing our first study: "Should We Stop Using the Penny?" We will not only reiterate the major conclusion of our analysis from last winter but also reinforce them in light of new developments, mainly the information included in the RCM's 2006 Annual Report published last May. The fourth section uses the international-accepted D-metric model to analyze the current and future structure of coins and bank notes to maintain in circulation in Canada. We ask the following question: "Should we soon make other changes besides eliminating the penny?" The last section discusses various myths associated with the penny's removal. Despite the many comments and discussions on the consequences of removing the penny from circulation since our study was published in February 2007, a number of misconceptions on the topic still persist. Finally, our conclusion will consist of four messages, one of which includes making three major changes to coins and bank notes in circulation in Canada over the next 20 years.

2. SUMMARY OF THE STUDY "SHOULD WE STOP USING THE PENNY?"

2.1 THE CANADIAN PENNY: A NOW POINTLESS COIN

In Canada, low-denomination coins have so little purchasing power that Canadians increasingly refuse them as change for their retail purchases. This is especially true with the penny. Because its face value represents only a tiny fraction of the purchase price, even for the smallest transactions, the one-cent coin is becoming obsolete. Notwithstanding this fact, the RCM issued, on average, just over 825 million pieces per year from 2001 to 2005, or about 25 per inhabitant each year. Since 1908, the year the penny was introduced, the RCM has struck just over 30 billion pennies (950 pieces per person). **These astronomical figures show that many pennies do not find their way back into the retail distribution system either because they are hoarded, which is usually the case, lost or simply thrown away.**

The foregoing was confirmed by a [survey](#) of Canadians conducted by Desjardins Group in 2006. Only 37% of

¹ We would like to thank Norman Cameron, Professor Emeritus, Department of Economics at University of Manitoba, Bill Melbourn, Currency Consultant and member of the advisory board of Currency News and Claude Montmarquette, Professor, Department of Economics at Université de Montréal and Robert Whaples, Director, Department of Economics at Wake Forest University.

² See the *Economic Viewpoint* of February 15, 2007 entitled "Should We Stop Using the Penny?"

³ A small gain or loss for the government does not alter the business case because in both cases, the amounts are minimal when compared to the costs of the other economic agents. In fact, according to the RCM, the positive seigniorage generated between 2001 and 2005 amounted to \$1.5 million while our estimate for the same period shows a negative seigniorage of \$3.75 million. Lastly, in our view, the costs for society were at least \$130 million in 2005 and the government's gross costs amounted to \$11.25 million. Even if we use the RCM's unit cost of production of 0.8 cents, our gross cost estimate only decreases to \$6 million, bringing society's total cost of keeping the penny in circulation to about \$125 million for 2005.

Canadians regularly use the penny to pay for their cash purchases.⁴

2.2 EROSION OF THE PENNY'S PURCHASING POWER

Compared to the beginning of the 20th century, **the penny now has a very small value in relation to the purchasing power and standard of living of Canadians.** In the early 1900s, workers earned an average of 20 cents per hour and the penny represented 5% of this value. Today, the average wage is about \$20 an hour and the one-cent coin accounts for just over 0.05% of this amount, or 100 times less.

2.3 EXPENSIVE FOR SOCIETY

When you factor in the amount of money spent to produce, transport, store and handle the penny as well as to record deposits and withdrawals by consumers and businesses, keeping this coin in circulation is an expensive proposition for Canadian society, **one that cost at least \$130 million in 2005.**

2.4 THE SOLUTION IS TO REMOVE THE PENNY AND ROUND CASH TRANSACTIONS

If the penny is removed from circulation, only the totals of cash transactions will be rounded to the nearest five cents. For example, a transaction for one or more items with a final price of \$9.98, \$9.99, \$10.01 or \$10.02 will be \$10.00; if the final price is \$10.03, \$10.04, \$10.06 or \$10.07, the final price will be \$10.05. Rounding off cash amounts will not allow buyers or sellers to realize a monetary gain over the current situation where cash transactions are settled to the nearest penny. Over many transactions, consumers and retailers do not realize enormous gains or suffer significant losses if prices are rounded symmetrically. If companies (operating in a competitive market as is the case with most retail businesses) could actually increase their prices and ultimately their profits by raising their selling price by a few pennies, they would do so.

In a competitive environment, it is therefore false to claim that sellers would realize a gain at the expense of buyers by systematically rounding up their prices. **It is also incorrect to say that eliminating the penny would permanently increase prices or even the inflation rate. Moreover, the experience of many countries that have stopped producing low-denomination coins goes against this type of erroneous thinking.**

⁴ To find out more, see the Press Release of February 15, 2007 entitled "Should We Say Goodbye to the Penny?"

2.5 CONCLUSIVE EXPERIENCE OF OTHER COUNTRIES

For example, Australia and New Zealand not only removed pennies from circulation at the end of the 1980s and early 1990s but discontinued their two-cent coins as well. **In hindsight, their decisions have proven to be sound and no increase in prices have been noted.** In 2006, New Zealand even stopped issuing the five-cent coin. Some countries in the euro zone such as Finland, the Netherlands and Belgium do not use or suggest no longer using their one- and two-centime coins.

In the past few years, the government of Canada would have done well to better inform Canadians as to how removing the penny from circulation would affect inflation. **Economic theory and the actual experience of various countries in this regard are well-documented,** particularly at the Bank of Canada and the Reserve Bank of New Zealand (RBNZ). We will return to this question in section 5.1.

2.6 A STEP-BY-STEP APPROACH

The first step for the federal government (it alone can take this step)⁵ **is to make the decision to eliminate the penny.** If removing the penny is successful – and it should be – and if the experience reassures the public, **the second step would be for the Canadian government, within the next few years, to examine the relevance of removing the five-cent coin.** In 2010, the purchasing power of the nickel will be approximately one quarter of the penny's value in 1908!

3. COIN PRODUCTION ROSE SHARPLY IN 2006

3.1 CANADIANS ARE INCREASINGLY HOARDING

Released in May 2007, **the RCM's 2006 Annual Report shows that coin production in Canada rose sharply over 2005 (from 1.5 billion to 2.2 billion pieces).** According to the RCM, this spectacular increase is explained by changes in the methods of paying small-value transactions, particularly those associated with parking and public transit. Moreover, the widespread increase in electronic payments and the emergence of new methods of micro payment (for low-value purchases) reduced the quantity of coins that consumers put back in circulation whereas growing retail sales and the booming Canadian economy fuelled store transactions and the demand for coins.

⁵ It is up to the Minister of Finance, together with the elected government, to make currency-related decisions. In order to remove the penny, amendments will be required to the law governing the RCM as well as the law governing currency. Moreover, parliamentary approval will be required. The RCM is currently controlled and supervised by the Minister of Transport, Infrastructure and Communities.

Table 1 – Annual Canadian coin production ^{(1) (2)}

Coins	2002	2003	2004	2005	2006
\$2	27,020,000	11,244,000	12,908,000	38,317,000	30,279,000
\$1	2,301,000	5,102,000	10,894,000	44,375,000	47,490,000
50¢	14,440,000	-	-	200,000	98,000
25¢	187,992,000	100,638,000	210,047,000	269,586,000	473,027,000
10¢	252,563,000	164,617,000	213,025,000	211,350,000	311,847,000
5¢	135,960,000	101,793,000	123,925,000	148,082,000	182,316,000
1¢	830,040,000	748,123,000	842,486,000	767,425,000	1,160,408,000

⁽¹⁾ Total coins of each date and denomination regardless of the calendar year in which they were produced.
⁽²⁾ Figures are rounded to the nearest thousand pieces.
⁽³⁾ Includes the 2006 Lucky Loonie commemorative circulation coin which was produced in 2005.
 Sources: Royal Canadian Mint 2006 annual report and Desjardins, Economic Studies

We believe these explanations are only partially correct. Booming retail sales and economic growth cannot possibly be responsible for such an increase in annual coin production, particularly since the production of \$1 and \$2 coins fell by 6% in 2006 (see Table 2). It should be recalled that according to Statistics Canada, retail sales rose 6.4% in 2006 in Canada, whereas sales in convenience stores and specialty food stores, where people generally spend small cash amounts, inched up only 2.5%. In nominal terms, the economy grew 5.2% during the same year. In our view, taking into account the growing effect of electronic payments and micro payments on coin hoarding, the phenomenal increase in coin production in Canada stems essentially from the fact that Canadians are increasingly tossing their low-denomination coins in a variety of containers rather than using them to pay for their cash purchases.⁶

Table 2 – Production of coins in Canada: 2006 vs. 2005

Coins	2005 (in millions)	2006 (in millions)	Difference (in millions)	Variation (in %)
\$1 and \$2	82.7	77.8	-4.9	-6.0
50¢	0.2	0.1	-0.1	-51.0
25¢ ⁽¹⁾	269.6	473.0	203.4	75.5
10¢	211.3	311.8	100.5	47.6
5¢	148.1	182.3	34.2	23.1
1¢	767.4	1160.4	393.0	51.2
Total for 1¢, 5¢ and 10¢	1126.8	1654.6	527.8	46.8
Grand total	1479.3	2205.5	726.2	49.1

⁽¹⁾ Note that the sharp increase in production of the 25-cent piece in 2006 was due to the arrival of thematic coins, particularly those for the 2010 Olympics in Vancouver.
 Sources: Royal Canadian Mint 2006 annual report and Desjardins, Economic Studies

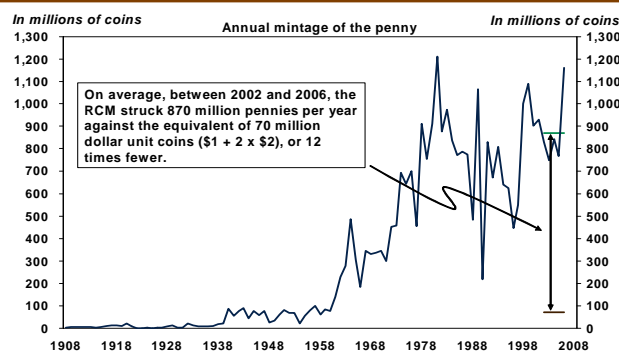
⁶ To our knowledge, no study has been conducted in Canada to determine just how many coins—particularly pennies—have been hoarded. However, a study conducted by David T. Griffiths in 2002 for the U.S. mint showed that approximately 65% of U.S. pennies were being hoarded. The rate in Canada could be similar given that surveys routinely show that the vast majority of people in Canada and south of the border no longer use the penny.

In truth, the "artificial" demand for small-denomination coins is rising primarily because merchants and financial institutions have to constantly add new coins to the retail distribution system due to a shortage caused not by commercial or economic factors but rather by the fact that consumers do not put their small-denomination coins back into circulation. The hoarded coins do not circulate and are not used for any productive purposes. Moreover, most people cannot be bothered to take the time to count, roll and deposit these coins so that financial institutions can put them back into circulation, no doubt because over the years, the Canadian standard of living has continued to rise, eroding the purchasing power of these coins. If nothing changes, this situation will only be exacerbated in the coming years and decades.

3.2 THE PRICE TAG OF KEEPING THE PENNY IN CIRCULATION WAS AT LEAST \$150 MILLION IN 2006

In 2006, the penny's production rose 51% over the previous year, reaching 1.2 billion pieces, or about 35 coins per capita (25 coins per capita, on average, from 2001 to 2005). Taking into account the 2006 production, the cumulative annual mintage since the penny was first issued in 1908 is 31.7 billion coins, or about 950 coins per capita! In 2006, the penny's annual production was fifteen times higher than the corresponding production of \$1 and \$2 coins,⁷ which should typically be used more by consumers to pay their cash purchases because larger-denomination coins are rarely hoarded. It seems rather clear that many pennies simply do not return to the distribution system, either through retail businesses, or financial institutions. **The resulting strong "artificial" demand forces the RCM to produce more coins**

Graph 1 – Comparison between annual production of the penny and \$1 and \$2 coins



Sources: Royal Canadian Mint website and Desjardins, Economic Studies

⁷ Between 2002 and 2006, this ratio is 12 times.

because merchants need them to give change to the nearest cent.⁸

Lastly, in its 2006 annual report, the RCM says little about the fact that citizens toss many of their small-denomination coins, particularly pennies, into a variety of containers. According to our calculations, **the increased production of the penny drove the minimum cost of keeping it in circulation from \$130 million in 2005 to \$150 million in 2006.**⁹ It will be recalled that in addition to the RCM's production costs, these figures include the amount of money spent by the different economic agents to transport, store, handle and keep records of this coin. In the interest of transparency, the federal government should inform Canadian citizens about the estimated costs of all the activities associated with keeping the penny in circulation. And since penny-related costs are so high, the government should not waste any more time or valuable resources on an increasingly obsolescent coin.

Table 3 – Coins and bank notes in circulation in Canada at the end of 2006 and equivalence ratio

Denomination	Number in circulation (in millions)	Equivalence ratio ⁽¹⁾
Bank notes		
100	230.1	0.11
50	138.5	0.06
20	751.4	0.34
10	106.1	0.05
5	198.9	0.09
Coins		
2.00	584.4	1.00
1.00	1,012.7	
0.50	167.9	0.08
0.25	5,416.8	2.48
0.10	6,610.9	3.03
0.05	4,514.7	2.07
0.01	31,717.8	14.54

⁽¹⁾ Corresponds to the number of denominations in circulation divided by the number of \$1 coins plus two times the number of \$2 coins.
Sources: Bank of Canada 2006 annual report, Royal Canadian Mint 2006 annual report and Desjardins, Economic Studies

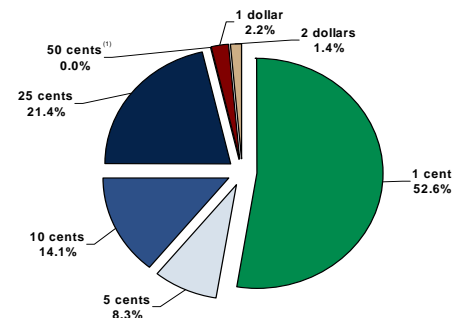
3.3 THE PENNY TAKES UP PRODUCTION CAPACITY

Over the past few years, the penny has taken up more than half of the RCM's production capacity used for Canadian coins, thus affecting its revenues. In 2006, in addition to losing its alloy coin contracts (the sharp increase in base metal prices drove the cost of coins above their face value, prompting many countries to postpone their orders despite the strain of the resulting shortage on their economy), the RCM was not able to fully capitalize on its expertise in producing and

⁸ It should be noted that to avoid handling pennies, an increasing number of merchants already round their prices to the nearest five cents.

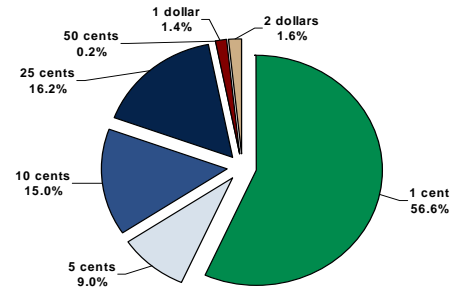
⁹ In order to estimate the total cost for Canadian society for 2007, we need to know the quantity of pennies produced in 2007. This information will become available in the coming weeks when the RCM publishes its 2007 annual report.

Graph 2 – Production in percentage of Canadian coins in 2006



⁽¹⁾ In 2006, the production of the 50-cent piece accounted for 0.0044% of total coin production.
Sources: Royal Canadian Mint website and Desjardins, Economic Studies

Graph 3 – Average production in percentage of Canadian coins between 2002 and 2006



Sources: Royal Canadian Mint website and Desjardins, Economic Studies

exporting relatively inexpensive plated coins because its production capacity was almost entirely taken up by Canadian coins.¹⁰

In fact, in 2006, small-denomination Canadian coins—notably the penny—took up most of the RCM's production capacity, to the detriment of foreign production. During that year, the one-cent, five-cent and 10-cent coins represented 75% of the RCM's total Canadian coin production, including 53% for the penny alone. The RCM therefore had to turn away more lucrative orders for foreign coins, causing its revenues in this area to fall 42.2% or \$18 million.¹¹ The RCM ascribes this decrease to strong demand for Canadian coins.

Retiring the one-cent followed later by the five-cent coin would free up production capacity to fulfill foreign orders and boost

¹⁰ See page 31 of the RCM Annual Report 2006 entitled "External Forces, Internal Strength."

¹¹ See page 4 of the RCM Annual Report 2006.

Table 4 – Number of coins and bank notes in the main industrialized countries

	Coins		Bank notes		Total denominations
	Denomination	Number	Denomination	Number	
Canada ⁽¹⁾	0.01; 0.05; 0.1; 0.25; 0.5; 1; 2	7	5; 10; 20; 50; 100	5	12
United States ⁽²⁾	0.01; 0.05; 0.1; 0.25; 0.5; 1	6	1; 2; 5; 10; 20; 50; 100	7	12
United Kingdom	0.01; 0.02; 0.05; 0.1; 0.5; 1; 2	7	5; 10; 20; 50	4	11
Euro zone	0.01; 0.02; 0.05; 0.1; 0.2; 0.5; 1; 2	8	5; 10; 20; 50; 100; 200; 500	7	15
Sweden	0.5; 1; 2; 5; 10	5	20; 50; 100; 500; 1,000	5	10
Norway	0.5; 1; 5; 10; 20	5	50; 100; 200; 500; 1,000	5	10
Denmark	0.25; 0.5; 1; 2; 5; 10; 20	7	50; 100; 200; 500; 1,000	5	12
Switzerland	0.05; 0.1; 0.2; 0.5; 1; 2; 5	7	10; 20; 50; 100; 200; 500; 1,000	7	14
Japan	1; 5; 10; 50; 100; 500	6	1,000; 2,000; 5,000; 10,000	4	10
Australia	0.05; 0.1; 0.2; 0.5; 1; 2	6	5; 10; 20; 50; 100	5	11
New Zealand	0.1; 0.2; 0.5; 1; 2	5	5; 10; 20; 50; 100	5	10

⁽¹⁾ While rarely used, the 50-cent piece is part of the Canadian monetary denomination.

⁽²⁾ \$1 coins were minted in the U.S., but \$1 bank notes continue to be more widely used.

Sources: Bank of Canada, United States Mint, Bank of England, European Central Bank, Riksbank, Norges Bank, Danmarks Nationalbank, Swiss National Bank, Bank of Japan, Reserve Bank of Australia, Reserve Bank of New Zealand and Desjardins, Economic Studies

the RCM's revenues and profits. **It bears mentioning that the RCM is well placed to land other international contracts due to its expertise in producing quality coins.**¹²

4. EXAMINING THE CANADIAN CURRENCY

4.1 THE CURRENT DENOMINATION STRUCTURE AND THE PRINCIPLE OF LEAST EFFORT

The denomination mix of coins and bank notes is very important for an economy, because it facilitates, and even optimizes the payment system as well as the settlement of past, current and future transactions between individuals, businesses and the different levels of government. In fact, a country's fiat money is characterized by a system of denominations of different values that make it possible to store purchasing power (a value reserve for future use), to facilitate transactions of goods and services and to serve as a

medium of exchange (tender used to set prices). **The number of coins and bank notes for a given economy depends on several factors** such as the extent of household consumption, the level of interest rates, changes in price indices, average personal income tax rate, the number of ATMs as well as the prevalence of electronic payment, and methods of use (for example, credit cards, debit cards and, eventually, smart cards). However, the greater the number of denominations, the greater the cost of keeping them in circulation for the issuing institution. The existence of too many denominations—particularly coins—can make it difficult for users to quickly differentiate between them when making purchases. In short, having too many denominations probably reduces their use, which largely explains the phenomena of hoarding by users and the resulting increased production costs.

An industrialized country typically has approximately 12 denominations broken down as follows: five to seven coins and four to seven bank notes. In the past few years, some countries have reduced their denominations to fewer than 12 due to demonetization or non-use of their low-denomination currency (as occurred in Australia, New Zealand, Sweden and Norway, to name just a few). Other countries, like Japan and the United Kingdom, prefer to keep a limited number, i.e., four

¹² It should also be noted that if production capacities used for the penny can be reassigned to other more profitable uses, the loss from not producing other coins (for foreign countries) should be included in the penny's unit costs, which would increase the negative seigniorage associated with producing the one-cent coin, further underscoring the need to act immediately in this regard.

bank notes in circulation. It should be noted that the euro zone is the exception among industrialized countries with 15 denominations (eight coins and seven bank notes). The challenges of creating euroland currency involved, among other things, reconciling various monetary systems, which resulted in a larger number of denominations for the member nations.

Durability and production costs are two factors behind the decision to issue coins or bank notes. Except for low-denomination coins, which are very inexpensive to produce compared to their bank note counterparts, **as a rule, bank notes have lower production costs while coins are more durable.**¹³ Moreover, coins weigh more than bank notes, and are less popular among consumers.

In general, the smaller a bank note's face value, the greater its circulation and the faster it wears out, which explains why issuing institutions tend to use durable coins for their small denominations. In major industrialized countries, coins last, on average, from 20 to 30 years and cost from one to 20 cents to produce depending on their size, the metals used and the type of production process. For their part, bank notes in most countries have a lifespan of one to two years for small denominations, five to 10 years for highly used medium denominations and more than seven years for high-value denominations, which typically do not circulate widely.¹⁴ In fact, the larger denominations have a longer lifespan because they mainly serve as a store of value and are therefore handled more carefully and less frequently. Conversely, small-denomination bank notes have a shorter lifespan due to more careless handling and wider circulation, i.e., they are used in more transactions during the same period of time.

The cost of producing bank notes varies significantly from one country to the next due to major differences in the materials used (types of paper and plastic), anti-counterfeiting elements

added to bank notes and the quality of the notes themselves. According to a recent study conducted by the Federal Reserve Bank of St. Louis, euro bank notes cost, on average, about 12 cents Canadian per unit to produce, whereas the unit cost of U.S. bank notes is about 5.5 cents Canadian. In Canada, the cost of producing a bank note is estimated, on average, at 9 cents (11 cents if distribution costs are included). Total production costs for striking coins are substantially higher than the corresponding figure for bank notes simply because far more coins than bank notes are issued each year. In Canada, for example, the RCM struck 2,206 million coins in 2006 (up 726.2 million coins or 49% over 2005) whereas the number of notes in circulation issued by the Bank of Canada increased by 75 million (i.e., 5.5%) in the same year.¹⁵

Due to problems associated with counterfeiting, money laundering, organized crime, the black market, commercial transactions not disclosed to tax authorities, as well as widespread use of electronic payments, fewer very large-denomination bank notes are being issued. This is also why some countries have fewer bank notes than others. For example, the denominations in circulation in Canada are actually made up of seven coins (1¢, 5¢, 10¢, 25¢, 50¢, \$1 and \$2)¹⁶ and five bank notes (\$5, \$10, \$20, \$50 and \$100). For crime-related reasons, Canada stopped issuing its \$1,000 bank note at the beginning of the century. This point will be covered in section 4.4.6.

In most countries around the world, the spacing of denomination structures is usually as follows: 1-2-5, 10-20-50, 100-200-500, 1,000-2,000-5,000, 10,000-20,000-50,000... In Canada, the spacing is slightly different:

- 1¢, 5¢, (for 1-2-5)
- 10¢, 25¢, 50¢, (for 10-20-50)
- \$1, \$2, \$5, (for 100-200-500)
- \$10, \$20, \$50 (for 1,000-2,000-5,000) and
- \$100 (for 10,000).

It should be noted that Canada does not have a two-cent coin, and that the 20-cent coin is replaced by the quarter and the 50-cent coin still exists but is rarely used.

¹³ Let us take two examples with the \$5 and \$100 denominations in Canada. Assume these two notes cost 8 and 12 cents respectively to produce (the average actual production cost for bank notes in Canada is about 9 cents excluding distribution costs). However, the \$5 bill's lifespan is only one year while the \$100 bill's is about 10 years. The annual production cost amortized over the lifespan of these notes is therefore 8 cents for the \$5 bill and 1.2 cents for the \$100 bill. If we had a choice to issue the same quantity of these two denominations in coins and if we assumed that these new coins would both last about 20 years and their production cost was 20 cents for the \$5 coin and 30 cents for the \$100 coin, the annual cost amortized over the lifespan of these pieces would be one and 1.5 cents respectively. These two simplistic examples show that it is better to produce a \$5 coin (annual production cost of one cent versus eight cents for the note) and to keep the \$100 bill (annual production cost of 1.2 cents versus 1.5 cents for the coin).

¹⁴ The lifespan is generally estimated by the ratio of the number of coins or notes in circulation to the number of coins or notes destroyed. In Canada, \$5 and \$10 bills have a lifespan of one to two years; \$20 bills, two to four years; \$50 bills, four to six years; and \$100 bills, seven to nine years.

¹⁵ This figure of 75 million notes represents the difference between the number of notes put in circulation and the number taken out. Unlike the RCM, the Bank of Canada takes back the surplus from financial institutions. These notes are then either resold to financial institutions or simply destroyed, if they are deemed unfit for circulation. It should be noted that notes issued by the Bank of Canada are printed by two private firms, whereas the RCM strikes and issues the coins itself.

¹⁶ As mentioned earlier, the 50-cent coin is an official part of our currency with a very low circulation. It exists almost entirely for numismatic purposes.

In mathematical language, this sequence (1-2-5) is referred to as binary-decimal triplets. They are consistent with a decimal system containing three denominations per factor of 10 and use only two dividers of 10, i.e., 2 and 5. The beauty of this structure is that it does not produce any decimals (with the exception of three operations for the Canadian spacing, i.e., \$50 divided by \$20, \$5 divided by \$2 and 25 cents divided by 10 cents).¹⁷ However, **this spacing between denominations is optimal and facilitates mental calculations.**¹⁸ A number of countries still use a small variation of this spacing: 1-2,5-5, 10-25-50, 100-250-500... or 1-3-5, 10-30-50, 100-300-500... Non-decimal based systems are rarely used today. In the past, other forms of spacing such as 1-3-6, 12-30-60, 240-1,200-2,400 was used in the United Kingdom during much of the 20th century until the currency was decimalized in February 1971. In terms of ease of use, this denomination spacing was very problematic for users.

A decimal monetary system with well-spaced denominations increases the efficiency with which the public can settle cash payments, and typically leads to a reduction in the total number of coins and bank notes in circulation. **This is referred to as the principle of least effort, i.e., cash transactions can be settled with as few tokens—coins or bank notes—as possible.** This principle is important for the convenience of users, and for issuing institutions due to the reduced cost of having fewer denominations. By cutting down on the number of coins and bank notes in circulation, a streamlined or optimized denomination mix is thus more efficient for all the stakeholders concerned. As mentioned above, while Canada has a reasonably good denomination structure, as prices and standard of living continue to rise, a number of improvements may well be warranted.

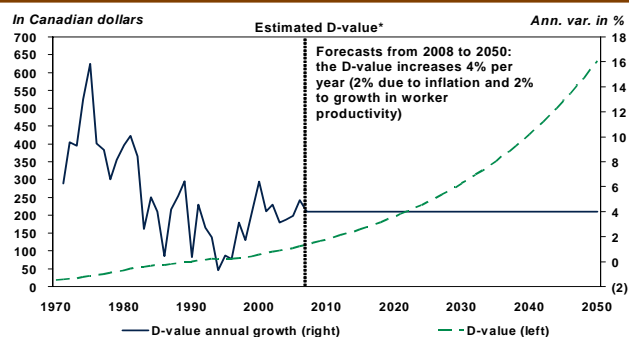
4.2 ANALYSIS OF OUR DENOMINATION STRUCTURE USING THE D-METRIC MODEL

Among the methods to analyze the sequence of denominations in circulation over time in a given country, **the D-metric model**

is known for its simplicity and ease of use.¹⁹ In fact, the D-metric model identifies when a country should change its denomination structure to reflect erosion of purchasing power by inflation. It also helps economic agents make their cash transactions as efficiently as possible by specifying only the range of denominations appropriate for agents' purchasing power (i.e., that they use as few denominations as possible in relation to their purchasing power). However, given that it has a certain margin of error, the model should only be viewed as an indicator, among others, of whether or not some denominations should be removed. Moreover, **other factors should be taken into consideration; i.e., the public's use of each denomination, the purpose of this use and the cost of producing denominations.** This aspect will be discussed at greater length in section 4.3.

The key variable in the D-metric model is the amount of the average day's net pay (referred to as D-value). Its exact definition for Canada is as follows: total nominal labour income minus personal transfer payments made to governments, divided by the total number of business days. The figure is then re-divided by the total number of jobs to bring the figure down to a per-worker basis. **This variable shows the change in the average worker's daily purchasing power in a given country.** It fluctuates over time with the inflation rate and economic growth (productivity, shifting economic conditions, interest rate movements, etc.). Graph 4 below shows the evolution of the D-value in Canada between 1970 and 2050. At approximately \$18 in 1970, the D-value is currently about \$120 and should increase, on average, 4% per year for the next 40 years. It will reach approximately \$180 in 2018 and \$270 around 2028.

Graph 4 – Change in the average day's net pay of a Canadian worker (D-value)



* The D-value corresponds to labour income minus personal transfer payments made to governments divided by the total number of business days and workers.
Sources: L. C. Payne and H. M. Morgan (1981), Statistics Canada and Desjardins, Economic Studies

¹⁷ Technically, this involves a spread where the denominations increase between the powers of 2 and 3. The powers-of-two system can be defined as follows: 1-2-4-8-16-32-64-... and the powers-of-three: 1-3-9-27-81-243-729-...

¹⁸ In an optimal sequence (in mathematical language, a harmonic series), the ratio between two consecutive denominations is a constant, as for example in the following sequences: 0.01-0.1-1-10-100-1,000... or 1-5-25-125-... Of course, these spreads have no meaning for a country's denomination structure. Hence, a compromise has to be found between, on the one hand, a system that resembles the constant ratio between consecutive denominations and, on the other, one that is easy to use for individuals and issuing institutions.

¹⁹ Other models exist such as the Hentsch method and econometric analyses, notably that of Boeschoten's model.

Table 5 – The years of major changes in the management of Canadian denominations according to the D-metric model

D-value	Exclusion threshold, value smaller than:					Coin/note boundary		Bank notes						Year	
	Coins														
	D/2,000	D/1,000	D/500	D/200	D/100	D/50	D/20	D/10	D/5	D/2	D	2D	5D		
\$20	1¢	(2¢)	5¢	10¢	25¢	(50¢)	\$1	\$2	\$5	\$10	\$20	\$50	\$100	1972	
\$50	1¢	(2¢)	5¢	10¢	25¢	(50¢)	\$1	\$2	\$5	\$10	\$20	\$50	\$100	(200)	1982
\$100	(2¢)	5¢	10¢	25¢	(50¢)	\$1	\$2	\$5	\$10	\$20	\$50	\$100	(200)	(500)	2003
\$200	5¢	10¢	25¢	(50¢)	\$1	\$2	\$5	\$10	\$20	\$50	\$100	(200)	(500)	(1,000)	2021
\$500	10¢	25¢	(50¢)	1 \$	\$2	\$5	\$10	\$20	\$50	\$100	(200)	(500)	(1,000)	(2,000)	2044

Note: The 2¢ coin as well as the \$200, \$500, and \$2,000 bank notes are not in circulation in Canada whereas the 50¢ coin exists but is not widely circulated and the \$1,000 is no longer issued but remains in circulation. **The years presented in the table correspond to the years major changes should be made according to the D-value.**

Sources: L. C. Payne and H. M. Morgan (1981) and Desjardins, Economic Studies

The developers of this model define the structure of denominations in D-value multiples that provide a rule of thumb for deciding whether to maintain, remove or add coins and bank notes in a given country. In their view, the minimum coin denomination should have a value of D/5,000 (in reality equal to or greater than this ratio), and the largest-denomination coin should have a value of D/50. The other coins, if applicable, should correspond to a value of D/2,000, D/1,000, D/500, D/200 and D/100. Moreover, the smallest bank note should correspond to a value of D/20 and the largest to D multiplied by 5, with the other notes at D/10, D/5, D/2, D and 2D. Moreover, the note/coin boundary should be between D/20 and D/50. However, a bank note should be replaced by a coin only between D/35 and D/50 in order to minimize, among other things, the costs of converting certain systems, notably vending machines, as well as to reduce the issuing institution's production and transport costs. Consequently, changes in D-value should be tracked and compared over time (see Table 5 above).

As such, according to this model, and with Canada's D-value currently at \$120, the Canadian denomination structure should comprise six coins (5¢, 10¢, 25¢, 50¢, \$1 and \$2) and six notes (\$5, \$10, \$20, \$50, \$100 and \$200). Moreover, the model calls for the penny's removal and the introduction of a \$200 bill as

well as a \$500 bill. However, Canada should wait before issuing the latter bill (see section 4.4.6 for our explanations). In 10 years, when the D-value is around \$180, the optimal sequence would then be seven coins (5¢, 10¢, 25¢, 50¢, \$1, \$2 and \$5) and six notes (\$10, \$20, \$50, \$100, \$200 and \$500). The model also suggests reintroducing a \$1,000 bill, but it would be better to postpone this decision (see section 4.4.6 for our explanations). Table 6 on the next page summarizes the results of the D-metric model for this year, in 10 years and in 20 years.

As the D-metric model suggests, three groups of decisions could be taken over the next 20 years:

Now:

- (1) Remove the penny (it should have been done many years ago, i.e., in 1982 according to the model),²⁰
- (2) Add a \$200 bill;

²⁰ According to the D-metric model, the penny should have been retired in 1982 or a little later given that Canadian currency does not include a two-cent coin. If the latter had existed, the model would have suggested its removal in 2003.

Table 6 – D-metric model results for the years 2008, 2018, 2028 and corresponding denominations

D/35
↓

Year	Coins in order of increasing value						Bank notes in order of increasing value							Year
	1 st	2 nd	3 rd	4 th	5 th	6 th	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	
D-metric result → 2008	0.06	0.12	0.24	0.61	1.22	3.48	6.10	12.19	24.38	60.96	121.92	243.83	609.58	← D-metric result 2008
Associated coin →	5¢	10¢	25¢	50¢ ⁽¹⁾	\$1	\$2	\$5	\$10	\$20	\$50	\$100	\$200	\$500	← Associated bank note
D-metric result → 2018	0.09	0.18	0.36	0.90	1.80	5.16	9.02	18.05	36.09	90.23	180.47	360.93	902.33	← D-metric result 2018
Associated coin →	5¢	10¢	25¢	50¢ ⁽¹⁾	\$1	\$2	\$5 ⁽²⁾	\$10	\$20	\$50	\$100	\$200	\$500	← Associated bank note
D-metric result → 2028	0.13	0.27	0.53	1.34	2.67	7.63	13.36	26.71	53.43	133.57	267.13	534.27	1,335.67	← D-metric result 2028
Associated coin →	10¢	25¢	50¢ ⁽¹⁾	\$1	\$2	\$5	\$10	\$20	\$50	\$100	\$200	\$500	\$1,000	← Associated bank note

⁽¹⁾ While rarely used, the 50-cent piece is part of the Canadian monetary denomination.

⁽²⁾ In 2018, given that D/35 is greater than 5, the \$5 denomination should be replaced with a coin.

Sources: L. C. Payne and H. M. Morgan (1981) and Desjardins, Economic Studies

Within 10 years:

- (3) Replace the \$5 bill with a \$5 coin,
- (4) Add a \$500 bill;

Within 20 years:

- (5) Remove the five-cent coin,
- (6) Add a \$1,000 bill.

This list of changes suggested by the D-metric model clearly illustrates that inflation does not ultimately result in an increase in the number of denominations but rather in a gradual increase of their value, a **normal process in any modern economy**.

4.3 ADDITIONAL QUESTIONS

As prices rise, the D-metric model is a very useful tool for governments to determine the most appropriate time to change their denomination structure. **However, governments must**

temper any conclusions they draw from this model with other information that can affect the timing of certain changes. Factors such as production volume and popularity of and cultural attachment to the denomination are important to consider. More specifically, the following information should be taken into account:

- **Data on the use of small-denomination coins:**

Is the denomination being used and put back into circulation in the retail distribution system or simply hoarded by consumers? Is the denomination unpopular among consumers for practical reasons (coin size for example) or for psychological reasons (as is the case with the \$2 bill in the United States)? Should a denomination be kept in circulation simply because people have an affinity for it?

- **Data on the quality of small-denomination notes:**

Are the notes only returned to financial institutions when they are so dilapidated, they must be destroyed

(smallest note syndrome²¹)? Is there a greater need for the denomination to be a coin rather than a bank note?

- **Data on the demand for large-denomination notes:**

Have the other payment methods reduced the demand for these large denominations? Are these denominations primarily used for illegal activities, particularly money laundering?

4.4 OUR RECOMMENDATIONS WITH REGARDS TO CANADIAN DENOMINATIONS

Following the previous results, we would like to make the following recommendations and comments concerning certain coins and bank notes:

4.4.1 THE PENNY

The penny should have been eliminated from circulation in the early 1980s. **The government has waited far too long to remove this coin**, which is produced in vast numbers each year simply because so many Canadians hoard it. Besides reducing costs for Canadian society, its removal would make the payment system more efficient because fewer coins would be used per transaction.²²

4.4.2 THE FIVE-CENT COIN

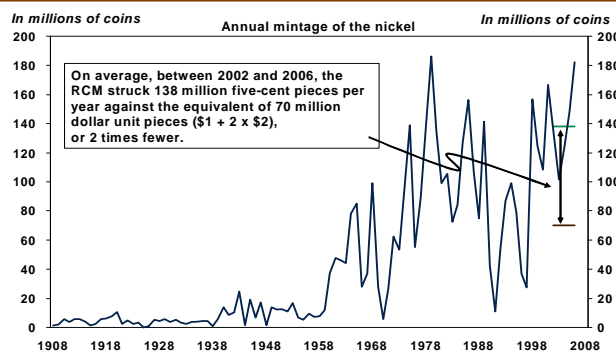
The penny must first be successfully eliminated before withdrawing the five-cent coin. **Five or 10 years after the penny is gone, and contrary to the D-metric model, which suggests removing it much later, the government should consider the merits of eliminating the nickel.** More specifically, the government would have to evaluate whether consumers tend to hoard rather than use this coin for their cash transactions as is currently the case with the penny.

²¹ When a currency's purchasing power falls, the speed at which its smallest note wears out goes up. This phenomenon is referred to as the smallest bank note syndrome. To avoid the cost of depositing these notes and obtaining replacements, merchants tend to hold on to them longer. Many notes in circulation are in such bad condition that the central banks or issuing institutions have no choice but to destroy them and issue new ones on the retail market. As a consequence, production costs for the smallest notes continue to rise and it becomes imperative to replace them with coins. Canada experienced this very situation with its \$1 and \$2 bills in the 1980s and 1990s respectively. At the present time, the \$5 bill appears to be headed in the same direction. The notes in circulation are either in very poor condition or brand new because they have just been printed.

²² A number of studies show that removing the smallest coins from circulation tends to reduce the number of denominations per transaction and thus makes the retail payment system more efficient.

According to a survey conducted by Desjardins Group in February 2007,²³ almost half of Canadian consumers no longer use this coin for their cash payments. This proportion will likely exceed two thirds within the next 10 years. Moreover, the annual production of the five-cent coin is already relatively high, i.e., 138 million pieces, on average, over the past 5 years (see Graph 5 below). In our view, this means that more people are hoarding this coin. It would also be a good idea to evaluate the number of five-cent coins returned through the government's new recycling program.²⁴ The higher the number, the greater the sign that this coin is more rarely used for commercial transactions, in which case its removal should be considered in the short-term.

Graph 5 – Annual production of the five-cent coin compared to the production of \$1 and \$2 coins



Sources : Royal Canadian Mint website and Desjardins, Economic Studies

The question of rounding transactions will come up again, but this time to the nearest 10 cents. However, as it was the case in New Zealand, the experience of rounding to the nearest five cents following the penny's removal should make Canadians more confident about the fact that rounding to the nearest 10 cents will be done symmetrically, and more importantly, without creating an upward pressure on prices.

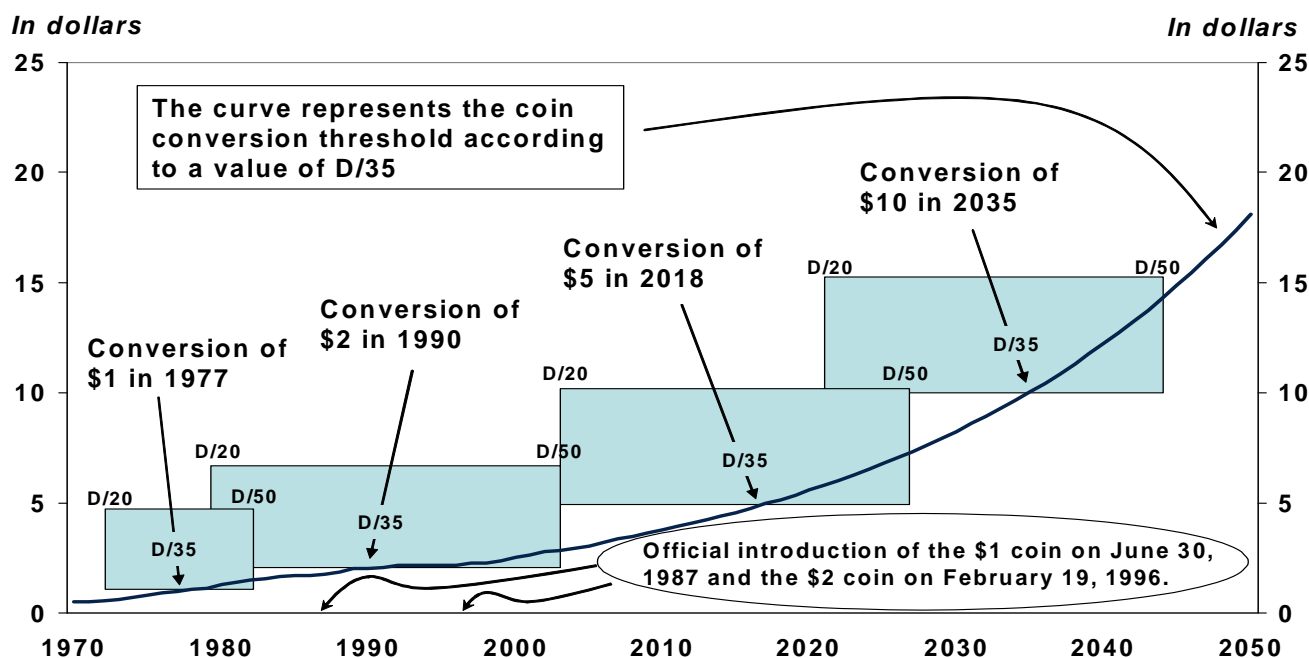
4.4.3 THE 50-CENT COIN

"The 50-cent coin has hardly been used for commercial transactions for the past few decades, but it remains popular among collectors." This statement taken from the RCM website tells the tale of the 50-cent coin. **Used primarily for numismatic purposes, it is essentially a collector's coin.** Consumers do not use it to pay for their cash purchases and merchants do not use it when giving change to consumers and have no space for it in their cash registers. Not surprisingly therefore, the annual average production of 50-cent coins in

²³ For more information, see the Press Release of February 15, 2007 entitled "Should We Say Goodbye to the Penny?"

²⁴ See section 5.4 for more information on this program.

Graph 6 – When to consider converting the smallest bank note to a coin in Canada according to the D-metric model



Sources: L. C. Payne and H. M. Morgan (1981), Statistics Canada and Desjardins, Economic Studies

the five-year period from 2002 to 2006 has been 83 times smaller than the corresponding figure for 25-cent coins (3 million compared to 248 million pieces).

This case clearly shows that consumers and merchants have their word to say on the usefulness of a coin or bank note for cash transactions. It is also quite apparent that consumers do not want to use too many denominations, particularly coins, for commercial transactions. **Concerning the 50-cent coin, its weight and size certainly worked against it;** its mass and diameter are respectively 57% and 14% greater than the 25-cent coin. The usefulness of the 50-cent coin should increase once the one-cent and five-cent coins are removed from circulation and a \$5 coin is introduced. However, we believe the government should follow the example of the Reserve Bank of New Zealand (RBNZ) and rethink the size and weight of its small-denomination coins. In fact, over the past 20 years, the RBNZ began by reducing the number of small-denomination coins in circulation (under \$1) from six to three (1¢, 2¢, 5¢, 10¢, 20¢ and 50¢ to 10¢, 20¢ and 50¢) followed by their size. Thus, on July 31, 2006, the RBNZ introduced smaller and lighter coins into circulation. The new 10-cent, 20-cent and 50-cent coins in New Zealand kept the same appearance as their predecessors except for the 10-cent coin, which is

The old and new small-denomination coins in New Zealand

Small Change



Smaller Change

Smaller coins, but of higher denomination



Source: Reserve Bank of New Zealand website

now copper-coloured. Lastly, the \$1 and \$2 coins were not modified.

4.4.4 \$1 AND \$2 COINS

The conversion from paper money to coins occurred at about the right time for the \$1 and a bit ahead of schedule for the \$2. The loonie should have been introduced, according to the D-metric model (i.e., between D/50 and D/35), between

1977 and 1982. Instead, it was officially introduced on June 30, 1987 (see Graph 6 on page 12). For its part, the toonie should have appeared between 1989 and 2003 but was officially introduced on February 19, 1996. The federal government decided to proceed more quickly in this regard in order to reduce costs and also to meet the demand of merchants, particularly from businesses conducting transactions with coin-handing machines and coin dispensers (for example, public transit, parking, etc.). The stronger demand for \$1 and \$2 coins over their paper counterparts shows that these denominations are more useful in coin form.²⁵ **At the time, the quality of \$1 and \$2 notes in circulation had deteriorated substantially (smallest bank note syndrome), which signalled the need to replace them with coins.**

4.4.5 THE \$5 BANK NOTE

As mentioned earlier, the \$5 bill is now beginning to suffer from the smallest bank note syndrome. The state of these bills is making them increasingly unfit for circulation and their lifespan is also becoming shorter (just over a year according to the Bank of Canada²⁶). **While the \$5 bill's conversion to a coin should be postponed as long as possible in order to minimize the costs of the change, the currency's ever-shortening lifespan should also be considered since bank note replacement costs are directly affected.** According to the D-metric model, the \$5 bill's conversion should occur within the next 10 years (see Graph 6). While not the main consideration, consumers' attachment to the \$5 bill should also be taken into account. Lastly, past experience in Canada and elsewhere shows that if the issuing institution waits too long to replace a bank note suffering from the smallest bank note syndrome, its condition will deteriorate to such an extent that circulation will slow over time and the denomination structure will become less efficient.

Two final observations can be made with regards to the \$5 bill. First, while not an essential consideration (see introduction), the money the federal government would save by replacing the bill with a coin would increase the seigniorage associated with this denomination, particularly if demand increases over the years.²⁷ Second, the introduction of a \$5

coin should ultimately result in fewer total coins in the pockets of users, especially if the one-cent and five-cent coins are removed from circulation. Canadians will be more likely to accept these changes **if the government, in addition to reducing the number of coins, also reduces their weight and size.**²⁸

4.4.6 \$200, \$500 AND \$1,000 BILLS

On May 12, 2000, the Bank of Canada stopped issuing the \$1,000 bill. Commencing on this date, when holders deposited them in the bank, these notes were removed from circulation.²⁹ Issued by the Bank of Canada since its inception in 1935, \$1,000 bills were largely an accident of history. Prior to 1935, these notes were used to settle local banks' clearing operations. Over the years and decades, it was only as the real value of these denominations fell that they began to be used in general circulation.³⁰ In 1999, the total number of \$1,000 bills in circulation amounted to 3.9 million, representing only 0.3% of the total number of notes in circulation issued by the Bank of Canada. Today, in Canada or elsewhere in the world, there are just over one million of these notes in circulation. The \$1,000 bill, which represented an even smaller proportion of bank notes used for cash transactions because they were put back into circulation in the retail distribution system far less quickly than other bank notes,³¹ was taken out of circulation in an effort to fight money laundering and to a larger extent, organized crime. In this regard, authorities considered that these bills facilitated too many illegal activities (essentially drug trafficking, gambling, prostitution and extortion).³²

An analysis of whether or not large denominations should be issued must take the following three considerations into account:

²⁸ In Canada, because ATMs usually dispense only \$20 bills, demand for these notes has risen sharply. Moreover, merchants typically use \$5 bills to hand out change on purchases made with \$20 bills. As a result, demand for these two denominations is strong, to the detriment of the \$10 bill.

²⁹ See the Bank of Canada's press release of May 8, 2000: <http://www.bankofcanada.ca/en/press/2000/pr00-8.html>.

³⁰ For many years Canada had the distinction among the largest countries of the world of issuing the largest denomination bank note. However, following the appreciation in the 1970s, and to a lesser extent, in the 1980s of the German mark and Swiss franc, the 1,000 mark and 1,000 Swiss franc bank notes reached a value in the 1990s similar to the Canadian \$1,000 bill. For its part, the U.S. stopped issuing the following denominations in 1950: \$500, \$1,000, \$5,000 and \$10,000.

³¹ In technical terms, we mean that these notes have a low circulation velocity or speed.

³² It should be noted that even if the underground economy remains illegal as regards taxes, some of the activities are not by nature criminal.

²⁵ The conversion to coins allowed the federal government to save close to \$500 million over 20 years.

²⁶ Compared to two to four years for \$20 bank notes and seven to nine years for \$100 bank notes according to the Bank of Canada.

²⁷ It bears mentioning that seigniorage is the revenue a country earns from issuing fiat money, minus its cost to produce, circulate and maintain the currency (replacement of coins and, especially, used bank notes). In Canada, seigniorage currently stands at about \$2.1 billion per year, i.e., \$2 billion for bank notes and about \$100 million for coins.

- The usefulness of these bills for cash transactions (daily);
- The usefulness of these bills as a store of value;
- The usefulness of these bills as an anonymous financial asset (they leave no trace and are not registered in the holder’s name).

For example, \$5 and \$20 bills are used extensively for cash transactions primarily because ATMs typically dispense only \$20 bills, and \$5 bills are most often used for making change. However, **the \$1,000 bank note is useful because it is a store of value as well as an anonymous financial asset.** It bears mentioning that the D-metric model described earlier does not recommend re-issuing this bank note at the present time. Clearly, this would also have been all the more true in 1935. The reason stems from the fact that the D-metric model focuses on the usefulness of a denomination for daily cash transactions, i.e., the need for a denomination in relation to the average purchasing power of workers. It is with this in mind that the model’s following recommendations should be weighed: **keep the \$100 bill in circulation; in a few years consider introducing a \$200 bill in order to adjust to the rising prices** and in order to reduce the total number of notes in circulation.

However, it would be appropriate to wait another decade or so before issuing one or more denominations larger than the \$100 bill. In the past few years, the relationship between inflation and the level of cash payments has blurred, particularly for large denominations. **The inflationary effect has been tempered by the proliferation of new payment methods.** Moreover, Canada resembles most other countries, except the euro zone and Switzerland, in terms of its largest bill in circulation (see Table 7 below). Before introducing large denominations, it is important to first ensure that most merchants will accept \$50 and \$100 bills for cash payments. Relatively high counterfeiting rates have raised concerns

among business owners who prefer more secure methods of payment (notably debit cards, credit cards and soon, smart cards). However, this attitude may change if the observed reduction in the counterfeiting rates resulting from the introduction by the Bank of Canada of a new series of more secure bank notes persists.

While the \$200 bill will not be introduced within the next few years and the \$500 bill is decades away, the government should routinely assess its denomination structure. There may come a time when the only way to reduce the total number of denominations in circulation is to create new, larger ones, provided there is demand in this regard. Generally speaking, **when rising prices continue to erode a currency’s value, the smallest denomination quickly becomes obsolete. Conversely, when circulation of the largest bank note increases, a larger denomination will eventually have to be introduced.**

5. SIX MYTHS TO DEBUNK

This study concludes by refuting the main arguments against the penny’s removal.

5.1 MYTH NO. 1: REMOVING THE PENNY WOULD BE INFLATIONARY

As mentioned earlier, many Canadians fear that removing the penny from circulation would increase inflation. They think that rather than round cash transactions symmetrically to the nearest five cents, merchants would tend to round up prices to their advantage and thus create inflationary pressures. However, the experience of many countries (for example, New Zealand and Australia) has clearly shown that this does not occur. Moreover, as predicted by economic theory, rounding is done symmetrically in these countries due to the competitiveness of retail trade. There is no reason to believe that Canada would be any different in this regard. While experts have written extensively on the topic and many empirical and theoretical studies have proven otherwise, many people still publicly claim that removing the penny would drive prices up. However, we believe they would still cling to their views even if the number of studies refuting their claims were doubled or even tripled. **Suffice it to say that the economic arguments and past experience of many countries shed enough light on the topic (see box on the following page).**

Why are these misconceptions still around and why are they still being pushed by many public stakeholders? **The successive governments of the past few years have not considered relevant to inform Canadians about the result of these studies.** The topic has therefore remained ambiguous and even created a real fear that rounding would tend to increase inflation.

Table 7 – The smallest and largest bank notes in the main industrialized countries

	Smallest bank notes		Largest bank notes	
	In local currency	In Canadian dollars ⁽¹⁾	In local currency	In Canadian dollars ⁽¹⁾
Canada	5	5	100	100
United States	1	1	100	100
United Kingdom	5	10	50	99
Euro zone	5	7	500	716
Sweden	20	3	1,000	152
Norway	50	9	1,000	178
Denmark	50	10	1,000	192
Switzerland	10	9	1,000	863
Japan	1,000	9	10,000	88
Australia	5	4	100	86
New Zealand	5	4	100	76

(1) Exchange rate as of December 20, 2007.
Sources: Bank of Canada, United States Mint, Bank of England, European Central Bank, Riksbank, Norges Bank, Danmarks Nationalbank, Swiss National Bank, Bank of Japan, Reserve Bank of Australia, Reserve Bank of New Zealand, Datastream and Desjardins, Economic Studies

WHY WILL REMOVING THE PENNY NOT HAVE AN IMPACT ON INFLATION

The economic arguments: first, the second decimal of the retail process (after taxes and after rounding) will be distributed uniformly, meaning that rounding to the nearest five cents will be symmetrical, i.e., will cancel itself out over a large number of transactions. Second, this symmetrical rounding will, in average, have no effect on business profits or on the prices paid by consumers and will therefore not be inflationary. In a competitive environment, prices reflect costs and move in tandem. Third, if prices were rounded up more often than down (which, we reiterate, will not be the case over a large number of transactions), the adjustment of the price level will only occur once. In other words, there will be a one-time price adjustment. Fourth, cash transactions account for just a small proportion of the basket of goods and services purchased by consumers and are often below \$20. Hence, their impact on the inflation rate is negligible. Fifth, for marketing reasons and depending on the nature and price of transactions, businesses may round retail prices down more often than up, which would therefore result in a slight decrease in inflation. This is precisely what occurred in several countries after their smallest coin was removed from circulation. Hence, for all these reasons, the penny's removal would not unduly favour business and drive inflation up. Lastly, in a competitive environment, would any merchant want to be characterized as someone who systematically adjusts prices upward? The answer is obvious.

Experiences of some countries: the countries that no longer use or removed their small-denomination coins include Australia, New Zealand, Finland, Netherlands and Belgium. In all these cases, prices were rounded symmetrically and prices did not go up. In the short term, some countries even saw their retail prices fall slightly. An experiment conducted in various U.S. states also showed these results.

Lastly, some people are drawing a comparison between the introduction of new currency in 2002 in the euro zone and the removal of coins from circulation. This type of statement merits clarification. Effectively, member nations saw their coins and national bank notes replaced by a new currency—the euro. The complexity of national currency conversion rates to the euro did drive inflation up temporarily in some countries as for example, food and clothing prices rose. However, competitive forces resolved this situation in the medium term. This cannot be compared to removing a single coin—the smallest denomination—from a given currency.

Moreover, to complicate matters further, until last year, the RCM has remained rather mute on the penny's inordinately high production level. Finally, in its 2006 annual report, in which it should have explained why the annual production of the penny had reached 1.2 billion pieces, it briefly mentioned that this issue required further analysis in collaboration with the Department of Finance and the Bank of Canada.³³ Admittedly, the RCM is in a rather difficult position. If it suggests the penny's removal to the Department of Finance, it would then lose, in the short term, more than half of its national production of Canadian coins.³⁴

The Department of Finance and the RCM jointly published a market study on this issue in fall 2007.³⁵ However, the authors do not inform Canadians on the merits of certain economic arguments or the pros and cons of the penny's removal. They simply report the opinions of the various economic agents (consumers, merchants, financial institutions, armoured car companies, etc.) on the withdrawal of the penny and on what should be done if the government were to make this decision. Prepared by a marketing firm, this study mentions that in the two to three years following a decision to remove the penny from circulation, studies should be conducted to evaluate the resulting inflationary consequences. Would the government make such a decision without first evaluating the consequences of removing the penny from circulation on price levels? Probably not. In our view, this discussion only fuels

³³ See page 27 of the RCM Annual Report 2006.

³⁴ However the current situation is different from the past. As mentioned in section 3.3, retiring the penny would free up production capacity to produce coins for other countries. The RCM would therefore not see its total production affected.

³⁵ "The Future of the Penny in Canada," a market study conducted by Altitude Marketing Research on behalf of the RCM and the Department of Finance.

the fear of asymmetrical rounding and inflation. **In fact, one of the conclusions of an internal RCM report published in 2000 was that eliminating the penny would not be inflationary.**³⁶

According to the market study published last fall, if the government were to decide to remove the penny, it would clearly explain its reasons to the public. However, ensuring that the public debate is based on a better understanding of the issue by providing information in this regard is currently not a government priority. We think it is high time that the government share its expertise on the matter and provide the Canadian public with accurate information.

By participating in various forums to explain the results of our February 2007 study, we have learned that when Canadians receive a clear explanation on the issue, they understand that their inflation fear is unfounded. **Once they are well-informed, Canadians overwhelmingly support the penny's removal.**³⁷

5.2 MYTH NO. 2: THE PENNY'S REMOVAL WOULD INCREASE DEMAND FOR OTHER SMALL-DENOMINATION COINS (NICKEL, DIME AND QUARTER)

One of the arguments used to minimize the net benefit of removing the penny is to say that production of the other low-denomination coins will have to be increased (nickel, dime and quarter). We analyzed the production of these pieces in New Zealand, before and after their one-cent and two-cent coins were removed. From 1968 to 1987, New Zealand issued, on average, 26.6 million five-cent, 10-cent and 20-cent coins per year (see Table 8). With the removal of the one-cent and two-cent coins, the average production of small-denomination coins (5 cents, 10 cents and 20 cents) for the following period from 1988 to 2004 remained almost unchanged, i.e., 26.8 million pieces. The decrease in production of 10-cent and 20-cent coins almost completely offset the corresponding 31% (4.3 million) increase in the number of five-cent pieces. This increase was very small compared to nominal GDP growth between these 2 periods and to the 40 million coins reduction

Table 8 – Annual average coin production in New Zealand: before and after removal of the one- and two-cent coins

	1968-1987	1988-2004	Variation (in %)	Variation (in millions)
20¢ coins	5.8	2.2	-62.1	-3.6
10¢ coins	6.8	6.3	-7.4	-0.5
5¢ coins	14.0	18.3	30.7	4.3
Subtotal	26.6	26.8	0.8	0.2
2¢ coins	18.3	0	—	—
1¢ coins	21.6	0	—	—
Total 1	66.5	26.8	-59.7	-39.7
2 X 2¢ + 1¢	58.2	0	—	—
Total 2	84.8	26.8	-68.4	-58.0

Note: While the one-cent coin was removed in 1989, the production of the coin was no longer significant in 1988, which explains why the averages were calculated for a period ending in 1987 and for a period beginning in 1988.
Sources: Reserve Bank of New Zealand website and Desjardins, Economic Studies

of the total production of coins, a number which is 9 times larger. Moreover, if we use a measure that represents the number of one-cent coins that New Zealand would have had in the absence of the two-cent coins (two times the number of two-cent coins multiplied by the number of one-cent coins), the reduction in the annual production would have been 58 million units, or 13 times less than the increased production of the five-cent coin.

This analysis leads us to conclude that New Zealand's decision to remove the one-cent and two-cent coins did not boost demand for their other low-denomination coins (5 cents, 10 cents and 20 cents). Indeed, this decision was confirmed by one of the executives of the Reserve Bank of New Zealand (RBNZ). In short, **it is clear that the potential increase in production of small-denomination coins in Canada (nickel, dime and quarter), if the penny were removed, is very small compared to the production savings (between 1 and 1.5 billion coins) that would result from its removal.** Once the penny is removed, if production of the five-cent coin rises slightly because it is perceived as still being useful, this would be a good thing. However it is more likely that Canadians will continue to hoard the nickel, because its purchasing power is already very small and will only continue to become smaller over the next few years. Ultimately the nickel will have to be relegated to the museum of coins, alongside the penny.

5.3 MYTH NO. 3: REMOVING THE PENNY WILL REDUCE TRANSACTION (COMMERCIAL, FINANCIAL OR OTHER) ACCURACY

Some people view the penny as the keystone of our structure of coins and notes, and even of our monetary system. Without it, our denominations and payment system cannot be efficient and accurate. In its editorial of November 8, 2007, a large city daily informed its readers that the penny has a certain value of usefulness, because currency traders use a Canadian rate

³⁶ See the following quote on page 14 of the Sussex Circle Report: "Our analysis does not support the notion that rounding would be inflationary." This internal document was obtained thanks to the *Access to Information Act*.

³⁷ As proof, two TVA surveys conducted in the *Journal de Montreal* (in February and July 2007), following the release of our first study on the topic, showed that close to 80% of Quebecers support the penny's removal. Once they know the facts, people lean in favour of removal, particularly when the question asked is specific and direct. If it were better informed, the public would be much more disposed to removing the penny. For this very reason, the program to remove the penny must be accompanied with a good communication plan.

of exchange to fractions of a cent (for example, US\$1.0252).³⁸ **In our view, this is a flagrant misinterpretation of the monetary system.** What the newspaper failed to say is that in New Zealand, currency traders use a rate of exchange with the same level of accuracy as it did 20 years ago even if they no longer have one-cent, two-cent or five-cent coins in circulation.

If the penny is retired, only cash transactions will be rounded to the nearest five cents. All other payments (by cheque, credit card, debit card, bank transfer, etc.) will continue to be settled to the nearest cent. In addition, the prices of the various goods and services will still be posted and charged to the nearest cent. Table 9 below shows an example of a purchase before and after the penny's removal.

Table 9 – Example of a purchase of four \$4.99 items

Before the penny's removal		After the penny's removal	
4 X \$4.99 =	\$19.96	4 x \$4.99 =	\$19.96
Tax 7%	\$1.40	Tax 7%	\$1.40
Total	\$21.36	Total	\$21.36
Settlement		Settlement	
Payment other than cash	\$21.36	Payment other than cash	\$21.36
Payment in cash	\$21.36	Payment in cash	\$21.35
		The retailer absorbs a one-cent loss	

Source: Desjardins, Economic Studies

Furthermore, **the process of rounding causes no problem to the price setting mechanism of the consumer goods and services.** For consumers and merchants, the maximum loss or gain due to rounding will be two cents on a cash transaction, regardless of its value. If prices are rounded symmetrically, at the end of the year, the gain will offset the losses, both for consumers and merchants (see table 10 opposite). Besides, as mentioned earlier, merchants will probably round certain prices in favour of customers.³⁹

If the Reserve Bank of New Zealand (RBNZ) had noticed a problem in terms of the accuracy and efficiency of its cash

³⁸ The editorial published in the *Calgary Herald* (November 8, 2007) and in many Canadian newspapers stated: "[... Critics say it costs more to produce a penny than it's actually worth. Maybe so, but not completely. Otherwise, currency traders wouldn't talk in terms of a fraction of a cent. The dollar's worth is in fact measured to the fourth decimal place...]."

³⁹ This would be a relatively temporary effect on price levels, because there would be only one wave of price rounding. The level of certain prices could therefore fall slightly as was the case in New Zealand.

Table 10 – Gains and losses due to rounding to the nearest five cents

Transactions values ending in (in the cent column)	Proportion	Effect of rounding on a transaction	Gain or loss for the consumer
0 or 5	20%	No change	0 cent
1 or 6	20%	The merchant absorbs a one-cent loss	+ 1 cent
2 or 7	20%	The merchant absorbs a two-cent loss	+ 2 cents
3 or 8	20%	The merchant gains two cents	- 2 cents
4 or 9	20%	The merchant gains one cent	- 1 cent
Taking into account the proportions for the five types of transactions, the average gain or loss is 0.			

Source: Desjardins, Economic Studies

payment system when it removed the one-cent and two-cent pieces from circulation, it would not have decided, in 2006, to also remove its five-cent coin. **New Zealand's experience clearly shows the importance of informing the population on the consequences of the penny's removal and, especially, the relevance of having all the facts before debating the topic publicly.**

5.4 MYTH NO. 4: THE COIN RECYCLING PROGRAM IN CANADA MEANS THAT IT WILL NO LONGER BE NECESSARY TO REMOVE THE PENNY AND EVENTUALLY THE NICKEL FROM CIRCULATION

In partnership with a private company, the RCM has recently begun installing self-service automated coin-recycling machines in certain supermarkets. Canadian consumers can use this service to return the coins they have been accumulating around the house. Without needing to count or roll the coins, consumers can empty their containers in a coin counter and receive a voucher equal to the value of the coins less 9.8% (management fee deducted from the total value of coins deposited). This voucher can be cashed at the supermarket checkout counter. Thanks to this program, the RCM can recycle these coins and put them back into circulation via financial institutions and thus cut down on its annual production.

In our view, it would not be surprising if the vast majority of coins processed in this way were pennies, given that they are the most hoarded pieces. Moreover, in 2007, the RCM probably recycled tens even hundreds of millions of coins, most of which were pennies. So does this mean that we no longer have to remove the penny from circulation? No, for the following reasons:

- If our assumption is correct that most of the recycled coins are pennies, this means the hoarding rate is high and that many people have stopped using these

coins for cash payments. **It therefore makes no sense to issue these coins only to recycle them in large quantities when in fact the primary goal of striking new coins is to meet the needs of the retail distribution system.**⁴⁰ Moreover, Canadians must pay a near 10% fee for this service. Where is the logic? Why keep the penny in circulation when its use by consumers continues to decline.

- If the program managed to substantially cut the penny's annual production and bring it back down to 2001-2005 figures—from 1.2 billion to 750 million pieces—the level would be the same as the one used in our first study, which called for the penny's retirement.
- Since our study was published in February 2007, two events have had an impact on our estimate of the annual cost of keeping the penny in circulation. First, annual production rose by more than 50% in 2006 over 2005. This increases our estimate to no less than \$150 million for the years to come, notably due to the greater volume of coins handled by merchants, financial institutions and consumers. For the government, this increase boosts its costs by close to \$6 million.⁴¹ Second, the recycling program cuts production down by tens, even hundreds of millions of pennies and saves the government approximately \$2 million for every 100 million coins recycled. If 500 million coins are recycled each year, the government will reduce its costs by about \$10 million. For merchants and financial institutions, this program brings no changes. For their part, rather than counting, rolling and depositing their coins, consumers can use this service provided they pay a management fee of 9.8%. Together, these two factors change our estimate for 2006 to around \$140 million. It bears mentioning that this is a very conservative estimate. **While the recycling program does generate savings, it does not bring annual costs down to an acceptable level.** In fact, the increased propensity of consumers to hoard coins observed in 2006 will only be exacerbated in the years to come. To reiterate, retiring the penny is the best solution for Canadians.

⁴⁰ According to the RCM annual report (page 27), this program helps not only to meet increased demand (which we referred to previously as artificial demand in the penny's case), but also returns alloy coins to the RCM, from which it extracts the metals.

⁴¹ Here is the calculation: 400 million coins at \$0.015 per piece equals \$6 million.

5.5 MYTH NO. 5: REMOVING THE PENNY MEANS SAYING GOODBYE TO PART OF OUR HERITAGE

There is no denying that after 100 years of use, the penny is part of our collective landscape. The coin is rich in symbolism. One need only think of the following expressions: "Every penny counts;" "Save your pennies and the dollars will follow;" "He saved penny after penny..." etc. But time marches on and things change. Even Unicef has stopped collecting pennies.

Year after year, rising prices will continue to erode the cent's purchasing power. Most Canadians already simply hoard rather than use the coin. This trend will continue and annual costs, which reached at least \$150 million in 2006 (over \$140 million if the recycling program is taken into account), will continue to rise. How much longer does this have to go on: 5 years, 10 years, 20 years, or more than 50 years? With each passing year, the number of people who simply throw this coin away will only increase.

One of the consequences of keeping the penny in circulation will be that Canadians will increasingly lose respect for this coin, and even for the Canadian monetary system as a whole (coins and bank notes). **The attempt to protect a symbol is jeopardizing an even bigger and more important emblem for Canadian society – our currency.** In fact, the situation of the penny can be compared to a hockey player who has had a long and illustrious career but refuses to retire even when his performance deteriorates significantly. He gradually becomes less useful and ultimately is a liability to his team. He is increasingly booed by fans. We certainly would not like the situation for the penny and ultimately for the other denominations to deteriorate to this point. So why is the government taking so long to act?

In Canada, a similar discussion took place before the federal government decided to replace the dollar bill with the loonie. Some said that such a change would give Canadians and the rest of the world a negative image of our currency. Today, these comments are a distant memory, the loonie is widely used, and most people would be hard pressed to remember when we still had the dollar bill. Lastly, the loonie's introduction certainly did not prevent our currency from enjoying a meteoric rise in value and recently, even surpassing the greenback!

5.6 MYTH NO. 6: SALES TAXES AND CASH REGISTERS WILL HAVE TO BE MODIFIED IF THE PENNY IS REMOVED

Some merchants and, to a lesser extent, consumers believe that calculating sales tax will become complicated and that

cash registers will have to be reprogrammed if the penny is removed. Others even believe that consumption taxes will have to be readjusted. **This is yet another misunderstanding of the adjustment process involved in the penny's retirement.** First, only the totals of cash transactions will be rounded to the nearest five cents. The example in Table 9 on page 17 illustrates a purchase of a variety of items totalling \$21.36, taxes included. How much will consumers pay? By credit or debit card, the consumer will pay \$21.36. If the consumer gives the merchant \$25, he will receive change of \$3.65, because the bill of \$21.36 will be rounded to the nearest five cents, or \$21.35. If the bill was \$21.38, the total would have been rounded to \$21.40. This practice is already widely used in service establishments (restaurants and hair salons for example) when customers pay cash.

What happens when stores balance their cash registers at the end of the day? First, merchants will not change their prices. When balancing their cash registers at the end of the day, they will enter a surplus or deficit of a few cents on their books in much the same way as when incorrect change is given to customers during a given day. Over several days or many transactions, the small surplus amounts will be almost the same as the deficit amounts. As such, prices will not have to be changed, taxes will not have to be recalculated and the cash register will not have to be reprogrammed, because credit or debit card transactions will still be made to the nearest cent. **The only new practice required will be rounding to the nearest five cents for cash purchases.**

Based on comments from merchants who already round to the nearest five cents, prices have not changed. In fact, when balancing their cash registers at the end of the day, they either enter a deficit or surplus of a few cents. Taxes are calculated and paid in the usual manner, cash registers have not been reprogrammed, customers are happy about not receiving pennies, and merchants save time (receiving and dispensing cash, cash balancing, etc.) The costs of obtaining penny rolls have also been eliminated. For their part, consumers are amenable to this adjustment because merchants are honest about rounding prices up or down. Lastly, wait times at the cash are reduced and payments are made more quickly. All in all, both merchants and consumers alike are satisfied with the experience.

6. CONCLUSION

What can we infer from this second study without reiterating the conclusion of our earlier work? What are the main messages that emerge from both studies?

The first message is that periodically re-examining the usefulness of coins and bank notes in circulation is a normal

and recommended practice. In doing so, the government must keep in mind the progression of prices, the increase of the standard of living and the changes in other payment methods. At various points in time, this will mean:

- Eliminating the smallest coin;
- Replacing the smallest bank note with a coin of the same denomination;
- Adding a large-denomination note (greater than the largest one in circulation).

Our second message is that world-renowned models can help the government conduct such analyses and relatively accurate signs from measurable data can allow the government to best identify when to make such changes. However these signs must be tempered by other more qualitative considerations and factors. In this regard, the analysis of Canada's situation leads us to believe three major groups of changes are warranted:

1. **Remove the penny from circulation as quickly as possible;** it should have been done in the early 1980s;
2. A few years later, the government should consider making a series of joint, carefully thought out and planned changes. In our view, **it should begin by removing the five-cent coin and replacing the \$5 bill with a coin of the same value** (as was done in 1987 with the \$1 bill and in 1996 with the \$2 bill). **It could then introduce a new series of smaller and lighter, small-denomination coins** (10 cents, 20 cents and 50 cents) as was done in New Zealand. The government could well decide to keep the 10-cent coin, given its current small size. Since removal of the nickel will then require rounding to the nearest 10 cents, **the government could decide to replace the quarter with a 20-cent coin in order to be consistent with the 1-2-5 sequence.** Because the value of cash transactions will all be a multiple of ten cents (for example, \$1.00, \$1.10, \$1.20, \$1.30...), the utility of the quarter will be strongly reduced. Lastly, **a new series of \$1, \$2 and \$5 coins could be introduced.** These coins should also be relatively lighter and smaller than their predecessors;
3. **Every five years, evaluate the relevance of introducing a \$200 bill,** taking into account changes in other payment methods, the perception of merchants as regards counterfeiting risk and the view of crime-fighting authorities.

Through its Department of Finance, **the Canadian government should also ensure that the public debate on these issues is based on quality data and studies.** Consequently, the government should be more proactive about preventing the proliferation of myths and misunderstandings on the topic. Too many people mistakenly believe that removing the penny will play in favour of merchants and increase inflation.

Lastly, notwithstanding technological advances and long-standing talk about the subject, the move to a cashless society remains the stuff of dreams. Because of the sense of security it affords, the habit of having paper money and coins is not something consumers will be ready to give up any time soon. In light of this, the points mentioned earlier take on even greater importance. In short, there is nothing wrong with rethinking and changing a monetary structure with a view to optimizing the retail payment system and reducing costs for society. However, **in the search for productivity, there are no small actions and economies to help countries reduce costs and become more competitive internationally.**

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