

The *Canadian Journey*: An Odyssey into the Complex World of Bank Note Production*

Jill Moxley, Helen Meubus, and Maura Brown, Communications Department

- *The Bank of Canada is responsible for supplying Canadians with bank notes that are secure and readily accepted by the public. Note security has always been the primary consideration behind the design and artwork of bank notes.*
- *To date, the Bank has developed a new series of bank notes approximately every 15 years as a way of staying ahead of counterfeiting.*
- *Rapid advances in computer technology that began in the late 1980s have changed the counterfeiting environment. In the process of designing and producing the *Canadian Journey* series of bank notes at the start of this decade, the Bank faced several challenges, including a sudden surge in counterfeiting activities.*
- *These challenges prompted the Bank to develop a new approach to its currency program. In 2002, the Bank adopted a comprehensive strategy to address counterfeiting: complementing increased bank note security with extensive public education and an intensified focus on law enforcement.*
- *This strategy, which involves active collaboration with the Bank's partners in the retail, law-enforcement, and legal communities, has reduced counterfeiting and increased public confidence in Canadian bank notes.*
- *The *Canadian Journey* series combines world-class security features and special user features with designs that represent the aspirations and accomplishments of Canadians.*

The creation of secure, attractive, and durable bank notes has always been challenging, but never more so than in the past decade, because of the rapidly improving technology available to counterfeiters. This article traces the development of the Bank's new anti-counterfeiting strategy as it evolved in parallel with the production of the new *Canadian Journey* series of notes.

To provide some background, the counterfeiting environment that evolved in the decades prior to the launch of the *Canadian Journey* series is described, together with details of the security features used in previous note series. This is followed by a discussion of the challenges encountered in developing the new series and the Bank's response. The final section reviews the valuable lessons that the Bank learned as it developed the *Canadian Journey* series.

Background: Counterfeiting and Confidence

Because bank note design has always been focused on ensuring that notes are accepted by the people who use them and that public confidence is maintained, security has been the main consideration in the design and artwork of bank notes (Bank of Canada 2006; Lefebvre-Manthorp 1988). Throughout the nineteenth and most of the twentieth century, along with the specialized paper on which bank notes are printed,

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the artwork itself was a major security feature. The ornate engraving and intaglio¹ created designs that made notes difficult to reproduce, thus protecting them from counterfeiting.²

Security has been the main consideration in the design and artwork of bank notes.

Since opening for business in 1935, the Bank has developed a new note design approximately every 15 years, because experience has shown that familiarity with a design allows counterfeiters to produce increasingly sophisticated copies that are accepted by the public. For example, it was not until 13 years after it was issued that the 1954 *Canadian Landscape* series was heavily counterfeited. In 1973, counterfeiting of the \$50 note from the 1954 series pushed counterfeiting levels to over 950 counterfeits detected per million genuine \$50 notes in circulation. For many years afterwards, retailers were reluctant to accept the \$50 note. In 1973, the \$5 note from the 1954 series was also heavily counterfeited.³

The Bank responded to these increased levels of counterfeiting with the multicoloured *Scenes of Canada* series, issued between 1969 and 1979. Because the range of tints beneath the dominant colours on these notes could not be easily reproduced through offset printing, the number of counterfeits fell dramatically (Chart 1).

Before the 1980s, counterfeiting was largely the domain of organized criminals, because the expert skills and expensive equipment required to produce counterfeits could only be financed by the extensive distribution networks maintained by such groups. The development of colour photocopiers in the 1980s, however, meant that counterfeits could be produced

using the costly and sophisticated equipment available in some offices and copy shops. As the 1990s progressed, so did technological innovation. Before long, anyone with a personal computer and an inkjet printer could produce passable facsimiles of the images on bank notes.

With the 1986 *Birds of Canada* series, the Bank introduced a state-of-the-art security feature: the OSD, or optical security device, which anticipated the use of colour photocopiers for counterfeiting. A rectangular foil patch applied to the upper left-hand corner of the higher-denomination notes (\$20 and up), the OSD shifted from gold to green when the note was tilted and was extremely difficult to reproduce.

Developed in partnership with the National Research Council, the OSD was first applied to the \$50 note in December 1989. As a security feature, it was easy to check, and because its colour-shifting property could not be reproduced by colour copiers or scanners, it protected the high-denomination notes in the *Birds of Canada* series from counterfeiting for most of the 1990s.

Two other security features introduced with the *Birds of Canada* series were not apparent to the public. These were an anti-copier feature, which causes commercial photocopiers to recognize and refuse to copy a bank note, and a digital watermark, which has the same effect on most personal computer printers and scanners. However, it took some time for machines that could read these codes to become widely deployed.

Challenges in Producing a New Note Series

The development of the *Canadian Journey* series took place in this environment of rapidly accelerating technological progress. In 1997, the Bank established a currency development team and, the following year, began a design partnership with its two security printers: BA Banknote (now BA International Inc.) and the Canadian Bank Note Company, Limited.

The team faced several key issues in developing the new note series: an environment of budgetary restraint in the public sector; the search for a more secure substrate;⁴ the choice of a design theme; the need to improve the readability of the notes by the visually impaired; and a surge in counterfeiting. In managing these chal-

1. Intaglio is a printing technique in which an image from a design is cut or etched into a metal plate, resulting in the image being reproduced in raised ink.

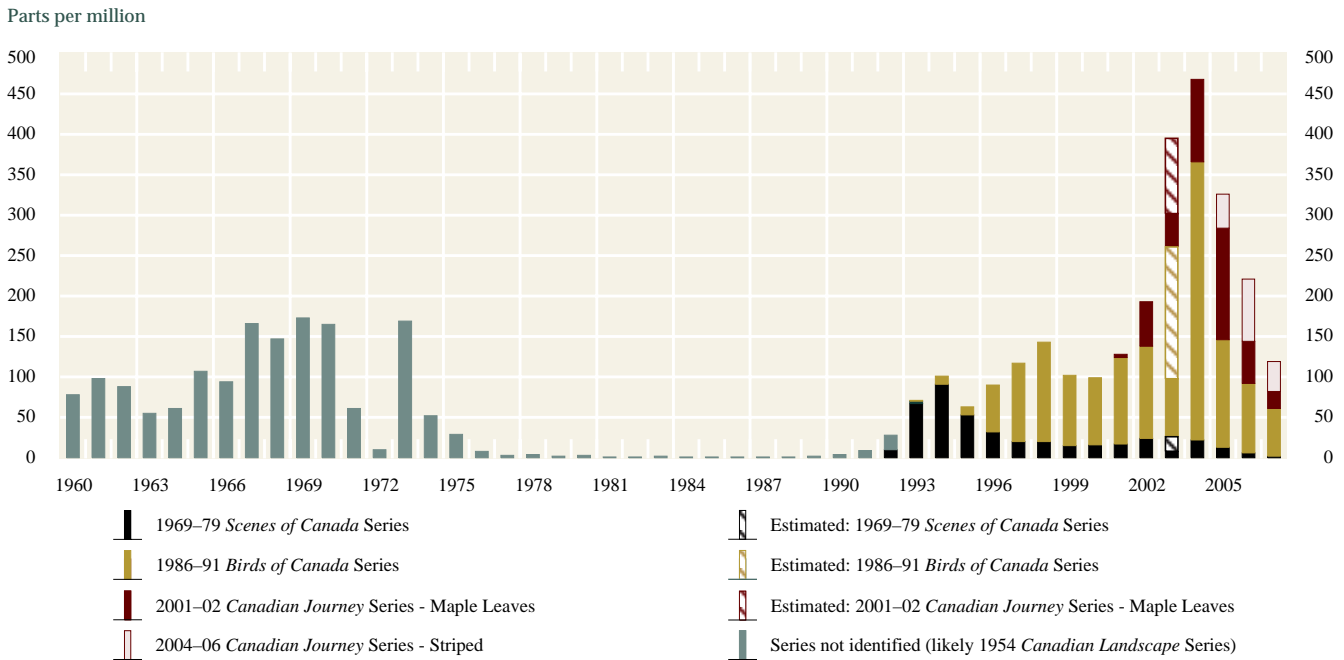
2. For an illustrated history of bank note design at the Bank of Canada, including details on the design and security features of previous note series, see Bank of Canada (2006).

3. Quarterly statistics on counterfeiting by series and by denomination are published in Table B4 of the monthly *Bank of Canada Banking and Financial Statistics*, now available at <<http://www.bankofcanada.ca/pdf/bfs.pdf>>.

4. Substrate is a term used in the security printing industry to refer to security paper that in itself offers basic security features such as fibre, a security thread, and a watermark. Substrates can also be made of polymer or consist of layers that sometimes sandwich an inner layer of plastic.

Chart 1

Counterfeit Canadian Bank Notes Passed for Every One Million Genuine Notes in Circulation (PPM)



lenges, the Bank learned several lessons, which it incorporated into a new anti-counterfeiting strategy, discussed later in this article.

The development of the Canadian Journey series took place in this environment of rapidly accelerating technological progress.

Budgetary restraint

In 1995, the federal government began a program review and a sweeping cost-cutting exercise to restore fiscal balance. The Bank embraced this policy direction and began its own review of operations in order to find more economical ways of conducting its business. In the process, the Bank closed seven agencies across the country in 1997–98 and outsourced the functions of note recirculation and inventory holding to the major financial institutions (Bilkes 1997).

The note-issuing department of the Bank, reacting to increased counterfeiting activity, had been advocating

the development of a new series before obtaining approval to go ahead in 1997. But the emphasis on cost cutting in the mid-1990s, as well as the influence of a number of other factors, affected some of the Bank’s choices as it moved forward with plans for the new series. Counterfeiting levels had been relatively low through to the mid-1990s, and the increasing popularity of debit cards suggested that there would be a reduction in the use of cash. Some financial observers were even musing about the possibility of a cashless society.⁵ The Bank reasoned that if Canada was moving in that direction, perhaps it should be cautious about investing in costly research and development for bank notes. Having spent millions of dollars over 16 years to develop the OSD, the Bank concluded that it might be more cost effective to buy products developed by the bank note industry. It focused its efforts on producing a new series of economical notes that would not only be more secure, but would last longer in circulation and have a life-cycle cost per note the same as, or lower than, that of the *Birds of Canada* notes, thanks to new developments on the substrate front.

5. See, for example, Bank for International Settlements (1996). The Bank of Canada was also exploring the issue (Stuber 1996).

The search for a substrate

For the substrate on which the notes of the new series would be printed, the Bank investigated several options on the market or under development before focusing on an experimental new material being developed by a major Canadian paper manufacturer. Trademarked as Luminus, this new substrate was a sandwich of durable polymer laminated between two sheets of paper (McGovern 1995). The longer life expectancy of notes printed on Luminus would reduce the cost of replacing worn notes. The internal polymer layer was also thought to offer increased security because it could carry a coloured image similar to a watermark.

Between 1995 and 1998, Luminus was tested in active circulation with 100,000 *Birds of Canada* \$5 notes. No major problems were identified, and in June 1998, the Bank was preparing to use Luminus as the substrate for the first two denominations of the *Canadian Journey* series—the \$10 and \$5 notes. In September 1999, this decision was extended to the higher denominations as well. However, technical issues with the production of Luminus, as well as questions about its market potential, led the owner of the technology to withdraw its offer to supply the product in December 1999.

As it became clear that Luminus would not be ready in time for the introduction of the first note in the *Canadian Journey* series (the \$10 note), the Bank opted to issue the note on a 100 per cent cotton fibre substrate with surface characteristics similar to those of Luminus. This substrate would permit a seamless transition to Luminus when it became available.⁶ In January 2001, the new \$10 note was issued using this substrate, followed a year later by the \$5 note on the same substrate.

Like the *Birds of Canada* notes, the original *Canadian Journey* notes featured microprinting, fine-line patterns, and intaglio print, as well as three new security devices:

- A *hidden number* to the left of the portrait that became visible when the note was tilted horizontally.
- *Fluorescent elements* consisting of: (i) random fibres on the face and back of the notes that glowed red or yellow under ultraviolet light; and (ii) printed images that appeared in blue over the portrait on the face of the

6. The Bank obtained the Canadian rights to Luminus and continued to develop it with the help of other partners, since it remained convinced of the value of the substrate.

notes under ultraviolet light. This relatively simple fluorescent feature was later developed into the more sophisticated fluorescence found on subsequent issues in the *Canadian Journey* series.

- *Three gold maple leaves* that were embedded in the design of the note face as an improvised substitute for the Luminus “watermark.” Printed in a pale iridescent ink, the leaves reflected the light when the note was tilted.

These security features did not prove sufficient to protect the *Canadian Journey* \$10 and \$5 notes against counterfeiting.

Choosing a theme

A major challenge in the development of any new series is the choice of a theme for the series and then the selection of specific subject material for each denomination. In 1997, for the first time, the Bank held public consultations across the country on themes for the new notes. The resulting choice was images of Canadian wildlife. Prototypes were designed and presented for approval.⁷

Consultations generated public interest in the notes and greatly contributed to the public's ultimate acceptance of the new series.

However, with the series being launched at the beginning of the new millennium, the government proposed developing a theme that would project a more modern image of Canada, one that reflected the country's diversity, history, and values. Over the next year, new rounds of public consultations were held. Once themes for the individual notes were chosen and approved, the Bank also consulted interest groups that had a stake in the content and accuracy of the various note

7. Under the Bank of Canada Act, S. 25(4), the “form and material” of bank notes are subject to approval by the Minister of Finance. These prototypes can be seen in *The Art and Design of Canadian Bank Notes* (Bank of Canada 2006, 100).

Box 1: *Canadian Journey* Design Themes

The design themes on the back of each note are:

\$5 note, Children at Play. The images of children skating, tobogganing, and playing hockey represent young Canadians as the future of our nation, and play as a healthy part of their physical, social, and cultural development.

\$10 note, Remembrance and Peacekeeping. The design commemorates the role of Canadians in past wars and evokes Canada's part in peacekeeping missions around the world.

\$20 note, Arts and Culture. Internationally renowned artist Bill Reid (1920–98) drew inspiration from the Haida culture of Canada's northwest coast to create

the works pictured: *The Spirit of Haida Gwaii*, *The Raven and the First Men*, *Haida Grizzly Bear*, and *Mythic Messengers*.

\$50 note, Nation Building. To mark the accomplishments of women who campaigned for equal rights and social justice, the design features the statue of the Famous Five that can be seen on Parliament Hill and in Olympic Plaza in Calgary, Alberta, as well as the Thérèse Casgrain Volunteer Award medallion.

\$100 note, Exploration and Innovation. A map of Canada drawn by Samuel de Champlain in 1632 and a birchbark canoe are paired with modern symbols of Canadian achievements in cartography and telecommunications.

designs. While consultations with these stakeholders⁸ required additional time and work, they generated public interest in the notes and greatly contributed to the public's ultimate acceptance of the new series (Box 1).

Features for the blind and visually impaired

In addition to leading-edge security features, *Canadian Journey* notes incorporate new features for the blind and visually impaired. In the 1970s, consistent with the new Canadian Human Rights Act, the Bank began to review and assess possible ways of making bank notes more user-friendly for this group. Research indicated that a hand-held electronic note reader would be a better solution than such features as Braille, which many blind and visually impaired people cannot read, or different-sized denominations, which would add significantly to the costs of processing bank notes. The note reader, which could distinguish among the different denominations and read them out in a synthesized voice, was first distributed to users in 1990 by the Canadian National Institute for the Blind (CNIB) on behalf of the Bank.

In developing the *Canadian Journey* series, the Bank worked closely with the CNIB to explore and test

alternative features. These consultations resulted in notes with many more user features that now serve a much wider group of individuals in the blind and visually impaired community:

- The colours on the notes were strengthened to assist people who have trouble distinguishing between browns and reds (the colours of the \$100 and \$50 notes) and purples and blues (the colours of the \$10 and \$5 notes).
- The numerals were enlarged and displayed on the front and back of the notes on two different, high-contrast backgrounds.
- A tactile feature was developed by the Canadian Bank Note Company in collaboration with Queen's University, the CNIB, and the Canadian Council of the Blind. While not Braille, the particular patterns of raised dots in the upper right-hand corner of each denomination identify the value of the note.
- The electronic note reader was made smaller, lighter, and more versatile.

The new features were very well received within the blind and visually impaired community, which numbers over 100,000. Upgrading the bank notes was a forward-looking initiative since, as the baby boom generation ages, the number of visually impaired users is expected to grow.

8. Stakeholders provided expert guidance on images to depict each theme. For example, stakeholders for the \$100 note, with its theme of Exploration and Innovation, included Natural Resources Canada, the Canadian Space Agency, the National Archives of Canada, and the Canadian Canoe Museum.

Box 2: Canadian Journey Security Features

The key security features of the *Canadian Journey* series are:

Metallic holographic stripe—Along the length of the stripe, multicoloured numbers and maple leaves change colour through the various shades of the rainbow. Half of each maple leaf reflects one colour, half another colour. Small numbers that appear in the background of the stripe indicate the denomination of the note.

Ghost image (watermark)—A small, ghost-like image of the portrait and the denomination number appear on the front and back of the note when it is held to the light.

See-through number—Like the pieces of a jigsaw puzzle, irregular marks on the front and back of the notes (between the watermark and the large numeral) form a complete and perfectly aligned number representing the denomination when the note is held to the light.

Security thread—A solid vertical line can be seen from both sides when the note is held to the light. On the back of the note, the security thread is visible as a dashed line that changes colour from gold to green when the note is tilted. The thread contains the text “CAN” and the denomination number.

Escalation of counterfeiting

In 2001, highly deceptive *Birds of Canada* \$100 notes featuring high-quality paper, fluorescent elements, and a copy of the OSD began turning up in stores along the length of the Windsor-Montréal corridor. In all, over 60,000 of these sophisticated counterfeit notes have been found in circulation. Some retailers in the concerned areas began displaying signs notifying their customers that they would no longer accept \$100 notes. Fuelled by media stories, their refusal soon caused retailers across Canada to follow suit. At the peak, approximately 10 per cent of Canadian retailers were posting signs indicating their refusal to accept \$100 notes.

As well, counterfeiting of the \$20 *Birds of Canada* note increased markedly between 2002 and 2004, and counterfeiting of the new \$10 *Canadian Journey* note rose dramatically. At the peak in 2004, counterfeiting of the \$10 and \$20 notes reached 1,292 and 601 parts per million, respectively.

A New Strategy

The Bank’s response to this surge in counterfeiting was to adopt a comprehensive strategy designed to meet both the challenges posed by counterfeiters and the needs of the public. Under the new strategy, adopted in early 2002, the Bank would increase the intrinsic security of notes, build awareness of security features through education, promote the deterrence of counterfeiting by law-enforcement agencies and

Crown prosecutors, and remove notes from older series from circulation.

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Increased security

As it became clear that Luminus would not be ready on time to meet the immediate need to quickly issue higher-security notes, the bank note team began to investigate proven substrates for the higher-denomination notes in the *Canadian Journey* series (\$20, \$50, and \$100).⁹ The Bank chose a cylinder-mould-made substrate of 100 per cent cotton fibre that could carry the sophisticated, but user-friendly, new security features: a metallic holographic stripe, a watermark, a see-through number, and a colour-shifting windowed thread developed from the Bank’s own OSD material (Box 2). This substrate was widely used by central banks in Europe and elsewhere.

9. At that time, Luminus was still the substrate of choice to reissue the lower-denomination notes.

Once government approval for this substrate was obtained, a European security-paper manufacturer was selected as the supplier through a competitive international tender, and all three *Canadian Journey* notes were issued in quick succession during 2004.^{10,11} Luminus did not measure up to the mould-made watermark, so the \$10 and \$5 notes were later upgraded with the more advanced features of the other denominations in the series and were reissued in 2005 and 2006, respectively.

At the same time, the Bank worked with financial institutions to accelerate the removal of older series notes from circulation.

Building awareness

In 2004, the Bank undertook a national communications campaign to increase awareness of the security features used on the \$20, \$50, and \$100 notes among retailers, financial institutions, and law-enforcement agencies. The campaign involved working with the media and providing training and information sessions conducted by Bank representatives at the regional offices (Bank of Canada 2005, 30).

In addition, with the issue of the high-denomination *Canadian Journey* notes in 2004, for the first time in the Bank's history, the unveiling of each new note took place several weeks or months prior to its release. These launches, to which the media and the Bank's partners were invited, occurred in the major cities across Canada where the Bank has regional offices. The advance publication of information about the notes gave the manufacturers of bank-note-processing equipment time to make adjustments and allowed retailers to familiarize themselves with the new notes so that they would readily accept them when they were put into circulation.

Promoting counterfeit deterrence

Education had been part of the Bank's currency program since the opening of regional offices in 1997, but playing an active role in counterfeit deterrence was new. In meetings with the law-enforcement and legal communities, the Bank began to draw attention to the social and economic costs of counterfeiting, which go far beyond the monetary loss suffered by the person who receives a worthless piece of paper (Healy 2002;

Chant 2004). The Bank devised tools which served as resources for retailers, police, and public prosecutors in deterring counterfeiting activities.¹² Partnering with the Bank in counterfeit deterrence led the Royal Canadian Mounted Police (RCMP) to identify economic integrity as one of its strategic priorities in 2005. More recently, in May 2007, the Bank, the RCMP, and the Minister of Public Safety announced the launch of nationwide Integrated Counterfeit Enforcement Teams (ICETs) to fight organized counterfeiting.¹³

As a result of this new strategy, the number of counterfeit notes detected in circulation between 2004 and 2006 fell by almost half, and of these, nearly three-quarters were notes from older series (Bank of Canada 2007, 24). Improved public confidence in bank notes is evident from the decline in the percentage of stores that display signs refusing \$100 notes, from a peak of 10 per cent to between 2 and 4 per cent.

Lessons Learned

Chief among the lessons that the Bank learned is the importance of having a comprehensive strategy in which all of the elements work together to reinforce public confidence in Canada's bank notes. Conducting research into and employing the most advanced security features creates secure bank notes, while promoting awareness of the security features supports their proper recognition and use. Removing from circulation notes from older series also reduces confusion among the public and retailers. As well, sensitizing the law-enforcement and legal communities to the costs of counterfeiting helps them to reinforce the message that counterfeiting is a serious crime. A number of specific lessons contributed to the development of this strategy.

Security is the key priority

Designing and producing secure bank notes has always been a primary objective of the Bank's currency program. The experiences with the *Canadian Journey* series reinforced the necessity of adhering to this goal and showed that low-denomination notes are now as vulnerable to counterfeiting as higher-denomination notes, and require the same level of protection.

10. Substrates offered by domestic suppliers could not provide the desired level of security.

11. The \$20 *Canadian Journey* note won the "Bank Note of the Year for 2005" award from the International Bank Note Society for "its well-balanced design, strong images, and advanced security features" (IBNS 2007).

12. Some of this material is available on the Bank of Canada's website at <<http://www.bankofcanada.ca/en/banknotes/counterfeit/index.html>>.

13. The ICETs are based in Toronto, Montréal, and Vancouver, with counterfeit specialists also based in Halifax and Calgary.

Recognizing the value of partnerships in its efforts to combat counterfeiting, the Bank has intensified collaboration with its partners in the security printing industry, in equipment manufacturing, and at other central banks. It is a member of several international currency organizations, including the Central Bank Counterfeiting Deterrence Group, which shares information and collaborates in the development of solutions to counterfeiting at an international level.

Research and development must be continuous

In light of the accelerating pace of technological innovation and subsequent counterfeiting threats, as well as the long lead times involved in developing a new note series, ongoing research and development that is focused on preventive, high-quality security features is essential. Experience with the *Canadian Journey* series showed that it is easier to prevent problems than it is to fix them afterwards. With its new currency strategy, the Bank has adopted a more proactive approach to dealing with the ongoing threat of counterfeiting. The Bank has strengthened its research and development function to include surveying and monitoring activities in such areas as confidence levels and awareness of security features.¹⁴ It is thus much better positioned to detect—and assess—counterfeiting threats as early as possible.

Research and development takes time, however, and is intrinsically risky. The Bank continues to develop the technology necessary to provide bank notes with the highest possible security, particularly where these requirements are not met by products currently on the market. But, when appropriate, it also purchases proven, leading-edge technology, which, in turn, requires continuous research into what is currently available. Such research also ensures that the Bank will always have a contingency plan in place to deal with unexpected surges in counterfeiting, which can erupt suddenly.

Plans for the next generation of bank notes call for a series that will be even more difficult to reproduce.

14. More details on the Bank's program of currency research are available at <http://www.bankofcanada.ca/en/fellowship/highlights_res_07.html#6>.

In the future, the Bank will likely increase the frequency with which it issues new series of bank notes. The Bank is currently investigating new materials and technologies that might be used to improve security, as well as the factors that facilitate verification by the public. Plans for the next generation of bank notes, to be launched in 2011, call for a series that will be even more difficult to reproduce and easier to authenticate.

Retailers and the public must be familiar with security features

As noted above, the Bank regularly conducts surveys that track public awareness of security features. As part of its ongoing initiatives to build awareness and promote counterfeit deterrence, the Bank will continue to familiarize retailers and the public with the security features and designs of any new notes before they are released into circulation.

Old notes must be removed from circulation as quickly as possible

Since notes from previous issues with less-secure features are more vulnerable to counterfeiting, their speedy removal from circulation is essential, but even this is not enough. In 2002 and 2003, there was a spate of counterfeit notes from a series that had long dropped out of circulation (see Chart 1). It is thus important to discourage the use of older notes in trade (Bank of Canada 2004, 28).

The demand for bank notes continues to grow

Although electronic payment methods are gaining in popularity, the volume of bank notes in circulation continues to grow in line with the economy. This indicates that bank notes are still a significant means of payment and store of value in the Canadian economy, and that the positive attributes of cash, namely, convenience, the protection of privacy, broad acceptance, and public confidence, continue to be valued (Taylor 2006). The Bank therefore needs to base its currency strategy on the assumption that bank notes will be part of the retail payment environment for the foreseeable future.

Conclusion

In dealing with the challenges of the *Canadian Journey* series, the Bank has developed a currency strategy designed to meet the requirements of a modern, complex economy. The goal of the strategy is, as always, to supply Canadians with high-quality bank notes that are readily accepted and secure against counterfeiting.

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