

Banknote counterfeiting problem in Poland

The paper presents the phenomenon of banknote counterfeiting in Poland and a selection of methods used against this type of crime. It shows that the number of counterfeit banknotes in Poland is much lower than in the eurozone countries. Moreover, a share of counterfeit Polish zloty banknotes significantly dropped in 2015-2018 to the level of 2.6-2.7 PPM. This reduction should be associated with the Polish zloty banknotes upgrading in 2014 and 2016 that introduced a set of new security features discussed in this paper. This leads to the conclusion that a regular currency modernization and an introduction of new security features are a very effective anti-counterfeit method.

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KEYWORDS

banknotes, counterfeiting, currency modernization, security features

Introduction

Currency plays a crucial role in economic and social relations in every state. It serves three fundamental functions: it is a medium of exchange, a store of value, and a unit of account. As a medium of exchange, currency facilitates transactions. Without currency, the possible way to make a transaction would be barter involving direct exchange of one good or service for another. However, due to obvious limitations of barter, the Mesopotamian civilization introduced a universal, commonly accepted medium in the form of currency in 3000 BC¹. At the first stage of its development, money took a form of the so-called *shekel*, which was a unit of both weight and currency, referring to a specific weight of barley and equivalents of silver, bronze, as well as copper. Later, between the years 700 and 500 BC, the first manufactured coins started to appear respectively in India, China, and the cities around the Aegean Sea². They were made of gold, silver or bronze.

1 Kramer, S.N. *History Begins at Sumer*. 3rd edition, University of Pennsylvania Press, 1981, pp. 52-55.

2 Graeber, D. *Debt: The First 5000 Years*. Melville House Publishing, 2011, p. 212.

On the other hand, paper money, i.e. banknotes, was introduced in China in the 11th century. In Europe, notes started to be issued in Sweden in 1661 and replaced the copperplates used as a means of payment.

Nowadays, contemporary economies are based on non-cash money (about 85% of the total value in circulation), banknotes (about 97-98% of the value of cash currency in circulation), and coins (2-3% of cash currency in circulation). For instance, the total value of euro banknotes in circulation equals to EUR 1.2 trillion, whereas the value of euro coins equals only to EUR 28.8 billion, so coins constitute only 2% of the total cash euro in circulation³. In Poland, the total value of Polish zloty banknotes equals to PLN 214.4 billion and value of coins is PLN 4.8 billion, i.e. 2% of the total value of cash money in circulation.⁴ However, the total value of both cash and non-cash currency in circulation (M3 aggregate) is PLN 1.4 trillion⁵. Therefore, banknotes and coins constitute only 16% of the total value of money in circulation in Poland. That is why not only cash money but also electronic records on bank accounts lay in the center of interest of criminals. Nonetheless, both types of crimes, i.e. money counterfeiting and electronic thefts from bank accounts, are serious threats to the economic security. This paper, however, focuses only on the issue of banknote security and skips coins security because of its relative low importance and weight in the total value of money in circulation and a low face value in comparison to banknotes.

Security of banknotes is critical to state economic security. Figure 1 shows the relationship between economic security and factors which constitute the security of banknotes. The link between them are the confidence and trust that money in circulation is authentic as well as stability of payment system and lack of significant volume of counterfeit banknotes in circulation. The confidence and trust concerning banknotes are mainly controlled by the banknote manufacturer.

This paper takes into consideration the role of currency (banknotes, in particular) in the economic security of the state and discusses their security features as well as methods and activities of counterfeiters. Moreover, it gives estimations of the magnitude of banknote counterfeiting in Poland against the situation in other countries. Such a study helps to improve the state's resistance to this serious crime and methods of fighting against counterfeiting.

Literature review

The aspect of currency protection in the context of the national payment system and the economic security of state is not widely discussed in literature. According to R. Lewandowski and T. Goliński, currency manufacturing is strategic for the state, and many countries keep

3 https://www.ecb.europa.eu/stats/policy_and_exchange_rates/banknotes+coins/circulation/html/index.en.html, data for February 2019. Accessed 13 April 2019.

4 https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/struktura-obiegu.html, data for December 2018. Accessed 13 April 2019.

5 https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/miary.html, data for February 2019. Accessed 13 April 2019..

the production of local money domestic⁶. Consequently, W. Kitler remarks that the lack of state control over strategic economic sectors is one of the threats to the economic security of the state⁷. S. Kurek defines the economic security of the state as a development condition of a domestic economic system which should ensure the high efficiency of its functions and an ability to effectively fight against external factors which may lead to development disturbances⁸. In this classic approach, the economic security of the state is related to the security of the payment system and, therefore, to the security of currency in circulation because, as A. Iwańczuk states, the oversight of the payment system by central banks covers, in a broad sense, payment instruments and the technical infrastructure, too. This, in turn, also means a secure system of supplying the central banks with adequately secured currency⁹. If this element is violated, it may weaken the financial stability, influencing financial markets, as R. Lewandowski underlines¹⁰.

The research on a scale of counterfeit banknotes in Poland is not common. The last data published by R. Lewandowski refer to 2014 and show that the PPM index (counterfeit banknote per million banknotes in circulation) was quite stable and not too high, i.e. between 7 and 8, between the years 2011 and 2014¹¹. Since 2014, there has been no research published concerning this issue, especially in the context of the 2014 and 2016 banknote modernization. However, the phenomenon of money counterfeiting is analyzed from a different point of view and considering a number of criminal proceedings. R. Nesterowicz shows that severe criminal penalties for money counterfeiting do not completely discourage counterfeiters, and the number of criminal proceedings between 2010 and 2014 was stable and equalled to about 7-8 thousand per year¹². Similar findings are presented by N. Grabowska¹³.

An interesting point of view is given by the case-study literature on banknote counterfeit. An analysis of methods and technologies used by criminals is presented by R. Nesterowicz¹⁴ as well as M. Kamiński and R. Nesterowicz¹⁵, and it shows that criminals use a variety of different methods in order to imitate the security features and that they do not replicate the original production process of banknotes. An analysis of the security features of Polish and

6 Lewandowski, R., and T. Goliński. "Zarządzanie wiarygodnością dokumentów a bezpieczeństwo ekonomiczne." *Zarządzanie w systemie gospodarczym. Szanse i zagrożenia*, edited by K. Raczkowski. Warszawa 2015, p. 135.

7 Kitler, W. *Bezpieczeństwo narodowe RP. Podstawowe kategorie, uwarunkowania, system*. Warszawa 2011, p. 50.

8 Kurek, S., et al. *Bezpieczeństwo ekonomiczne Rzeczypospolitej Polskiej*. AON, 2004, p. 25.

9 Iwańczuk, A. *Systemy płatnicze i rynek płatności w Unii Europejskiej*. Warszawa 2011, p. 51.

10 Lewandowski, R. "Contemporary Monopolies in the Polish Economy – a Case Study of PWPW." *Quarterly Journal Oeconomia Copernicana*, no. 5(3)/2014, p. 143.

11 Lewandowski, R. "Bezpieczeństwo państwa a bezpieczeństwo dokumentów publicznych i banknotów." *Kryminalistyka – jedność nauki i praktyki. Przegląd zagadnień z zakresu zwalczania przestępczości*, edited by M. Goc et al., Volumina. pl, 2016, pp. 295-296.

12 Nesterowicz, R. "Rozważania o fałszerstwach pieniędzy." *Op. cit.*, edited by M. Goc et al., 367.

13 Grabowska, N. "Fałszowanie pieniędzy – proceder wcale nienowoty." *Kortowski Przegląd Prawniczy*, no. 3/2015, p. 35.

14 Nesterowicz, R. "Fałszerze pieniędzy." *Człowiek i Dokumenty*, no. 44/2016, pp. 73-82.

15 M. Kamiński, M., and R. Nesterowicz. "Likwidacja ośrodka fałszerskiego banknotów 100 PLN – glosa w sprawie i studium przypadku." *Człowiek i Dokumenty*, no. 36/2015, pp. 23-34; Kamiński, M., and R. Nesterowicz. "Polscy fałszerze banknotów euro." *Człowiek i Dokumenty*, no. 40/2016, pp. 87-97; Kamiński, M., and R. Nesterowicz. "Walka z fałszerstwami pieniędzy w Polsce." *Człowiek i Dokumenty*, no. 25/2012, pp. 11-16.

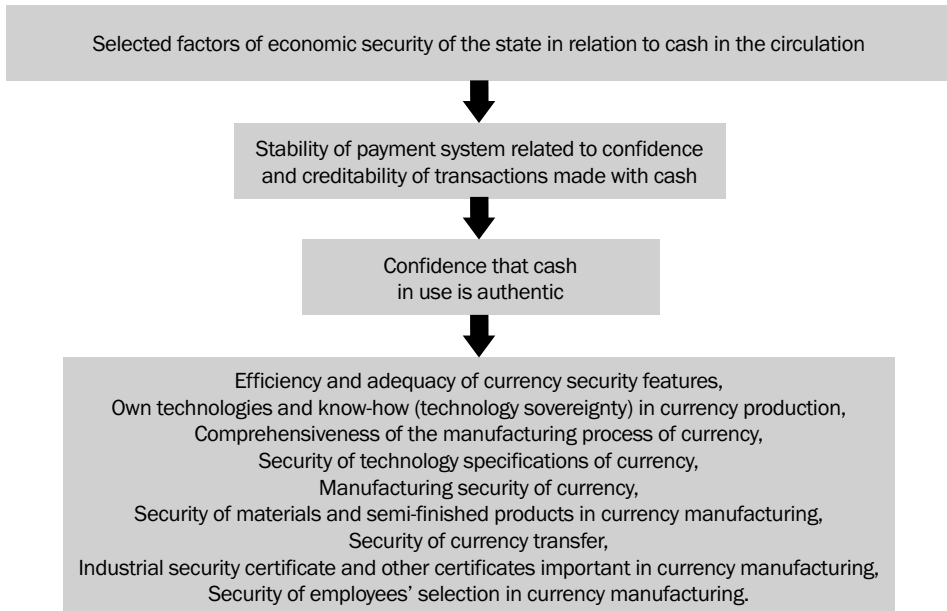


Figure 1. Relationship between state economic security and banknote security.

Source: Own compilation on the basis of: Lewandowski, R. "Dylematy metodologicznej triady: bezpieczeństwo, gospodarka, władza państwowa." Kitler, W., *Metodologiczne i dydaktyczne aspekty bezpieczeństwa narodowego*, edited by T. Kośmider, Warszawa 2015, p. 278.

some other banknotes is discussed by U. Konarowska¹⁶. However, the analysis in question does not cover the newest series of Polish zloty banknotes. More recent analyses are presented by J. Dziemidowicz¹⁷ as well as U. Konarowska and A. Pruszek¹⁸. They show that the security features in the newest-series Polish banknotes belong to the most modern ones and are used by other central banks in developed countries.

Methods

The research is based on an analysis of both quantitative and qualitative data. The quantitative data includes the volume of criminal proceedings related to money counterfeiting and the volume of counterfeit banknotes in circulation. It makes it possible to conclude on the

16 Konarowska, U. "Efektywność zabezpieczeń banknotów." *Przegląd Bezpieczeństwa Wewnętrznego*, no. 5/2011, pp. 151-164.

17 Dziemidowicz, J. "Polski banknot o nominale 500 zł." *Człowiek i Dokumenty*, no. 44/2017, pp. 23-28; Dziemidowicz, J. „Nowe zabezpieczenia w polskich banknotach.” *Człowiek i Dokumenty*, no. 31/2013, pp. 11-16.

18 Konarowska U., and A. Pruszek. "Problematyka fałszywych banknotów." *Człowiek i Dokumenty*, no. 33/2014, pp. 33-44.

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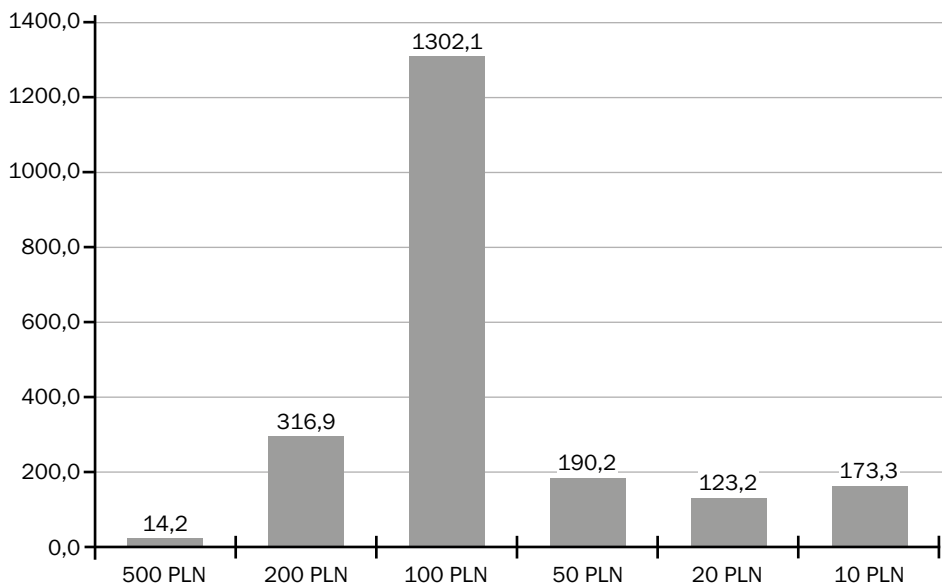


Figure 2. The number of Polish banknotes in circulation in millions; data as at 31/12/2018.

Source: Own compilation on the basis of: https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/struktura-obiegu.html/.

scale of banknote counterfeiting in Poland. On the other hand, the qualitative data refer to a selection of non-secret security features used in modern banknotes and examples of counterfeiting activities. They are presented on an example of the Polish PLN500 banknote and Polish criminal groups.

Banknotes in the economy

The first two functions of money, a medium of exchange and a store of value, make currency very attractive from a point of view of criminals. It refers both to coins made of gold or silver (holding the intrinsic value of precious metal itself) and to banknotes (with the face value only and a promise or guarantee of the issuing bank). With the relatively low cost of counterfeiting, criminals can make an enormous return on their crime. This high return concerns both old gold-coins times (coins counterfeited with the use of non-precious metal) and the present days with paper money in the circulation. Banknotes usually store a significant face value but their manufacturing costs are low due to popular mass production techniques which lead to economies of scale that were impossible to be reached 100 years ago or earlier. Of course, the higher the face value of counterfeited money, the greater the rate of return on a crime. In Poland, there are 6 types of banknotes with the face value of PLN 10, 20, 50, 100, 200 and 500. The number of these banknotes in circulation is shown in Figure 2.

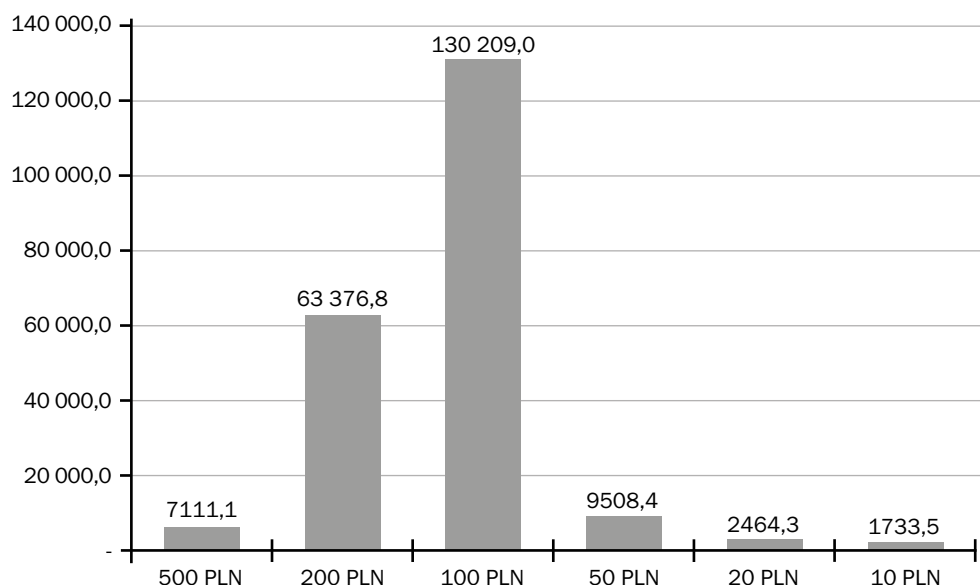


Figure 3. The value of Polish banknotes in circulation in PLN, in millions.

Source: https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/struktura-obiegu.html/.

The most common banknote in Poland is PLN 100, whose number in circulation is 1.3 billion. It constitutes 61% of total Polish banknotes in circulation. The second most popular banknote is PLN 200 (15%), and the third one is PLN 50 (9%). With an exception of PLN500, these three banknotes represent the highest face value and the greatest popularity in terms of usage. The PLN500 banknote is an exception as it was introduced quite recently and its face value may be perceived as relatively high in relation to the value of cash transactions in Poland, resulting in some reluctance to use it due to the threat of counterfeiting.

The face value of banknotes related to their volume shows which banknotes play a crucial role in the economy. It is presented in Figure 3.

According to Figure 3, the highest value of banknotes in circulation refers to PLN100 banknotes, and it amounts to PLN 130.2 billion (61%). The second highest value refers to PLN200 banknotes and equals to PLN 63.4 billion (30%). Finally, the third highest value covers PLN50 banknotes with the value of PLN 9.5 billion (4%). The PLN500 banknote represents 3% of the total value of banknotes in circulation. These observations might lead to a conclusion that PLN100, PLN200 and PLN50 banknotes provide the highest rate of return to criminals as:

- 1) their face value is not too low (such as PLN20 and PLN10 notes) and not too high (such as PLN500 notes);
- 2) their high share in circulation,

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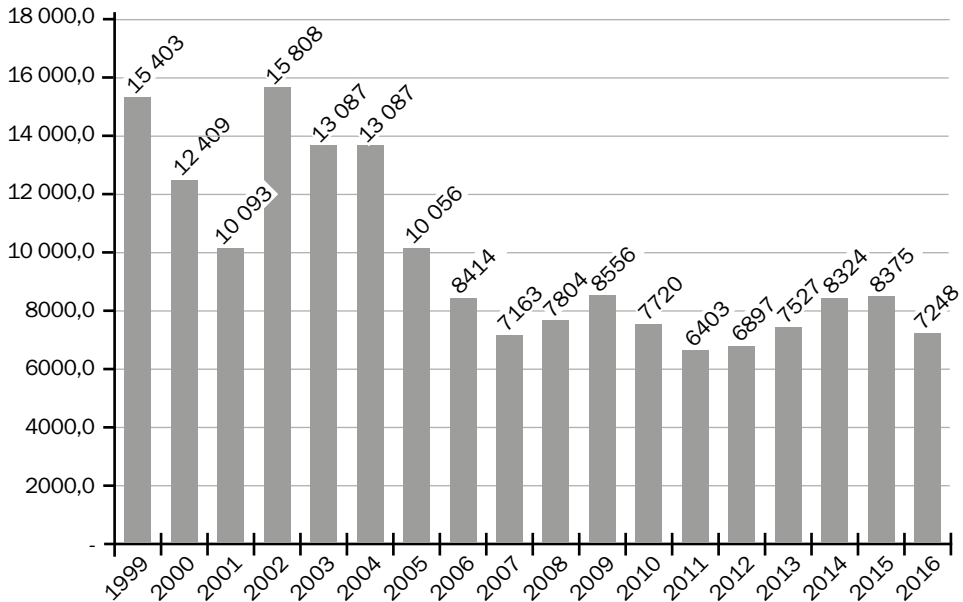


Figure 4. The number of proceedings concerning money counterfeiting in Poland (Penalty Code, Article 310). Source: Own compilation on the basis of: <http://www.statystyka.policja.pl/st/kodeks-karny/przestepstwa-przeciwko-18/63904,Falszowanie-pieniedzy-i-papierow-wartosciowych-art-310.html/>.

provided that, in case of these banknotes, the counterfeiting does not require some ultra-difficult, time-consuming and costly activities. Therefore, it is definite that the vulnerability to counterfeiting also depends on the security features applied in banknotes and the possible ways of copying their effects.

Money counterfeiting is a serious crime in Poland. According to Article 310 § 1 of the Criminal Code, it carries a maximum of 25 years and not less than 5 years in prison. Also, accepting, storing, transferring and bringing counterfeited money in circulation as well as assisting in such practices brings the penalty of a maximum 10 and not less than 1 year in prison (Article 310 § 2). Despite these heavy legal consequences, the level of money counterfeiting still remains stable. Figure 4 presents the number of proceedings concerning money counterfeiting in Poland (Article 310 of the Penalty Code).

Figure 4 shows that the number of money counterfeiting proceedings in recent years varies between 6 and 8 thousand per annum. This level may be observed since 2006. Before 2006, the number of proceedings had been much higher and amounted to almost 16 thousand in 2002. It is hard to identify reasons of the visible drop in the number of proceedings in 2006. It is not connected with modernization of Polish banknotes (with introduction of new security features) because this took place much later, i.e. in 2014 (PLN 10, 20, 50 and 100) and 2016 (PLN 200). Therefore, a possible reason might be a lower effectiveness of the police or a lower activity of criminals counterfeiting banknotes.

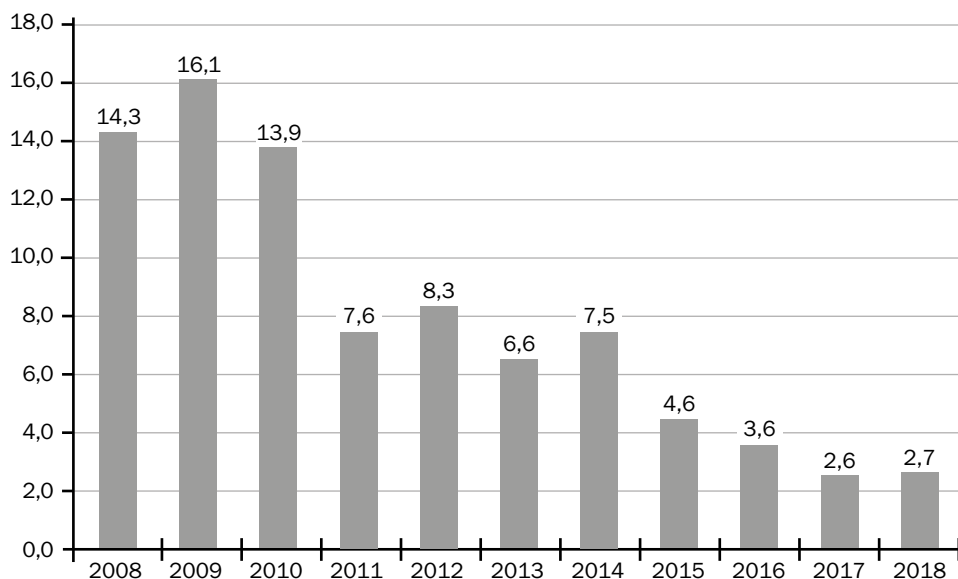


Figure 5. The PPM index in Poland.

Source: National Bank of Poland, data presented to the author.

Nevertheless, the aforementioned modernization of Polish banknotes definitely brought positive consequences in terms of the number of counterfeit banknotes. Figure 5 presents the PPM index for Polish banknotes, i.e. the number of counterfeits detected for every million banknotes in circulation.

As figure 5 shows, the PPM index in Poland fell down dramatically in two periods: in 2011, when it dropped from around 14-16 to 7-8, and in 2015, when it gradually dropped to 2.7 in 2018. The 2011 change is not correlated with any changes in security features. However, a drop to 4.6 in 2015 and further to 3.6 in 2016, 2.6 in 2017 and 2.7 in 2018, evidently effects from a banknote modernization process, as it was anticipated in the literature¹⁹. Similar effects of a lower PPM index following banknote modernization have been observed in many countries. For example, in Namibia, in 2012, the PPM index of old-series banknotes equaled to 2.53 and was reduced to 0.04 for new series banknotes. In Canada, the 2014 PPM index amounted to 470 and due to banknote modernization, trainings for cashiers and law enforcement was significantly lowered to 76 in 2008, 29 in 2013 and 9.1 in 2018. An effective prevention of money counterfeiting evidently requires an instant upgrade of banknotes and the introduction of new security features which

19 Lewandowski, R. "Bezpieczeństwo państwa a bezpieczeństwo dokumentów publicznych i banknotów." *Kryminalistyka – jedność nauki i praktyki. Przegląd zagadnień z zakresu zwalczania przestępczości*, edited by M. Goc et al., Volumina. pl, 2016, p. 295.

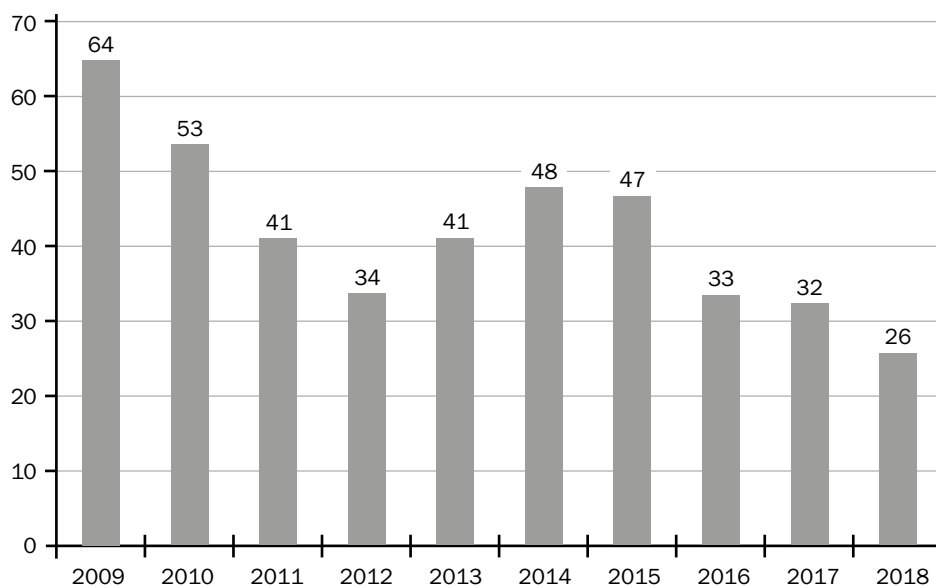


Figure 6. The PPM index in the eurozone.

Source: <https://www.ecb.europa.eu/pub/annual/html/ar2018~d08cb4c623.pl.html#toc43/>.

make counterfeiters' work harder and more costly. This is a never-ending process. It takes some time for counterfeiters to find methods of efficient imitation of security features. Central banks respond to this threat by upgrading the banknotes. What is important, counterfeiters do not use original manufacturing processes, original technologies, or security features²⁰. They are either too expensive or impossible to reach by non-official banknote producers.

A relatively small number of counterfeit Polish banknotes also results from the limited liquidity of Polish zloty and a low face value in relation to some stronger currencies such as euro or US dollar. Euro and US dollar are international currencies with the currency-to-Polish-zloty exchange ratio of about 0.2 and 0.3 respectively. Therefore, they are more attractive to counterfeiters. First of all, manufacturing one counterfeit euro or dollar banknote is 3-4 times more profitable than a Polish zloty banknote (because of exchange ratio and similar costs of production). Secondly, it is easier to circulate euro or dollar banknotes as they are recognized internationally. This attractiveness of dollar or euro banknotes implies a number of counterfeit banknotes, much higher than in Poland's case. Figure 6 presents the PPM index in the eurozone.

20 Jakielaszek, E. "Dokument tożsamości w aspekcie współczesnej przestępczości." *Kryminalistyka – jedność nauki i praktyki. Przegląd zagadnień z zakresu zwalczania przestępczości*, edited by M. Goc et al., Volumina.pl, 2016, p. 303.



Figure 7. The face of the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieczeniadenadze/500_en.html/.



Figure 8. The back of the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieczeniadenadze/500_en.html/.

In recent years, the PPM index has stabilized on a level between 20 and 30. It is still about 10 times higher than in Poland despite the quite modern security features adopted in euro banknotes. However, this is the price euro pays for being an international currency.

Security features

There is not a single security feature which protects banknotes against counterfeiting completely. Therefore, it is important to apply a set of different security features and to modernize them or add new ones every 5-10 years. Polish banknotes were modernized in 2014 (PLN10, PLN20, PLN50 and PLN100 notes) and 2016 (PLN200 notes). A new PLN500 banknote was introduced in 2017. The security features applied in Polish banknotes are advanced and similar to those which are present in banknotes of other developed economies. Figures 7 and 8 present selected security features of Polish modernized banknotes on the example of the PLN500 note.

Security feature No. 1 is a watermark. The watermark field is free from print. When the banknote is held against the light, a multitone watermark with a repeat of the image of King

John III Sobieski from the face side of the banknote and a light monotone value numeral “500” (filigree) are visible. Figure 9 shows the watermark against the light. The banknote paper together with the watermark is produced by the Polish Security Printing Works (Polska Wytwórnia Papierów Wartościowych), i.e. the manufacturer of Polish banknotes.

When the banknote is held against the light, a security thread (security feature No. 2), i.e. a line with a microprint including the value numeral of the denomination “500” and “500 ZŁ” is visible. Fragments of the so-called windowed security thread are visible on the face of the banknote, and the whole security thread is visible when checked against the light. The security thread is presented in Figure 10. The windowed security thread also combines a color-shift effect (when moving a banknote horizontally and vertically, the color smoothly changes from green to blue) and a motion effect (two crossing lines appear to move). The Polish Security Printing Works purchases it from foreign suppliers.

Security feature No. 3 is composed by a latent image. The value numeral “500” on the right side of the portrait of the king becomes light or dark depending on the angle at which it is viewed. On the left side of the portrait, in the escutcheon, there are rectangular fields visible depending on the angle at which the banknote is viewed. A latent image is an effect of the intaglio printing technique. This technique also makes printed image raised, which can be felt by running a finger over it or scratching it gently with a fingernail. In PLN 500 banknote intaglio printing is used in a portrait, value numeral, the name of the issuing bank (National Bank of Poland) as well as a mark for blind people (in the bottom left corner of the front).

The banknote also takes advantage of the color-shifting ink (security feature No. 4). When the banknote is tilted, the ornamental graphic element to the right of the portrait (lobster-tailed pot helmet) smoothly changes color from green to blue, and the pattern of a wavy line placed on it appears to move in the vertical plane. The ink is supplied to the Polish Security Printing Works by an external company. The feature is shown in Figure 11.

Microlettering (security feature No. 5) is a very popular way of protecting banknotes and documents. Tiny inscriptions are made with high precision in offset or intaglio printing techniques. The smallest inscription on the banknote should be sharp and readable when magnified. There are two microletterings on the back of the banknote, i.e. intaglio microlettering – “RZECZPOSPOLITA POLSKA”; and offset microlettering – “NARODOWY BANK POLSKI”; “NBP 500 NARODOWY BANK POLSKI.” They are presented in Figure 12.

The see-through register (or recto-verso; security feature No. 6) is another popular method of securing banknotes. Elements of the graphic design on the face and back of the banknote are visible in transmitted light align perfectly to form a complete image and is presented in Figure 13.

The iridescent ink is often used by security-printing producers as it is eye-catching for users and compliant with the “look-and-tilt” method of authentication. The ornament on the back of the banknote is printed with gold iridescent ink. The ornament is visible or almost invisible depending on the angle at which the banknote is viewed. The ink is supplied to the Polish Security Printing Works by an external producer. The effect is shown in Figure 14.

Security features also concern wavelengths other than daylight. Some security features are visible in UV and IR light. Certain graphic elements appear in UV light: a square with the

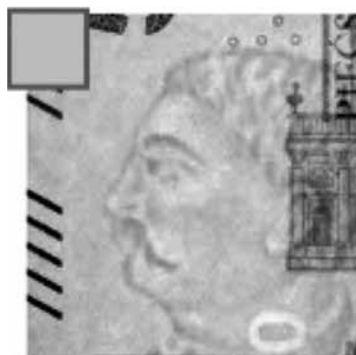


Figure 9. The watermark on the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieznepieniadze/500_en.html/.



Figure 10. The security thread of the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieznepieniadze/500_en.html/.



Figure 11. The color-shifting ink on the PLN500 banknote.

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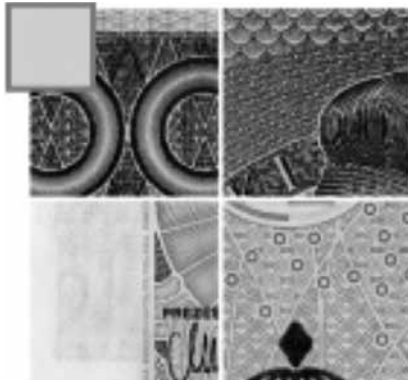


Figure 12. Microlettering on the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieznepieniadze/500_en.html/.

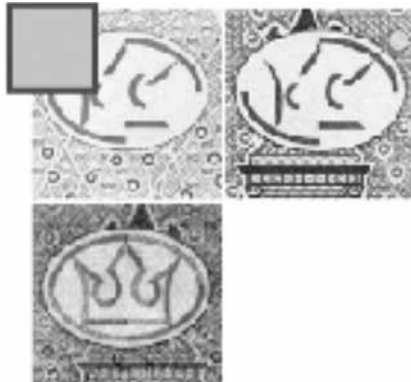


Figure 13. The see-through register on the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieznepieniadze/500_en.html/.

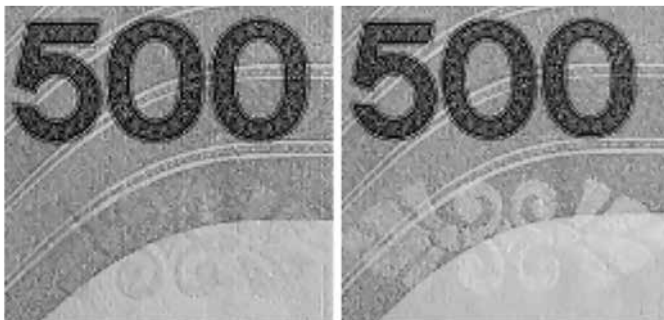


Figure 14. The iridescent ink on PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpieznepieniadze/500_en.html/.

value numeral “500” and the abbreviation “ZŁ” to the left of the portrait; the serial number on the left side of the banknote; the stripe on the top right-hand side of the king’s portrait; and some other graphic elements on the front and back of the banknote. These are presented in Figure 15. Some graphic elements on the front and back of the banknote appear in infrared light. They are shown in Figure 16.

On the example of the PLN500 banknote, the above analysis presents the most popular, contemporary, non-confidential security features applied by many central banks worldwide. Generally, there four characteristics of them:

- 1) they should be eye-catching and easily recognized by the public in order to authenticate a banknote;
- 2) they should be difficult to be imitated;
- 3) they should include a set of different security features with different authentication effects observed by the public;
- 4) the introduction of upgraded currency should be accompanied by an education process of the public.

Apart from the non-confidential security features, there are also confidential security features which are not disclosed to the public. An example of them is the Counterfeit Deterrence System (CDS), which consists of anti-counterfeiting technologies that prevent personal computers and digital imaging tools from capturing or reproducing the image of a protected banknote. It prevents the unauthorized reproduction of banknotes. Polish banknotes are covered by the CDS as well.

Banknote designing and upgrading constitute a complex, long and difficult process. It should include 4 main factors²¹:

- 1) the aims of upgrading or designing new series (e.g. making banknotes more secure against counterfeiting, expanding banknotes’ life span in circulation or political reasons);
- 2) the analysis of counterfeiting methods;
- 3) the design of machine-readable features (sorting machines, ATMs);
- 4) the conditions in which banknotes will be used (e.g. climate, habits of users).

Money counterfeiting

There are two general types of money counterfeiting²²:

- counterfeiting by states;
- counterfeiting by criminal groups or individual criminals.

Both have a long history. Some states used counterfeiting mainly for political reasons, whereas criminal groups or individual criminals are motivated by an economic profit. State counterfeiters have access to professional equipment, materials and know-how, so that they can organize a production process very similar to the original one. The so-called “Bernhard operation” performed by Nazi Germany during World War II was one of

21 Dziemidowicz, J. “The role of a banknote producer.” *Człowiek i Dokumenty*, special ed., no. 2/2014, p. 11.

22 Nesterowicz, R. “Rozważania o fałszerstwach pieniędzy.” *Zagadnienia z dowodu ekspertyzy dokumentów*, edited by R. Cieśla, Uniwersytet Wrocławski, 2017, pp. 362-363.

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Figure 15. UV-visible images of the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpiecznpieniadze/500_en.html/.

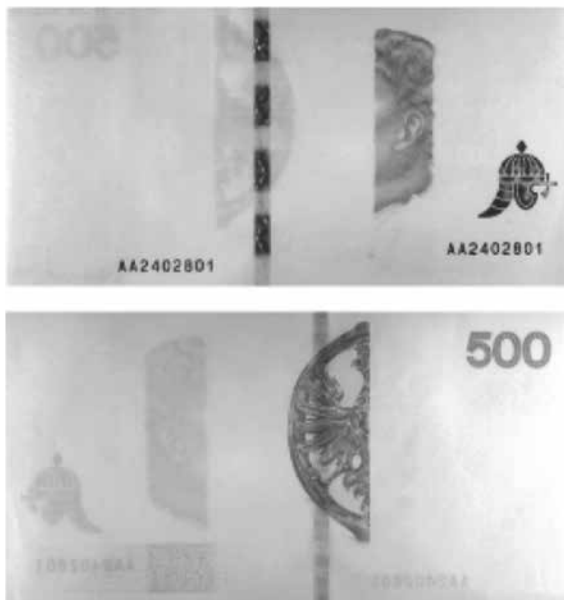


Figure 16. IR-visible images of the PLN500 banknote.

Source: https://www.nbp.pl/homen.aspx?f=/bezpiecznpieniadze/500_en.html/.

Table. Examples of money counterfeiting by different states

Military conflict	State engaged in counterfeiting	Currency counterfeited
Italian city-states conflicts (1423-1508)	Milan	Venetian ducat
American revolution (1775-1783)	Great Britain	Colonial currencies
Napoleonic wars (1805-1812)	France	Austrian Banco script notes, Russian ruble
Mexican-American war (1846-1848)	Mexico	Texas Republic dollar
American Civil War (1861-1865)	United States	Confederate States of America dollar
World War I (1914-1918)	Great Britain	Turkish lira
October Revolution (1917-1921)	The White Army	Russian ruble
World War II (1939-1945)	Great Britain	Burmese rupee
	Germany	British sterling pound, French franc, Hungarian pengő, US dollar, Yugoslav dinar
	Japan	Chinese yuan
	United States	Burmese rupee, German reichmark, Japanese yen
Bay of Pigs Invasion (1961)	United States	Cuban peso
Vietnam War (1964-1973)	United States	North Vietnamese dong
Terrorist activities	Unknown	US dollar

Source: Altig, D.E. "Why Is Stable Money Such a Big Deal?" *Economic Commentary*, May 2002, p. 3, <https://www.clevelandfed.org/newsroom-and-events/publications/economic-commentary/economic-commentary-archives/2002-economic-commentaries/ec-20020501-why-is-stable-money-such-a-big-deal.aspx/>.

the greatest counterfeiting operations. It enabled the Germans to manufacture almost 9 million of British sterling (GBP) banknotes whose value amounted to 10% of the total value in the British circulation²³. Table presents selected examples of money counterfeiting by war-time states.

"Private" counterfeiters have much poorer conditions of work and that is why they imitate the security features and do not replicate the manufacturing process. Among them, there are both professional counterfeiters who invest in equipment and pay the highest attention to quality as well as amateur counterfeiters who often use only photocopier machines or simple ink-jet printers.

23 Lewandowski, R., and T. Goliński. "Zarządzanie wiarygodnością dokumentów a bezpieczeństwo ekonomiczne." *Zarządzanie w systemie gospodarczym. Szanse i zagrożenia*, edited by K. Raczkowski, Wolters Kluwer, 2015, p. 122.

Poland is a country where money is counterfeited as well as a country to which counterfeit money is introduced from abroad. The counterfeiting in Poland is organized by domestic criminal groups and refers to Polish zloty and other currencies such as euro. However, the introduction into circulation is controlled not only by Polish but also by foreign and criminal groups. Foreign currency (mostly euro) is generally transferred from abroad by couriers. In recent years, there have been a few cases of discovering large, professional counterfeit-money production sites. In 2009 and 2010, the Central Investigation Office of the Police Headquarters (Centralne Biuro Śledcze KGP) and Europol carried out the "MOST" operation against distributors of counterfeit euro banknotes. The operation led to arresting more than 100 persons in Italy, Germany, Spain, Austria, Norway, Finland, and Poland, including the leaders and active members. The criminal group specialized in introducing EUR100 and EUR50 banknotes in shops and shopping malls in European Union²⁴. The counterfeit banknotes were of good quality; they were made by applying the offset technique and had well-imitated security features (such as the hologram, security thread, and see-through register). The original technology (e.g. intaglio printing technique) was not applied during their manufacture; the manufacturing process was based on the imitation of the outcomes of the original production process.

In 2010, the Central Investigation Office also discovered in Skarżysko-Kamienna the largest manufacturing site of counterfeited money in Poland. The criminals had a complete production line of counterfeit PLN100 banknotes and some equipment for counterfeiting EUR50 banknotes. The manufacturing site had been active since 1998. The losses of the Polish Treasury resulting from this criminal group were estimated to amount to PLN 30-50 million. Each counterfeit banknote was composed of two layers of paper of a low basis weight (40-50 g/m²) which were glued after imitating the watermark and the security thread. The counterfeited banknotes were produced in the offset technique (no intaglio printing). The quality of counterfeited banknotes was poor. However, the color scheme similar to genuine banknotes and precise imitations of UV security features were enough to introduce them successfully into circulation²⁵. Interestingly, the counterfeiter had no education in printing technologies. He was a baker. Figure 17 presents counterfeit banknotes in the production process (drying).

Conclusions

Money counterfeiting remains a serious issue of contemporary economies. Despite the fact the propensity to counterfeit is significantly greater in the eurozone countries and the United States, Poland is still prone to this type of threat, which is confirmed by a large number of criminal proceedings concerning money counterfeiting. Due to the critical role of the currency in the payment system and the economic security of the state, money counterfeiting, and banknote counterfeiting in particular, central banks and governments must stron-

24 Kamiński, M., and R. Nesterowicz. "Walka z fałszerstwami pieniędzy w Polsce." *Człowiek i Dokumenty*, no. 25/2012, pp. 12-13.

25 Nesterowicz, R. "Falszerze pieniędzy." *Człowiek i Dokumenty*, no. 44/2016, pp. 78-79.



Figure 17. Counterfeit banknotes in the production process (drying stage).

Source: Kamiński, M., and R. Nesterowicz. "Walka z fałszerstwami pieniędzy w Polsce." *Człowiek i Dokumenty*, no. 25/2012, p. 15.

gly fight this phenomenon. Therefore, not only severe criminal penalties and efficient police investigation activities but also regular upgrading of currency security features are of necessity. The case of the 2014 and 2016 Polish zloty banknotes modernization shows that such actions bring significant positive effects and reduce the number of counterfeit banknotes in circulation. This modernization also emphasizes four fundamental rules of efficient banknote upgrading:

- 1) easy recognition of genuine banknotes by the public,
- 2) difficulty of imitation,
- 3) composition of a set of different security features,
- 4) education of the public on banknote security features. ■

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