

---

# *THE FIRST EUROS*

*The creation and issue of the first euro banknotes and the road to the Europa series*

---



---

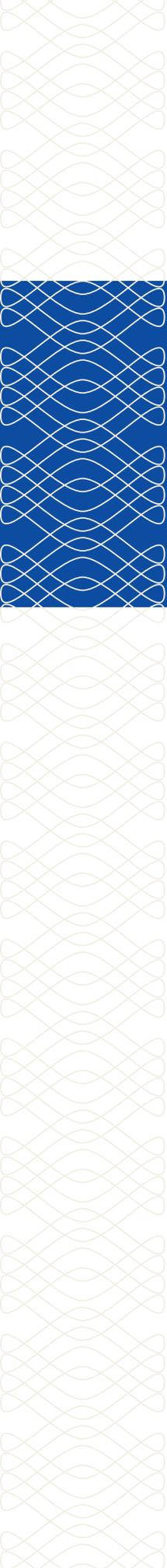
◆ Antti Heinonen ◆

---



## THE FIRST EUROS





---

# *THE FIRST EUROS*

*The creation and issue of the first euro banknotes and the road to the Europa series*

---

◆ *Antti Heinonen* ◆

Suomen Pankki and the European Central Bank

*For Salli, Ida, Emil, Siri, Samu and Erik*



**EUROPEAN CENTRAL BANK**  
**EUROSYSTEM**



Publishers: European Central Bank (in English), Suomen Pankki (in the original Finnish)

Layout and typesetting: Edita Publishing Ltd

Copyright ©: the Author, Suomen Pankki, © European Central Bank, [2015]

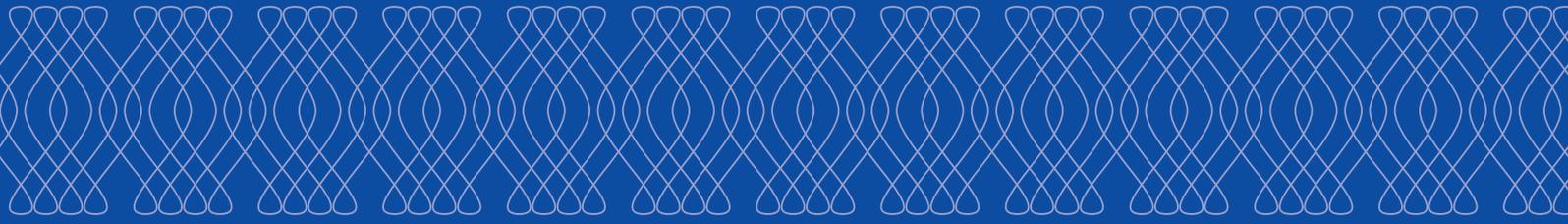
Design and layout: Suvi Sillanpää

English translator: Pat Humphreys

Original title: Ensimmäiset eurot - Eurosetelisarjan synty, liikkeeseenlasku ja ensi vuosikymmen  
(Edita Publishing Ltd. 2014)

ISBN 978-92-899-1508-3

Printed in Finland in 2015 by Bookwell Ltd, Porvoo



# *Contents*



# Contents



## *Preface ...17*

Acknowledgements ...18

Preface and acknowledgements of the Finnish edition ...19

## *Preamble ...23*

### *1. Questions to be resolved for Europe's common currency ...27*

Planning starts in 1991, prompted by the prospect of monetary union ...28

Banknote working group begins planning work in spring 1992 ...32

European Monetary Institute established in 1994 ...35

Summer 1994: More central banks join currency planning ...36

### *2. Denominations, and design of a common European banknote series ...39*

Clear principles for determining denominations ...40

Challenges of appearance and lettering ...42

*Tales of banknote signatures ...45*

Banknote sizes adjusted for the visually impaired ...47

*Acceptable minimum banknote size almost unchanged for decades ...49*

*Establishing principles for choosing security features ...49*

*New chair appointed to the banknote issue task force ...52*

### **3. The choice of banknote themes and the design competition ...55**

*Advisers identify wide range of potential themes ...56*

*Banknote design competition arranged in early 1996. ...59*

*Banknote group begins annual meetings outside Frankfurt ...60*

### **4. Winning design finalised, details settled ...87**

*Refining the winning entry into a finished banknote design ...88*

*EMI's Lamfalussy: Picking the winner was unexpectedly easy ...90*

*Detailed consideration of potential legal issues ...92*

*Seeking a consistent solution for banknote numbering ...94*

### **5. ECB begins operations, ESCB banknote committee established ...99**

*Reorganising banknote planning as ECB Director of Banknotes ...100*

*Eugenio Domingo Solans, the ECB Executive Board member for banknotes ...104*

### **6. Planning logistics for the euro cash changeover ...107**

*Euro cash issuance date and changeover formalities fixed long in advance ...108*

*EMI and ECB begin regular meetings with stakeholders in autumn 1997 ...111*

*Regular reassessment of volume of banknotes required at launch ...112*

### **7. Banknote production from preparations to full-scale start-up ...115**

*Preparations for production divided into many separate phases ...116*

*Testing the ability of printing works to produce uniform banknotes ...116*

*Printing plate production, a zero-production run and quality management ...119*

*A hologram original lost in flight ...120*

*Full-scale euro banknote production begins in summer 1999 ...121*

*Euro printing "is not mass production" ...127*

## **8. Production hiccups not entirely avoided ...129**

- Error in printing a security feature to prevent colour copying ...130
- Corrosion problems with security thread metallisation ...131
- Hologram missing from 500 euro note ...133

## **9. Getting ready to issue euro banknotes ...135**

- Europe's greatest peacetime logistical operation ...136
- The pedigree of the linear debiting model ...140*
- Conversion of cash dispensers and vending machines ...141
- CashCo takes charge of cash changeover coordination ...143*

## **10. The Euro 2002 Information Campaign ...145**

- 200 million brochures distributed to the public ...146
- Strong media coverage of changeover planning ...155*

## **11. The cash changeover ...157**

- National banknotes exchanged faster than expected ...158
- The eve of the launch, and €-day itself ...162*
- Cash dispensers quickly converted, vending machines more slowly ...166
- Successful changeover draws wide attention ...168*

## **12. Banknotes and counterfeits after the launch ...171**

- Continuous increase in number of banknotes ...172
- Lehman Brothers bankruptcy spurs euro banknote demand ...177*
- Euro changes national patterns of banknote use ...178
- Security features prevent euro counterfeiting ...184
- Human interest in the "alchemy" of counterfeiting ...195*

### **13. Events and challenges after banknote issuance ...199**

- Common systems for Eurosystem cash management ...200
- Better efficiency for all parties involved in cash circulation ...204
- Systemic risks to national cash management: the Heros bankruptcy ...205*
- Other central banks take note of euro banknote launch ...206

### **14. Controversies over banknote materials and features ...209**

- Environmental impacts of TBT and GMO cotton ...210
- Persistent rumours about radio identification tags ...211
- European Parliament asks for one-euro and two-euro notes ...212
- US Congress seeks advice on low-denomination notes ...213*
- The enigma of Berlin's brittle banknotes ...214

### **15. Cash changeover planning for the EU's new members ...217**

- Something old, something new ...218
- Playing a part in Estonia's euro debate ...221*

### **16. The making of Europa ...223**

- The arduous path towards a second euro banknote series ...224
- Council demands quantum leaps in security features ...225*
- Exploring new banknote features ...226
- The series receives its designer and its name ...228
- Governing Council approves security features ...230
- Printing works and letters in the Europa-series ...232
- Growing role of banknote handling equipment ...232
- From banknotes director to global anti-counterfeiting chair ...234*
- President Trichet's strong interest in euro banknotes ...236*

### **17. Looking back over two decades ...239**

*Endnotes ...243*

*Appendices ...249*

*Appendix 1. ...250*

The 1996 design competition jury

*Appendix 2. ...251*

Irrevocable conversion rates for the euro ...251

*Appendix 3. ...252*

Euro banknotes and their security features ...252

*Appendix 4. ...256*

The shares of the euro area national central banks in the ECB's capital key since 1 January 2015 ...256

*Appendix 5. ...257*

Euro banknote production 1999-2015

*Sources and literature ...263*

Archive sources ...264

Literature ...264

Newspapers and news reviews ...266

*Name index ...269*

## Charts

<i>Chart 1</i>	Value of banknotes in circulation relative to GDP, EU countries, end-1996.....	109
<i>Chart 2</i>	Frontloaded cash and maximum cash in circulation during changeover .....	138
<i>Chart 3</i>	Average value of a euro banknote in circulation .....	159
<i>Chart 4</i>	Values of euro and national banknotes in circulation in the first days of 2002 .....	160
<i>Chart 5</i>	Cash dispenser conversion times .....	167
<i>Chart 6</i>	Value of banknotes in circulation .....	173 (above)
<i>Chart 7</i>	Value of banknotes in circulation, observed and forecast.....	173 (below)
<i>Chart 8</i>	Annual growth of euro banknote value in circulation.....	174
<i>Chart 9</i>	Net euro banknote shipments, monthly and cumulative .....	175 (above)
<i>Chart 10a</i>	Euro banknote sales (= exports) to non-euro area, 2013, %.....	175 (below)
<i>Chart 10b</i>	Euro banknote purchases (= imports) from non-euro area, 2013, %.....	176 (above)
<i>Chart 11</i>	Change in volume of low and high denomination euro banknotes.....	176 (below)
<i>Chart 12</i>	Markka and euro banknotes issued by Finnish central bank .....	179
<i>Chart 13</i>	Cash issued by Finnish central bank in proportion to GDP.....	180 (above)
<i>Chart 14</i>	Value of euro banknotes issued in Germany, by denomination .....	180 (below)
<i>Chart 15</i>	Value of euro banknotes issued in Finland, by denomination .....	182
<i>Chart 16</i>	Value of euro banknotes issued in Austria, by denomination .....	183 (above)
<i>Chart 17</i>	Value of euro banknotes issued in Portugal, by denomination .....	183 (below)
<i>Chart 18</i>	Number of euro banknote counterfeits, half-yearly 2002–2014.....	185
<i>Chart 19</i>	Ratio of counterfeits to euro banknotes in circulation, 12-month moving average.....	186
<i>Chart 20</i>	Losses from euro banknote counterfeits .....	187
<i>Chart 21</i>	Euro banknote counterfeits in Finland .....	188
<i>Chart 22</i>	Number of counterfeit national and euro banknotes in Germany, 1990 onwards .....	189 (above)
<i>Chart 23</i>	Losses in Germany from banknote counterfeits, 1990 onwards .....	189 (below)
<i>Chart 24</i>	Euro banknote counterfeits in Italy, half-yearly 2010–2014 .....	190
<i>Chart 25</i>	Euro banknote counterfeits by denomination, 2014 .....	191
<i>Chart 26</i>	Values of euro and dollar banknotes issued, in euros.....	196
<i>Chart 27</i>	Is having the euro a good or a bad thing for your country?.....	241

## Photographs

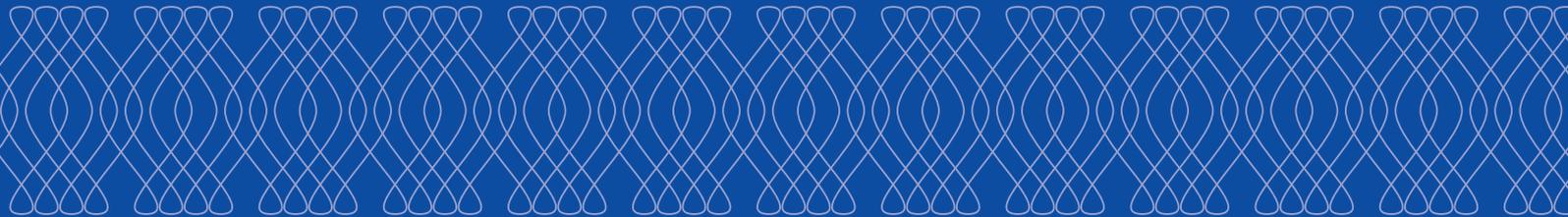
Fig. 1.	Wim Duisenberg, governor of the central bank of the Netherlands, 1991. <i>©European Central Bank / Claudio Hils</i> .....	29
Fig. 2.	Karl Otto Pöhl, governor of Deutsche Bundesbank, and Theo Waigel, German Finance Minister in 1989–1998. <i>©Deutsche Bundesbank</i> .....	30
Fig. 3.	European banknote planning begins in 1991 at the BIS in Basel. <i>©Bank for International Settlements</i> .....	31
Fig. 4.	Alex Jarvis, general manager of the Bank of England Printing Works, and Jean-Claude Trichet, governor of the Banque de France, in September 2003. <i>©European Central Bank / Walter Breitinge</i> r.....	33
Fig. 5.	Banknote denominations were based on national banknotes, varying from 50 drachmae in Greece to 1000 Marks in Germany. <i>Photo by Jaakko Koskentola</i> .....	41
Fig. 6.	Finland’s Euro 2002 conference was arranged at Hotel Marina Palace in September 2001 and opened by ECB President Wim Duisenberg. <i>©European Central Bank / Claudio Hils</i> .....	46
Fig. 7.	Wim Duisenberg’s signature on the euro banknote was exactly the same as on the banknotes of The Netherlands. <i>Photo by Jaakko Koskentola</i> .....	46
Fig. 8.	In 1995 all Member States used cotton paper as their banknote substrate. <i>©European Central Bank</i> .....	51
Fig. 9.	The jury of the euro banknote design competition headed by EMI Secretary General Hanspeter K. Scheller, convenes in September 1996. <i>©European Central Bank / Philippe Jolivel</i> .....	62
Figs. 10.	Shortlisted designers and their proposals. <i>©European Central Bank</i> .....	64–85
Fig. 11.	The winning entry, from Robert Kalina. <i>©European Central Bank</i> .....	89
Fig. 12.	EMI President Alexandre Lamfalussy in September 2003. <i>©European Central Bank / Walter Breitinge</i> r.....	90
Fig. 13.	French overseas territories were placed in map insets on the banknote. <i>Photo by Jaakko Koskentola</i> .....	91
Fig. 14.	Robert Kalina examines details of the obverse of the 20-euro banknote. <i>©European Central Bank / Claudio Hils</i> .....	93
Fig. 15.	Pictures of the banknotes were distributed to the media in July 1997, but details of security features were withheld. <i>©European Central Bank</i> .....	93
Fig. 16.	The code letters of banknote serial numbers. Z tells that the note was ordered by the Belgian central bank, L by Suomen Pankki. <i>Photo by Jaakko Koskentola</i> .....	95

Fig. 17.	The printer identification codes D and U tell that the banknotes in question were produced by Setec and Valora. <i>Photo by Jaakko Koskentola</i> .....	95
Fig. 18.	The first Executive Board of the ECB in June 1998. <i>©European Central Bank / Claudio Hils</i> .....	101
Fig. 19.	German Chancellor Helmut Kohl arrives at the inauguration of the European Central Bank at Frankfurt's old opera house. <i>©European Central Bank / Martin Joppen</i> .....	103
Fig. 20.	President Wim Duisenberg addressing the inaugural event of the ECB. <i>©European Central Bank / Martin Joppen</i> .....	103
Fig. 21.	Eugenio Domingo Solans, ECB Executive Board member from 1998 to 2004. <i>©European Central Bank / Martin Joppen</i> .....	105
Fig. 22.	ECB Executive Board member José Manuel González-Páramo, in conversation with Erkki Liikanen, governor of Suomen Pankki. <i>©European Central Bank / Martin Joppen</i> .....	105
Figs. 23.	Test notes were printed by potential printing works. <i>©European Central Bank</i> .....	117
Fig. 24.	Hot-stamping holograms on to banknote sheets at Setec. <i>HPhoto by Jussi Aalto</i> .....	118
Fig. 25.	Banknotes being sorted in central bank high-speed sorting machines. <i>©European Central Bank / Claudio Hils</i> .....	119
Fig. 26.	Cotton bales being delivered from storage to a French paper mill. <i>©European Central Bank / Claudio Hils</i> .....	122
Fig. 27.	Euro banknote paper was produced in nine different mills. <i>©Deutsche Bundesbank</i> .....	122
Fig. 28.	Production of banknote paper at Louisenthal paper mill in Germany. <i>©Deutsche Bundesbank</i> .....	123
Fig. 29.	Barrels of banknote ink at Setec, Finland. <i>©European Central Bank / Claudio Hils</i> .....	124
Fig. 30.	Inspecting the first 10-euro banknote sheets produced by offset printing at Oesterreichische Nationalbank. <i>©European Central Bank / Claudio Hils</i> .....	124
Fig. 31.	Quality inspection of a 10-euro banknote sheet at Setec, Finland. <i>©European Central Bank / Claudio Hils</i> .....	125
Fig. 32.	Rollers of an offset machine printing 50-euro notes. <i>©European Central Bank</i> .....	125
Fig. 33.	Finishing of banknote packaging at Setec, Finland. <i>©European Central Bank / Claudio Hils</i> .....	125
Fig. 34.	Euro banknotes were produced by 15 printing works in the euro area and Great Britain. <i>©Deutsche Bundesbank</i> .....	126
Fig. 35.	Different printing works produced euro banknotes by different methods. <i>©European Central Bank / Claudio Hils</i> .....	127
Fig. 36.	Banknote paper being inspected at a paper mill of the Banque de France. <i>©European Central Bank / Claudio Hils</i> .....	132

<b>Fig. 37.</b>	Police cars escorting a delivery from Valora to the Banco de Portugal. ©European Central Bank / Claudio Hils.....	137
<b>Fig. 38.</b>	Euro banknotes from several printing works were tested by manufacturers of cash dispensers and vending machines in May 2000. ©European Central Bank / Claudio Hils.....	142
<b>Fig. 39.</b>	In 1983 the Oesterreichische Nationalbank issued a new Austrian 1000-schilling banknote and a detailed brochure about its security features. ©Oesterreichische Nationalbank.....	147
<b>Fig. 40.</b>	Central banks around the euro area arranged training events for cash handlers. Suomen Pankki held some at head office in Helsinki. ©European Central Bank / Claudio Hils.....	148
<b>Fig. 41.</b>	Information kits leaving the Deutsche Bundesbank, bound for stakeholders. ©European Central Bank / Claudio Hils.....	149
<b>Fig. 42.</b>	ECB President Wim Duisenberg and Eugenio Domingo Solans reveal the final design of euro banknotes at Frankfurt's new opera house. ©European Central Bank.....	150
<b>Fig. 43.</b>	Concurrently with the unveiling of the euro banknotes, enormous copies were placed on view at the ECB's Eurotower building. ©European Central Bank.....	151
<b>Fig. 44.</b>	The five-pointed star containing euro banknotes became the symbol that the ECB President presented each country as it adopted the euro. ©European Central Bank.....	152
<b>Fig. 45.</b>	From March 2001 onwards, blind people could try out the feel of the banknotes from sample copies, which bore the text "No value". ©European Central Bank / Claudio Hils.....	153
<b>Fig. 46.</b>	The winners of the "Be a Euro SuperStar" competition were invited to Frankfurt and even visited Wim Duisenberg's office. ©European Central Bank / Martin Joppen.....	154
<b>Fig. 47.</b>	Executives of the ECB and Deutsche Bundesbank exchanging national banknotes with journalists just before midnight. ©European Central Bank.....	162
<b>Fig. 48.</b>	Finnish Finance Minister Sauli Niinistö, today the President, withdrawing Finland's first euro banknotes. ©Lehtikuva / Martti Kainulainen / rj.....	163
<b>Fig. 49.</b>	At midnight in Frankfurt, thousands of revellers turned out to celebrate the start of the euro cash changeover. ©European Central Bank / Uwe Dettmar.....	164
<b>Fig. 50.</b>	The euro countdown clock in Frankfurt's Rossmarkt Square. Photo by Antti Heinonen.....	164
<b>Fig. 51.</b>	The Banque centrale du Luxembourg celebrates €-day on a neon billboard. ©European Central Bank / Claudio Hils.....	165
<b>Fig. 52.</b>	Finland began exchanging money an hour earlier than Continental Europe and provided the world with the first news pictures. © Suomen Pankki / Peter Mickelsson.....	165

Fig. 53.	“Anna and Alex take on the banknote forgers” was published in 2010, to teach children the security features. @European Central Bank.....	192
Figs. 54.	Fake euro banknotes, both accepted at least once despite their bizarre appearance. @European Central Bank.....	193
Fig. 55.	The Eurosystem has developed easy-to-use digital authentication methods. @European Central Bank.....	194
Fig. 56.	At the launch of the new 10-euro banknote, people were urged to take “selfies” to send to the ECB. @European Central Bank.....	194
Fig. 57.	Suomen Pankki’s Erkki Liikanen (at right) signs an agreement on a common cash management system with Guy Quaden of the Belgian national bank. @ Suomen Pankki / Peter Mickelsson .....	202
Fig. 58.	A robot handling 50-euro banknotes at Suomen Pankki. Photo by Jaakko Koskentola .....	203
Fig. 59.	The main building of Banka Slovenije, the Slovenian central bank, before its euro cash changeover at the start of 2007. @European Central Bank / Claudio Hils.....	220
Figs. 60.	Sample notes were produced for laboratory testing, using various materials and coatings that were potentially suitable for low-denomination banknotes. Photo by Jaakko Koskentola .....	227
Fig. 61.	Reinhold Gerstetter, the winner of the competition for ideas for the Europa banknote series. His watermark gave the series its name. @Deutsche Bundesbank.....	229
Fig. 62.	ECB President Mario Draghi and Professor Egon Wamers before an ancient vase bearing a portrait of Princess Europa. @European Central Bank.....	229
Fig. 63.	The six-phase approach, used for development of the Europa series. @European Central Bank.....	231
Fig. 64.	Unveiling of the 10-euro banknote in the Europa series on 13 January 2014 by Yves Mersch of the ECB Executive Board. @European Central Bank.....	231
Fig. 65.	The way banknotes are handled and authenticated has dramatically changed during the last 40 years. @European Central Bank.....	233
Fig. 66.	Directors of Banknotes old and new, Antti Heinonen and Ton Roos, with President Jean-Claude Trichet in November 2009. @European Central Bank / Martin Joppen.....	235
Fig. 67.	ECB President Trichet presents the euro banknote symbol to Michael C. Bonello of the Central Bank of Malta, in autumn 2007. @European Central Bank / Michael Durand.....	237
Figs. 68.	Banknote security features. @European Central Bank.....	253–254





# *Preface*



When this book in its original language was nearing completion in early 2014, the Deutsche Bundesbank and the European Central Bank were both interested in having it translated from Finnish into German and English respectively. Deutsche Bundesbank was due to participate in the Frankfurt Book Fair in October 2014, for the first time with its own stand. Finland was the theme country of the Fair that year, so the book was ideal for the Bundesbank's publication programme. The ECB, in turn, wanted to issue an English-language version of the book in February

2015, to coincide with the unveiling of the design for the 20-euro banknote in the new Europa series.

Because the original book had been written for a Finnish public, it required some changes, first for a German and then for an international readership. Details, photographs and charts have been added to this English-language edition that were not in either previous version. I have however retained information and illustrations specific to Finland and Germany that I believe will be of general interest at an international level.

*January 2015*  
*Antti Heinonen*

## Acknowledgements

Preparations for the English edition did not get properly under way until the German edition became available in September 2014, after which my colleagues at the ECB could read it and offer their comments. This has imposed a demanding schedule, requiring very effective cooperation with the ECB.

I offer sincere thanks to Director of Banknotes Ton Roos for enthusiastically coming up with ideas for this book and commenting on it. Appreciation is also due to Antonio Arrieta, Henk Esselink, Martin Münd, Olivier Strube, Jozef Vrana and other colleagues in the banknote department who aided in obtaining charts and statistical data. Great assistance in planning and acquiring

new illustrations has been rendered by Olivier Radelet and his team members Consuelo Capri, Xavier-Yves Gauthier-Fetsch, Melissa Oezkol and Simone Thoenelt, responsible for communications about euro banknotes, as well as the ECB's archive, Jan Lohman and Ewan Evans, and its photo archives. Banknote Committee members Franz-Josef Behringer of the Deutsche Bundesbank, Enrica Teresa Vignoli of the Banca d'Italia, Jan Binnekamp of De Nederlandsche Bank, Stefan Augustin of the Oesterreichische Nationalbank and Pedro Marques of the Banco de Portugal helped me obtain material from their euro area countries. Some material for the appendices came from Juan Carlos

San Jose in the ECB's Financial reporting and policy division.

The book's production schedule narrowly permitted most of the book's diagrams to be updated with information at the end of 2014. The ECB's Olivier Strube and Vicente Ventura participated in this eleventh-hour slog, as did Silvia Allegrani and Dierk Dominicus of the Deutsche Bundesbank and Kari Takala of Suomen Pankki.<sup>1</sup> Ritva Järvinen and Alison Sallmann assisted on the practical side. I owe a debt of gratitude to all the above.

Warm thanks go to Pat Humphreys, who accepted the challenge of translating the work

into English on a very tight timetable and has done an excellent job of conveying my meaning. I also appreciated the work of Taina Seitovirta, Head of the Language Services Division of Suomen Pankki, who coordinated the translation.

Editor Matti Lehtinen and graphic artist Suvi Sillanpää were responsible for editing and layout at Edita Publishing. Mika Pösö, Jenni Hellström and Richard Brander at Suomen Pankki kindly joined in work and discussions with ECB colleagues. Everyone mentioned above has been subject to a stringent schedule, making my thanks even more warranted.

## Preface and acknowledgements of the Finnish edition

I was at an international conference in Stockholm in June 1998 when a note was thrust into my hand, asking me to contact my workplace urgently. At Suomen Pankki they told me that Eugenio Domingo Solans of the European Central Bank wanted me to call him in Frankfurt.

I knew from the newspapers that Domingo Solans, like Sirkka Hämäläinen of Finland, was one of the six newly appointed members of the ECB Executive Board. When I called him he congratulated me and said we needed to meet as soon as possible. The Board, he said, had just decided to appoint me ECB Director of Banknotes.

They had not asked for formal applications and there had been no interviews for the job so his call came out of the blue, but I didn't need to think about it for long. I had actively

represented Suomen Pankki in preparations for Europe's common currency and, for a couple of years, had been heading a task force planning the issue of euro cash. On the personal side, the move came at an opportune time because our daughters had already left home. For someone who had been interested in the history of money since childhood, it was a great privilege to be put in charge of central planning and coordination for this momentous process. The next day I flew from Stockholm to Frankfurt and a week later I was ready to start my new job, initially in tandem with my old one. My stint has continued in various roles and forms to the present day.

Over the years I often thought about writing a book on the dawn of euro banknotes but the events had always seemed to be too recent. In 2012 Suomen Pankki published

my book, *Viimeiset markat*, on the history of Finland's markka banknotes 1945–2002, and when, soon afterwards, Mika Pösö, the Head of the General Secretariat at Suomen Pankki, suggested that I should now write a book about euro banknotes, the time seemed to be right. One reason was that the 5-euro banknote of the second banknote series, Europa, was soon to be issued, and I recognized that there might soon be an adequate perspective for studying the advent and development of the first series, which had its roots more than 20 years earlier.

I have received comments on the text from Mika Pösö, who instigated the book; Kari Takala, Senior Adviser at Suomen Pankki; Kjell Peter Söderlund, head of its secretariat during the period covered by the book; and Antti Juusela, head of its communications unit at the same time. Kari Takala has also provided me with time series data and graphs for banknotes issued by Suomen Pankki denominated in euros and markkas. I have received more help from the photo archives of the ECB and Suomen Pankki and from my successor Ton Roos and other colleagues at the ECB. The ECB photo archive contains a large number of photographs that I have been able to use, especially those taken by Claudio Hils and Martin Joppen.

I warmly thank all of them. I am grateful to Suomen Pankki and its board for their interest in my literary project and to Deputy Governor Pentti Hakkarainen for the milieu provided by the bank for my writing work.

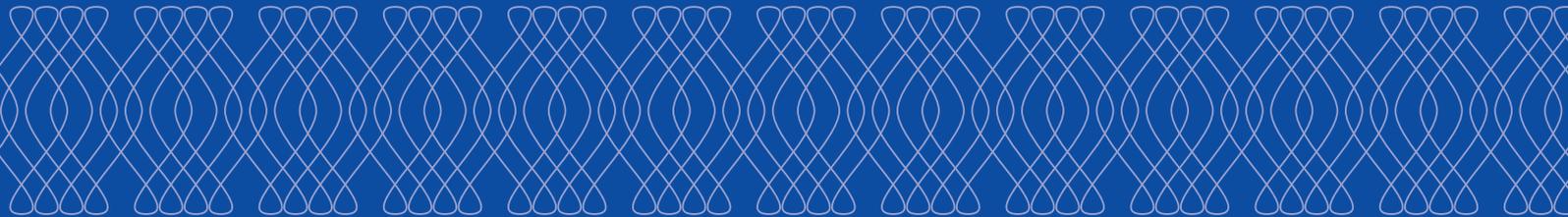
My phraseology has been reviewed by Kaisa Paasovaara of Suomen Pankki's language and publication services, and the text has been edited for publication by Matti Lehtinen at Edita Publishing, where design and layout was done by graphic artists Marjut Heikkinen and Suvi Sillanpää. The curator of Suomen Pankki's museum Jaakko Koskentola has taken some of the photographs of the book and smoothly managed communications with Edita. Their pleasant and fruitful collaboration has been much appreciated. I also thank my long-term PA, Ritva Järvinen, who helped my writing work in many ways.

Although I was able to write most of the book during normal working hours, the project obviously required support and assistance from my family. Thank you, Varpu, Nora, Nelli and Niini. My daughters' generation experienced the changeover from markka to euro at first hand and have personal memories to match. My grandchildren were not yet around to witness the event, and I dedicate this book to them.

*January 2014*  
*Antti Heimonen*







# *Preamble*





There is no shortage of literature on the banknotes of the euro, their derivation and how they were issued. The European Monetary Institute, forerunner of the ECB, surveyed the origins of the notes in its contemporary annual reports, and the European Central Bank has tackled the subject in annual reports, monthly reviews<sup>1</sup> and other publications.<sup>2</sup> I too have written articles at various times on topical questions related to euro banknotes, as well as participating in the planning of ECB publications on the matter.<sup>3</sup> Many of my colleagues at the ECB and national central banks have also written on the subject.<sup>4</sup>

Because of the wealth of existing literary material, I have sought a different perspective

for examining the origins and issue of the first euro banknote series, and the challenges of the euro's first decade. This is why the work at hand contains personal experiences during the planning process, which I have included in sidebars so as not to disrupt the flow of the main narrative. As my excuse for telling these subjective stories, I quote Willem "Wim" Duisenberg, the first President of the European Central Bank, at the historical unveiling of euro banknotes in August 2001. Speaking at the opening of the event, Dr Duisenberg said that "central bankers are not supposed to express emotions or to have dreams; they are supposed to think and speak about numbers". He then apologised for having to make an exception on that occasion. In the same way,

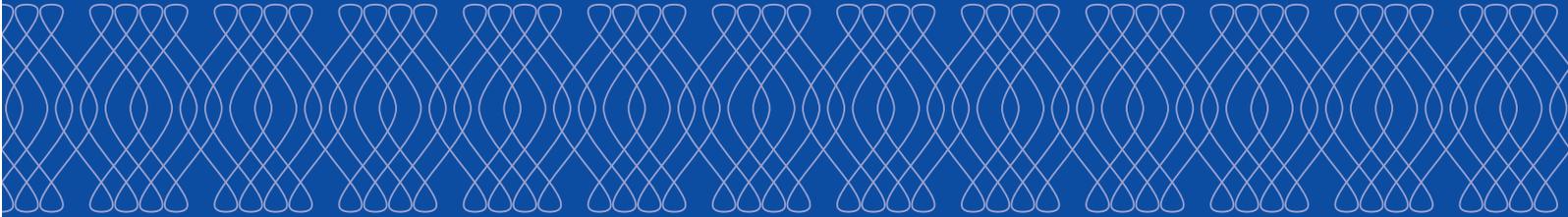
I hope that the stories in this book will bring a human perspective to an otherwise technical analysis.

Events are related mostly in chronological order. The book begins by examining how the planning of euro banknotes was organised, and the main questions relating to the banknotes and their appearance. Then it studies the challenges of introducing the notes, producing and issuing them, providing the public with information about them, and then arranging the changeover. The following chapters look at banknote developments and management from various perspectives, and the road to a second series, the Europa series. The final chapter summarises two decades of euro banknotes.

The book does not cover the political and economic decision-making of the EU and the euro area, or any other questions related to the euro except where they have had an impact on euro banknotes. Nor does it focus on profound numismatic details. Despite the fact that euro banknotes lack specific national features, numismatists have found plenty of interesting combinations of banknote values, signatures, responsible central banks and printing works. At the time of writing, over a thousand variations have been identified.<sup>5</sup>

The illustrations, diagrams and tables of the book have been obtained from the photographic archives and statistical databases of the ECB and various euro area central banks, unless otherwise stated.





1.  
*Questions to be resolved  
for Europe's  
common currency*



## Planning starts in 1991, prompted by the prospect of monetary union

When the European Economic Community was established in 1957, a common currency was still regarded as too ambitious. The immediate goal was to create a Single Market by eliminating trade barriers and customs duties. In 1970, experts under Luxembourg's Prime Minister Pierre Werner produced the first blueprint for an economic and monetary union but it did not advance because of changes in the economic environment at the time. Instead of monetary union, the EEC made other arrangements.

A decade and a half elapsed before the idea reappeared in the Single European Act of 1986. Two years later, the European Council reaffirmed the objective of Economic and monetary union (Emu), to be implemented by stages, and established a committee to propose a practical plan of advance. The committee was headed by the President of the European Commission, Jacques Delors, and included the central bank governors of the 12 Member States

of the European Community and Alexandre Lamfalussy, then the General Manager of the Bank for International Settlements.

The Delors Report, published in April 1989, set out a plan to introduce Emu in three stages. In the first, controls on capital movements would be eliminated. In the second, economic convergence between Member States would be promoted. In the third, a common currency and monetary policy would be adopted.

Even before the foreign and finance ministers of the 12 Member States<sup>1</sup> signed the Maastricht Treaty on economic and monetary union in the EU in February 1992, the central banks had pointed out that preparations for common banknotes would have to begin well in advance. In April 1991, the governor of the Netherlands central bank, De Nederlandsche Bank, Wim Duisenberg, who later became the first President of the European Central Bank, sent a letter on the subject to Karl Otto Pöhl, the governor of Deutsche Bundesbank



◆  
**Fig. 1** Wim Duisenberg, governor of the central bank of the Netherlands, calls on European Community central bank governors to discuss the question of European banknotes at their meeting in 1991.  
◆

and, at the time, the chair of the committee of governors of European Community central banks.<sup>2</sup> It was already clear that the issue of banknotes in the third stage of Emu would be the responsibility of a European central bank.

In view of the substantial investments required, Duisenberg wrote that the matter should be discussed at the next governors' meeting, which should decide whether to establish a working group to identify and resolve the challenges,



◆ Fig. 2 Karl Otto Pöhl (left), governor of Deutsche Bundesbank, was the chair of the EU central bank governors committee when planning of future euro banknotes was first discussed. Theo Waigel (right) was German Finance Minister in 1989-1998 and a major figure in decisions about the euro. ◆

principally technical ones, related to common European banknotes.

In line with Duisenberg's proposal, the production of common European banknotes was placed on the agenda, and the governors' committee decided that an ad hoc meeting of specialists would be arranged on the subject. Jacques Van Droogenbroeck of Belgium, responsible for supply of currency and banknote printing at the Belgian central bank,<sup>3</sup> was appointed to chair the meeting, and each central bank of the 12 Member States

was invited to send two experts, on banknote issue and printing. The meeting took place in September 1991 in Basel at the Bank for International Settlements, which was home to the secretariat of the central bank governors' committee.

The main conclusion of the ad hoc meeting was that, after a decision had been taken to produce common European banknotes, another 6–8 years would be required before they could be issued. It was decided that planning should begin by compiling detailed



◆ Fig. 3 European banknote planning begins in 1991 at the premises of the Bank for International Settlements in Basel. ◆

information about characteristics of the banknotes currently in use in the EEC, such as their value, size, and security features; matters related to supply of currency and banknote printing such as printing techniques and production capacity; and how central banks organised banknote sorting, circulation and the destruction of worn banknotes.

The very first discussions regarded it as axiomatic that the common banknotes would also be used in the world beyond the EEC, so they should incorporate the latest technology

for preventing counterfeiting. The needs of the visually impaired were also recognised from the outset. The question was raised about whether the notes should be entirely uniform or could include national features. The importance of keeping the general public informed was recognised; the banknotes would be one of the most concrete symbols of a common currency area and a sign that Europe had entered a new era.

The ad hoc meeting recognised the production challenges involved; there were no common technical standards for banknote

printing in the EEC. Similarly, common banknotes would transform the circulation of currency and the equipment used for handling and authentication, such as vending machines and banknote dispensers, so it was obvious that other stakeholders should be included in the discussions at an early stage.

Van Droogenbroeck, the chair of the ad hoc meeting, sent a letter to the chair

of the governors' committee, proposing the establishment of a working group at the appropriate time. The group would be responsible for preparing a comprehensive report on the aforementioned banknote characteristics as well as arrangements for their handling and production. It should also explore various scenarios for the transition to a common physical currency.

## Banknote working group begins planning work in spring 1992

The organisation of preparations for the common banknotes began concretely after the signing of the Maastricht Treaty in 1992. In May the European Community central bank governors established a Working Group on Printing and Issuing a European Banknote, to study and resolve the technical and logistic problems involved. The group's legitimacy was established by article 105a of the Maastricht Treaty: the European Central Bank had been given the exclusive right to authorise the issue of banknotes inside the community, banknotes that would be issued by the ECB and national central banks.<sup>4</sup>

By this time, the chair of the first ad hoc meeting, Jacques Van Droogenbroeck, had moved to a job in the private sector so the central bank governors chose the general manager of the Bank of England printing works, Alex Jarvis, to head the banknote working group. Jarvis held this position for six years, until the ECB was established in 1998.<sup>5</sup>

Each central bank was allowed to appoint two members to the banknote working group,

in order to provide the necessary expertise on both production and issuance. Usually the members chosen were the head of the printing works (if the central bank had its own) and the chief cashier.

In keeping with its mandate, the working group was required initially to draw up a comprehensive report and, additionally, a cost-benefit analysis on the different models for banknote production and design elements. The central bank governors expected an interim report on these subjects within a year from the date that the group was established. It was also authorised to examine the effect of a common currency on various aspects of the supply of currency, and to study the legal questions involved and ways of managing the cash changeover.

The group convened to consider these questions for the first time at the end of June 1992, in the premises of the Bank for International Settlements in Basel, Switzerland. The banknote group was one cog in the planning organisation of the central banks,



◆  
Fig. 4 Alex Jarvis (right), general manager of the Bank of England Printing Works, in conversation with Jean-Claude Trichet, governor of the Banque de France, at the opening of an exhibition about the euro banknote design competition in September 2003. Jarvis was in charge of planning common European banknotes from 1992 to 1998.

which also contained subcommittees and working groups on questions of monetary and exchange rate policies, banking supervision, payments systems, statistics, accounting and information systems.

A major report had to be drawn up by the banknote working group on a very short

schedule. The experiences of various central banks about new banknote series they had recently issued would be invaluable but this was obviously a project on an entirely different scale. The group therefore decided at its first meeting to divide the work between six task forces. The tasks given to the six were as follows:

1. A comprehensive database of all national banknotes and their lifecycle features, to be compiled from the results of a detailed questionnaire.
2. The appearance of the banknotes, alternatives ranging from an entirely uniform series to national notes with standard features. This task force was also to examine how the alternatives would affect handling of the notes and the public's attitude to them.
3. Details of the notes, including lettering, signatures, numbering, denominations, size, printing technique, substrate characteristics, identifying features for the visually impaired, etc.
4. Questions related to supply of currency, including storage, issuance, handling, recirculation, transport and destruction of banknotes.
5. Banknote verification, including security features and their usefulness in combating counterfeiting and in automatic banknote handling.
6. Costing the different alternatives, involving the development of a unified cost norm that would allow a cost-benefit analysis of alternative models.

At this point in time, the unit of currency in question was referred to either as the common European currency or the *ecu* because the name *euro* was not settled until the European Council summit in Madrid in December 1995. Thus, when the initial reports of the task forces were discussed in October 1992, the banknote working group agreed unanimously that the unit of five ecus should be a banknote. It

saw no need for a one-ecu note although the question has arisen from time to time since the euro was issued (see Chapter 14). The two-ecu unit was seen as a grey area, a unit which could temporarily be a banknote in order to reduce the burden on mints, but which would be a coin after the transitional period.

In December 1992 the banknote working group reached the unanimous conclusion that, regardless of the proportion of common and national elements in the appearance of the banknotes, the denomination of each would be expressed only in the common currency. At the same time the group also had its first discussion about the duration of the cash changeover period.

At the end of the 1980s Australia had been the first country to issue banknotes printed on polymer, a substrate that subsequently gained popularity around the world. However, no single banknote printing works in the European Union had experience of polymer banknotes, and it was decided that because of the great production challenges it would be safer to stay with traditional cotton paper.

After receiving the intermediate report of the banknote working group, the central bank governors met in summer 1993 to clarify a few of the options that the group had considered. The two main alternatives were now an entirely uniform banknote or a note where one side was uniform and the other national. The banknote group then continued its work in 1993 and 1994, looking at the detailed appearance of the banknote and, in the case of notes with some national characteristics, the costs to central banks of sorting notes to

establish their origin and of repatriating them to the country of issue. On the printing side, the group analysed the cost benefits of joint production and the effects on the schedule,

comparing these to a scenario where, at the time of issue, each central bank would be responsible for the banknotes required in its own area only.

## European Monetary Institute established in 1994

It had been agreed in the Maastricht Treaty that Economic and monetary union would be implemented by phases. In the second phase, starting from 1994, monetary cooperation between the Member States of the European Union (no longer the European Community) was to be strengthened and, with this aim, the joint bodies of their central banks were reorganised. The committee of central bank governors, responsible for planning till now, and its secretariat were abolished, and the European Monetary Institute began operations. Replacing the governors' committee was the EMI's governing body, its Council. The first Council President was Alexandre Lamfalussy of Belgium and its Director General was Robert Raymond of France. Its most important task was to make practical preparations for the third stage of monetary union and the adoption of a common currency.

The banknote working group already began reporting to the EMI Council in January 1994. At a meeting of the group in May, Director General Raymond outlined the EMI's functions and underlined its role in planning the regulatory, organisational and logistical framework for the European System of Central Banks (ESCB). At the time, Raymond thought

it was possible that banknotes and coins would be issued within a few months of the start of the third stage of Emu, which obviously created a tight schedule for the banknote working group. Recognizing the pressure they were under, Raymond proposed that the group should prepare a memorandum for the EMI Council about the most urgent decisions needed.

The group was responsible for planning common banknotes only, so there were a number of questions about coins that needed to be coordinated. EU economy and finance ministers had given the task of planning the common coinage to directors of the national mints of Member States. Thus, euro cash was being planned and implemented in the same way as most national currencies had been; the central bank was in charge of the banknotes but the finance ministry, which ran the mint, was in charge of the coins. In September 1994 the banknote group met to hear preliminary ideas about the production and issue of coins. They were told that it would take three years, plus a period of 6–12 months when national and European coins would be in circulation at the same time so that all coin-operated machines could be adapted to accept the new currency.

## SUMMER 1994: MORE CENTRAL BANKS JOIN CURRENCY PLANNING

June 25th, 1994 was not a milestone for the euro but for Austria, Finland, Norway and Sweden it marked the date when their central banks were permitted to have observers on the working groups that were planning the new currency. The EMI Council took this decision after the four countries had signed accession agreements with the European Union. All but Norway joined the EU at the start of 1995, after which their representatives became full working group members.

The first banknote working group meeting that I attended was on 13 July 1994. I was there as chief cashier of Suomen Pankki, accompanied by Veli Tarvainen, the Managing Director of Setec.<sup>6</sup> The first EMI employees had already taken up offices in the 36-storey Eurotower building in Frankfurt am Main, where the EMI had initially leased nine floors, but in 1994 the working groups were all still meeting at the Bank for International Settlements in Basel. The Eurotower first had to be modernised to EMI standards, and appropriate conference rooms were not available till the start of 1995.

The meeting in July 1994 was not my first contact with the affairs of the banknote working group because, in spring 1993, the central bank governors committee had decided that European Free Trade Association members should receive summaries of the state of planning by the different working groups. These were sent in particular to the EFTA members that had applied to join the EU. Even so, on the day before the banknote group meeting, chair Alex Jarvis arranged

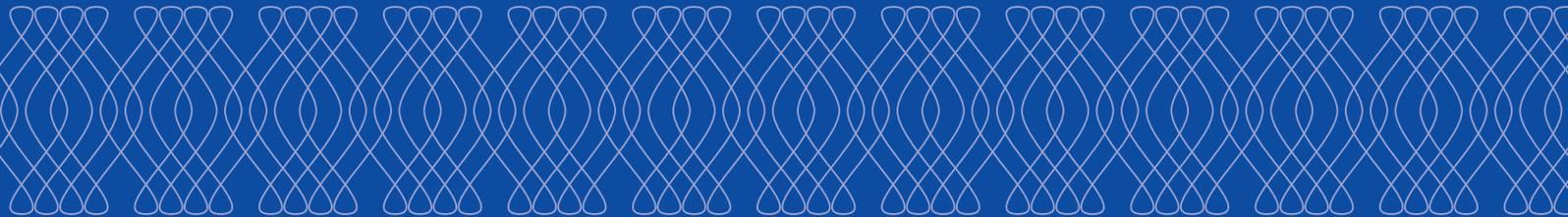
an event for the new observers where they could ask supplementary questions about the material they had received in advance, including the main interim reports and memorandums to the governors' committee.

At the event, Jarvis explained that he ran the meetings in an informal way and said he hoped that, from the outset, the observers would participate to the same degree as full members. We went over the main challenges that the working group faced: choosing the appearance of the notes, the question of language, their size, security features, sorting and possible repatriation, and the timing of their issue. He asked the observer countries to provide information as soon as possible about their national banknotes, printing and handling, the same information that existing members had already contributed to the database. At that time the European Union's twelve members had almost 12 billion banknotes in circulation. Nearly 6 billion notes were printed per year and the central banks had nearly 8 billion notes in storage. The figures gave a good picture of the enormous volumes involved when planning common banknotes and a changeover from national notes.

After the event, we participated in an informal dinner of the banknote working group, prior to its formal meeting the following day. Although many members were already familiar faces from international events, shared leisure time eased our entry into the group and our first encounter with the planning process.







2.  
*Denominations,  
and design  
of a common  
European banknote series*



## Clear principles for determining denominations

The denominations of a currency series affect how many units of cash are required to make any given payment. The greater the number of denominations, the fewer coins or banknotes will be needed. Mathematically, the smallest number is required when the denominations follow a binary series 1, 2, 4, 8, 16 and so on, but calculations are difficult for values that do not follow the decimal system. Many countries have chosen a monetary series that resembles the binary series as closely as possible: 1, 2, 5, 10, 20, etc. Indeed, of the 15 Member States of the European Union in 1995, all but Denmark, Greece and Luxembourg had banknote series with at least one denomination containing the number two (20, 200 or 2000, in The Netherlands 25 and 250). It seemed obvious, therefore, that common European banknotes should follow the same system: 1, 2, 5, 10, 20...

It was less easy to find a compromise for the number of banknotes in the series, which varied in the Member States from three in Luxembourg to eight in Germany, while the

other members had 4-6 different banknote denominations. The value of the banknotes also varied. At the start of 1995 there were 74 banknotes in use in the European Union, with a relative worth ranging from about 0.2 ecus in Greece (50 drachma) to some 520 ecus in Germany (1000 Marks).

The number of different banknote denominations was also naturally affected by the denomination at which banknotes took over from coins. In general the smallest banknote in the member countries was worth more than 2 ecus; only Austria, Greece and Italy had a banknote worth less than 2 ecus. Moreover, there would have been an excessive number of different banknote denominations if the series had included very small and very large notes, and this would also have complicated banknote handling and storage. Because most Member States used two as the border line, the 2-ecu banknote, which had originally been regarded as one option, was eliminated from the plan. Both working groups, for banknotes



◆ Fig. 5 Banknote denominations, chosen at the end of 1994, were based on the national banknotes of member countries, varying from 50 drachmae in Greece to 1000 Marks in Germany. ◆

and coins, proposed that the largest coin should be 2 ecus and the smallest banknote 5 ecus. They rejected the idea of a banknote and a coin both worth 2 ecus, because it would have increased the amount of work for stakeholders to prepare for the new currency and because most countries that had a coin and a banknote of the same denomination had found that the

public generally preferred one over the other, whether it was the banknote (USD 1 in the United States, AUT 20 in Austria and FIM 5 in Finland) or the coin (DEM 5 in Germany).

There were many discussions about the largest banknote denomination. Six member countries (Austria, Belgium, Germany, Italy, Luxembourg and The Netherlands) had high-

denomination banknotes for which there was growing demand. For example 1000-Mark banknotes had accounted for 33% of the total value of banknotes in circulation in Germany in 1994, compared with 5% in 1970. In fact, it was estimated that 30–40% of the total value of German banknotes was held in other countries where citizens had little confidence in their own currency and monetary system and so held cash reserves in a currency unit that they thought was more stable. Obviously if a 500-ecu banknote was not produced, a greater number of 200-ecu banknotes would be needed, greatly increasing production and handling costs.

It was no secret that the grey economy and organised crime used high-denomination banknotes but eliminating them would not have altered this behaviour because criminals would simply have opted for smaller

banknotes or other currencies. The existence of cash is not the reason for the grey economy. Considerations of preparedness also argued for a 500-ecu banknote, which would naturally take less storage space than small denomination notes.

The EMI Council decided to keep the 500-ecu banknote in the series and, in November 1994, approved the working group's proposal that the smallest note should be 5 ecus. At the same time it agreed that the series would consist of seven banknotes of the aforementioned numeric progression: 1, 2, 5, etc. After the euro was issued there was some criticism of the high-denomination notes in the series but the decision proved to be wise, especially at the time of the collapse of Lehman Brothers investment bank, when public confidence in the banking system was shaken and demand for euro cash rose steeply (see Chapter 12).

## Challenges of appearance and lettering

The appearance of the new European banknotes was the subject of constant discussions in the banknote working group at the time. Technical considerations argued for an entirely standard banknote which, it was believed, would simplify production, handling and the prevention of counterfeiting. On the other hand, political and psychological factors related to the appearance of the note were harder to assess.

As it studied questions of banknote appearance, the working group identified the following six alternatives:

- a) a series of entirely uniform banknotes.
- b) a uniform series in which the Member State issuing the banknote could be identified by some notation. (In this connection the main exemplar in mind was the US dollar banknote series, where a letter at the start of the serial number and in the seal indicates one of the 12 issuing Federal Reserve Banks.)
- c) a uniform banknote series containing an easily identified national feature.
- d) a series in which one side was standard and the other national.

- e) a national banknote series containing an easily identified European feature.
- f) a national banknote series containing a small motif indicating that it was a common European banknote.

The different alternatives of appearance were compared and evaluated on the basis of four criteria:

1. how the public would feel about the banknote as an instrument of payment.
2. how the public would recognise a banknote as genuine.
3. how banknote could be handled by machines.
4. what banknote printing costs would be.

Although it was obvious that Europeans appreciated their national banknotes, the working group felt that a banknote series to be used in many Member States should be as uniform as possible. Otherwise EU citizens would have to learn to recognise all the different banknotes, which was certain to cause unnecessary confusion. The same was true about validating notes. The fewer the differences between the European banknotes of different Member States, the easier it would be for citizens to recognise a genuine note.

Because the common banknotes would be legal tender in all Member States, they naturally had to be usable in machines too. The greater the degree of banknote standardisation, the easier it would be to ensure machine readability. At the same time, banknotes that contained a significant number of national features would not enjoy economies of scale, particularly in annual production after the changeover, when volumes would be smaller.

Consequently banknotes containing many national features (alternatives d – f) seemed to be a bad idea by all criteria. It was therefore decided that the appearance of the banknote series would be a choice between alternatives a, b or c; an entirely uniform series or a series where one side of the note contained a national characteristic in a standardised form.

The world offers several examples of monetary unions that have tried the various alternatives. The Economic and Monetary Community of Central Africa used banknotes in the 1970s that conformed to alternative d (one side uniform, the other national), but in the 1980s it shifted to a series where the notes were standard except for the name of the issuer. Later, in the 1990s, the issuer was indicated only by a letter.

The East Caribbean Currency Union showed a similar trend. At first its banknotes identified the issuer with a letter contained in a ring, and later by only a letter preceding the banknote's serial number, until the identifier was finally omitted entirely.

The use of languages in lettering was another tricky question for the appearance of banknotes. Typically national banknotes contain text that identifies the issuer, the value of the note and often also the office of the signer. Some countries' banknotes also have legal text about counterfeiting, such as French franc banknote, which had many rows of small print about maximum punishments and fines. German banknotes had followed the same practice, although a new series issued in the early 1990s had eliminated the text about the criminality of counterfeiting on aesthetic grounds.

Nor was the matter of language unique in the history of banknotes. The notes of Austria-Hungary had expressed their denominations in ten languages and the notes of the Soviet Union in as many as 16 languages, but the security requirements of banknotes had evolved since those times. It was already clear at the planning stage that a European banknote could not contain a lot of lettering because of the impossibility of fitting in all the different language versions of the text. The banknote group's discussions were therefore mainly about how to show the future issuer of the banknotes, the European Central Bank. Printing the name of the bank in all the languages of Member States was out of the question, so the functional solution to use the initials of the central bank in different languages. Three sets of initials – BCE, ECB and EZB – covered most of the abbreviations for the European Central Bank in various languages. To these were added the Greek abbreviation EKT and, after Finland joined, EKP. Briefly, in September 1994, preparations included ESB for Norway, but then the total number of abbreviations fell back to five, which was manageable.<sup>1</sup>

Another headache concerned the signing of banknotes and how to show the position of the signer. Banknotes had begun life as certificates of deposit and so it was quite natural that they had always borne the signatures of officials of the bank that had issued them, like other certificates of deposit. The signatures showed that a deposit with a bank had created a debt and at the same time confirmed that the note was a genuine certificate issued by the bank in question.

The general public today no longer sees banknotes as certificates of deposit and, indeed, under prevailing currency acts they are not. The banknote working group even considered omitting signatures altogether but, because almost all the world's banknotes still bear them, it seemed sensible to preserve this practice in the banknotes of Europe. This was the conclusion of the working group's discussions.

Different countries had different practices regarding whose signature or signatures were on their banknote. Most Member States had two signatures though British banknotes had only one<sup>2</sup> and the notes of Austria, France and Spain had three. Despite the national differences the group very soon agreed on the plan that the notes should bear only the signature of the President of the European Central Bank. No appropriate way was found for text to show the office of the signer because space would not allow the President's title to be printed in all the official languages of the European Union. Instead, printing the signature in close proximity to the abbreviations for the European Central Bank offered a functional solution that did not require the position of the signer to be explained.

The choices about banknote lettering were thus reduced to the following alternatives (assuming that the banknotes had a visual national feature, which was still regarded as one possibility at this stage):

1. The notes would display no text apart from five abbreviations for the name of the issuer in the languages of the Member States (ECB, BCE, EZB, EKT, EKP).

2. In addition to the above, the value of the note would be written in all the official languages.
3. The value of the note would appear in the language of the issuing country only.
4. In addition to the above, the name of the issuer would be written in full in the languages of all member countries.

In the discussions of the banknote group, support was voiced for alternatives 1 and 2 only.

When the EMI Council considered the appearance of the banknotes in summer 1995 it concluded that, if they had a national feature, it should be limited to no more than 20 percent of one side of the note, and all the other characteristics of the banknotes were to be uniform. Regarding lettering, the Council decided that the banknotes should bear only the name of the currency and the abbreviated name of the issuer (alternative 1, above), whereas the denomination of the note, for example, should be shown by numbers only. In accordance with the banknote group's proposal, the signature

of the European Central Bank's President was placed near its abbreviated name. Later, in summer 1997, the Council decided to add the copyright symbol © before the abbreviations.

It was not until December 1996, after the design competition for the banknotes had been arranged, that the Council took its final decision on the use of a national feature on the banknotes. During the process, support had grown stronger for an entirely uniform banknote and after the design competition a great majority of the banknote group were in favour of this. The EMI Council accepted the view and decided that euro banknotes should be entirely standard, without national features.<sup>3</sup>

In spring 1995, central banks were asked for their views on the length of the transitional period when national currencies and the common currency would both be legal tender. The survey indicated that modifications to machinery and the logistics of the changeover required a transitional period of 6 – 12 months.

## TALES OF BANKNOTE SIGNATURES

As part of the Euro 2002 information campaign (see Chapter 10) a conference about the issuing of euros was arranged for stakeholders in each euro country. The Finnish conference was arranged in Hotel Marina Palace in Helsinki on 17 September 2001. The keynote speaker at the event was the ECB President Wim Duisenberg.

Obviously Duisenberg was making a lot of speeches around that time and we worked with the ECB's communications department to draft his speech at the opening ceremony. His script mentioned that, later in the conference, the challenges of the cash changeover would be dealt with in detail by me. At this point Duisenberg lifted his eyes from the paper and



◆ Fig. 6 Finland's Euro 2002 conference was arranged at Hotel Marina Palace in September 2001 and opened by ECB President Wim Duisenberg. ◆



◆ Fig. 7 Wim Duisenberg's signature on the euro banknote was exactly the same as on the banknotes of the Netherlands, but the lettering around the signature was different, illustrating the innovative solutions required to minimise the amount of text on euro notes. ◆

diverged surprisingly from the prepared text. He said that the 1st day of January 2002 would be a sad day for Antti Heinonen, because his signature would be banished from Finnish banknotes and replaced, on euro notes, with the moniker of Wim Duisenberg.

The remark was typical of Duisenberg, who often added light comments to the draft speeches prepared for him. I did not find out how he knew that mine was one of the names on Finland's markka banknotes, because we never discussed it. Perhaps he had spotted it when changing money into markkas for his upcoming trip to Finland.

I ran into the question of euro banknote signatures with Duisenberg once more at a later date. After Duisenberg, new euro notes began to bear the signature of his successor, Jean-Claude Trichet, and then of Trichet's successor, Mario Draghi. A few months after Duisenberg had resigned the post of ECB President at the end of October 2003, I received a call from his assistant, telling that the former president wanted to speak with me. It was unexpected.

After exchanging pleasantries, Duisenberg said that he had been buying food at a shop in France and his change had contained a banknote bearing

someone else's signature. I said that it must have been signed by Trichet, the new President. The reason for Duisenberg's surprise was that, in The Netherlands before the introduction of the euro, it had been the practice that the two signatures on a banknote when it was introduced were kept on the banknote until it was replaced by another design. Although Duisenberg had moved to the European Monetary Institute in 1997 and then had become the ECB President in the following year, his signature had remained on all but one Netherlands banknotes (10 guilders) right up to the point where the guilder was replaced by the euro. The ten-guilder note had been redesigned in 1998 and was therefore signed by Duisenberg's successor as governor of the Dutch central bank.

There is another amusing tale about Trichet's signature on euro banknotes. It dates from early summer 2006, when the media were arguing about who should be called Mr Euro. Should it be Olli Rehn, who was the European Commissioner for Economic and Monetary Affairs? Should it be Jean-Claude Juncker, the president of the group of finance ministers of the euro area? No, I am Mr Euro, replied Jean-Claude Trichet, the President of the European Central Bank. "I sign the banknotes."<sup>4</sup>

## Banknote sizes adjusted for the visually impaired

The sizes of banknotes in circulation varied significantly between the Member States. The largest was Germany's 1000-Mark note which measured 178 x 83 mm, and the smallest was

Italy's 1000-lire note which was 112 x 61 mm. At the time, the only member where all banknotes were identical in size was Finland. When this Finnish banknote series had been

issued in 1955 it had been likened to dollar bills because notes of the same size were very common in countries where the currency was called the dollar, in North America and the Pacific. Although European Union countries apart from Finland used notes of varying sizes there was a trend towards smaller size differences. Belgium, France, Luxembourg, The Netherlands and Portugal had changed to using banknotes of the same height but of different lengths. In another five countries, the banknotes varied in height by 3–5 mm and in length by 7–8 mm.

A standard banknote size simplified machine handling, packing, storage and transportation but notes of the same size could cause confusion for users and problems for the visually impaired, for whom size differences were the best way to distinguish one denomination from another. The shape of common European banknotes had to take into account the needs of the blind and visually impaired, a group estimated to contain more than seven million people. From 1995 onwards, the banknote working group worked very closely with the European Blind Union in planning the appearance of banknotes and particularly their size. The work was also guided by the idea that if it was easy for the visually impaired to use banknotes, it would be easy for everyone else.

A recurring question was what banknote size difference would be sufficient for the visually impaired. On the other hand, a certain

minimum and maximum size was required for automatic handling in printing works and central banks. The banknote working group therefore decided to propose a compromise to the EMI Council: that banknotes could vary by 7 mm in length and 5 mm in height. However, to simplify machine handling of banknotes, it was proposed that the notes of the highest denomination— 100, 200 and 500 ecus — should be of the same height, but with various embossments for the visually impaired added to 200 and 500 ecu notes. The EMI Council endorsed the working group's proposals on banknote size in September 1996.<sup>5</sup>

As an additional aid for the visually impaired, it was planned that a large number showing the denomination of the note should appear on both its sides. The number was to appear in the same position for the whole series. A number that stood out clearly would also help the visually impaired to decide which way to feed the banknote into vending and other machines.

These decisions meant that Finland had to get used to notes of varying sizes after an interregnum of nearly 50 years. Before the cash changeover there was some concern about whether people would have to buy new wallets. Indeed, this seemed to be a seriously distressing issue, to judge from reports in the foreign press about public sentiment in the countries preparing to adopt the euro.<sup>6</sup> After the changeover, the matter was hardly ever mentioned.

## ACCEPTABLE MINIMUM BANKNOTE SIZE ALMOST UNCHANGED FOR DECADES

As part of the planning for a European banknote, central banks and banknote printing works were asked in the mid-1990s about the smallest note size that they would be able to handle comfortably. From the answers it was concluded that a note smaller than 120 x 62 mm could not be printed efficiently nor sorted in the high-speed sorting machines of all the central banks.

It is interesting to compare the results with a similar survey conducted in Finland in the 1940s,<sup>7</sup> when the

board of Suomen Pankki had asked cashiers about the smallest size for banknotes that could still be sorted and counted by hand. On the basis of their answers, the board decided on the size of 120 x 63 mm, exactly the same length as the European banknote working group picked fifty years later, and only one millimetre wider. This meant that the minimum banknote size hardly varied at all, whether the efficiency criteria were suitability for printing and sorting machines or for the manual operations of Finnish cashiers.

## Establishing principles for choosing security features

It is said that a banknote *can* be beautiful but it *must* be secure.<sup>8</sup> Applying this logic, the banknote working group spent a lot of time considering security features. Agreement was needed on a relatively large proportion of security features before the design competition, because the positioning of these features would have a major influence on the appearance of the banknotes and the space available. Consequently, the working group made its proposal on security features to the EMI Council at the same time as the design competition was being organised. All design entries would thus be able to take into account the features and the positions determined for them.

The central principles were clear. Firstly, the banknotes should have at least the same level of security as did the national notes of Member States that were in circulation when the common banknotes were issued. The working group produced its proposal on security features many years before the common banknotes were due to be issued and many countries were currently engaged in modernising their national banknotes or planning to do so. France was in the middle of a banknote revision that continued until 1997, Portugal modernised its banknotes in 1996 and 1997, Finland and The Netherlands in 1997. Belgium and Germany introduced new banknotes as late as 1998, when the 500-franc and 50-Mark notes were

modernised. If possible, the level of security in common European banknotes ought to be even higher than in national banknotes because the European notes would be in more widespread use.

Secondly, apart from providing security, the features should allow the effective recognition of the banknotes by various types of users: the general public, the special group of the visually impaired, the banking sector, retailers, cash dispensers and vending machines. Thirdly, all Member States should be able to produce the notes and their security features to the same standard, whatever banknote paper mills they used and regardless of their banknote printing machines. Finally, all the central banks had to be able to sort the notes using their existing sorting machines in the same way as their national banknotes.

The security features of banknotes are generally divided into four groups:

1. Features that can be recognised without equipment, such as a watermark, a security thread, optically changing elements, the feel of the banknote paper and the roughness obtained from intaglio printing. The main function of these features is to make it easy for the general public to recognise when a note is genuine.
2. Features that can be recognised with simple equipment such as a magnifying glass or an ultraviolet lamp. These include microprinting and printing with fluorescent colours. Their aim is to make it easier to recognise genuine notes at cash desks in banks and shops that handle money professionally.

3. Machine readable features that allow cash dispensers and vending machines to recognise when a note is genuine. These include the ultraviolet, infrared and magnetic properties of banknotes.
4. Machine readable features for central banks to identify genuine notes in their high-speed sorting machines. These features are secret; information about them is not given to outsiders.

It was proposed that banknotes of all denominations should use security features from each of the four groups, but the working group thought it was axiomatic that security features would be given special emphasis in banknotes of high denominations.

The prevailing situation in the Member States was the starting point for the working group's discussion on which security features should be used. As noted above, all used cotton paper for their banknotes although the weight of the paper varied.

Apart from French banknotes, national notes weighed 79 – 92 g/m<sup>2</sup> and most were in the range 83 – 85 g/m<sup>2</sup>. France had traditionally used very thin paper and, even in the mid-1990s, the old series that still made up most of its notes had a weight of 57 g/m<sup>2</sup> although, with a new series, it was shifting towards heavier paper.

Deciding on a watermark was easy because all members used one in their banknotes and the general public was very familiar with this security feature. Similarly, a thread was in use in all notes except those of The Netherlands. Intaglio printing, which gave the banknote a rough feel, was used in all notes except for



◆ Fig. 8 In 1995 all Member States were using cotton paper as the substrate for their banknotes. ◆

small Italian 1000 and 2000 lire notes. Intaglio was typically used to print the portrait and the denomination of a banknote.

Beyond these traditional security features the situation was much more fragmented. New security features that responded to the threat posed by new copying technology – which at that stage was mainly colour photocopiers – had been adopted by Member States but to varying extents. Most countries were using microprinting as well as see-through, where elements from the front and back of the note

formed an image together when held against the light. Germany, Luxemburg and Spain had reflective colours in their notes, Austria, Finland, France and The Netherlands used holograms and kinegrams, and some countries used a latent image that appeared when the note was tilted.

The new security features, most of them developed over the previous decade, were the subject of long and detailed discussions in the working group, and advisory votes were sometimes taken. In the case of optically

variable features, it was eventually decided that high denomination banknotes should have a hologram and colour-shifting ink while small notes should have a hologram stripe and iridescence.

The group's discussions formed the basis for a preliminary proposal, made for the design competition. However, the development

in copying technology and the new threat posed by the arrival of personal micro-computers, scanners and printers, meant that the development of security features had to be monitored throughout the planning process. The last amendments to the technical specifications were made in spring 1999, just before the start of full-scale banknote printing.

## NEW CHAIR APPOINTED TO THE BANKNOTE ISSUE TASK FORCE

Suomen Pankki became an observer, in July 1994, on the working group planning the European currency and in January 1995 it gained a full position, as did the other countries that joined the European Union at the start of 1995. However, the composition of the various task forces had already been settled, so only a few places were available to the newcomers. Then, in spring 1996, Roberto Andrade of Spain resigned the chair of the task force on banknote issuance, and Alex Jarvis asked whether I would be willing to take over. The task forces were known by letters: security features were planned in task force A, production in B, issuance in C, and so on. The request to head the task force was a mark of respect for Suomen Pankki, too, so naturally I agreed. I had just promised, a few months earlier, to serve as secretary of the statistics and banknote handling committee of the Banknote Printers' Conference, involving various European central banks, not just those of the European Union. Now, in the same week in April 1996, I was asked to

chair that committee, too, when Roland Tornare of Switzerland asked to be released from his promise to chair it. Through these almost simultaneous events I ended up, in spring 1996, heading two groups of major importance to cash management for European central banks. This and probably other coincidences resulted, a couple of years later, in my being chosen by the recently established Executive Board of the European Central Bank to be the ECB's first Director of Banknotes.

When I began chairing task force C of the banknote working group, I felt I already had plenty of experience, from work and leisure time, of heading meetings and working groups. I noticed fairly soon, however, that running an international meeting was an entirely different ball game. Firstly, almost everyone had to make speeches in a language that was not his or her own, because the task forces did not use interpreters and the working language was English. The banknote working group had originally had simultaneous

interpretation but for French and German only. That was ended in autumn 1997 after a misunderstanding had resulted in no interpreters being ordered for a meeting held outside Frankfurt, when it was noticed that the meeting went well anyway.

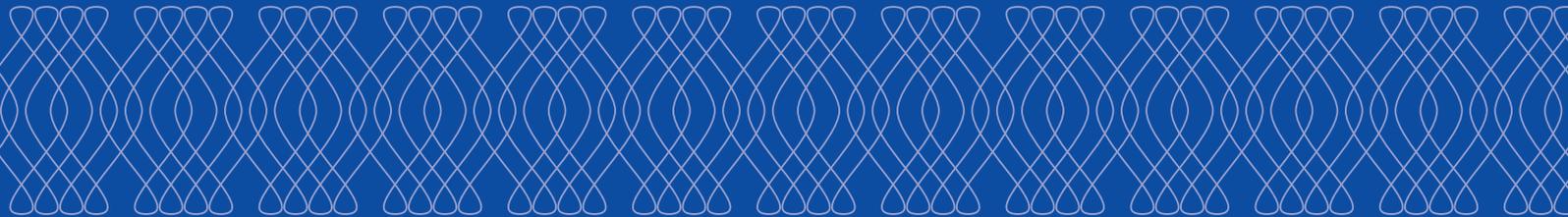
Even so, from time to time, language problems made it harder to understand the opinions expressed and moreover the group members had very different cultural backgrounds which were reflected in communication. I gradually learned from experience to understand both factors better. Sometimes in later years, even people who spoke English as a mother language said they were surprised that I had understood the proposals of all the participants, which they had not always managed to do.

I still vividly remember one meeting from the early years. The job of the task force was to prepare for the issue of the common European currency and decide what proposals it would make to the banknote group. The central question of principle was what matters

each national central bank could decide for itself, what matters had to be coordinated and exactly how much should be coordinated.

As we talked about the coordination of issue, I let the debate stray occasionally into questions that would arise after issuance, because I thought that a common currency would have an impact on it. During one such early discussion, a task force member asked to speak and said excitedly that he did not understand what we have been talking about for the last half-hour because a common currency meant only a common currency and all other matters related to supply of currency would be unchanged. Taken aback, I could only respond that this might well be true but that perhaps it would be good for everyone to know how other central banks managed supply of currency, so as to compare to their own practice and possibly improve them. This approach was indeed useful later, when harmonisation of the supply of currency began (see Chapter 13).





3.

*The choice of  
banknote themes and  
the design competition*



## Advisers identify wide range of potential themes

After a comprehensive discussion at a meeting in November 1994 about how the design of European banknotes was to be organised, the banknote working group suggested the establishment of an advisory team of experts in the fields of history, psychology, sociology, the graphic arts and so on, proposed by each national central bank. From the candidates nominated, the group sought to build a balanced team.

The advisory team's first task would be to propose a range of banknote themes, each of which could form a unified series of seven notes. It was then to select the three best themes, in order of preference.

Initially, the Theme Selection Advisory Group came up with eighteen possible themes (see page 57), which it then whittled down to ten for further evaluation. Next, each team member evaluated the ten in pairs. By adding together the points given to each, they placed the alternatives in order of preference. Finally

the team informed the banknote group of the three top point-scorers:

1. Ages and styles of Europe. In this alternative, the obverse of the banknote would show portraits of ordinary men and women across the ages, taken from European paintings and drawings, while the reverse would show architectural styles. The theme would stress the common cultural heritage of the nations of Europe, giving the banknotes a clear European message. An argument in its favour was that Europe's most famous buildings and monuments are better known than its leaders.
2. Heritage of Europe. The obverse would show famous men and women of the past, from a variety of fields. The reverse would illustrate their achievements (in music, painting, science, architecture, literature, medicine and education). The appearance of the seven banknotes would be harmonised with a common background, a map of

Europe without borders. This theme was broader than the “Ages and styles” theme because it showed seven distinct disciplines. However, the team feared that it might be hard to strike a balance between countries and between men and women.

3. Abstract theme and security. This alternative would involve the use of geometric shapes and abstract elements. It offered designers great flexibility and would make it easier to include a variety of security features, such as holograms and colour-shifting inks.

Although most Member States had a tradition of placing portraits of famous people on their currency, the banknote working group felt that alternative 2 suffered the serious defect of an inevitable national bias. If only one portrait were selected for each of the seven notes, only seven nations could be represented. Erik Bruun, a graphic artist nominated to the advisory group by Suomen Pankki, had proposed that each note could, on its obverse and reverse, bear four portraits,<sup>1</sup> which would have allowed all countries to display their famous men and women, but there was not enough support for this idea from other members of advisory group.

The banknote working group felt that an advantage of alternative 1 was that it would avoid a bias in gender or nationality. Furthermore, it would portray fields for which Europe is renowned (art and architecture). The group also liked the advisers’ idea for using the European flag of stars as a common design element, which would make it easy to recognise the banknotes as Europe’s common currency.

## The eighteen themes first identified by the advisory team

- ◆ Ages and styles of Europe
- ◆ Heritage of Europe
- ◆ Abstract theme and security
- ◆ Aims, ideals and aspirations of the European Union
- ◆ Collective memory of Europe and cultural achievements of Europe
- ◆ Fauna, flora and the natural environment
- ◆ Great European figures associated with a single discipline
- ◆ Aspects of Europe (things vital to a united Europe, like communications)
- ◆ Great European poems and narratives
- ◆ Several portraits on both sides of each banknote denomination
- ◆ Landscapes
- ◆ Cities with an important role in Europe’s history, like university towns
- ◆ Monuments
- ◆ Myths and legends (Scandinavian, German, Greek, Roman and Celtic)
- ◆ European scripts and written work
- ◆ Maps of Europe through the ages
- ◆ The “founding fathers” of the European Union
- ◆ Cosmology

After discussing the matter, the working group decided to propose to the EMI Council that options 1 and 2 should be developed prior to the design competition. Because option 3 was abstract, and did not therefore contain any predetermined elements, there was no immediate need to elaborate it. On the other

hand, before the design competition could get under way, alternative 1 required a proposal about the ages and styles to be used for each of the seven notes. The group asked the EMI Council to set up a new advisory group for this purpose.

For scheduling reasons it made sense to use most of the same advisers as before, but supplemented with extra experts in art and architecture.

From the banknote working group's proposal, the EMI Council approved two of the three alternative themes in June 1995. These were "Ages and styles of Europe" and

"Abstract/modern design", as alternative 3 had been renamed. At the same time the Council also concluded that the only words on the banknotes would be the name of the currency and the initials of the ECB in the languages of the Member States, as mentioned earlier.

A new advisory group then held its first meeting to prepare a proposal on the seven architectural styles to be portrayed in the "Ages and styles of Europe". Initially they talked about ten alternatives, from which they selected Classical, Romanesque, Gothic, Renaissance, Baroque and rococo, Age of iron and glass, and Twentieth century architecture.

## Periods and architectural styles chosen by second advisory team

### Period

8th century BC to 4th century AD  
 11th and 12th centuries  
 13th and 14th centuries  
 15th and 16th centuries  
 1600 to 1750  
 1850 to 1914  
 1930s onwards

### Style

Classical (Greek and Roman)  
 Romanesque  
 Gothic  
 Renaissance  
 Baroque and rococo  
 Age of iron and glass  
 Twentieth century architecture

One of the advisory group then began to plan how each style would be used and the features that characterised it. Similarly, work began on creating a compendium of portraits of anonymous men and women across the ages to appear on the notes. The majority of the team feared, however, that it would be difficult to find pictures that would always remain nameless, that would be aesthetically pleasing,

and that would represent the genders and different nationalities in a balanced way. There was always the possibility that a portrait would be identified and associated with some region or country on the basis of its features, decoration, style and location. The team therefore favoured the alternative of using recognisable images that would strike a balance between different regions and historical periods.

Professor Jaap Bolten, a Dutch member of the advisory group, proposed that the colours of the banknotes should be based on the colour wheel. The wheel had first been invented by Isaac Newton and later developed by the Swiss painter and teacher Johannes Itten (1888–1967). The location of colours on the wheel is as follows:



Bolten proposed that the three primary colours – yellow, blue and red – should be

reserved for the three most frequently used banknotes (10, 20 and 50 ecus) because the contrast between them was optimal. The secondary colours should be used for the most valuable notes, with the most distinguished colour, purple, used for the highest denomination. Because there were to be seven denominations, neutral grey could be used for the smallest note. To achieve the best possible contrast between notes of successive denominations (like 10 and 20) and between denominations containing some of the same digits (like 10 and 100), their colours should come from opposite sides of the colour wheel. In this way, Bolten devised the following plan: purple for 500, orange for 200, green for 100, yellow for 50, blue for 20, red for 10 and grey for 5. This proposal formed the basis for the colours of euro banknotes, except that the banknote working group wanted to switch the colours of the 50 and 200 notes, because it believed that 50 would be a heavily used denomination and yellow would easily become discoloured. Dirt on banknotes is usually yellow and brown in colour because it originates mainly from grease on the fingertips.

## Banknote design competition arranged in early 1996.

Once the potential themes of banknotes began to coalesce, the banknote working group turned its attention to the form of the design competition. There were four alternatives available:

1. An open competition in which anyone could participate.

2. A competition among graphic and banknote designers invited by central banks.
3. A competition limited to those who had previously designed banknotes.
4. A closed competition among banknote designers of central banks.

An objection to an entirely open competition was that hitherto unpublished information about the banknotes, such as security features, would have to be divulged. On the other hand, a closed competition among central bank designers would have eliminated member countries where the central bank did not have in-house banknote designers. A solution had to be found between these extremes, and the banknote group ultimately decided to propose that every EU central bank could invite 1 – 3 participants (individuals or teams), each allowed to submit no more than one entry per theme.

The group sent its proposal on the design competition to the EMI Council in November 1995. At the same time it made its preliminary proposal, referred to previously, on banknote security features. It thought that the schedule would allow the competition to begin in

early 1996 and that the winning entry would be chosen in the second half of the year. The banknotes' appearance and technical details could then be finalised in 1997, so that printing could begin in 1998. In fact the Council postponed its decision till January 1996, at which time European leaders had already decided that the common currency would be named the euro, an alternative that worked well in the different languages. The Council approved the working group's proposal on the design competition and that the name of the currency in the design brief for competitors would be written in both the Latin (EURO) and Greek (ΕΥΡΩ) alphabets.<sup>2</sup> All central banks of the Member States except Denmark nominated participants for the competition.

The competition got under way in February 1996, when the participants chosen by the

## BANKNOTE GROUP BEGINS ANNUAL MEETINGS OUTSIDE FRANKFURT

The banknote working group met at first in Basel at the Bank for International Settlements. From the start of 1995 the meeting room moved to premises rented by the EMI in Frankfurt's Eurotower. Around the same time, the idea came up at the EMI that all the working groups engaged in preparing the European currency and monetary policy could meet outside Frankfurt once a year, where unity of purpose could be enhanced by adding extracurricular activities to the programme. It was agreed that Deutsche Bundesbank

would arrange the first such meeting in September 1995.

The meeting was held at Berlin's Landeszentralbank, which was located in the east of the city and had been used by East Germany's leaders before German reunification. Planning for a European banknote took place at a table where the chairman's gavel had previously been wielded by Erich Honecker. The next meeting of the group outside Frankfurt was arranged at Suomen Pankki in Helsinki in June 1996.

central banks were sent a design brief, laying out the detailed criteria that their designs for a banknote series should meet. The notes had to be easily distinguished, difficult to counterfeit and aesthetically pleasing, with designated security features located in specified positions. In addition, the numbers signifying their denominations had to appear at least twice, on both sides of the note, and had to stand out clearly against the background. The brief gave technical specifications of the security features planned for each banknote. The instructions totalled more than 30 pages, plus an appendix containing anonymous images for the different eras, selected by the advisory group. A briefing was arranged for the participants in Frankfurt in March at which they received more information about the competition arrangements and brief, and where there was discussion about all the questions received from participants in advance.

At this point the EMI Council had still not settled whether Europe's banknotes would be entirely uniform or whether they would contain some national feature, so the design brief stated that the reverse of each note should reserve an area of at most 20 percent where a national motif could be added later if so decided.

The competition ended on 13 September 1996. The designers or design teams that took part numbered 29. Of the design proposals, 27 were for the theme "Ages and styles of Europe" and 17 were for "Abstract or modern". Some of the competitors had therefore produced designs for both themes.

The technique to be used in draft designs had not been specified; some competitors

sketched or painted their designs by hand while others used a computer. The choice of technique had no effect on the selection process, where the proposals were reviewed in the form of colour photocopies. The designers sent their proposals to central banks, which checked whether they conformed to the design brief and technical specifications and then, within a week, forwarded them to Frankfurt notary appointed by the EMI.

The notary eliminated from each draft all references to the author and gave each draft a random three-digit reference number before sending them to the EMI. Throughout the selection process, the competition entries were anonymous, identified only by their reference numbers. This ensured that the EMI Council and all its advisers assessed the drafts objectively, uninfluenced by their origins.

Concurrently with the start of the competition, the banknote working group began to plan how the winner would be selected. It proposed to the EMI Council that unidentified entries would be assessed by a separately appointed jury of experts. Each member country could name one jury member, who could not be a member of either of the groups that had previously worked on banknote themes or details. Central banks could propose 2 – 3 respected authorities from the fields of marketing, psychology, design, art or art history. From these the President of the EMI would select a jury of balanced skills. Fourteen central banks proposed members for the jury.<sup>3</sup> Naturally none of these candidates had ties to the banks that had proposed them, nor to their banknote printing works.<sup>4</sup>



◆ Fig. 9 The jury of experts, consisting of representatives from each EU country except Denmark and headed by EMI Secretary General Hanspeter K. Scheller, convenes in September 1996 to consider the 44 entries submitted to the euro banknote design competition. ◆

The jury, headed by EMI Secretary General Hanspeter K. Scheller, met on 26-27 September 1996. On the first day it considered *Ages and styles of Europe*, on the second *Abstract or modern*. Its duty was to assess all the designs submitted and to select five from each subject that would go forward to the final round. The criteria for selection were creativity, aesthetics, style, effectiveness and acceptability, with special attention to be paid to avoiding national bias. The jury was to provide a written report

on its choices and could also, if it wished, make proposals for improving the designs selected for the final round.

The jury felt that the series to be chosen had to have a European appearance. There were few portraits in the various series it selected because even the slightest similarity to a real person could have been interpreted as favouritism towards a certain nationality. In successive discussions and votes, the proposals were placed in order of preference by eliminating the

least satisfactory ones, the same method as used in architectural competitions. Initially, designs were rejected by a qualified majority (75%). In the second stage a simple majority was enough and in the same way, where necessary, in a third stage of discussion and voting. When voting had reduced the number of proposals on each theme to five, the jury members placed them in order of preference by giving their favourite one point, their second choice 2 points, and so on. By adding together the number of points, they came up with the following finalists:

#### **Ages and styles of Europe**

1. Yves Zimmermann
2. Robert Kalina (Austrian central bank)
3. Ernst and Lorli Jünger
4. Inge Madlé (Joh. Enschedé, banknote printing house)
5. Daniel and Johanna Bruun

#### **Abstract/modern theme**

1. Klaus Michel and Sanne Jünger
2. Roger Pfund
3. Robert Kalina (Austrian central bank)
4. Maryke Degryse (Belgian central bank)
5. Terry Thorn (De La Rue Currency / Harrisons & Sons, banknote printing house)

In the design proposed for Ages and styles of Europe by Robert Kalina, which was ultimately chosen by the EMI Council, the jury praised its symbolism, bridges linking people of Europe and the continents of the world, and doors and gateways onto the future.

In the next stage of the competition, the banknote working group produced a technical

commentary on the jury's shortlist. It pointed out that for some of the jury's choices, sheets could not be cut into banknotes with a single stroke and the notes would therefore have to have the same colour at the top and bottom edge and also at both ends. Other common deficiencies were incompatible printing techniques, space where extra zeros could be added to denominations, poorly differentiated colours and weak contrast between the denomination and the background. Because the proposals that the jury liked best would require a lot of extra work and resources before being fit for printing, the banknote group expressed the hope that the Council would select only one and not two finalists.

Not contenting itself with the views of technical and artistic experts, the EMI Council decided to explore the opinion of the general public and people who handled money in their work, by interviewing target groups from the Member States. In October 1996 the ten banknote series selected by the jury were shown to representatives of the public in the countries that would probably adopt the euro.<sup>5</sup>

EOS Gallup Europe, the polling company selected to do the research, asked 1 896 people their opinions of the designs. The subjects were aged 15–86 and almost half of them were chosen because their jobs involved handling large numbers of banknotes. A detailed questionnaire was drawn up and each of the interviewees was shown photocopies of the draft designs selected by the jury. The questions, totalling some 30, explored the distinctiveness of the notes, their acceptability and what the feelings they aroused.

Although Maryke Degryse’s abstract/modern design was preferred by more respondents (35%) than Robert Kalina’s traditional series (23%), the majority (76%) felt that Kalina’s banknotes represented European characteristics better. They also aroused feelings of confidence in 60 percent of respondents. Interestingly, surveys show that the more

positive the first impression of a banknote is, the more confidence it generally inspires.

Interviewed about Kalina’s traditional design, the interviewees noted the architectural features of the banknotes but quickly observed the focus on Europe and the diverse imagery of a European identity in which the past and the future of the continent were combined.

**Figs. 10** Proposals of shortlisted designers: Yves Zimmermann (*Ages and Styles in Europe*, p. 66–67), Robert Kalina (*Ages and Styles in Europe*, p. 68–69), Ernst and Lorli Jünger (*Ages and Styles in Europe*, p. 70–71), Inge Madlé (*Ages and Styles in Europe*, p. 72–73), Daniel and Johanna Bruun (*Ages and Styles in Europe*, p. 74–75), Klaus Michel and Sanne Jünger (*abstract/modern* p. 76–77), Roger Pfund (*abstract/modern* p. 78–79), Robert Kalina (*abstract/modern* p. 80–81), Maryke Degryse (*abstract/modern* p. 82–83) and Terry Thorn (*abstract/modern* p. 84–85).



Inge Madlé



Robert Kalina



Yves Zimmermann



Maryke Degryse

◆ The choice of banknote themes and the design competition ◆



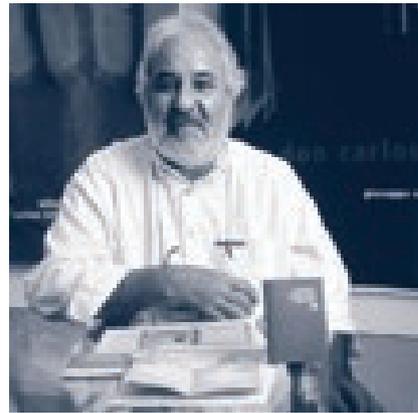
Sanne Jünger



Klaus Michel



Lorli und Ernst Jünger



Roger Pfund



Daniel Bruun



Johanna Bruun



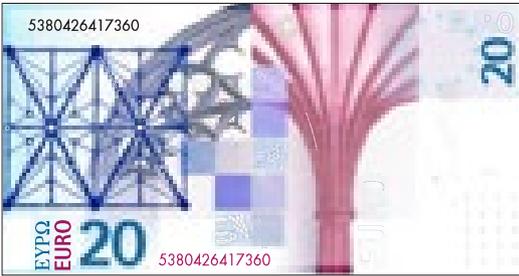
◆ ————— ◆  
Yves Zimmermann (Ages and styles)





◆ ————— ◆  
 Robert Kalina (Ages and Styles), in its revised form (see Chapter 4) finalised in June 1997 (Kalina's original proposal is presented on page 89).

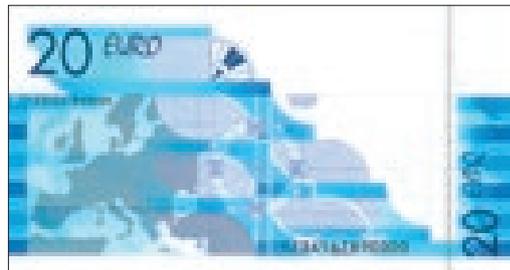
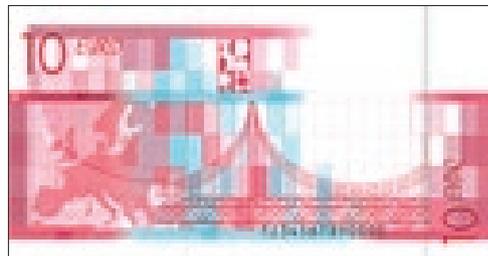
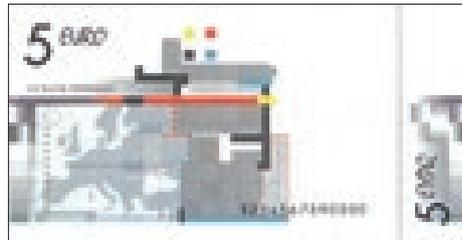




Ernst and Lorli Jünger (Ages and styles)

◆ The choice of banknote themes and the design competition ◆





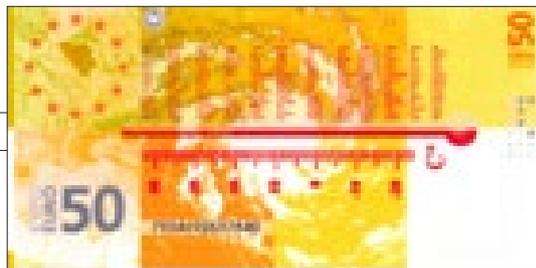
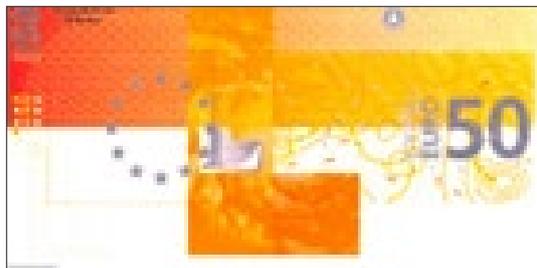
◆ ————— ◆  
Inge Madlé (Ages and styles)





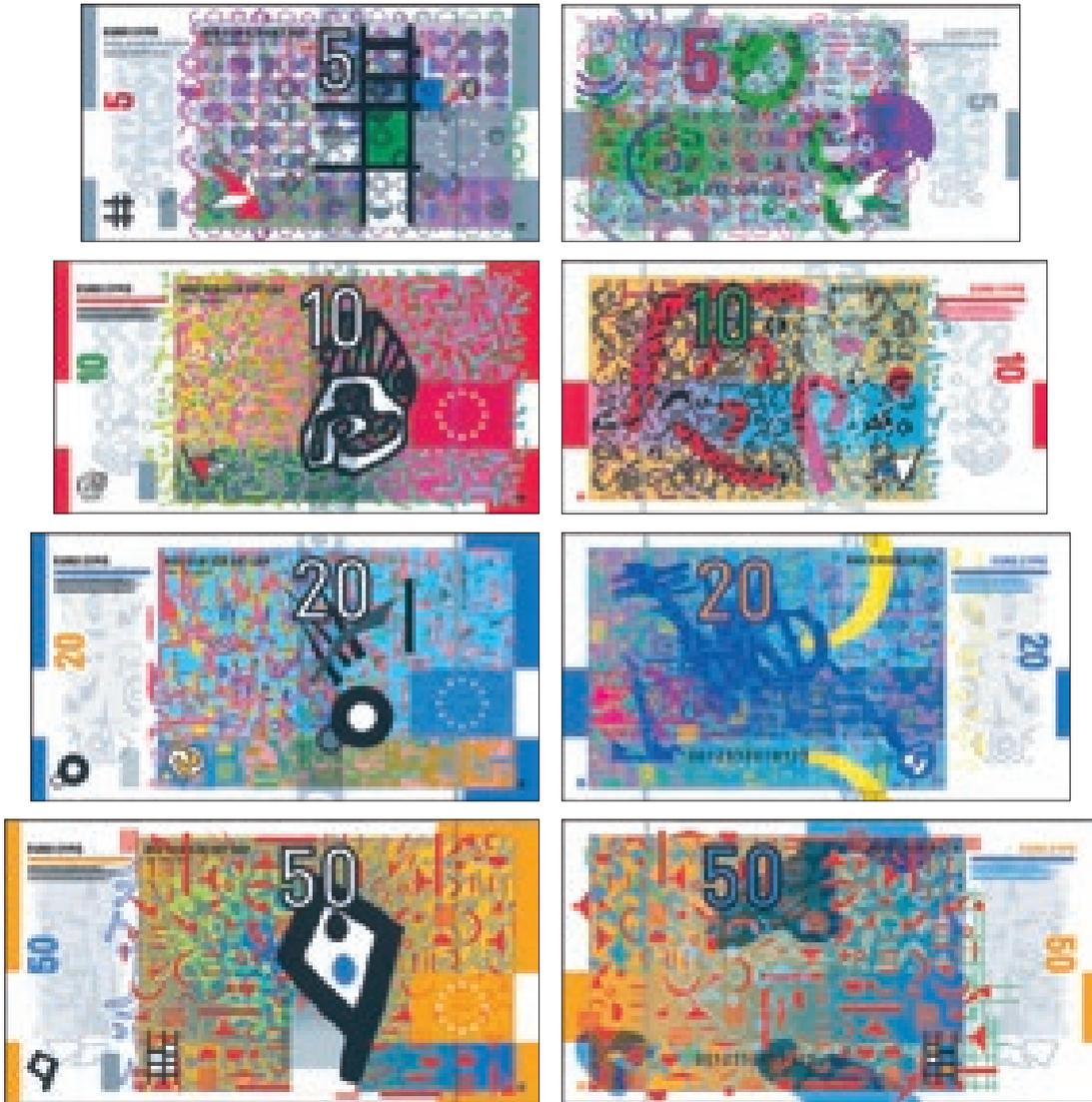
◆ Daniel and Johanna Bruun (Ages and styles) ◆





◆ Klaus Michel and Sanne Jünger (Abstract/modern) ◆





◆ Roger Pfund (Abstract/modern) ◆





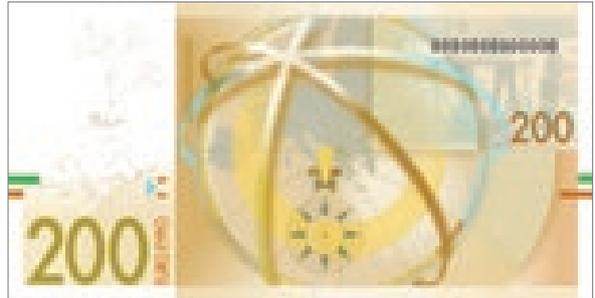
◆ ————— ◆  
Robert Kalina (Abstract/modern)

◆ The choice of banknote themes and the design competition ◆



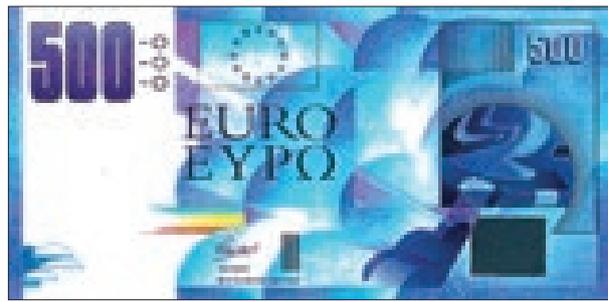
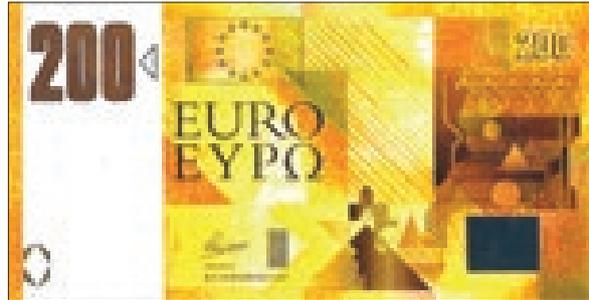


◆ Maryke Degryse (Abstract/modern) ◆

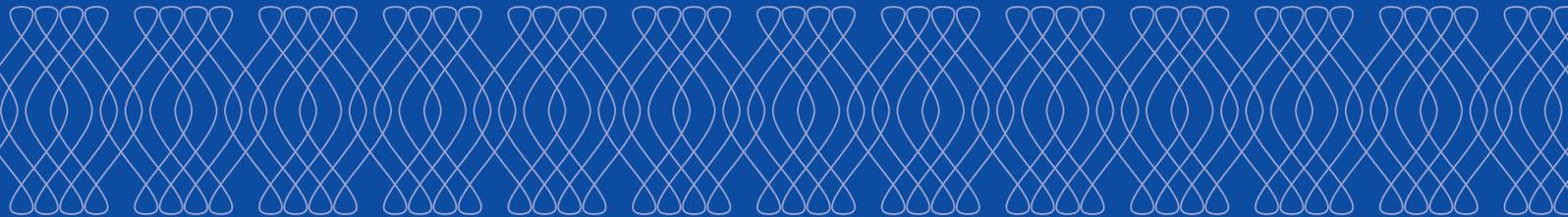




◆ Terry Thorn (Abstract/modern) ◆







4.  
*Winning design finalised,  
details settled*





Finally it was the turn of the EMI Council to consider the jury's findings, the banknote group's technical comments and public opinion, and to make its choice. In December 1996 all 44 proposals, still identified by three-digit random numbers allocated to them at the start of the competition, were presented to the Council, which selected T382. A series of traditional banknotes by Robert Kalina had made the greatest impression on council members.

The council's decision was published on 13 December 1996 at two press conferences arranged at the same time. The President of the EMI, Alexandre Lamfalussy, revealed the winner in Frankfurt and the then-governor of De Nederlandsche Bank, Wim Duisenberg, who had been picked to succeed Lamfalussy, announced the decision at a European Council summit in Dublin. Once the EMI Council had made its choice, only the winning entry was published, in order to keep the message clear.

## Refining the winning entry into a finished banknote design

Despite the meritorious and creative solutions it contained, the winning entry in the design competition could not be used as the basis for a euro banknote series before a whole range of questions had been resolved. In particular, there were vigorous discussions in the banknote working group about the map proposed for the reverse of the notes. Fixed positions are assigned to banknote security features so the space available for motifs

is limited. The consequent compromises needed in a banknote's appearance can be especially problematic in the case of maps. At worst, a wrongly drawn map on a banknote can lead to political friction, even requiring the design to be revised.<sup>1</sup> The problems with a map in the euro banknote series also resurfaced in 2004 with the accession of new Member States to the European Union (see chapter 16).

Fig. 11 The design competition was won by an entry on the theme of ages and styles of Europe from Robert Kalina, a graphic artist at the banknote printing works of the Austrian central bank, Oesterreichische Nationalbank. This picture was published by the EMI at the press conferences on 13 December 1996.



## EMI'S LAMFALUSSY: PICKING THE WINNER WAS UNEXPECTEDLY EASY

After euro banknotes had been issued, the European Central Bank felt it was the right time to show the general public the other entries in the design competition. It did so by publishing a book and arranging a touring exhibition of the design proposals. The exhibition was opened and the book published in Frankfurt in September 2003, at an event to which all competition participants were invited, together with Alexandre Lamfalussy, who had been President of the EMI Council when the competition took place. The event was addressed by ECB President Duisenberg and also by Lamfalussy, who recalled his impressions of the meeting in December 1996 when the winner was chosen.

In the run-up to the meeting, Lamfalussy said, he had been somewhat apprehensive because he thought that it would be a very difficult job to agree on the appearance of the banknotes. When this point on the agenda was reached, he concluded his introductory remarks by asking each council member to pick three favourites from the 10 shortlisted entries and write them down in order of preference. To his great relief

the ballot papers showed that a clear majority of the council had picked the same entry as their first choice, and that their favourite was among the top three of the other council members. This made it much easier to choose the winner than Lamfalussy had expected and the council quickly reached agreement.



◆ ————— ◆  
**Fig. 12** EMI Council President Alexandre Lamfalussy in September 2003, at the opening of an exhibition of entries to the euro banknote design competition, explaining how the council had made its final choice.

One option was for the reverse of the notes to show maps from different eras. However, some of them were hard to recognise as Europe, and they might also have been interpreted as focusing on Europe's past instead of its future. For these reasons it was decided to base the maps on satellite imagery.

Another map-related question was how islands should be treated; how large should they be to be included on the banknotes, and how far from the continent of Europe. Not all drafts showed the Aland archipelago between Finland and Sweden, for example, and some of them missed out northern Finland, to the consternation of the Finns.<sup>2</sup> It was decided that islands and territories would not be drawn

on the map unless they had a surface area of over 400 square kilometres, so as to avoid problems with the offset printing of lines. The EMI also approached certain cartographic institutes about defining of Europe's borders. The map extended to part of North Africa so as to include the Spanish enclaves of Ceuta and Melilla and the Canary Islands. On the other hand France's overseas territories of French Guyana, Guadeloupe, Martinique and Réunion were placed in map insets.

The publication of the winning entry sparked an intense discussion in the press. Some of the bridges proposed for the reverse of the banknotes were recognisable and experts could put names to a few of them.<sup>3</sup> It meant that the

◆ Fig. 13 French overseas territories of French Guyana, Guadeloupe, Martinique and Réunion were placed in map insets on the obverse of the banknote. ◆



bridges and also windows and doorways had to be changed to ensure that, while they still represented the right periods, they would not portray any particular structure and thereby avoid a national bias. The final images on the banknotes, however, had to display the era and its engineering skills correctly; for example, the bridges shown had to be able to support actual traffic. The EMI engaged four independent experts to study the changes made to Robert Kalina's designs.

The winning entry was also corrected so that the European Union flag of yellow stars on a blue background would be shown appropriately on the obverse of the notes. The

refinements to the appearance of the banknotes were completed in the first half of 1997.

The corrected versions of the banknotes were ready for publication in July 1997. However, details of their security features were not released at that time, so as to avoid giving counterfeiters time to copy them before the banknotes were issued. In the drafts published in summer 1997, the holograms were replaced by guilloches, patterns of overlapping spirals, and a grey EU flag appeared on the reverse of the notes. These dummies were used in all communications material about euro banknotes from July 1997 until the notes were published at the end of August 2001.

## DETAILED CONSIDERATION OF POTENTIAL LEGAL ISSUES

One task force of the banknote working group concentrated on legal questions surrounding euro banknotes. The main tasks concerned patents for banknote security features and questions about the monopoly position of producers of some of the materials needed to make the notes. Contracts were made to ensure that patent rights would not be breached by banknote printing works, and that no circumstances could interrupt supplies of raw materials. Legal experts also checked that the EMI and later the ECB held the rights to all the details of the banknotes' appearance.

In the years since the banknotes were issued, several patent holders have sued the ECB over their details. So far the ECB has won all of these cases and the courts have found no rights infringements. One

legal case was a suit issued by a French publisher of satellite maps, concerning the map used on euro banknotes. The ECB (EMI) had purchased the rights from an Austrian company and the court found no violation of rights in the use of the map.

Another time-consuming process concerning industrial property rights was a complaint by Document Security Systems Inc., a US company. DSSI complained that euro banknotes used an optical solution patented by it to prevent counterfeiting and sued the ECB for damages due to patent infringement. The ECB disputed the validity of the DSSI European Patent Convention (EPC) patent in the courts of all nine EPC countries where the patent was extended. The process took many years but all courts ultimately threw out DSSI's patent in all the relevant countries.

Fig. 14 Robert Kalina at his desk, examining details of the obverse of the 20-euro banknote.

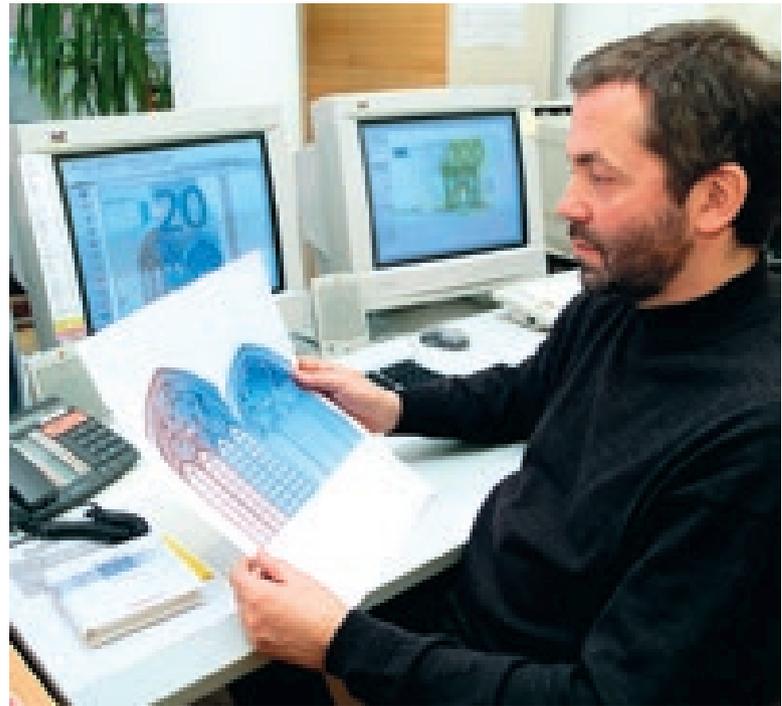


Fig. 15 Pictures of the corrected banknotes were distributed to the media in July 1997, but details of banknote security features were withheld. Holograms were not shown and were replaced by guilloche patterns. The national motifs mentioned in the design competition brief were shown by a grey EU flag on the reverse of each note.

A grid of Euro banknotes in various denominations, including 500, 200, 100, 50, 20, 10, and 5 euros. The notes are arranged in two columns. The left column shows the front and back of the 500, 200, and 100 euro notes. The right column shows the front and back of the 50, 20, 10, and 5 euro notes. Below the grid, the text reads: "In print: 13,000,000,000 euro banknotes".

*In print:*  
13,000,000,000 *euro banknotes*

## Seeking a consistent solution for banknote numbering

The Member States numbered their banknotes in a variety of ways, and a uniform solution was needed. The banknote working group felt it was important to be able to distinguish between notes ordered by central banks from different printing works, so it created a country code for notes that could be used to study their movements and the stock in circulation in each country. It also wanted the notes to bear an identification code for the printing works and a plate number so that, in the case of errors, the source and batch in question could be quickly established. The EMI Council approved a proposal on this basis in February 1998 as part of the technical specification for euro banknotes.

The banknote group's proposal for the country code of banknotes was intended to avoid an obvious connection between the country/central bank and its notes. The letters were allocated to central banks in reverse order according to the country's name in its own language, so that the first country in alphabetical order would receive the last letter in the English alphabet as its code. Belgium, the first, was allocated the letter Z and the United Kingdom, the last, the letter J. At the time a letter was allocated to each member country because the decision on the first wave of countries to adopt the euro was not made until the start of May 1998.

Not all codes were usable. The letters I, O and Q were not used because optical readers of serial numbers could have mistaken them for the numbers 1 and 0. One exception was also made in the allocation of letters. The code for Greece, according to its alphabetical order, would have been W, a letter that is not part of the Greek alphabet, so it was swapped with Denmark, Greece receiving Y and Denmark W. Because Denmark stayed out of the euro area, W was not actually used, nor was Sweden's K or Britain's J.

When it was the turn of Slovenia, which adopted the euro in 2007, to produce banknotes, there were 12 members of the European Union without country codes but only 8 codes still unused. It was therefore decided that codes would be allocated to new countries adopting the euro in the order in which they were needed. These codes, from H downwards, have been allocated as follows: Slovenia = H, Cyprus = G, Malta = F, Slovakia = E, Estonia = D, Latvia = C and Lithuania = B.

The code letter of a banknote was to be followed by a number of 11 digits, the last to be a checksum, so that errors could be detected when the banknote's serial number was read by a high-speed data system.



Fig. 16 The code letters of banknote serial numbers were allocated in accordance with the names of countries in their own language in reverse alphabetical order. The letter Z tells that the banknote was ordered by the Belgian central bank and L that it was ordered by Suomen Pankki.

◆ ————— ◆  
Fig. 17 The printer identification codes D and U tell that the banknotes in question were produced by Setec and Valora.



## Codes showing the national central banks of euro banknotes

The national central banks of the Eurosystem have been allocated the following letters, which appear in the banknotes they have commissioned at the start of the serial number.

### National central bank / country code

Belgium	Z	Luxembourg	(1)	Malta	F
Greece	Y	The Netherlands	P	Slovakia	E
Germany	X	Austria	N	Estonia	D
Spain	V	Portugal	M	Latvia	C
France	U	Finland	L	Lithuania	B
Ireland	T	Slovenia	H		
Italy	S	Cyprus	G		

(1) Euro banknotes issued by Luxembourg's national central bank bear the codes of the national central banks of the countries where Luxembourg ordered them printed.

Part of the obverse of euro banknotes contains a code in which the first letter shows which printing facility produced the note. The rest of the code, its plate number, indicates the sequential printing plate used and the location of the banknote on the sheet printed by that plate. Letters were assigned to printers in the opposite alphabetical order to the order of country codes. The letter A went to the last in the list of country names, in the language of each, by reverse alphabetical order, that country being the United Kingdom. Printing works that produced banknotes for a central bank without its own national printing facilities received the code of that central bank's country. Oberthur of France, which was printing banknotes for

Portugal at the time, received the Portuguese code E, and De La Rue of England, which printed Luxembourg's banknotes, received Luxembourg's H. But when the Portuguese central bank established a printing works named Valora before euro banknote printing began, it received the first unused code letter U. The banknote printing facilities of all 15 EU countries were given a code letter but, because some Member States did not join the euro area and the printing facilities owned by their central banks did not print euro banknotes, their code letters do not appear in the following table.

The letters I, O and Q were not used because of the possibility of confusion with numbers 1 and 0.

## Letter codes for euro banknote printers

### Printing facility / Letter

Setec, Finland D

Oberthur, France E

Oesterreichische Banknoten- und Sicherheitsdruck GmbH, Austria F

Johan Enschedé en Zonen, The Netherlands G

De La Rue, United Kingdom H

Banca d'Italia, Italy J

Central Bank of Ireland, Ireland K

Banque de France, France L

Fábrica Nacional de Moneda y Timbre, Spain M

Bank of Greece, Greece N

Giesecke & Devrient GmbH, Germany P

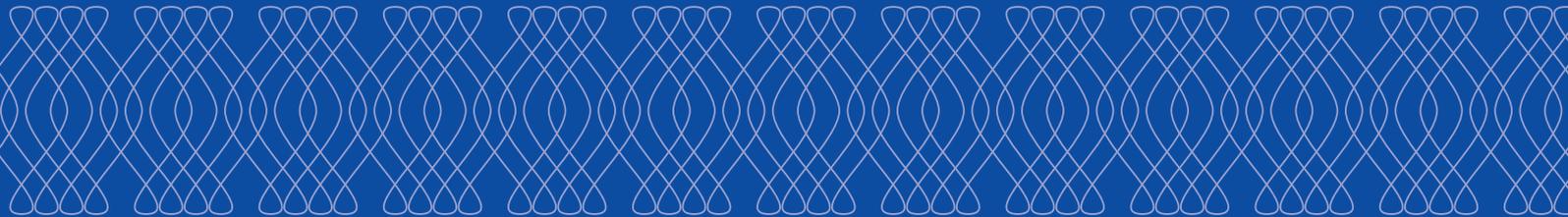
Bundesdruckerei GmbH, Germany R

Nationale Bank van België/Banque Nationale de Belgique, Belgium T

Valora, Portugal U

The second series of euro banknotes, the Europa series, no longer uses a code for the commissioning country. This has become unnecessary because of procurement by joint order (studied in Chapter 13). Instead, the first of the two letters of the serial number shows the printing facility where the note was produced and the same letter is repeated in the banknote's plate number (for more detail, see Chapter 16).





---

5.

*ECB begins operations,  
ESCB banknote committee  
established*





At the start of May 1998, the European Council decided unanimously that 11 member states – Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain – met the criteria for adopting a common currency. A month later, on 1st June 1998, the European Central Bank (ECB) was established and took over the functions of the European Monetary Institute (EMI),

including planning the common European banknote series. In place of the EMI Council, the supreme decision-making body from June onwards was the ECB Governing Council, which was therefore also responsible for matters relating to euro banknotes. After the establishment of the ECB, the EMI's Banknote Working Group became the Banknote Committee of the European System of Central Banks (ESCB).

## REORGANISING BANKNOTE PLANNING AS ECB DIRECTOR OF BANKNOTES

I had been representing Suomen Pankki of Finland for almost 4 years on the Banknote Working Group when my role suddenly changed. In June 1998, the ECB Executive Board appointed me ECB Director of Banknotes.

After receiving the call from Eugenio Domingo Solans, the Executive Board member responsible for the ECB's Directorate Banknotes, I immediately got in touch with my superior back home. Suomen Pankki was very pleased at my appointment and granted

me leave of absence, initially until the end of 2002 and then extended each time my appointment was continued. An amusing twist to this story was that my brother Juha Heinonen was Head of Materials at the banknote printing works Setec and in that capacity had become a member of a project team on legal questions related to euro banknotes. When news of my new job reached banknote printers, he started receiving congratulations – it's hard to tell one



◆ Fig. 18 The first Executive Board of the ECB begins work in June 1998. From left, Sirkka Hämäläinen, President Wim Duisenberg, Ottmar Issing, Eugenio Domingo Solans, Vice-President Christian Noyer and Tommaso Padio-Schioppa. ◆

Heinonen from another. Sometime later, when I was visiting the printing works of the Banca d'Italia, I was told by almost everyone I met that I would see an old friend at lunch. I realised that I was being confused with Juha and wondered how I could set things right without embarrassing my hosts. When lunchtime came, I seized the initiative by announcing that I was greatly looking forward to meeting my brother's very good friend Claudio Comastri.

I met Domingo Solans in Frankfurt in the second week of June 1998 and then talked with the Board of Suomen Pankki about the best way of combining their needs with the interests of the ECB in the changeover period. We agreed I would delay my formal move to the ECB's staff till the middle of August but would try to spend at least two days a week there in the meantime. Thus I could take up my new duties as I tried to tidy up unfinished business for my successor at Suomen Pankki to take over.

I began travelling to the ECB regularly after mid-June and arranged the first staff meeting of the banknote department on the 18th. There were not yet many of us because when the ECB had been established, only seven EMI employees had transferred to the new

banknote department. We had one specialist for each of the main sectors, such as banknote prepress, production, quality control, security features, issuance and anti-counterfeiting.

I knew all the department members already because they had made presentations at meetings of the banknote working group and a couple of them had served as secretaries in the task force I headed. Under the EMI time a major part of the planning of banknotes had been done by people who were employed by national central banks. The EMI did not begin to build up its own expertise in banknotes until its last couple of years, and some of the specialists had joined the EMI only a few months before the ECB was established.

At our first group meeting we settled the principles of how we would work together and the culture of our organisation. My starting point was that we would keep each other well informed, use forenames in our discussions, keep office doors open unless there was a meeting or a confidential discussion going on, and avoid unnecessary bureaucracy. International organisations are the crossroads of different styles of working and management. At the ECB there were people who initially found it difficult to call their

director by his first name, but everyone adapted surprisingly fast.

Within some five years, the number of staff in the banknote department increased to about 50, two divisions were established and a small unit was formed for each of the sectors mentioned above. ECB employees began to head all the task forces of the Banknote Committee, and the department established two centres, for counterfeiting analysis and R&D. As we built up the necessary expertise in the banknote department, we initially recruited most employees from central banks and banknote printing works but, as time went on, people joined us from ever more varied backgrounds, including research and anti-counterfeiting.

It was obviously a big step to move from national circles to an international organisation, but many small things helped me to fit in. On one occasion in the early days I was having lunch alongside Ottmar Issing, the Executive Board member responsible for monetary policy. Issing said that he had been dining recently with Finland's Prime Minister Paavo Lipponen and, when he had mentioned that he hailed from Würzburg, Lipponen had, to his amazement, spoken at length about Balthasar Neumann, the architect of the Würzburg Residence. Neumann was apparently one of Lipponen's favourite architects and the impression on Issing was enhanced by the fact that their conversation was in German. Now, over the ECB lunch tables, I was sharing some of the bonhomie this had created.

When the EMI was still operating and the schedule for working group meetings in 1998 was drawn up, it was pending the decisions of the ECB Governing Council. The first meeting of the banknote working group after the establishment of the ECB had been scheduled for 9 July, but while the meeting was being

prepared, the ECB Council had not yet decided how the working groups would operate in future. The ECB Executive Board therefore proposed to the Governing Council that I would act as the temporary chair of the banknote working group but, a couple of days before the meeting, the ECB Council decided to abolish the sub-committees and working groups of the EMI era. In their place it established 13 ESCB committees, one of them being the Banknote Committee (BANCO). The meeting that I chaired on 9 July was therefore the first BANCO meeting which, because of a lack of space, was arranged exceptionally at Deutsche Bundesbank's head office in Ginnheim, a few kilometres away from ECB headquarters in the Eurotower. I continued to chair the Banknote Committee for more than 10 years to the end of November 2008.<sup>1</sup>

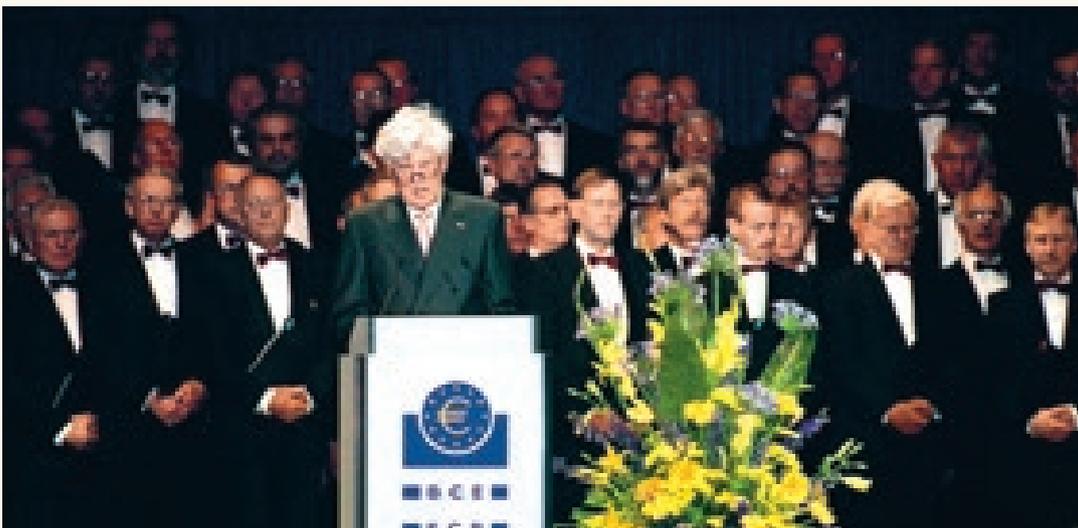
I was still formally an employee of Suomen Pankki, in transition to the ECB, when the ECB was officially inaugurated in an event at Frankfurt's old opera house, Alte Oper, on 30 June 1998. I had however already accepted the job of ECB Director of Banknotes so I hosted one of the tables of invited guests. We listened to the Maastricht male voice choir singing songs representing various musical cultures of Europe and heard speeches by the German Chancellor Helmut Kohl and the British Prime Minister Tony Blair, among others. Britain then held the rotating presidency of the EU.

Before matters were dealt with in the banknote committee, they were prepared in various working groups, which consisted of specialists from the national central banks and were headed by ECB employees. These experts sought to find common ground on the issues they studied and, when agreement was reached, the issue was brought before the banknote committee. Initially, representatives of all 15 EU countries took part in the committee work although only the euro countries attended some meetings. From



Fig. 19 German Chancellor Helmut Kohl arriving at the inauguration of the European Central Bank at Frankfurt's old opera house, together with ECB President Wim Duisenberg and Mrs Gretta Duisenberg.

Fig. 20 ECB President Wim Duisenberg addressing the inaugural event of the ECB, with the Maastricht male voice choir in the background.



spring 2003 onwards, new EU applicants provided ten extra participants in the meetings, first as observers and then as members. Later the same happened with representatives of Bulgaria, Romania and Croatia. The committees in turn, composed of specialists, sent their conclusions to the ECB Governing Council, via the ECB Executive Board, for a final decision.

When the EMI Banknote Working Group became the ESCB Banknote Committee, its organisational structure also changed. In place of task forces, it

established project teams with clearly defined assignments, schedules and budgets to prepare the technical specifications for banknotes, a system for quality control, contracts with suppliers of security features, a database on counterfeiting, an information campaign, and so on. This focus on projects was designed to ensure that euro banknotes could be issued in accordance with the timetable that had been politically established.

## **EUGENIO DOMINGO SOLANS, THE ECB EXECUTIVE BOARD MEMBER FOR BANKNOTES**

It was June 1998 when I first met Eugenio Domingo Solans, the member of the ECB Executive Board who was responsible for matters related to banknotes. He said he had every faith in me and we quickly moved on to agree how we would work together. From the very start to the end of his six-year term, we got on extremely well. We met regularly, at least once a week, to go over topical questions and the issues that would be coming up in the ECB Executive Board and Council. Once, in the early days, I kicked off our discussion by announcing that there was a certain problem; he calmly interrupted me and said that we had no problems, only challenges.

I learnt a lot from his approach to work, so it was all the more shocking, in January 2004, when he told me he was suffering from a serious illness. It was during

the last six months of his term of office, and he had invited me and two other directors who reported to him into his office to give us the news. He said he did not want to burden us with this information, but his treatment required him to be absent from Frankfurt on a regular basis and he didn't want us to interpret this as a loss of commitment to the job, now that his term was nearing its end.

Fortunately, the treatment was a success and he continued to the end of his term. Spirits were high at his farewell party in Frankfurt in May 2004.

A little earlier, when we had been attending a meeting in Madrid, he had invited me and his personal counsellor Gabriel Quiros to his favourite restaurant, where we spent a long and memorable evening going over the events and shared experiences of his six-year term.



Fig. 21 Eugenio Domingo Solans served on the Executive Board of the European Central Bank from 1998 to 2004, with responsibility for banknotes. His farewell party was held in the Frankfurter Hof hotel in May 2004.

Fig. 22 After Eugenio Domingo Solans, responsibility for banknotes was taken over by ECB Executive Board member José Manuel González-Páramo (right), in conversation with Erkki Liikanen, the governor of Suomen Pankki, on the terrace of Frankfurt's old opera house in October 2006, during the annual ECB reception.

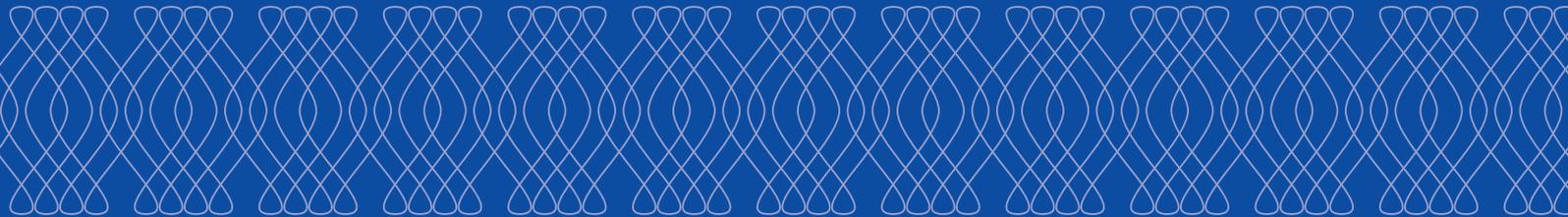


The leaders of the euro area appointed José Manuel González-Páramo to succeed Domingo Solans, and the banknote department reported to him throughout his eight-year term. If I had known at the beginning of my time with the ECB that my superiors for the next

decade would be Spanish speakers, I would certainly have studied Spanish.

I recall the optimism of my last encounters with Eugenio Domingo Solans but sadly he died on 9 November 2004, less than six months after our final meeting.





6.

*Planning logistics for  
the euro cash changeover*



## Euro cash issuance date and changeover formalities fixed long in advance

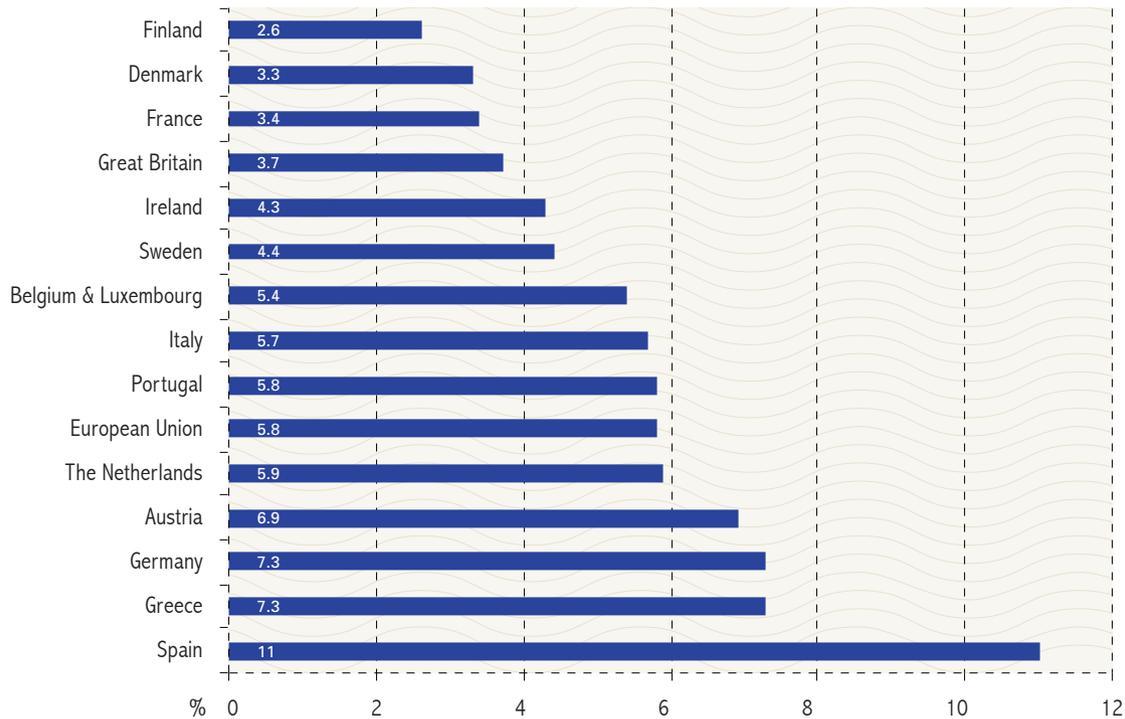
The logistics of issuing euro cash had to be planned well in advance, so as to ensure that it went smoothly and successfully and that all parties involved could begin their own preparations in good time. It was obvious that the speed of the cash changeover in different Member States would depend not only on the general public but also on the handling, storage and transport capacity of different parties and on existing infrastructure. There were major differences between Member States regarding the amount of money in circulation in proportion to the population and gross national product. They also had differing central bank branch networks, ATM density, the number of machines for handling and accepting cash payments, and geographical conditions.

The value of bank notes in circulation in the EU averaged 5.8 percent of GDP at the end of 1996, but the rates for individual Member States were distributed over a wide range, with Finland and Spain at the two extremes.

The value of banknotes in Finland was 2.6 percent of GDP and in Spain 11.0 percent (see chart 1). Germany's high rate (7.3 percent) is partly explained by the proportion of its Mark banknotes – about a third – that were thought to be held abroad (in more detail in chapter 2).

Because of these major national differences it seemed unsuitable to apply exactly the same cash changeover model to all Member States, but all needed to agree on the same date when euro cash would be issued. In choosing the date, the EMI Council wanted to take into account the wishes of those who used cash and would be instrumental in circulating it, but it was also constrained by the time required to print banknotes and mint coins. In December 1995, when the European Council fixed the schedule for Stage 3 of Economic and Monetary Union, it decided that euro banknotes and coins would be issued “by 1 January 2002 at the latest”. On the other hand, the Maastricht Treaty gave 1 January 1999 as the latest date for adoption

Chart 1. Value of banknotes in circulation relative to GDP, EU countries, end-1996



Source: European Monetary Institute (EMI).

of the euro. In December 1995 we did not yet realise that the euro would be launched at the 11th hour but, because the convergence process was so slow, this is what happened. The euro became an accounting currency on 1 January 1999 and a cash currency on 1 January 2002. The reason for the staggered introduction, first for accounting and then as cash, was not merely that producing and distributing the cash took time. The decision makers also needed to gather experience of the euro as a computational

currency before issuing cash that would affect all the citizens of the euro area, numbering over 300 million.

The general public, the commercial sector and banking would be affected by the date for the future currency changeover, and so would the plans of companies that transported cash, and the manufacturers and operators of machines that accepted cash. The pressure to fix the date increased all the time because the different parties wanted to prepare for

the changeover carefully, and there was a vigorous debate on the matter. In 1996, for example, Eurocommerce, representing retailers, wholesalers and other trading companies at the European level, published a report saying that 1 January was the worst possible date for the retail sector.

Central banks generally issue a new banknote design at a time when the volume of banknotes in circulation is small, so as to manage the changeover with minimum resources. Such dates include February–March or October–November. On the other hand there are seasonal peaks in the volume of banknotes in circulation at the turn of the year, during Easter and in summer because of tourism, and at Christmas also because people are buying presents.

The turn of the year is a bad time for shops and banks because of various inventories, days off and extra work related to the closing of accounts, as well as the sales that begin in shops after Christmas. For these reasons most members of the Banknote Working Group were also opposed to a cash changeover at the turn of the year and preferred, for example, September–October 2001, or February 2002 although it would have been the wrong side of the deadline set by the European Council.

The date of 1 January 2002 also had its advantages, however. It is the first day of the calendar year, when most accounting years also begin, which would make it easier for public administration to make preparations. Despite the aforementioned disadvantages the EMI Council, meeting in November 1997, ultimately selected the first day of 2002 as the

most suitable issuance date. This meant that euro banknotes would be issued three years after the start of accounting in euros. For the general public, cash issuance marked the date when the euro was really introduced, because only then did it become a tangible currency, reinforced by the dual pricing on product price labels.

Back in December 1995, the European Council meeting in Madrid had decided that the euro and national currencies would be in circulation side by side for no longer than six months. There were frequent discussions with different stakeholder groups about this maximum six-month period of dual circulation, and the advantages and disadvantages of the time reserved. A shorter period would reduce the handling costs imposed on banks, retailers and consumers, but a long period would make it easier to convert various vending machines to accept euro banknotes and coins. Consumer protection officials and organisations also supported a longer period so as to give consumers time to get used to the new unit of currency.

Following from this debate, the Economic and Financial Affairs Council of the EU, Ecofin, decided in November 1999 to reduce the maximum transitional period; the dual circulation of euros and national currencies would last no less than four weeks and no longer than two months. It also agreed that banks would convert national currencies into euros after this period but that national currencies would no longer be legal tender after two months, when the period of dual circulation ended.

In this connection Ecofin reached agreement on the main features of the cash changeover and issued the following statement:

- ◆ Member States will make their best efforts to ensure that the bulk of cash transactions can be made in euros within a fortnight from 1 January 2002.
- ◆ Financial institutions and certain other groups should be provided with notes and coins in advance, so that there will be a sufficient quantity for circulation in the first days of

January 2002.

- ◆ Limited quantities of coins should be available to the public, notably to vulnerable groups, in the second half of December 2001, so that citizens can familiarise themselves with the new coins, and to facilitate the cash changeover.

These procedures were intended to leave room for Member States to implement the changeover in the way that best suited the specific circumstances of each.

## EMI and ECB begin regular meetings with stakeholders in autumn 1997

From the outset, the Banknote Working Group thought it was obvious that questions about the issue of euro banknotes needed to be considered jointly with stakeholders. For this purpose, the first Europe-level meeting of stakeholder groups was arranged in Frankfurt in October 1997, over four years before the issue of euro cash. At the first meeting there were discussions with the banking sector about ways that the euro cash changeover might be simplified, testing the security features of banknotes and the logistical challenges of the changeover.

These Third-Party Meetings were arranged every six months, with invitations sent to representatives of Europe's three banking associations, the association of cash-in-transit companies, three organisations of the vending

machine sector, retailing, two consumer organisations and association of small and medium sized companies. It was these meetings that gave rise to many important measures necessary for simplifying the euro cash changeover, such as the frontloading and sub-frontloading (advance and further distribution) of cash and the possibility to try out euro banknotes as much as 18 months before they were issued.

The meetings have been continued after the cash changeover but subsequent arrangements have been handled with the European Commission and the meetings have alternated between Brussels and Frankfurt.

In addition to multilateral meetings, the EMI and the ECB had regular bilateral meetings, such as with the European Blind Union.

## Regular reassessment of volume of banknotes required at launch

Before starting the production of euro banknotes, a fairly good idea was needed of how many would be required at the time of the changeover and during the first year. In calculating quantities, the following categories were used:

1. The euro banknotes needed to replace the national banknotes in circulation.
2. Logistical stocks, meaning short-term stocks, the quantity of which depended on central bank branch offices and the distances between them. Logistical stocks are used to meet normal banknote demand, including predictable seasonal peaks, and are used to replace worn notes withdrawn from circulation. The more offices a central bank has, the greater logistical stocks it requires, so that each can respond to the need for banknotes of various denominations.
3. Strategic stocks, created to guard against disruptions in banknote demand or supply caused by strikes, natural cataclysms, production disturbances and the like. A national central bank could also resort to strategic stocks if its logistical stocks experienced a shortage of some denominations that could not be met from the surplus stocks of other central banks.

National central banks calculated their own needs for euro banknotes at the time of launch and during the rest of 2002. When these calculations were first done in 1998, the ECB concluded that 13 billion euro banknotes would be needed by the start of 2002.<sup>1</sup> At this stage it based its estimate on 11 countries,

because the decision that Greece would join the euro area was not made until 2000.

The forecast for the number of banknotes required was drawn up regularly and revised according to new information, such as which denominations would be used in the cash dispensers of each country and so would probably be in the greatest demand. Production plans were adapted accordingly.

Euro banknotes printed for the launch period would be intended to replace the national banknotes in circulation, but euro banknote denominations did not generally match the denominations of national notes. Each national central bank therefore sought to predict what euro banknotes would be used to replace specific national banknote denominations, whether some national banknotes would be exchanged for euro coins, and the effect on demand of high-denomination euro banknotes. Although six countries in the euro area had national banknotes of high denominations, the highest banknote in Spain, for example, was 10 000 pesetas, which was only about 60 euros, and Portugal's 10 000 escudo note was worth only about 50 euros. This made it hard for such countries to estimate demand for euro banknotes of high denominations – 100, 200 and 500 euros.<sup>2</sup>

Apart from national demand for banknotes, the demand from outside the euro area had to be considered. The German Mark, the French franc and the Austrian Schilling were used beyond their countries' borders. For example, about a third of the value of banknotes

denominated in German Marks was held outside Germany, particularly in central and eastern Europe.<sup>3</sup> An estimate was needed of the proportion of these notes that would be exchanged for euro banknotes and whether some would be exchanged in different euro area countries. Like dollars, German Marks were popular in Russia, which has a 1300-km border with Finland. Suomen Pankki had to be ready to supply not only the Finns but also people from beyond its eastern border.<sup>4</sup>

In 2001 the ECB Governing Council decided on an initial production volume of 14.9 billion banknotes (face value over 633 billion euros), 9–10 billion to replace national banknotes in circulation and the rest, about 5 billion banknotes, earmarked for logistical demand in the rest of 2002. The need estimated for the launch period was based on the number of national banknotes in circulation at the end of 2000 (11.7 billion). The shares of the different national central banks in this initial production amount varied from 46 million to 4.8 billion notes. The former was the responsibility of the Banque centrale du Luxembourg, the latter of the Deutsche Bundesbank.

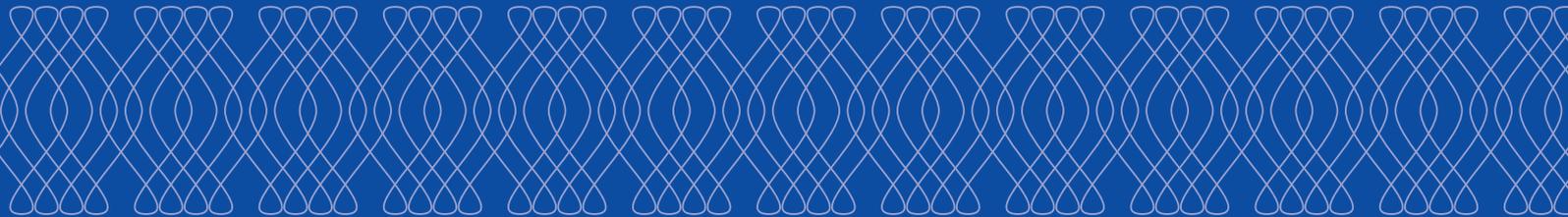
Some national banknotes were exchanged for euro coins. By the end of 2002, the number of euro banknotes in circulation was 8.2 billion, so the central banks had unexpectedly large stocks of euro banknotes at that time. This was only a short-term problem because, by the end of 2014, of the number of euro banknotes in circulation had risen to 17.5 billion.

In addition to the production volumes above, the Governing Council decided in the

first half of 2001 to print a Central Reserve Stock of 1.9 billion euro banknotes. This was to cover the risks of production shortfalls and higher-than-expected demand for certain denominations. Most of the reserve stock consisted of 5, 10, 20, 50 and 100-euro banknotes, the denominations most commonly used for payments. The ECB ordered the reserve banknotes from a group of European banknote printing works that had surplus capacity. In the months preceding the launch, many banks frontloaded more low-denomination notes than expected, so the reserve stock was needed. Between November 2001 and January 2002, national central banks took about 30% of the reserve stock – over 500 million banknotes – in denominations of 5 and 10 euros. The rest were transferred to the strategic stocks of the Eurosystem.

Unexpectedly great demand for low denomination banknotes just before the cash changeover period led to another precautionary measure. All national central banks agreed to the joint control of euro banknote stocks, so that any surplus in one national bank would be at the disposal of any other that could not meet acute demand from its own stocks. Because of this, the national central banks updated their forecasts in December 2001 for the maximum amount of euro banknotes they would need at the end of February 2002. Using these estimates and daily data on the number of banknotes issued after 1 January 2002, the ECB was able to monitor euro banknote demand and supply on the days crucial to the success of the changeover.





7.

*Banknote production  
from preparations to  
full-scale start-up*





## Preparations for production divided into many separate phases

The launch of euro cash contained three formidable challenges for the Eurosystem. The first chronologically was industrial, the production of more than 16 billion banknotes. The second challenge was logistical, how to carry out the changeover together with banks, cash-in-transit companies, retailers and machine manufacturers. The third challenge was communications, to make the new currency and details of the changeover familiar to every citizen of the euro area and everyone whose work involved handling cash.

Before full-scale production of euro banknotes could begin, there were many preparatory stages to be completed. These were necessary principally because of the great number of printing works involved; almost all EU countries had their own. In any case, many banknote printing works had to be used because the job demanded an exceptional amount of capacity. Many experts thought it was impossible for multiple printing works – more than ten in this case – to produce banknotes of consistent quality. Previous experience had indicated that it was hard enough in just two printing works.<sup>1</sup>

## Testing the ability of printing works to produce uniform banknotes

The first stage of preparations was the test banknote, a way of establishing whether the security features planned for the euro banknotes could be produced in different printing works. Euro banknotes were due to be printed by very different methods, including web printing, where

the paper is fed into the press in a continuous roll, and sheet-fed presses. In the same way, a variety of methods was used to produce the banknote paper, and some of the security features planned could be added either during paper production or at the time of printing.



◆ Figs. 23 Before trial printing of actual euro banknotes, the preparedness of the printing works that might participate was examined by asking them to print test notes. The test note was a traditional banknote with a portrait but included the security features planned at that time for euro banknotes. This required several printing works to use methods new to them. ◆

Because of the variety of printing and production methods, printing a test note was important for establishing that printing works could produce notes of sufficiently even quality. This stage of the preparations was begun in the first half of 1997 so that potential problems could be ironed out in good time. Test printing employed all the production techniques that were due to be used in producing the real euro banknotes. The test notes also contained all the security features that had so far been planned for the real notes, but the appearance of the test

notes and their predominantly brown colour were different, because these specifications were agreed before the design competition ended. The main imagery of the test note was a portrait, which was duplicated in the watermark.

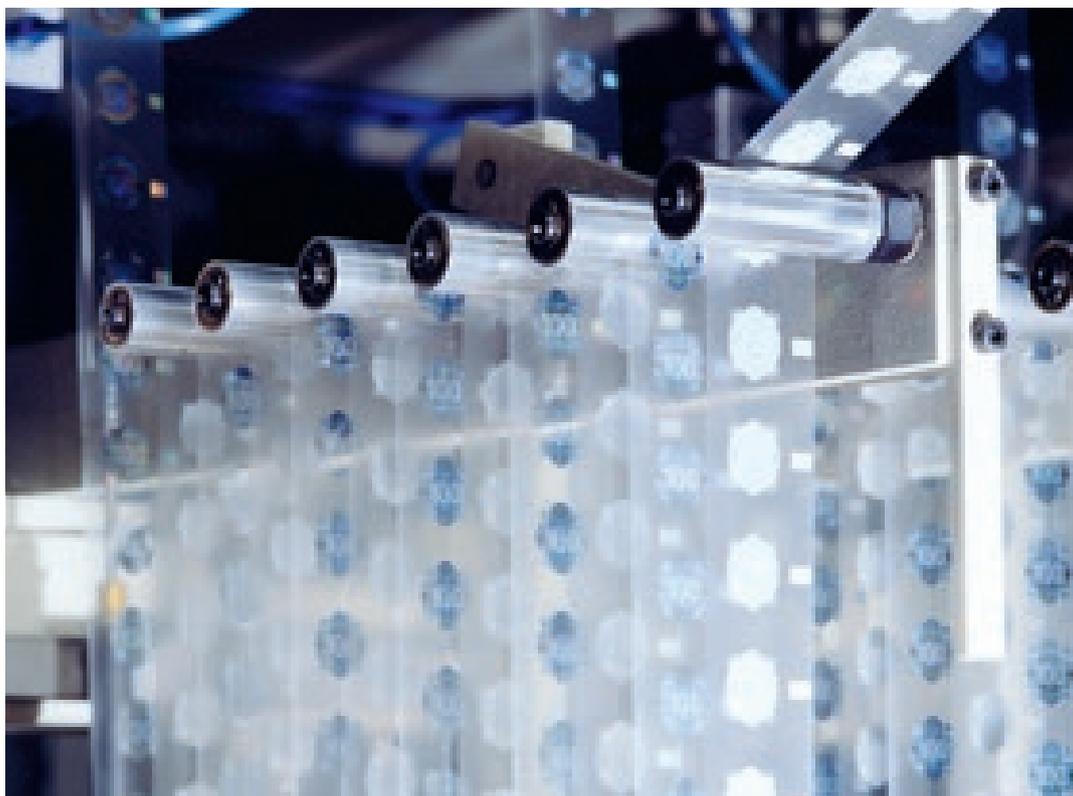
Ten printing works and eight mills producing banknote paper took part in producing the test notes. For some of the printing works it was their first experience of silkscreen printing with colour-shifting ink and of hot-stamped holograms.

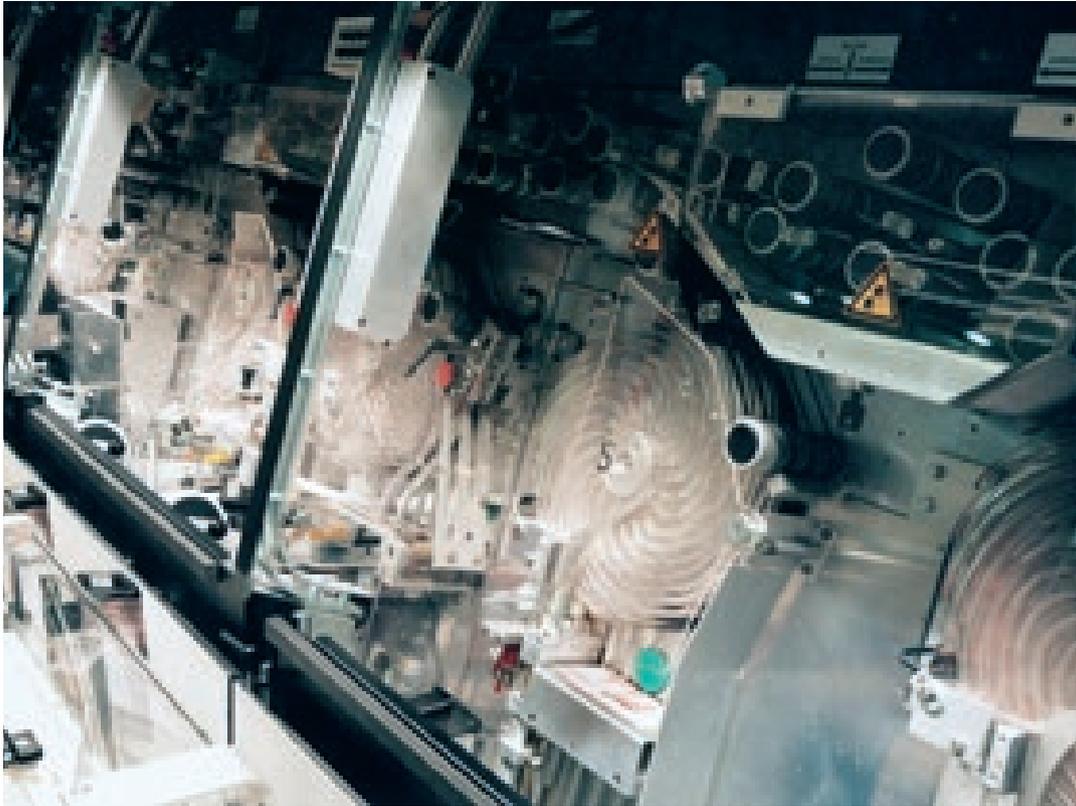
The visual features and machine-readability of the test notes were checked in a laboratory and their durability was studied using various strain tests. The notes were also tested on the high-speed sorting machines of central banks, which can process over 40 banknotes a second. These machines are used to examine whether banknotes returned to

central banks are genuine and good enough to be reissued.

The tests revealed fewer differences between the notes of different printing works than had been expected. These differences were minimised further by changing the technical specifications of the banknotes and fine-tuning the equipment of the printing works.

◆ Fig. 24 Hot-stamping holograms onto banknote sheets at Setec. ◆





◆ Fig. 25 Banknotes being sorted in central bank high-speed sorting machines. Their sensors check whether the notes are genuine and in good condition. ◆

## Printing plate production, a zero-production run and quality management

Using the results of the test note run, the EMI Council approved general specifications for euro banknotes in February 1998, concerning their appearance and the properties of their security features. After approval, origination could begin for each banknote denomination. In banknote production, origination refers to the transformation of the design into digital files, films and printing plates for the different stages of production. For most denominations,

origination was done by two printing works, one for the obverse and the other for the reverse. These materials were then supplied to the other printing works. Each printing plate was thus produced from a single origination. For most printing works, which had previously originated their own banknotes, this was a new and challenging way to work.

Ten printing works took part in origination of the banknotes. The schedule was tight, with

only six months reserved for a process that not only raised technical questions but also demanded coordination of the job between printing works that were using different processes.

Zero-production of euro banknotes began in September 1998. This consisted of the printing of several million notes under actual production conditions. There were several objectives. One was to ensure that origination complied with the general specifications for the notes and also to allow the specifications to be refined. Other aims were to establish acceptance procedure for banknotes and to confirm that the quality management system produced uniform notes.

Each of the denominations was printed in at least two printing works. Because cash dispensers were expected to take the 20-euro

note, which would therefore be heavily used, it was produced in nine printing works. On the basis of the zero-production run, the ECB Governing Council approved some of the banknote denominations in mid-December 1998 and some in the first half of 1999.

During the first half of 1999, national central banks and the ECB studied the banknotes printed extensively in their laboratories, and tested the visual details of the banknotes and their characteristics. In addition to its own tests and examinations, each printing works supplied 150 000 banknotes of each of the denominations that it had printed to the laboratories of other printing works for testing. Some technical details were adjusted in this connection but the overall conclusion was that all the printing works were able to produce banknotes of the required standards.

## A HOLOGRAM ORIGINAL LOST IN FLIGHT

Origination was marked by a peculiar occurrence. While materials were being transferred from one production plant to another in May 1998, a hologram original designed for the banknotes disappeared on a flight from Paris to Munich. It could not be located at its destination and, because reports by the French and German police did not establish whether it had merely been lost, accidentally discarded or stolen, it had to be originated again. If the first version had fallen into the hands of a thief, there would have been a significant risk of counterfeiting.

The new hologram had to be different from the earlier one, to eliminate the security risk. In fact, the need to produce another hologram proved to have a silver lining because the experts had not been entirely satisfied with the origination of the first but had approved it for scheduling reasons. Now that it had to be renewed, there was good justification for moving the deadline and the new result was far more satisfactory.

The loss of the hologram led to tighter regulations on secure transport for euro banknotes and origination material, to avoid similar accidents in future.

For the start-up of full-scale production, reference banknote sheets and a catalogue of acceptable and unacceptable banknotes were prepared for each banknote denomination, which printing works could compare to banknotes they produced and establish that they met the criteria for acceptance. The general specifications for all banknotes were developed into individual sets of technical specifications for the denomination, each running to about 200 pages. They included data, diagrams and drawings as well as descriptions of the chemical and mechanical tests that would be used to examine how the banknotes withstood sunlight, washing, tearing, folding, and so on.

A quality management system for euro banknotes was designed during zero-production. It comprised detailed methods for “printers of euro banknotes” to establish that their notes complied with the specifications at the various stages of production. The procedures were based on international quality control standards and

statistical inspection of production batches. They made it possible to eliminate banknotes that did not meet the technical specifications. It was important not merely to ensure that the banknotes were uniform in appearance; they also had to be suitable for the sorting machines, cash dispensers and vending machines of the whole euro area.

As part of the quality management system, ECB experts visited every printing works to study the visual appearance of control sheets, produced at the start of the print run of every denomination, and at every stage of production beginning from manufacturing of the banknote paper. They compared them to the reference banknote sheets and approved them when they met the required standards. ECB experts made a total to 170 inspection visits to banknote printing works and paper mills.

After test printing and zero-production, the time was arriving for the launch of full-scale production.

## Full-scale euro banknote production begins in summer 1999

When arrangements were being made for full-scale production of euro banknotes, the banknote working group considered at length whether it would be better for each national central bank to commission only the banknotes it needed, or for a few printing works to specialise in each denomination. The latter alternative of pooling production would enjoy economies of scale and would, moreover, make it easier to coordinate quality. On the other hand, distribution of the enormous volume of

banknotes required at the launch would put extra pressure on transportation capacity and also involve significant distribution costs.

Another problem with pooling was that production could not be allocated between central banks before it was known which countries would be adopting the euro. Fortunately the test banknotes and zero-production had shown that all the printing works involved were able to meet the technical specifications so there were no practical reasons

why production should be pooled. Consequently the ECB Governing Council decided at its first meeting in June 1998 that, during the first phase, there would not be specialisation in production and that each national central bank could decide independently where to print the banknotes it required. This allowed central banks to make bilateral agreements among themselves if they wished.

Some central banks commissioned the printing of all denominations at the same printing works and some made bilateral agreements with other central banks. The bilateral agreements mainly concerned the highest

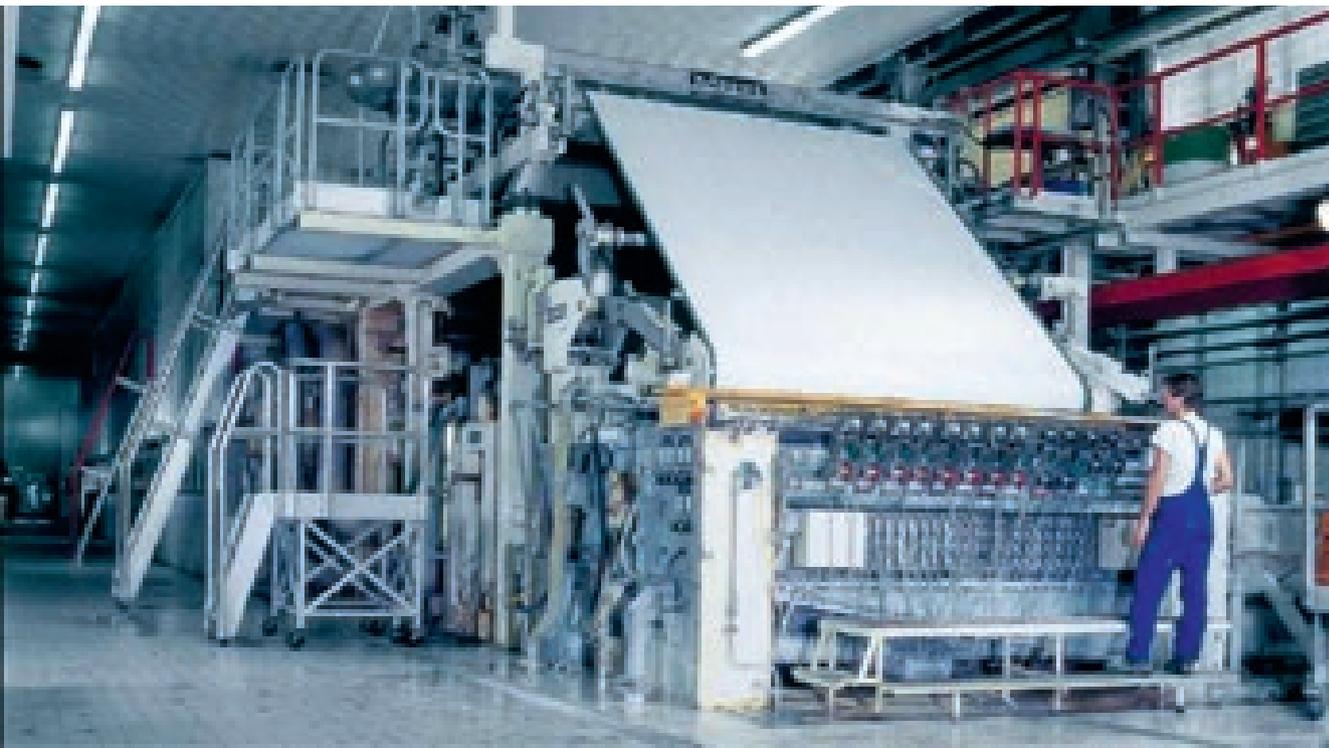


Fig. 26 Cotton bales being delivered from storage to a French paper mill. The printing works required a large amount of banknote paper before they could start full-scale production of euro banknotes.

Fig. 27 Euro banknote paper was produced in nine different European mills, three of them located outside the euro area.

- 1 Arjo Wiggins Security B.V., Apeldoorn (NL)
- 2 De La Rue, Overton (UK)
- 3 Arjo Wiggins Security SAS, Joussour-Morin (FR)
- 4 Banque de France Paper Mill, Vic-le-Comte (FR)
- 5 Fábrica Nacional de Moneda y Timbre Paper Mill, Burgos (ES)
- 6 Crane AB Paper Mill, Tumba (SE)
- 7 Papierfabrik Louisaenthal GmbH, Werk Papier, Grund am Tegensee (DE)
- 8 Lendipari AG, Lendquart (CH)
- 9 Pedregal SpA, Fabriano (IT)





◆ Fig. 28 Production of banknote paper at Louisenenthal paper mill in Germany. ◆

denomination banknotes –200 and 500 euros – which were required in smaller quantities and could therefore be produced more efficiently if production was pooled. Counting all the printing works, the denominations and the central banks that ordered them, a total of 70 different configurations were formed.

Production of the banknote paper began in the first half of 1999, at nine paper mills around Europe.

When production of euro banknotes began in summer 1999, the first printing works to start their machines were in Belgium, France, Germany, Italy, The Netherlands and Spain. In the months that followed, they were joined by

other printing works in accordance with their own schedules. The ECB monitored adherence to the production timetable on a monthly basis and checked back-up plans. Ultimately the scheduled amounts of banknotes were produced in time.

The reference banknotes, part of the quality management system, were produced by the printing works that first began printing the banknote denomination in question after the ECB had approved the start-up of production. These reference notes were used by the other printing presses as approved models.

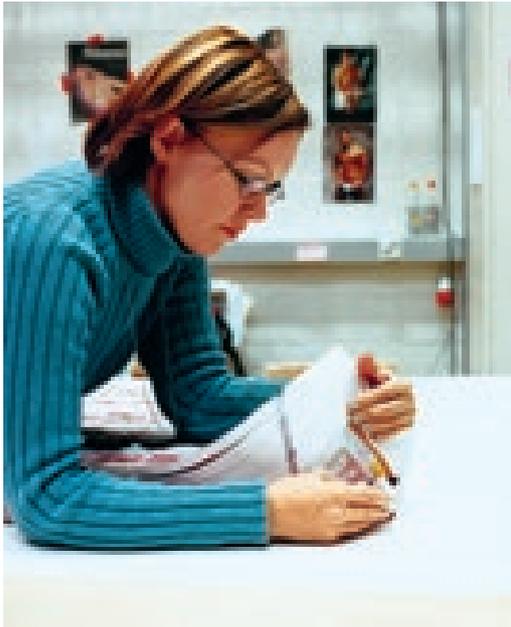
Some printing works had been producing the last batches of national banknotes before



Fig. 29 Barrels of banknote ink at Setec, Finland. Large amounts of other materials apart from paper were required for printing.

Fig. 30 Inspecting the first 10-euro banknote sheets produced by offset printing at Oesterreichische Nationalbank. It was a challenge for printing works to meet the schedule set for the production of euro banknotes and, in the initial phase, detailed inspections of printing quality were carried out.





Figs. 31–33 Quality inspection of a 10-euro banknote sheet (above left) and finishing of banknote packaging (below) at Setec, Finland.

Rollers of an offset machine printing 50-euro notes. When printed by offset, both sides of the note are printed at the same time (above right).



switching to production of euro banknotes. Setec in Finland, for example, supplied the last amounts of 20 and 50-markka banknotes to Suomen Pankki on 25 August 1999 and its first euro banknotes – a batch of 100-euro notes – in February 2000.

Greece began using the euro as an accounting currency on 1 January 2001 and started its production of euro banknotes at the end of 2000.

In the initial phase, euro banknotes were produced at 15 printing works. Three of these were located in Germany, two in France and one in each of the other euro area countries except for Luxembourg. One printing works was in Great Britain, outside the euro area. Six printing works were part of a national central

bank (in Austria, Belgium, France, Greece, Ireland and Italy). Finland's central bank had sold off 60 percent of its shareholding in Setec in 1998 and was therefore a minority shareholder in the Finnish printing works. In Portugal, Valora was a joint enterprise of the Banco de Portugal and a public limited company De La Rue. Two printing works, Germany's Bundesdruckerei and Spain's Fábrica Nacional de Moneda y Timbre, were state-owned. Germany sold Bundesdruckerei to a private investor in 2000 but bought it back in 2009. In addition to Britain's De La Rue, Germany's Giesecke & Devrient (which printed euro banknotes in Leipzig and Munich), the Dutch Joh. Enschedé and the French Oberthur were privately owned.

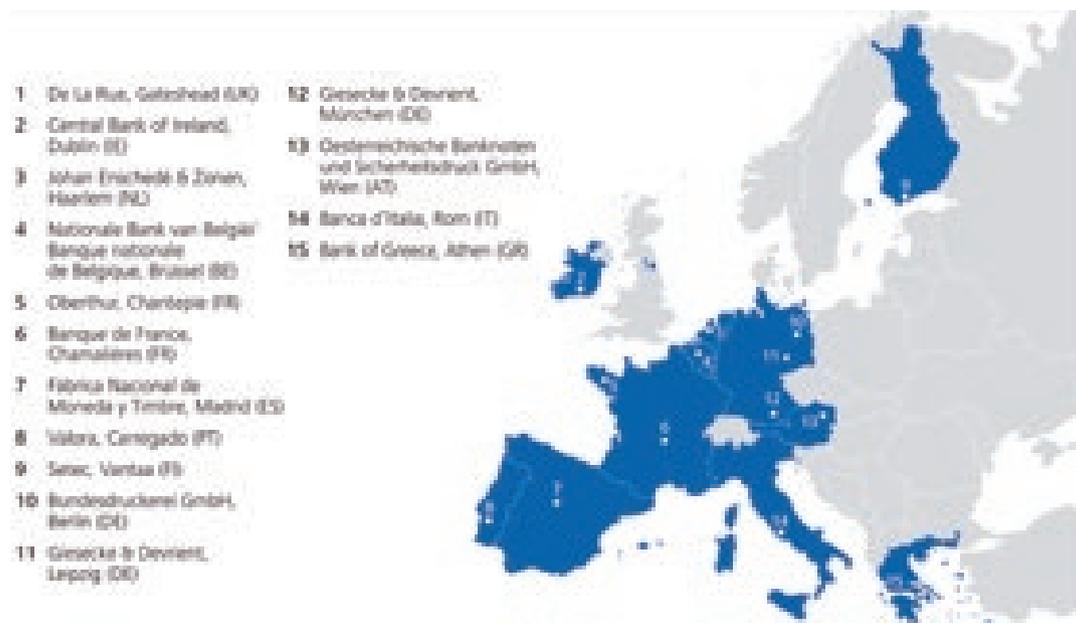


Fig. 34 Euro banknotes were produced by a total of 15 printing works in the euro area and Great Britain.



◆ Fig. 35 Different printing works produced euro banknotes by different methods, which made uniform quality an even greater challenge. The printing works of the Banque de France used sheet printing but also web presses, where the banknote paper is fed into the printing machine from a large roll and the different stages of printing are implemented one after another on the same machine. Only at the final stage are the banknotes cut into sheets. ◆

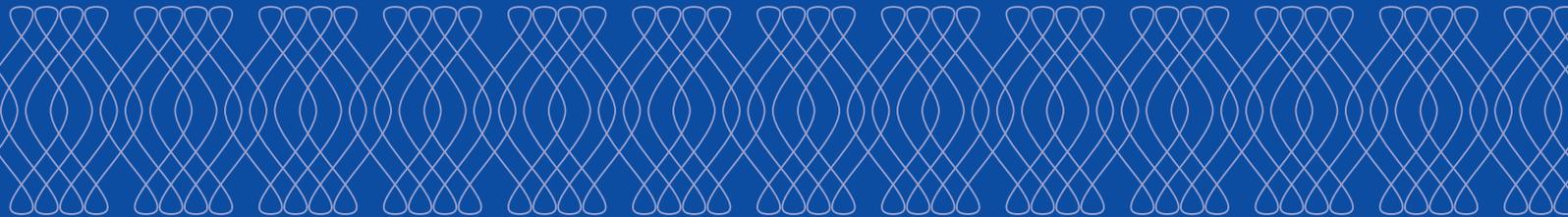
Once banknote production was underway in several printing works, the notes produced in different places could be compared. Eurosystem quality experts convened to assess visual uniformity. Although they found slight differences they concluded that the samples from different printers “looked very similar even to the critical eye of experts”.

## EURO PRINTING “IS NOT MASS PRODUCTION”

The Banknote Working Group divided production preparations into several stages. First came test production, then pre-production, which it called zero production, and finally it was ready for mass production. When the ECB was considering the launch of the final stage, its Governing Council pointed out that the word mass gave the wrong image to the kind of production

involved. Although billions of euro banknotes would be printed, the printing would take place according to very exact technical specifications and observing a common quality management system. On these grounds the Council decided instead to use the term large-scale production, although “mass production” had appeared a few times already in ECB press releases.<sup>2</sup>





8.

*Production hiccups  
not entirely  
avoided*





The start-up of large-scale production was understandably a great challenge, involving as it did the printing of uniform banknotes by 15 printing works on paper manufactured by nine mills, using inks, security threads, holograms and other materials ordered from about two dozen different suppliers. Despite careful preparations, some surprises were

inevitable. Moreover it was obvious that all problems in the production of euro banknotes would receive plenty of media attention because of the significance of the project and also because many had reservations about it. The reports from a few production plants did indeed cause concern but no situations that were insoluble.

## Error in printing a security feature to prevent colour copying

In May 2000, almost a year after the beginning of full-scale production of euro banknotes, a small aberration appeared in 100-euro notes ordered by Deutsche Bundesbank. A discussion between experts about its significance began immediately and it was later taken up on the decision-making level. Although all the printing works participating in production of euro banknotes were committed to success, bidding for orders sometimes created a mood of rivalry in which rumours about competitors gained greater credence. It was not therefore surprising that a problem with the appearance

of a euro note leaked to the press. On July 11 the German daily *Frankfurter Allgemeine Zeitung* headlined on its front page that there were problems in the production of 100 euro banknotes in Germany.<sup>1</sup>

On the same day the ECB issued a press release about the quality problems with banknotes produced by one printing works. The statement said that a security feature to prevent duplication in colour photocopier had an appearance on the 100-euro notes in question that was different from the same denomination produced by other printing works.<sup>2</sup> This feature

was to prevent the photocopying of banknotes. It had been jointly developed by central banks worldwide in the first half of the 1990s, and was part of the technical specifications of euro banknotes.

In a statement issued on the same day, Deutsche Bundesbank confirmed the problem was with 100-euro banknotes manufactured in Germany and another release by Germany's Giesecke & Devrient (G&D) said that they were the printing works in question.<sup>3</sup>

Naturally the Eurosystem did not want to issue banknotes of diverging appearance but, by the time information about the problem leaked to the press, G&D had already come up with an innovative way of correcting it, an additional printing stage. A problem had been created by human error but a working solution had been found. By the end of August the ECB and Deutsche Bundesbank were both able to announce that the difference in appearance had been eliminated and would not disrupt the schedule for banknote production.<sup>4</sup>

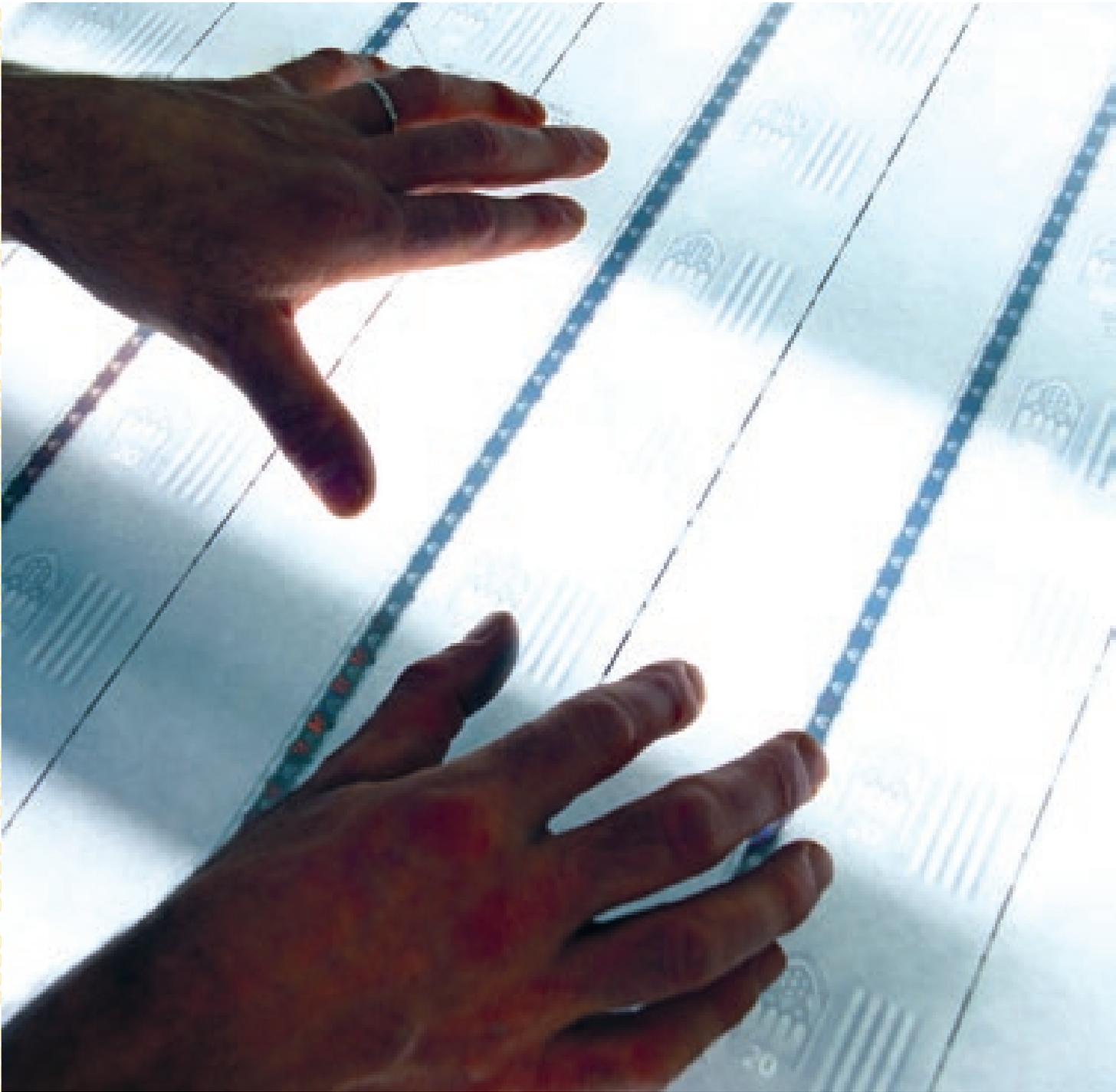
## Corrosion problems with security thread metallisation

The security thread was developed for banknotes in Great Britain as long ago as the 1930s. It was developed over the years and threads have been made of a variety of materials including polyester. When a thread was metallic, its magnetic properties could be read by machine, broadening the area of application of this security feature. By partial demetallisation, security threads could then be made more difficult to copy.

Euro banknotes incorporated a partly demetallised security thread. At the end of 2000 it was noticed that the demetallisation of threads produced by one manufacturer caused a degree of corrosion. Because the security thread is embedded in the banknote during manufacturing of the banknote paper, the ECB first needed to establish whether the corrosion was a consequence of the

thread manufacturing process or a reaction caused during papermaking. To find out, all the banknotes produced by the printing works that had used security threads from the manufacturer in question were subjected to laboratory testing. The ECB announced the matter while laboratory testing was still continuing, in a press release in March 2001 about a Governing Council meeting.<sup>5</sup>

In the laboratory an ageing process was developed to duplicate at speed the long-term progress of security thread corrosion. The tests established that the phenomenon was largely confined to one security thread manufacturer and one production batch from a single paper mill, so the corrosion problem did not have wider impact of production arrangements. The faulty notes were isolated during banknote quality inspection.



◆ ————— ◆  
Fig. 36 Ready banknote paper being inspected at a paper mill of the Banque de France. Security threads, like watermarks and hologram stripes, are incorporated into banknotes at the paper mill.

## Hologram missing from 500 euro note

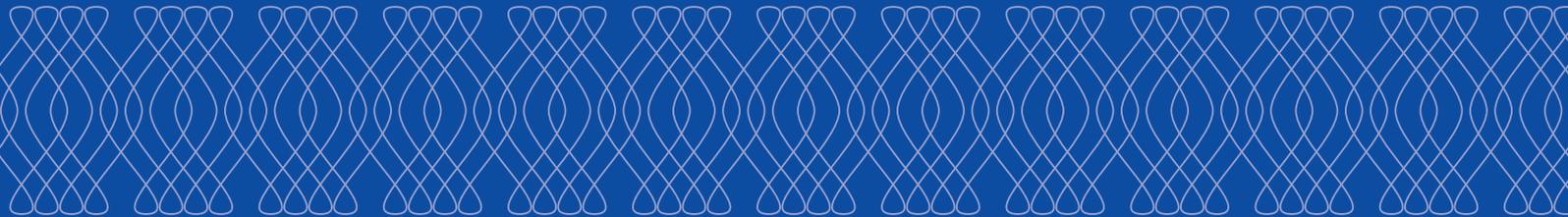
Holograms started being used in banknotes at the end of the 1980s, first by Austria. In November 1991 Finland was another early adopter, using kinegrams in its 500 and 1000-markka banknotes so, when euro banknotes were being produced, Setec had more experience with holograms than most other banknote printing works. Nevertheless Suomen Pankki had to announce on 4 January 2002 – just after the start of the cash changeover – that a 500-euro note without a hologram had been found in circulation. On closer examination, it proved not to be a forgery. The note had been made by Setec but the hologram had not been affixed to it.<sup>6</sup>

After the press release, the matter received a great deal of attention in Finland, especially after experts had pronounced that the faulty banknote could become a collector's item. Many people announced that they had found unusual banknotes, most of them falsely. By the second half of February, as the cash changeover was coming to its close, only three faulty banknotes had been returned to Suomen Pankki.

The bank and Setec had immediately examined all the 500-euro notes in their possession. After studying the matter, Setec concluded that the lack of a hologram was because three banknote sheets had become stuck to each other during printing and had stayed attached until the sheets were cut into notes. This had produced a few faulty banknotes that Suomen Pankki had issued.

The great interest in the matter in Finland was probably the result of two factors. The generally smooth launch of euro cash made even the tiniest negative event newsworthy. At the same time Finland's image as a country of high technology seemed to have been dented by the omission of the hologram.<sup>7</sup> The matter apparently aroused little attention abroad, not surprisingly as there were then almost 8 billion euro banknotes in circulation. If the cloud has any silver lining, it is that the missing hologram seems to have increased people's interest in studying the security features of banknotes.





9.  
*Getting ready to  
issue euro banknotes*



## Europe's greatest peacetime logistical operation

The launch of euro cash has been described as the greatest exercise in logistics that Europe has ever known in peacetime. Most of the countries in the euro area had previously renewed their banknote and coin series one or two denominations at a time, but now seven denominations of banknotes and eight different coins were to be launched simultaneously in 12 countries. The German press compared the operation to the adoption of the West German Mark in East Germany in 1990, and concluded that the changeover to euro cash was 100 times greater.<sup>1</sup> It was entirely obvious that exceptional measures were required to make it go smoothly.

The great quantity of cash to be transported, handled and stored, and the briefness of changeover period, meant that the currency needed to be actively distributed before the period began. If cash was already being held by the main target groups before the end of the year, most of the capacity for handling and transport would be available afterwards for removing national coins and banknotes from circulation.

The time required for early distribution of euro cash (frontloading) depended mainly on national changeover plans and on the national logistical infrastructure,<sup>2</sup> size and geographical factors. Because of various risks inherent in early distribution, the guiding principle was that it had to be done “as late as possible and as early as necessary”. The ECB Governing Council thus decided to fix only the earliest permitted date when euro banknotes could be distributed to the main parties. Within this time constraint each central bank could choose for itself.

The frontloading of euro banknotes to commercial banks was permitted during the last four months of 2001, but each national central bank could set its own schedule during that period. At a national level there could be periods of different lengths depending on the target groups or the banknotes and coins in question.

Distribution was begun in five countries in September 2001 but seven countries waited till October, November or December. Currency



◆ ————— ◆  
 Fig. 37 Police cars escorting a delivery from the Portuguese printing works Valora to the Banco de Portugal. Very tough security regulations were observed in the delivery of euro banknotes from printing works to central banks and in their early distribution to commercial banks.<sup>3</sup> There can scarcely ever have been so many banknotes “on the road” at the same time.

worth a total of 133 billion euros was distributed in advance to commercial banks, about 50 percent of the value of national banknotes in circulation at the end of 2001. All in all, about 80 percent of the banknotes and over 90

percent of the coins earmarked for circulation were distributed to banks before 1 January 2002 in order to smooth the launch of the currency. The quantity of frontloaded banknotes and coins in proportion to the greatest quantity of

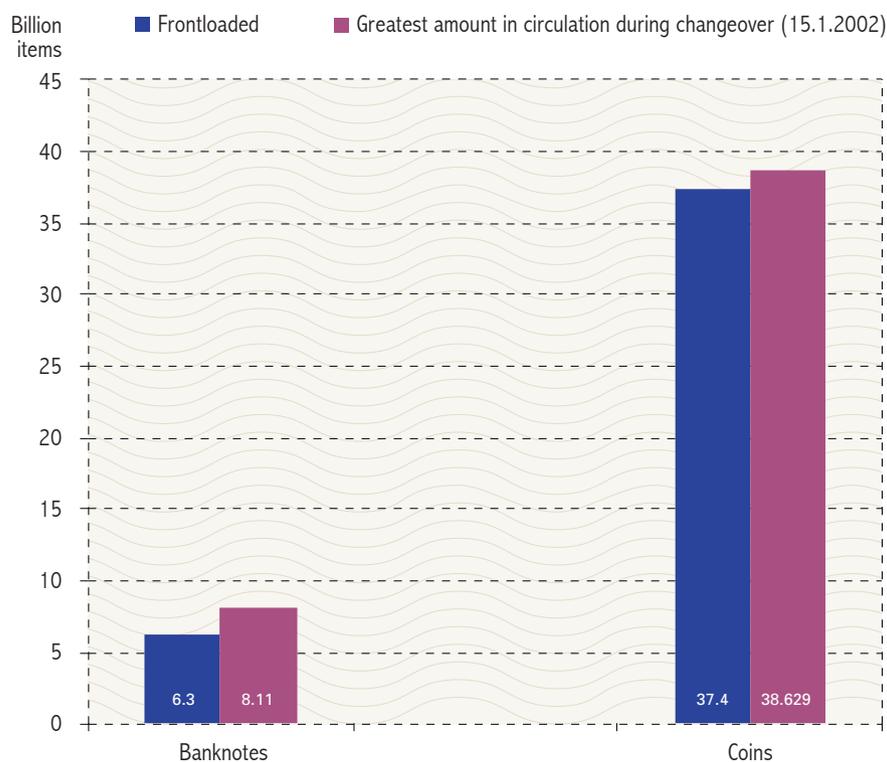
euro cash in circulation during the changeover period shows the importance of frontloading for the success of the changeover (chart 2). On 31 December 2001, euro cash was in the right strategic places ready for the launch.

The redistribution of euro currency by commercial banks, in advance of the cash changeover, to shops, restaurants, manufacturers of vending machines and companies was called sub-frontloading. In addition, all euro area

countries decided to allow the public to buy euro coins in advance, although only after the middle of December.

Because of the risks involved, ECB refused requests to allow the early distribution of banknotes to the general public. Its intransigence aroused a certain amount of criticism. Euro-commerce, an organisation representing European retailers, even reported that its study into the effects of the euro launch had found

Chart 2. Frontloaded cash and maximum cash in circulation during changeover



Source: European Central Bank.

that the whole cash economy might grind to a standstill in the first hours of 2002 unless the public received euro banknotes in advance. It warned that the police and army might have to be called out to keep the peace.<sup>4</sup>

Retailers were understandably concerned about the possibility of chaos in the shops if queues became so long that shoppers abandoned carts laden with frozen goods and the like. In simulations they had also found a lot of mistakes in the change when customer paid in national currency and received euros back. After the smooth launch, the ECB's ban on the early distribution of banknotes to the public was never mentioned by anyone again.

Naturally the new currency units were not legal tender before the turn of the year, so as to avoid mix-ups and confusion. The banknotes supplied to commercial banks remained the property of the national central bank in question until the launch of euro cash at midnight on 1 January 2002.

Obviously everyone involved would benefit from a rapid changeover, so it was important for consumers to be able to obtain euro banknotes after midnight from the 200 000 cash dispensers in the euro area. Similarly, shops needed euros to be able to give them in change from the first shopping day onwards. The public were urged to avoid making individual payments consisting of both euros and the national currency, and encouraged to pay with the exact sum if possible.

Because of the changeover the banks needed to hold unusually large reserves of cash around the clock. Funds held in cash did not earn them interest so, to encourage them to take large

amounts of cash in good time before the euro's launch, national central banks had to neutralise the extra costs. They did so by applying a special debiting model, where the costs of euro cash holdings were charged in three equally large amounts on 2nd, 23rd and 30th January 2002. The dates were fixed according to the main refinancing operations of the ECB at the start of 2002, in which it provided liquidity to the commercial banks. At the same time, the ECB Governing Council decided that this model, called linear debiting, would be the only instrument used at the Eurosystem level for neutralising the costs incurred by those involved in the cash changeover.

Commercial banks were permitted to distribute euro banknotes to their branches and headquarters located outside the euro area but only after the start of December 2001. On the same schedule they could pass on the banknotes to their subsidiaries and other banks outside the euro area. National central banks could send them to banks outside the euro area that specialised in the wholesale distribution of banknotes, which could in turn pass them to their customer banks outside the euro area. Euro banknotes could also be supplied in advance to central banks outside the euro area, which could in turn supply them to banks in their jurisdiction. However retailers outside the euro area were not to be frontloaded.

Euro banknotes were frontloaded to 26 non-euro area central banks, mostly in central and eastern Europe, the Mediterranean and Africa. Banks specialising in wholesale banknote distribution and central banks outside the euro area received banknotes worth a total of

4.1 billion euros. The Deutsche Bundesbank supplied 78 percent of this amount, the Banque de France 12 percent.

Frontloading and sub-frontloading were not the only ideas put forward for facilitating the cash changeover. Consumer organisations proposed to the Banque de France that banknotes denominated in francs should be printed or overprinted with their

corresponding value in euros to 2 decimal points, and similar suggestions were made in other countries. The idea was that people would become familiar with euro values as they spent money but, admirable as the objective was, printing or overprinting would have taken up a lot of capacity in banknote printing and central bank sorting at a time when it was direly needed.

## THE PEDIGREE OF THE LINEAR DEBITING MODEL

The question of how commercial banks should be encouraged to hold large quantities of euro cash created an awkward situation in the Banknote Committee. The matter had been under preparation in a joint task force of experts from central banks in various fields for more than 18 months before it was brought to the Banknote Committee. The proposal designed by that task force had been prepared in detail, so I imagined that its acceptance by the Committee was a foregone conclusion. However, during the meeting, one national central bank then suggested a model that was different from the task force proposal and similar to linear debiting.

There was a long debate and the committee members were fairly equally divided on the subject. It was an urgent matter and the ECB Executive Board and Governing Council had set a strict timetable, so I had no option but to bring the discussion to a close by saying that both models would be taken forward in

the decision-making process. It was annoying, because I felt that it was wrong to present the meeting with a new proposal that could have been raised in the task force during the preceding 18 months. Discussion on the matter continued during the decision-making process and the final linear debiting model took shape.

A couple of years ago I was studying the history of Finnish banknotes in the post-war period and happened to come across a report on the monetary reform at the start of 1963. It showed that Suomen Pankki had granted interest-free credit to commercial banks for frontloaded currency, repayable in two equal amounts, half on 7 January and half on 15 January 1963. The way the Finnish monetary reform was arranged in 1963 resembled the linear debiting model used in euro cash frontloading almost 40 years later. It was consoling knowledge that made up for the irritating memory of the Banknote Committee meeting in 2000.

## Conversion of cash dispensers and vending machines

Most members of the public obtain cash from automatic teller machines; these cash dispensers accounted for about 70 percent of all cash withdrawals from bank accounts in the euro area. It was clear from the start that cash dispensers would be important for the changeover and so plans for converting them started to be made with banks and manufacturers as early as 1998. In the first discussions at that time, the manufacturers predicted that they would need several months to adapt all the machines currently in use.

An idea put forward at that time was a hybrid conversion model, in which about half of the machines would be modified a few months before the changeover and the other half afterwards. Although manufacturers said that cash dispensers had shown very rapid technical development, there was a problem with the great geographical spread of machines to be converted, plus various capacity limitations such as the number of skilled technicians. Manufacturers of vending machines had the same worries.<sup>5</sup> Because the approach proposed by manufacturers seemed inimical to a smooth cash changeover, we began working with them on ideas for how the schedule could be significantly shortened.

As a first measure we agreed that manufacturers of cash dispensers and vending machines would receive the technical specifications for euro banknotes as early as summer 1999. Using the specifications, the producers of sensors used in the equipment would be able to see what characteristics for

identifying genuine notes (such as ultraviolet, infrared or magnetic properties) the euro notes contained.

The next stage was to test euro banknotes. Generally, national central banks used to offer machine manufacturers 2-3 months' time for testing new banknotes before their introduction. Now an entirely different approach was needed, not only due to the magnitude of the changeover but also because there were so many banknote printing works. Manufacturers of equipment sensors needed to test that their equipment would be able to identify all the denominations originating from all 15 printing works. It was therefore decided to offer phased opportunities for testing as the printing advanced and as more and more printing works were able to provide more and more denominations.

In phase one, in May and September 2000, equipment manufacturers were invited to test banknotes at the premises of the Deutsche Bundesbank in Neu-Isenburg, near Frankfurt. A total of 55 companies from Europe and beyond, including Japan and the United States, took part in the tests under ECB supervision. Each company was allocated a testing booth where it could analyse banknotes with its own equipment. Testing lasted a week. Banknotes were distributed to the testers each morning and collected back in the evening.

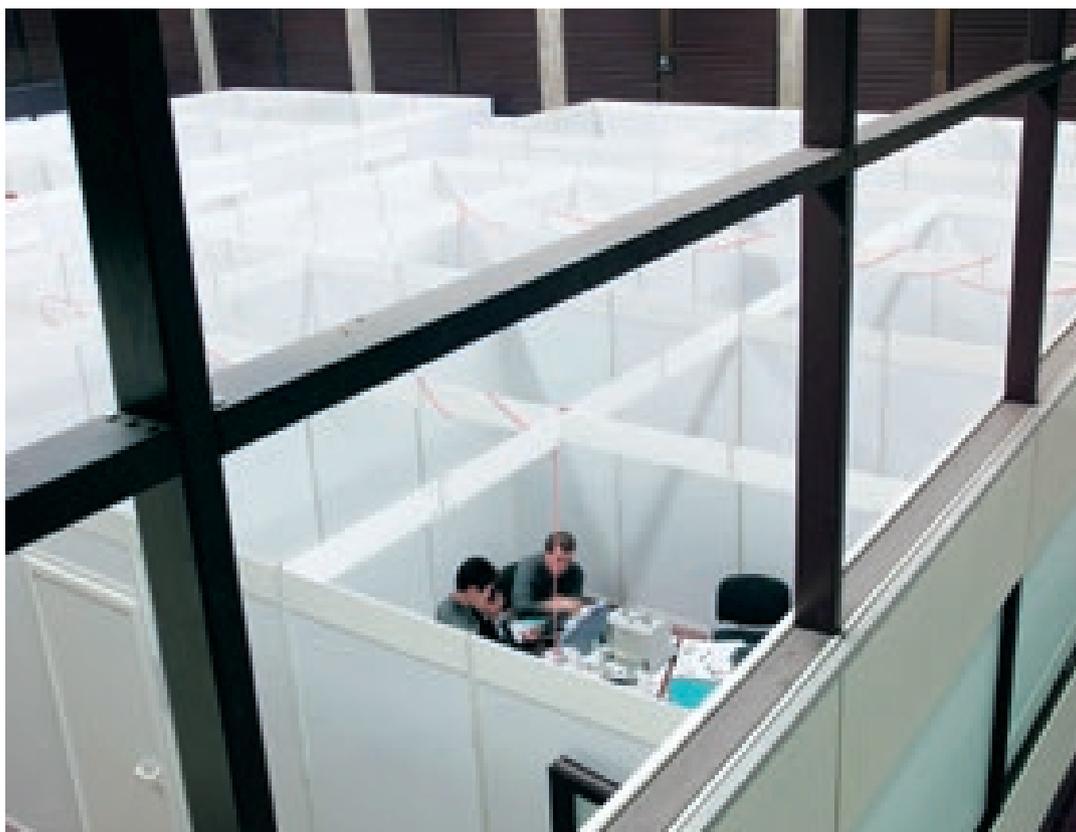
In addition to central testing arranged in 2000, banknote equipment manufacturers were allowed from March 2001 onwards to participate in tests arranged nationally in each

euro area country and in Great Britain. More than 150 organisations, including companies that maintained cash dispensers, took part in these devolved tests.

The third phase of testing arrangements began from 1 September 2001, when equipment manufacturers were allowed to carry out tests

in their own laboratories using frontloaded euro banknotes. Because banknotes could not be frontloaded at this time to equipment manufacturers outside the euro area, those manufacturers were given the opportunity to purchase euro banknotes from the Deutsche Bundesbank.

◆ Fig. 38 In May 2000, manufacturers of cash dispensers and vending machines were given the opportunity to test euro banknotes from several printing works. Testing was arranged near Frankfurt in Neu-Isenburg. All were allocated banknotes and a small testing booth where they could carry out tests privately, using their own equipment.



## CASHCO TAKES CHARGE OF CASH CHANGEOVER COORDINATION

Over the years, a large part of the planning for decisions concerning the euro cash changeover was done first in the Banknote Working Group and then in the Banknote Committee but, from the start of 2001, the ECB Governing Council decided to establish a committee that would entirely focus on the cash changeover. The Eurosystem Cash Changeover Coordination Committee, or CashCo, consisted of representatives of the ECB and the 12 national central banks of the Eurosystem, with the European Commission and Europol as observers.

Under the jurisdiction of the Eurosystem, the committee had general responsibility until the end of February 2002 for coordinating the launch of euro banknotes and coins and the removal of national currencies from circulation. Its job was to monitor the issue of the banknotes and coins and to plan their adoption. CashCo established a Eurosystem-wide structure for data exchange that was used both before issuance and afterwards.

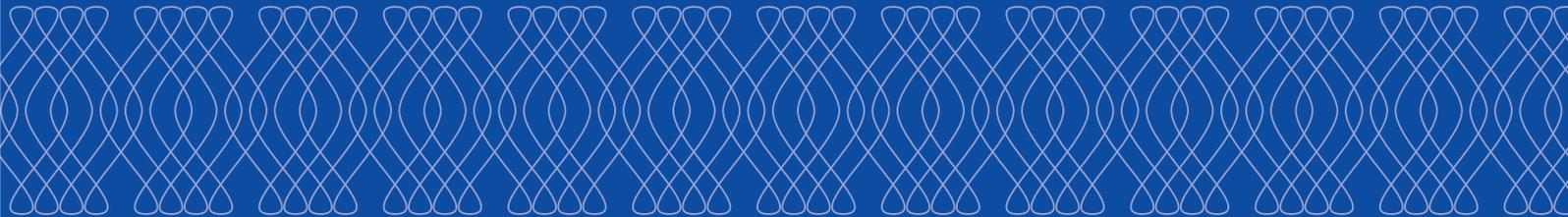
Following its establishment in March 2001, CashCo convened under my chairmanship each month. It held weekly telephone conferences in December 2001 and also after the first week of January 2002. There were three telephone conferences around the turn of the year, on 31 December and 2 and 4 January. All were in the form of roundtable discussions, where

each participant in turn explained the situation in their country, following a pre-agreed formula. The subjects on the formula were the general situation, unanticipated events, issues raised by the media, the progress of cash dispenser conversion, special national questions and cases of counterfeiting. My superior on the ECB Executive Board, Domingo Solans, also took part in the conferences.

The teleconference on the last day of 2001 was especially memorable because of its historic nature. Many special measures, such as testing arrangements for machine manufacturers, and the frontloading and sub-frontloading of cash in the months before issue, meant that there was a significantly higher risk of attempts to use genuine banknotes before the turn of the year or to circulate counterfeited notes around that time. Similarly, because vast amounts of money were being transported and stored, robberies were more likely. Difficult weather conditions at the turn of the year would also have made the launch more difficult.

Yet my colleagues at euro area national central banks had nothing disturbing to report during our roundtable talks on New Year's Eve. We wrapped up the conference in a calm state of mind and could start to prepare for the New Year.





10.  
*The Euro 2002  
Information Campaign*



## 200 million brochures distributed to the public

The third challenge of the cash changeover was communications, telling about the new currency and how it would be issued. An information campaign for over 300 million people required the use of multiple media channels. With this aim, the ECB and the 12 national central banks of the Eurosystem launched their Euro 2002 Information Campaign. The ECB Governing Council budgeted 80 million euros for it, and the central banks provided additional finance. Publicis Worldwide B.E. was the communications agency selected to assist the campaign. The multi-stage public tendering process preceding the selection aroused great interest in the advertising world.

Euro 2002 focused on the appearance of the euro banknotes and coins, their security features and how the cash changeover would take place. It was designed to complement information projects arranged by national central banks, officials and the European Commission. There were three main objectives:

- ◆ advise the general public and many special

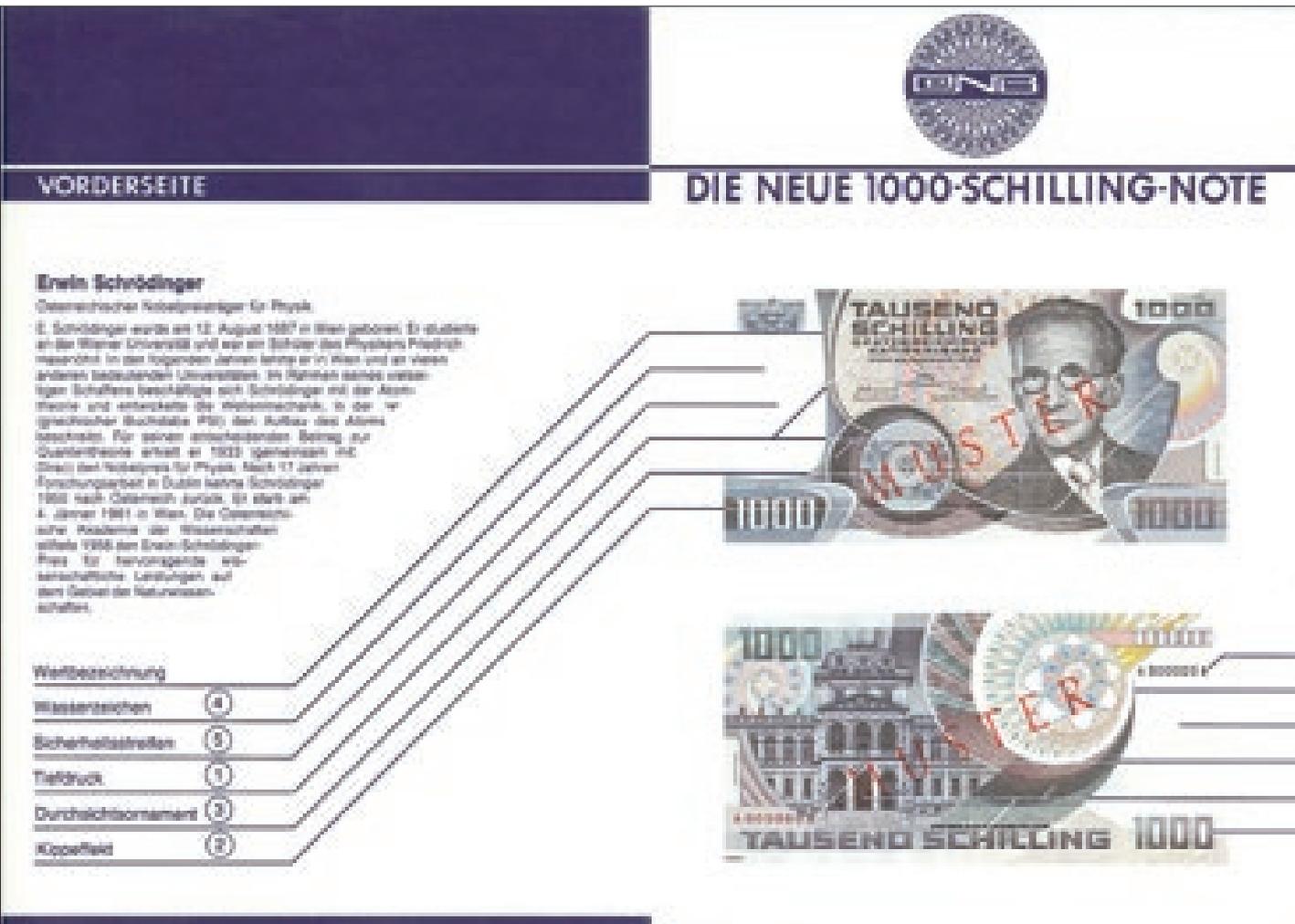
groups how to recognise genuine euro banknotes.

- ◆ educate shop and bank employees how to inspect euro banknotes quickly and efficiently in order to spot counterfeits.

- ◆ gradually prepare the public for euro banknotes and coins by pointing out features of the new currency and how the changeover would take place.

Apart from smoothing the changeover, the extensive campaign of information about euro banknotes also sought to prevent abuses, such as the use of counterfeits or play money, or even situations where swindlers might pose as official for money changers. The target public were not only people living in the euro area but also visitors and the citizens of other countries where euro banknotes would circulate.

It was a fairly new thing to provide information about the security features of any banknote. The first serious efforts in this area had not begun until the end of the 1970s. Up



◆ Fig. 39 In 1983 the Oesterreichische Nationalbank issued a new Austrian 1000-schilling banknote and a detailed brochure about its security features. ◆

till then, details of banknote security features were seen as valuable only to counterfeiters but when photocopying became available to the man in the street, this attitude gradually changed.<sup>1</sup> The first systematic efforts to educate

the broad public and money handlers about banknote security features began in Austria at the start of the 1980s but, in several euro countries, the euro information campaign was the first substantial effort to provide such

information, which made the task all the more demanding.

Euro 2002 used three main media channels; a partnership programme, a press campaign and a campaign targeted at the general public. There were also webpages in the 11 official languages of the European Union at that time.

The aim of the partnership programme was to help organisations in the public and private sectors to inform staff and customers about the arrival of euro cash. It therefore had a

multiplier effect. The programme also ensured that information material produced by the Eurosystem could be distributed effectively at retail and other sites where it was most needed. Electronic material was produced for partners that they could adapt to their own needs. The main groups targeted by the partnership programme were the public sector, banks, commerce, travel companies, transport companies and educational institutions. More than 3000 private and public sector

◆ Fig. 40 Central banks around the euro area arranged training events for cash handlers, at which the security features of euro banknotes were explained. Suomen Pankki held some of its events at head office in Helsinki. ◆





◆ Fig. 41 Information kits leaving the Deutsche Bundesbank, bound for stakeholders whose jobs involved handling money. ◆

organisations participated in the programme and produced more than 1 million posters and tens of millions of brochures.

Training material, including a training video, was produced for professional cash handlers. A total of 230 000 interactive CDs were distributed via the partnership programme and

national central banks, and more than 6 million educational brochures explaining the security features of euro banknotes were supplied to those being trained. The educational material was used in the programmes of national central banks that were aimed at people who trained cash handlers both in the euro area

and beyond. The first training events in the offices of national central banks started as early as January 2001 but training material was not distributed until after the euro banknote security features had been announced on 30 August 2001. Other targets of the campaign were boards of education and the police.

As part of the public relations operation and press campaign, each country in the Eurosystem held a Euro 2002 Conference. The first was in Brussels in March 2001, hosted by the Nationale Bank van België/Banque Nationale de Belgique and attended by more than 500

partners crucial to the money changeover. A Euro 2002 Conference was an event where matters related to the cash changeover could be discussed, and the issues raised were reported extensively by the media.

Another part of the campaign was “countdown days”, held at milestone dates as the changeover approached – 365, 300, 200, 100, 50 and 30 days before the cash would be issued. A press package was produced at each, reminding the media of the key matters.

The most prominent part of the Euro 2002 Campaign came in the final quarter of 2001.



◆ Fig. 42 ECB President Wim Duisenberg and Eugenio Domingo Solans, the Executive Board member responsible for the banknote department, reveal the final design of euro banknotes at a briefing held in Frankfurt's new opera house. ◆



◆ Fig. 43 Concurrently with the unveiling of the euro banknotes, enormous copies were placed on view at the ECB's Eurotower building. ◆

It was aimed at the general public and was launched at Frankfurt's new opera house, where the euro banknotes in their final form were shown for the first time, together with their security features. More than 500 journalists and 60 TV teams were present to witness the historic moment at the end of August 2001.

Because the job of spreading information about the euro was exceptionally challenging, the banknotes were unveiled far earlier than

national banknotes used to be. Their debut was timed to coincide with the start of banknote frontloading on 1 September 2001. For practical reasons, the technical details of the notes and their security features had to be unveiled earlier.

The campaign to inform the general public took the form of print advertisements and television commercials. Five different commercials were broadcast in each country of



Fig. 44 President Wim Duisenberg presents the euro banknotes. The five-pointed star containing them became the symbol that the ECB President presented to each national central bank as its country adopted the euro.

the euro area, in tandem with eight advertisements; in all the countries the content was the same except for the language. The commercials were broadcast on 50 television channels and the advertisements ran in more than 250 publications. To reach a foreign audience, commercials were also broadcast on six international television channels. A public information leaflet entitled “Getting ready for the euro: your guide to the euro banknotes and coins” was distributed to households, containing

more detailed information. Counting all 34 languages in which it was published, the print run was nearly 200 million.

The two main slogans in the information campaign about euro banknotes were “The euro. Our money” and “Feel, look, tilt”, to emphasise the ways of checking security features. The same slogans have been used on other occasions since the campaign.<sup>2</sup>

Extra measures were organised for groups that faced unusual difficulties from the launch of a new currency, such as the visually impaired. From March 2001 onwards, in a part of the European Commission campaign called “The euro made easy”, the ECB distributed 30 000 sets of sample banknotes to organisations for the visually impaired, to be used for training. Sample sets were also used for training people with other disabilities. A joint project with the European Blind Union produced a brochure that was also available in Braille.

The sample banknotes were printed on genuine banknote paper with embossing, but the reverse of the note was not printed so that it could not be confused with a genuine one. The obverse was printed with the text “No value”, did not use the final designs and was offset printed.

Children were another main target group of the Euro 2002 campaign. There was a special project for children, with a competition: “Be a Euro SuperStar”. More than 7 million posters about euro banknotes and coins were produced for schools of 8-12 year-olds, including a multiple choice quiz, which also appeared on line at the ECB’s website. More than 300 000 children took part in it, and 24 winners, two

from each euro country, were selected. The prize-winners were invited to Frankfurt to receive their awards from the ECB President at an event on 31 December 2001.

The website of the Euro 2002 campaign [www.euro.ecb.int](http://www.euro.ecb.int) was opened in February 2001 in all 11 official languages of the European Union. The site was divided into seven sections:

◆ Fig. 45 Various kinds of training material were produced for people with visual disabilities and other special groups. From March 2001 onwards, blind people could try out the feel of the banknotes from sample copies, which bore the text “No value”.



“Euro banknotes & coins”, “Getting ready for the euro”, “Information for organisations”, “Children’s zone”, “Background to the euro”, “News and events”, and “Partners’ area”, the last mentioned being reserved for members of the partnership programme.

◆ Fig. 46 The winners of the “Be a Euro SuperStar” competition, two from each euro country, were invited to Frankfurt to receive their prizes from the ECB President on 31 December 2001. They also visited Wim Duisenberg’s office.

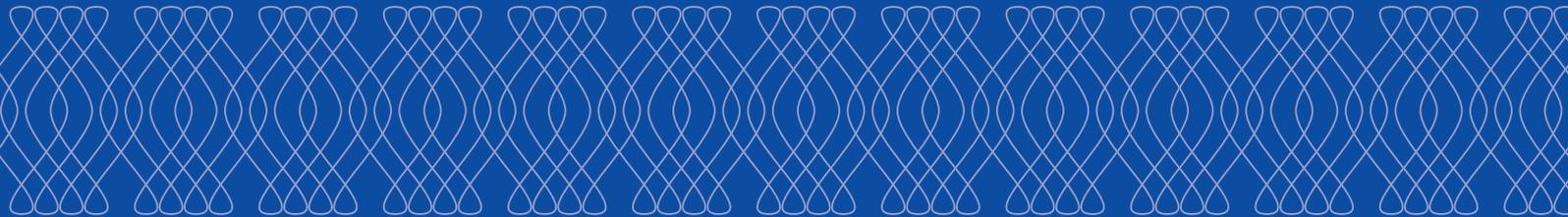


## STRONG MEDIA COVERAGE OF CHANGEOVER PLANNING

Naturally the press was intrigued by preparations for the cash changeover. Many foreign media sent correspondents to Frankfurt, and wide-ranging articles were published about the operation. An interview that appeared in the Wall Street Journal was one I remember the best because of its historic publication date, 11 September 2001.

Reporting on the upcoming cash changeover, Thomas G Sims had added a sidebar about me, so I told my family in Helsinki when the article would be appearing. On the day, my youngest daughter set off to the bookstore to obtain latest Wall Street Journal. Along the way she was shocked to see television images of aircraft, seized by terrorists, flying into the twin towers of the World Trade Center in New York.





11.  
*The cash changeover*



## National banknotes exchanged faster than expected

Even before the start of 2002 the general public began preparing for the upcoming euro cash changeover by reducing their holdings of banknotes, particularly in the final months of 2001. The value of national banknotes in circulation declined by almost a third, to 270 billion euros, before the end of the year. The reduction was even greater in Germany, where the value of banknotes denominated in Marks fell 43 percent in 2001, from 262 billion to 150 billion.

In view of the size of the logistical operation, officials in Belgium, France, Italy, Luxembourg and Spain tried to reduce the incentive to steal surrendered banknotes by announcing that they would be marked when they were withdrawn from circulation from 1 January 2002 onwards. Banknotes returned to commercial banks were to be clipped or perforated and any note thus marked would be invalid for exchange or payment. This was also a way of reducing the cost of insuring cash shipments and reducing the financial responsibilities of banks and post offices.

To make the cash changeover go more smoothly, it was important to issue substantial amounts of the lowest-denominations – 5, 10 and 20 euros – at the start of 2002, which would greatly reduce the need for shops to hold large quantities of cash in the first days of the year. For this reason the Eurosystem (the ECB and national central banks) encouraged banks to dispense cash sums mainly in low denominations. In the countries where social welfare payments were generally issued in cash, these too were paid using relatively small banknotes. In the first days of 2002, low denominations accounted for 82.4 percent of the volume of all euro banknotes in circulation and 43 percent of their value.

After the first days of the year, however, the volume of these small euro banknotes declined rapidly, the number of 5-euro notes by over 30 percent and 10-euro notes by nearly 20 percent. This was because, after the smooth cash changeover, the banks were able to return their surplus holdings of 5 and 10-euro notes to

central banks. At the same time, the demand for high denominations increased continuously. This is illustrated by the average value of a euro banknote in circulation, which rose from 28 euros on the first day of the year to 44 euros on the last. This average continued to rise for several more years before reaching a plateau, just below 60 euros last year (see chart 3).

The average value of a euro banknote in circulation at the end of 2014 was 58 euros.

In most euro area countries, the proportion of payments made by cash increased in the

first half of January 2002, as the public used up their national banknotes and coins and became acclimatised to euros. The shift to euro cash went significantly faster than expected. At the end of the first weekday of the year, an estimated 20 percent of cash purchases were already being made in euros. A week later the average had reached 75 percent and after two weeks 92 percent, although the proportion varied by country and by sector.

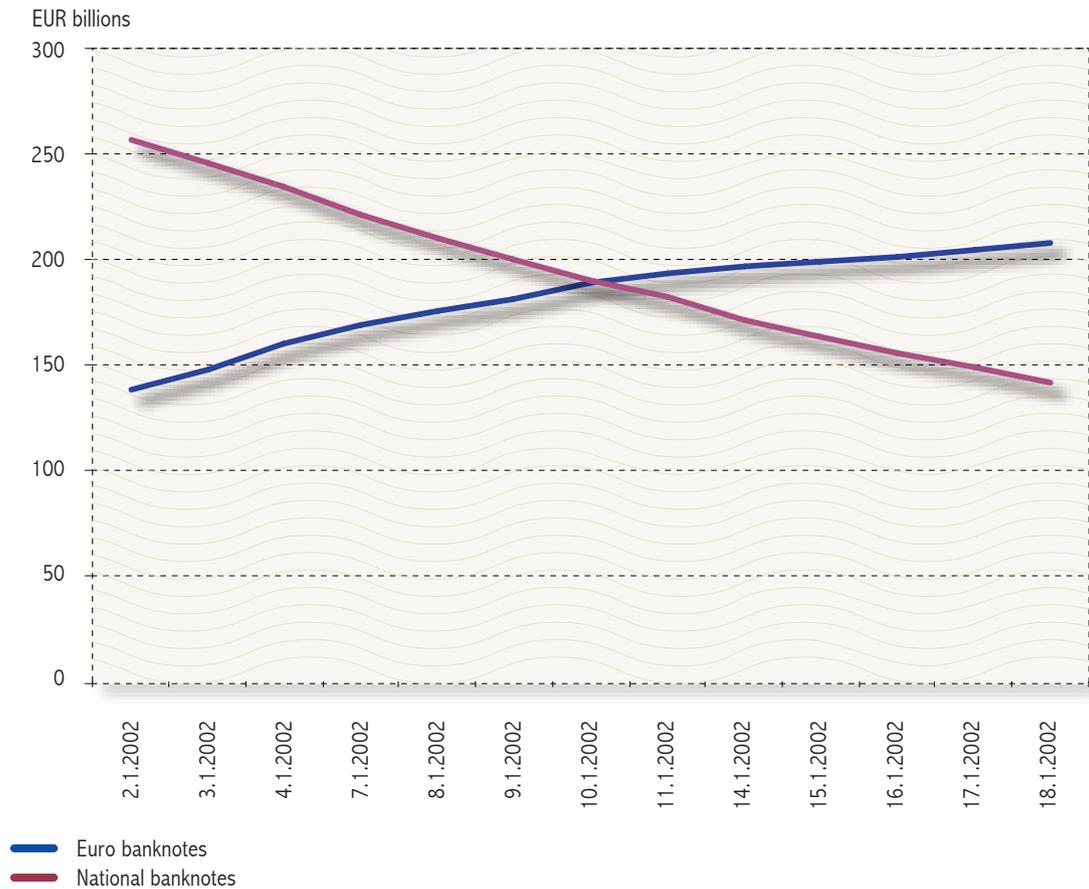
The value of euro banknotes as a proportion of all banknotes in circulation had already

◆ **Chart 3.** Average value of a euro banknote in circulation ◆



Source: European Central Bank.

Chart 4. Values of euro and national banknotes in circulation in the first days of 2002



Source: European Central Bank.

passed the 50-percent level by the eighth weekday of 2002, which was also faster than expected (see chart 4).

When Germany had issued a new banknote series at the start of the 1990s, about six months passed before the new notes accounted for more than 50 percent of all banknotes in

circulation. Obviously the adoption of the euro was a different situation but Germany is still an example of a changeover rate that is regarded as normal.

The number of national banknotes in circulation shrank rapidly, as commercial banks lodged 4-6 percent of the remaining

amount with central banks each day. When the changeover period ended on the last day of February, national banknotes still in circulation were worth 38.6 billion euros. The total in circulation declined constantly because more national notes were withdrawn each day than euro banknotes were issued. The daily issuance of euro banknotes exceeded the number of national banknotes withdrawn for the first time on 28 February. By that date, the total value of banknotes in circulation was 285.1 billion euros, which was about a quarter less than a year earlier. In practice, the speed of the cash changeover varied between Member States, not only because of human behaviour but also depending on the capacity of the different parties to handle, store and transport cash.

By the end of 2002, 95.1 percent of the value of national banknotes had been withdrawn from circulation. Each central bank could decide independently how long it would continue to exchange national banknotes. Some imposed no deadline whatsoever on the validity of their national banknote series, and

banknotes are still being presented from time to time at their offices. For example, German Mark banknotes still in circulation exceeded 6 billion Marks at the end of 2012, declining by about 90 million during 2013. Banknotes are still discovered when people move or die. Once the central bank received a plastic bag found in the forest that contained several clumps of paper, decomposed but recognisable as the remnants of German Marks. Bundesbank experts in damaged banknotes were able to identify a five-figure total, which was then paid in euros to the owner of the plastic bag.

Four central banks – Italy, Greece, France and Finland – imposed a 10-year limit on the exchange of their national banknotes. In Finland, the arrival of the deadline at the end of February 2012 made headlines. Ultimately Finnish banknotes worth 119 million euros were not exchanged.<sup>1</sup> Some national banknotes not lodged with central banks probably no longer exist, but a significant proportion is certainly still held by numismatists and other members of the public, partly for sentimental reasons.

## THE EVE OF THE LAUNCH, AND €-DAY ITSELF

Several years of planning culminated at the turn of 2001-2, so the last day of 2001 was a time of both work and celebration. In the morning the winners of the “Be a Euro SuperStar” competition (see chapter 10) received their awards at Festhalle in the Frankfurt Fair Centre. Each collected a prize, a specially framed series of euro banknotes and a laptop computer from the ECB President.

The evening programme got underway with a supper arranged by Domingo Solans, the Executive Board member responsible for the ECB’s Directorate

Banknotes, to which all ECB employees involved in preparing the cash changeover, and their family members, had been invited. Afterwards, at 2300 hours, we began a press briefing. Everything was proceeding according to plan, we announced, and with less than an hour left before the changeover was due to begin, we and the heads of the cashier’s department of the Deutsche Bundesbank offered to start exchanging the money for the journalists present. We had already put together kits of euro currency worth round sums such as 50 German Marks or 400 French francs.

◆ **Fig. 47** Executives and experts of the ECB and Deutsche Bundesbank exchanging national banknotes for euro cash with journalists just before midnight. From left, Armin Grief, chair of the ECB task force responsible euro cash issuance; Peter Walter, chief cashier of the Deutsche Bundesbank; Eugenio Domingo Solans, ECB executive board member; Edgar Meister, Deutsche Bundesbank board member; and Antti Heinenen, ECB Director of Banknotes. ◆





◆ Fig. 48 The launch of euro banknotes on New Year's Eve aroused interest everywhere. Finnish Finance Minister Sauli Niinistö, today the President of the Republic, withdrawing Finland's first euro banknotes from a cash dispenser at midnight. ◆

Senior executives responsible for cash at the Deutsche Bundesbank went on to another event, at a hotel in the centre of Frankfurt, where they promised to start changing German Marks into euros after midnight. In order to simplify matters, they announced that they would use the exchange rate of 2 Marks to 1 euro, and that the profit would be donated to a charity. They had set aside 500 000 euros for this purpose and it was all used up. In the early hours of the morning, Peter Walter, the chief cashier of the Deutsche Bundesbank, retired to his office to check the accounts.

Before that, we had gathered in the park next to the ECB around the large euro symbol. More than

10 000 people came there at midnight to celebrate the New Year and the launch of cash euros.

Next, Domingo Solans and a group of journalists withdrew euro banknotes from a cash dispenser in the foyer of the ECB. I walked home through the centre of Frankfurt in the small hours amid cheerful crowds of people waving euro banknotes.

On New Year's Day I woke early and took the same familiar route back through the centre of Frankfurt. I had been walking this way since August 1998. It took me through Rossmarkt Square, where a clock ten metres high had been erected, showing the countdown to the launch of the euro, in days, hours, minutes and



Fig. 49 Left: The euro symbol by the European Central Bank Eurotower building is one of the sights of Frankfurt. At midnight at the start of 2002, more than ten thousand revellers turned out to celebrate the start of the euro cash changeover.



Fig. 50 Right: The euro countdown clock in Frankfurt's Rossmarkt Square, showing the time left till the launch of euro cash to a second's precision.

seconds. Over the years, it had kept me acutely aware of my deadline.

Now the clock had no message to tell. The centre was utterly quiet and I was able to withdraw small euro sums from several cash dispensers without difficulty or queuing. It was clear the machines were working properly and I continued contently along my way. A few members of my department were on duty and

already present. We exchanged stories about the previous evening, after which I made a few calls to colleagues at national central banks. It seemed that €-day, as we were calling it, had gone well everywhere.

As I passed back through the town around midday, I noticed that several of Frankfurt's banks had opened their doors for a few hours just to exchange money. No other bank services were available. Despite the



Fig. 51 Left: The Banque centrale du Luxembourg celebrates €-day on a neon billboard in front of its building.

Fig. 52 Right: Finland, like Greece, began exchanging money an hour earlier than Continental Europe and provided the world's media with pictures of people waiting in fiercely cold weather outside Suomen Pankki in Helsinki. Although the queue was at times several hundred metres long, a warm drink and a gingerbread biscuit at the main door seem to have kept up morale.<sup>2</sup>

long lines, everyone appeared satisfied and seemed to regard themselves as players in a historic event rather than members of a queue.

The situation was not so calm everywhere else. When some branches of the Deutsche Bundesbank had opened their doors to the public at 9 a.m. on New Year's Day, queues had formed and, at one location, there was not enough room for everyone to wait inside. The mood cooled as the queue spilled

out into the street where a cold wind was blowing. The local manager contacted the chief cashier of the Bundesbank, Peter Walter, who recalled that the branch had a wine cellar and recommended that the staff should make up some mulled wine to raise spirits. At first the branch manager regarded the idea as too complex but, after finding a shop at the railway station that sold paper cups, he had the glühwein prepared. The mood of the queue was restored immediately.

## Cash dispensers quickly converted, vending machines more slowly

More than 200 000 cash dispensers and ATMs had to be converted. Some of them were located in bank offices, others in places like shopping centres. The schedule for modifying the machines to dispense euros varied slightly from country to country according to the number of technicians available and the location, quantity and type of the machines. There were also national differences in what was done to the machines that had not been converted by the turn of the year. In six countries they were turned off temporarily and in four countries they continued briefly to dispense national banknotes.

Thanks to comprehensive planning, cash dispensers were converted extremely rapidly throughout the euro area. By 2 January, 90 percent of them were ready and two days later the level had reached practically 100 percent (see chart 5).

Compared with the transitional period of several months that had been mooted when we first talked to equipment manufacturers and banks, this was a great achievement. It was made possible by the bold action of the different parties, and careful preparations for the changeover made by banks and machine manufacturers over a period of several years. That some countries would need no more than 24 hours to modify their cash dispensers is surely a promise no one could have made in 1998. The number of withdrawals from cash dispensers in the first week of January 2002 was exceptionally large because of public curiosity and enthusiasm over euro banknotes.

For example, the Dutch made 5 million withdrawals at cash dispensers in the two first days of the year. The number continued high at the beginning of the following week but then gradually began to decline towards a normal level.

The cash services of banks and post offices were also in far heavier demand than usual in the first days of January 2002, as people withdrew euros or converted national currency holdings into euros at the more than 200 000 offices of banks and post offices in the euro area. In Germany and Spain, where the banks were open on 1 January, customers withdrew more money over the counter than from machines. Retailers were also well prepared for the changeover. Some major retailing chains, in Germany and elsewhere, set up separate exchange desks in their stores where customers could change national currencies to euros without causing delays at the checkouts.

All machines that accepted banknotes and coins as payment had to be converted to accept euros. It took more time to modify about 10 million vending machines, some of which took banknotes as well as coins, than to adapt 200 thousand cash dispensers, but more than 90 percent of vending machines had been converted to accept euros by the end of January 2002. There were occasional problems from machines that still required national currencies when the rest of the cash changeover was complete.

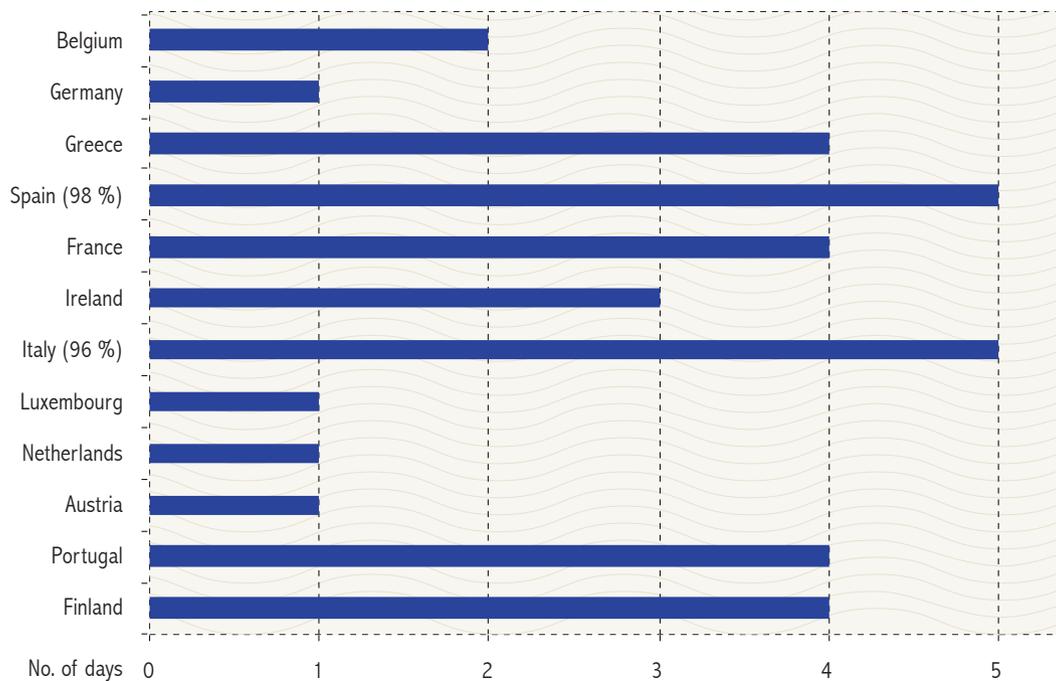
A less easily manageable problem than converting machines was the return of national

currencies to national central banks. There were bottlenecks, delays and also some confusion in handling the money. In certain cases the delays lasted months.

Around this time, there was a controversy about the effect of the changeover on prices. It was known as the “teuro” debate, teuro being derived by combining euro with the German word for expensive. In January 2002, when the new cash currency was being launched, consumers were shocked by a rise in the prices of fresh produce, due to bad weather, and in the

costs of some frequently used services. This led to the general idea that adoption of the euro had pushed up prices, and this belief fuelled consumer expectations of greater inflation, which began to diverge significantly from actual price inflation. A likely explanation of the phenomenon seems to be that a change in the cost of a frequently purchased item or service has a greater effect on inflation expectations than the price of something consumers buy more rarely.<sup>3</sup> In the second half of 2002, however, the gap between expected price

◆ Chart 5. Cash dispenser conversion times ◆



Source: European Central Bank.

movements and actual extremely moderate inflation began to normalise.

Prior to the launch of euro banknotes and coins, there were many public questions and doubts. In the end, however, the changeover to the cash euro went very well in all 12 euro

area countries. According to a Eurobarometer of public opinion, based on surveys conducted in January 2002, 88 percent of people believed that they had been adequately informed and 81 percent felt that the changeover had gone well for them personally.<sup>4</sup>

## SUCCESSFUL CHANGEOVER DRAWS WIDE ATTENTION

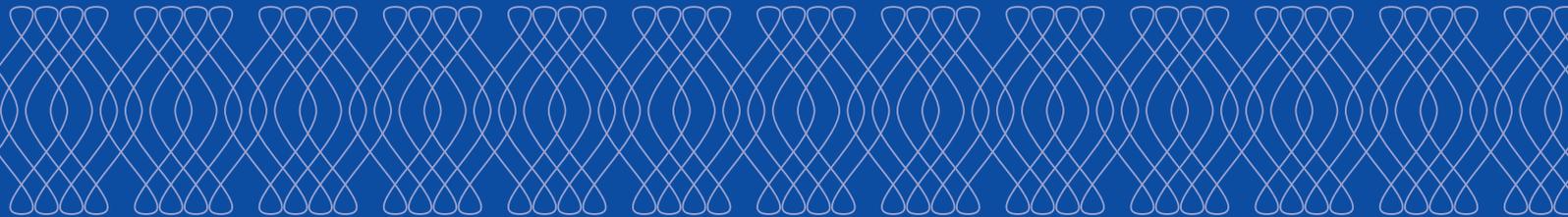
The successful launch of euro cash was noticed everywhere. Media across the board reported the changeover in a favourable light, sometimes to the point of speculating that its success would facilitate structural change in Europe.<sup>5</sup> Even the British press gave recognition to implementation of the changeover although it had been extremely critical beforehand. I experienced this attitude of British good sportsmanship myself.

The events of the changeover were reviewed in countless meetings and conferences in 2002, just as preparations for the changeover had been analysed in the preceding years. ECB executive board member Domingo Solans had been invited to speak at one such event in Madrid in July 2002. He was unable to attend because of another engagement and asked me to appear in his place.

The II International Financial Summit, as the event was called, was organised by the Economist magazine together with the Spanish bank Caja Madrid. I was due to speak in a session where the other speakers were Michael C. Bonello, the governor of the central bank of Malta, and Michael Howard, then a member of parliament for the British Conservative Party and later the party chairman. The session's theme was "Facing the euro". I spoke about my own experiences of the changeover, and then it was Howard's turn. He was extremely critical of the euro, and said so at the beginning of his speech. He then continued to say that, although that was his view, he had to admit that the cash changeover had gone extremely well.







12.  
*Banknotes and  
counterfeits after the launch*



## Continuous increase in number of banknotes

Euro banknotes have remained in strong demand since their launch (see chart 6). The value in circulation has grown distinctly faster than would have been expected from changes in the value of national banknotes. This becomes even clearer when one compares the line extrapolated from demand for national banknotes with figures for the actual value in circulation (see chart 7).<sup>1</sup>

Among the countries due to adopt the euro, demand for banknotes grew very modestly in 2000. In the following year, in the run-up to the launch of euro cash, the public gradually began to reduce their holdings of national banknotes, which were returned via commercial banks to national central banks. From 2002 to the start of 2007, the value of euro banknotes in circulation increased at an annual rate of more than 10 percent. Subsequently it gradually decelerated to just over seven percent, before taking off again amid the financial market crisis of October 2008, when it reached to about 13 percent (see chart 8). After a transitional

period, the growth rate resumed its previous trend. Annual growth at the end of 2014 was 6.3 %.

The steep climb in the number of euro banknotes in circulation, continuing until very recently, is principally because the public has been adapting cash holdings to conditions of low inflation expectations and low interest rates.

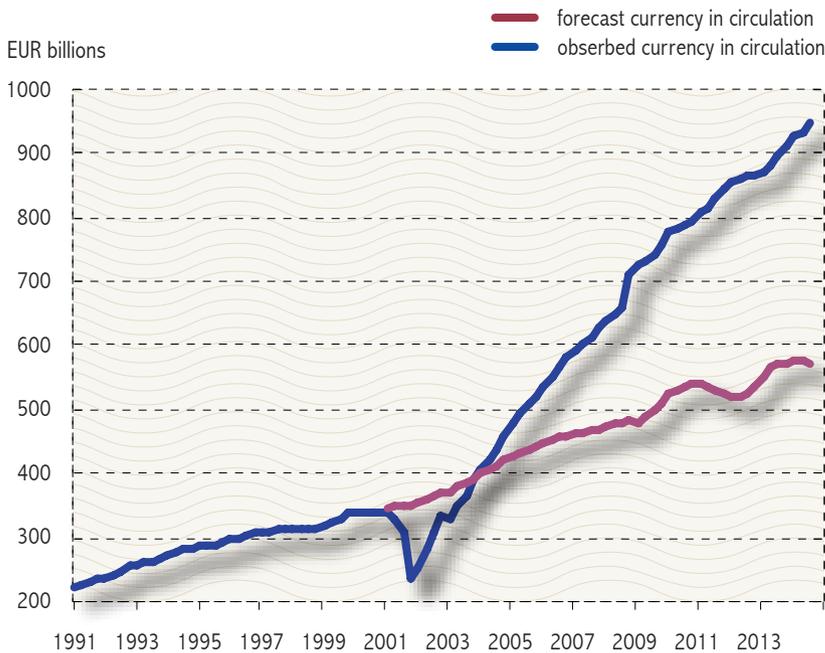
There has been substantial demand from outside the euro area, too, where it is estimated that more than 25 percent of euro banknotes are held. One way to estimate the amount of euro banknotes circulating abroad is to measure the accumulated net shipments of euro banknotes by euro area monetary financial institutions (MFIs) to destinations outside the euro area. On the basis of this indicator, around EUR 170 billion worth of euro banknotes were estimated to be in circulation outside the euro area at the end of November 2014 (see chart 9). However, this estimate is clearly regarded as a minimum, given that the banking channel is just one of

Chart 6. Value of banknotes in circulation



Source: European Central Bank.

Chart 7. Value of banknotes in circulation, observed and forecast



Source: European Central Bank.

the several ways that euro banknotes leave and re-enter the euro area. Anecdotal evidence suggests that the outflows of euro banknotes via non-MFI channels (such as tourism or workers' remittances) are, for most countries, greater than the inflows via such channels.<sup>2</sup>

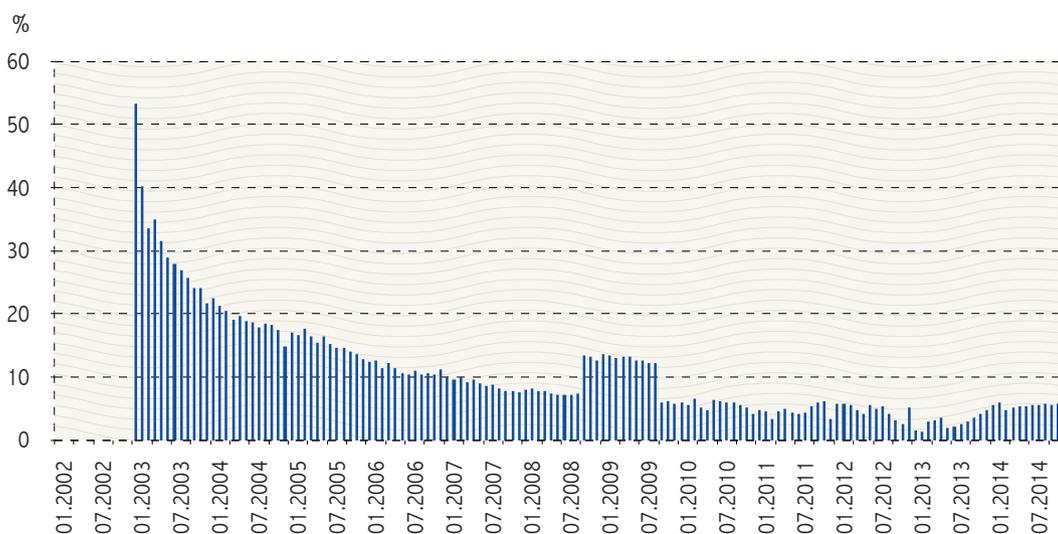
One main reason for non-euro area demand is seen as the ECB's strict inflation targeting, which often makes the euro a more attractive currency for savings in cash than national currencies are. It is a sign of confidence in the euro as a dual currency that, when the financial market crisis stimulated a strong increase in demand for euro banknotes, much of the demand came from outside the euro area. This shows clearly in the spike in net euro banknote

shipments in September 2008 (see chart 9). In the same way, the recent Ukraine crisis has been accompanied by increased external demand for euro banknotes.

The export of euro banknotes is greatest to regions close to the euro area, such as Switzerland, other EU countries and non-EU Eastern Europe (see chart 10a). In Switzerland, for example, euro banknotes can be withdrawn from practically every cash dispenser.

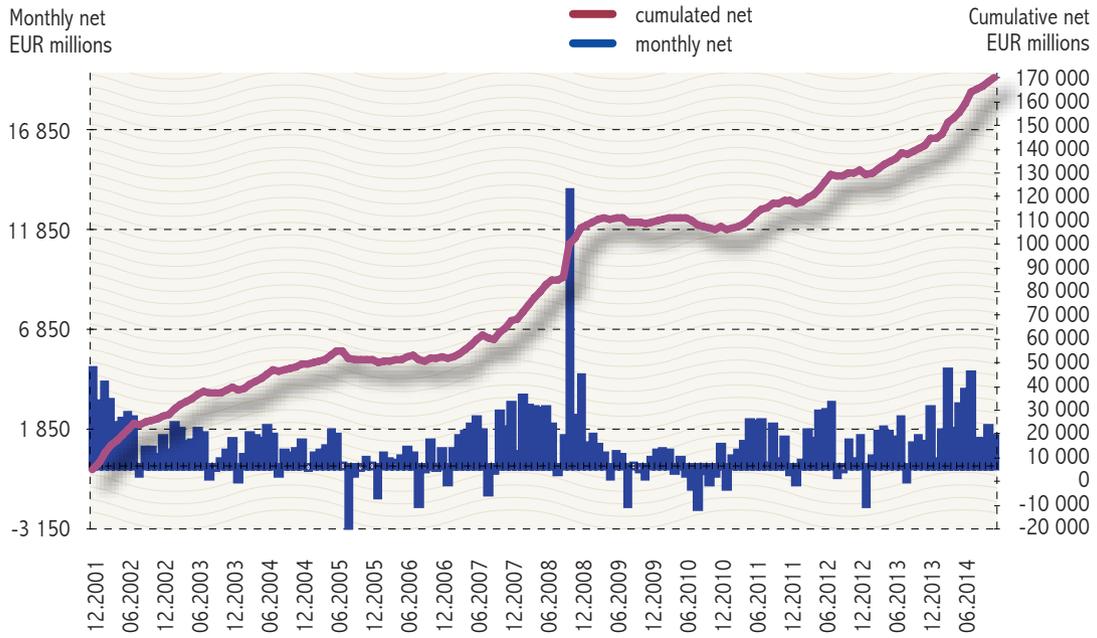
The greatest imports of euro banknotes into the euro area are from Asia, the Middle East, other EU countries and East Europe. Cash spent by euro area tourists in these regions returns via the banking system to euro area banks (see chart 10b).

Chart 8. Annual growth of euro banknote value in circulation



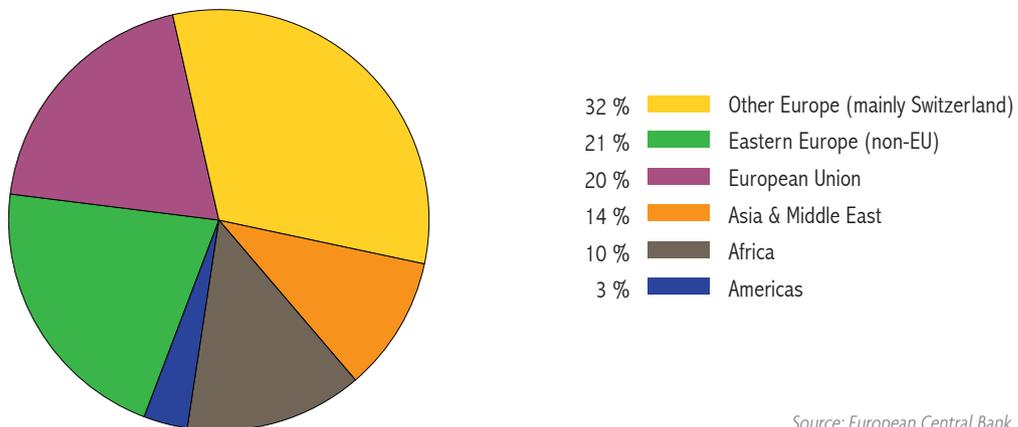
Source: European Central Bank.

Chart 9. Net euro banknote shipments, monthly and cumulative



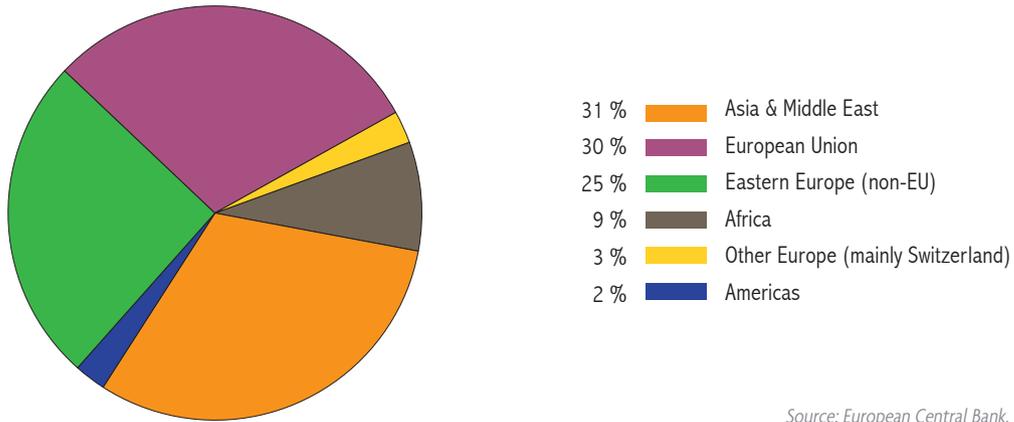
Source: European Central Bank.

Chart 10a. Euro banknote sales (= exports) to non-euro area, 2013, %



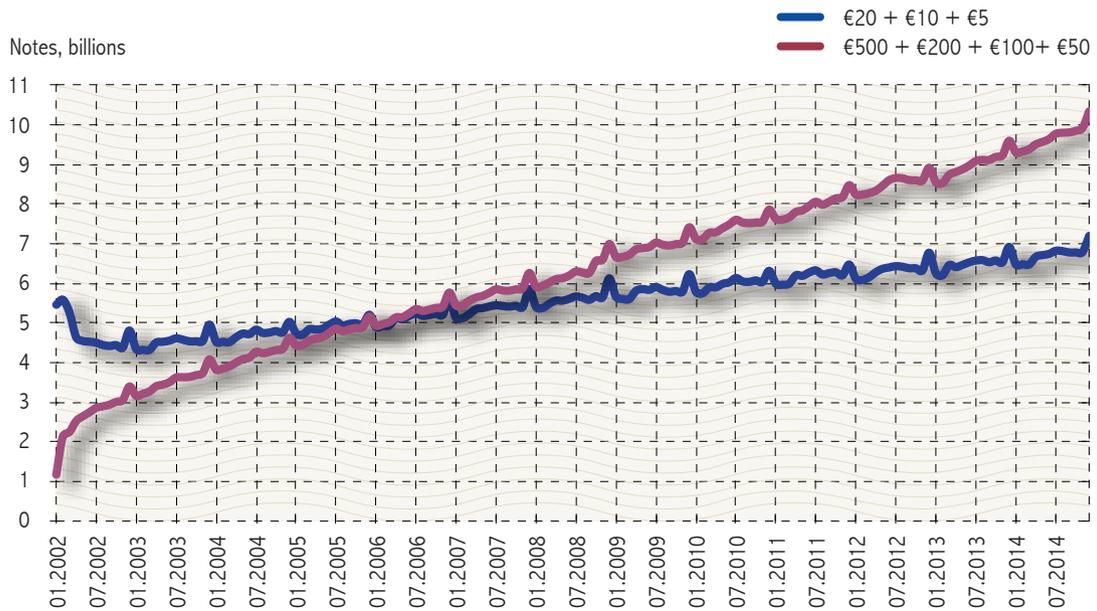
Source: European Central Bank.

Chart 10b. Euro banknote purchases (= imports) from non-euro area, 2013, %



Source: European Central Bank.

Chart 11. Change in volume of low and high denomination euro banknotes



Source: European Central Bank.

It is something of a paradox that while the spread of new payment methods has reduced the relative share of cash as a means of payment, the use of cash as a store of wealth has increased. The phenomenon is clear when one compares changes in the number of low-value banknotes (5, 10 and 20 euros) with the higher denominations (see chart 11).

Low denomination banknotes, as a proportion of all euro banknotes in circulation,

declined from 59 percent at the end of 2002 to 41 percent at the end of 2014. Although demand for low denomination notes has increased, demand for high denominations has increased much more. Small 5 and 10-euro notes are used principally for giving small change, in the same way as coins are. The 20 and 50-euro notes, in turn, are the spending cash of ordinary consumers and are also widely in use in cash dispensers.

## LEHMAN BROTHERS BANKRUPTCY SPURS EURO BANKNOTE DEMAND

Disturbances in the financial market always cause concern; negative news about a bank can even cause a run on it. The bankruptcy of Lehman Brothers investment bank on 15 September 2008 is in a class of its own. It was shown in the demand for cash as the public, particularly people living outside the euro area, became concerned about the fate of their bank deposits. Demand for euro banknotes rose very steeply in September 2008 (see chart 8).

In the third week of September 2008, I received a call from the chief cashier of the Deutsche Bundesbank, Helmut Rittgen, who was concerned about a major increase in orders for euro banknotes. The demand was especially great outside the euro area, and this demand was always felt strongly at the Deutsche Bundesbank, a legacy of the period when the currency of Germany was the Mark and also because of the central position and logistical arrangements of Frankfurt airport. We agreed that if the situation continued unchanged, we

would have to consider moving euro banknote stocks to the national central banks where the demand was greatest. We decided to see what happened on the following day and to arrange a teleconference of the Banknote Committee, if necessary.

The Committee did indeed hold a telephone discussion at short notice on the following day. After a roundtable discussion we decided on measures to meet to the demand for euro banknotes, including the question of where supplies were located. It was agreed to start making arrangements for moving stocks. A few national central banks were concerned that some of their branch offices might run out of notes of certain denominations if the situation did not end soon. Finally, we worked out our common response to questions on the subject from the public and the media. However, before final approval of these formulations, I wanted to get in touch with the ECB communications department.

The top people in ECB communications were in Washington at the time, at the annual meeting of the International Monetary Fund. I spoke on the phone with Regina Schüller, the head of the Press and Information Division, and explained to her the Banknote Committee's ideas on how to handle communications about the situation. About 20 minutes later I received a call from ECB President Jean-Claude Trichet in Washington. When I told him of the steep rise in demand for euro banknotes, he wanted to know where the demand was coming from and how much it had grown. As we went through the situation in detail, I mentioned in passing that the Banknote Committee had agreed on the statements we would make if the media and

the public asked. Trichet asked me to read out the draft text agreed.

I started with the positive part of the message; the Eurosystem would supply enough euro banknotes in every situation. When I then went on to qualify this assurance, Trichet exclaimed "Full Stop!" My protestations were in vain, so I had to tell the Banknote Committee that our commonly agreed statement could contain no other message than that we would meet the demand for euro banknotes under all circumstances. There could be no ifs and buts. We acted accordingly and were able to supply great quantities of notes to the central banks where demand was the greatest, which in turn supplied customers. Trichet's approach had been the right one.

## Euro changes national patterns of banknote use

The launch of the cash euro has changed the shape of demand for banknotes in many euro area countries. Chart 1 (page 109) showed that, when the markka was its currency, Finland had the lowest ratio of cash to GDP among EU countries. Before the launch of euro banknotes, Finns used the national currency mainly for purchases in their home country. The markka was not a dual currency like the German Mark or the French franc, which were accepted widely outside their home countries.

When euro banknotes were launched in an area consisting of 12 countries (later expanded to 19), the zone using the currency of Finland expanded overnight. Among

euro area countries, the ten favourite foreign holiday destinations from Finland, in order of preference, are Estonia (1), Spain (3), Germany (5), Italy (6), Greece (7) and France (10).<sup>3</sup> Even in the other countries of the top ten – Sweden, Russia, Turkey and Great Britain – euro banknotes can be used for purchases to varying extents. It is not therefore surprising that banknote demand since the introduction of the euro has grown much faster than when the currency was the Finnish markka (see chart 12). Prior to the euro, Finns often purchased foreign currency before leaving Finland and even the markka banknotes that they took with them to change abroad were repatriated via the

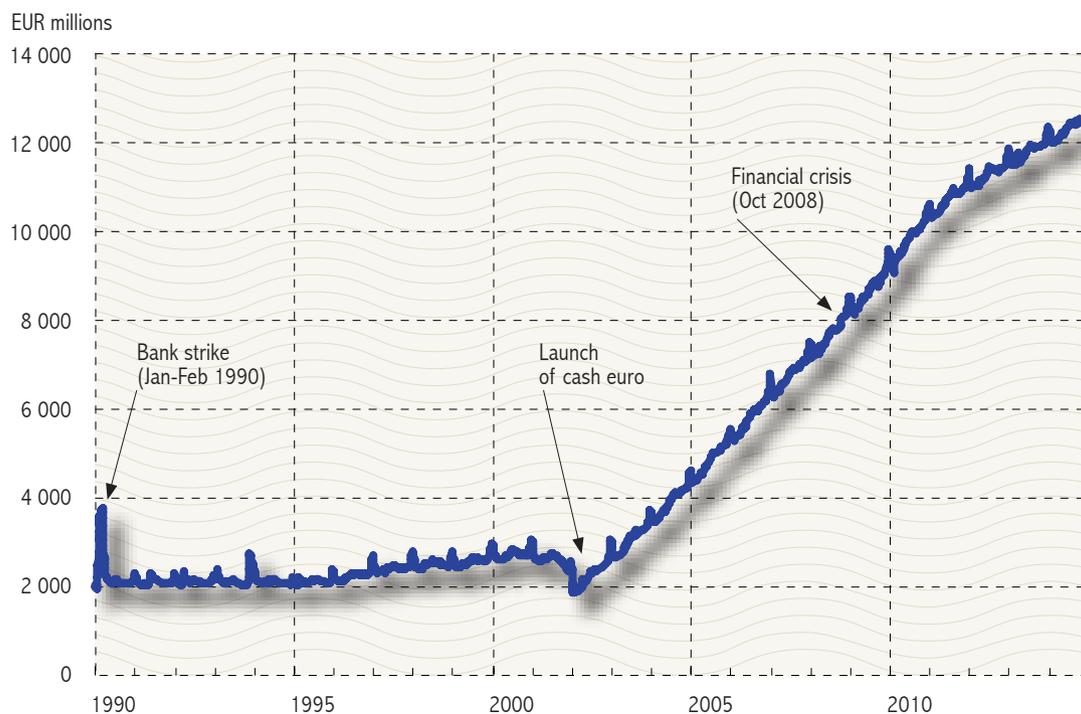
banking system to Suomen Pankki. Now that euro countries have a currency in common, cash taken abroad no longer returns via the banking system to the original country of issue. The euro banknotes they spend continue to circulate and could end up anywhere in the euro area<sup>4</sup>.

Since the launch of euro banknotes, it has no longer been possible to obtain precise information about the number of banknotes in circulation in each euro country, because the banknotes issued by each central bank may now be in circulation in other countries of the euro area and even outside it. Correspondingly,

visitors to a country may bring in banknotes originally issued by another country's national central bank. Finnish officials, for example, estimate that a significant part of the cash issued in Finland has ended up abroad (see chart 13).

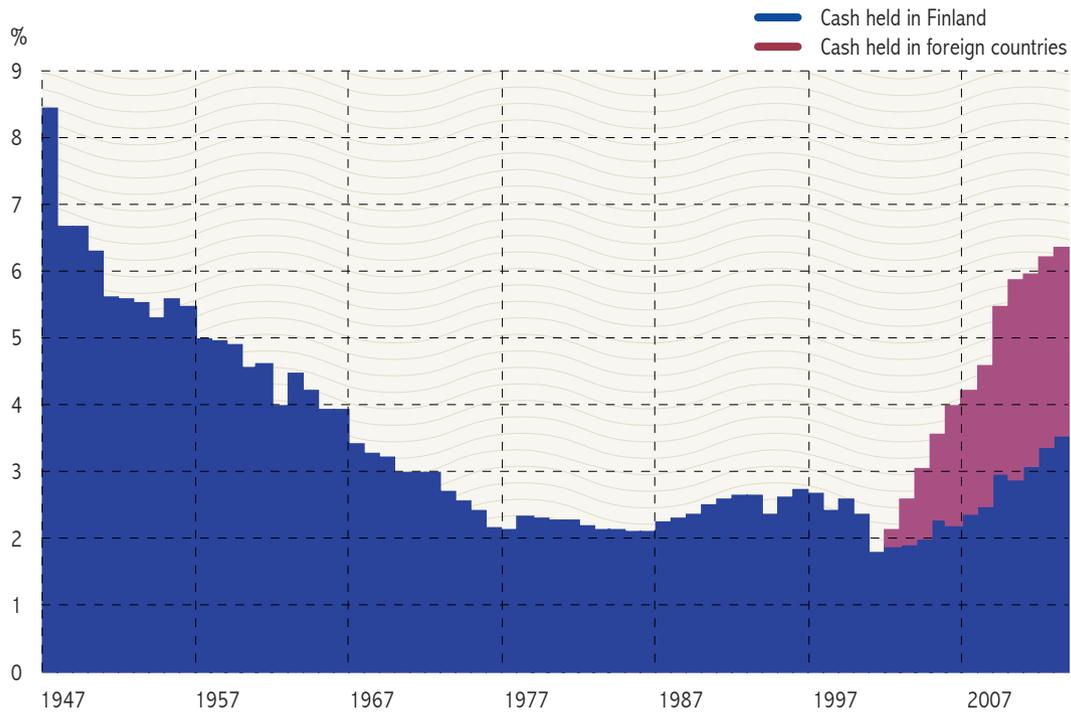
As the chart indicates, the relative share of cash in all payments declined gradually for several decades in Finland over the post-war period. Since the launch of the euro banknotes, however, the amount of cash in proportion to GDP has increased, although statistics and surveys show a falling use of cash in domestic payments in the past decade.<sup>5</sup> The

Chart 12. Markka and euro banknotes issued by Finnish central bank



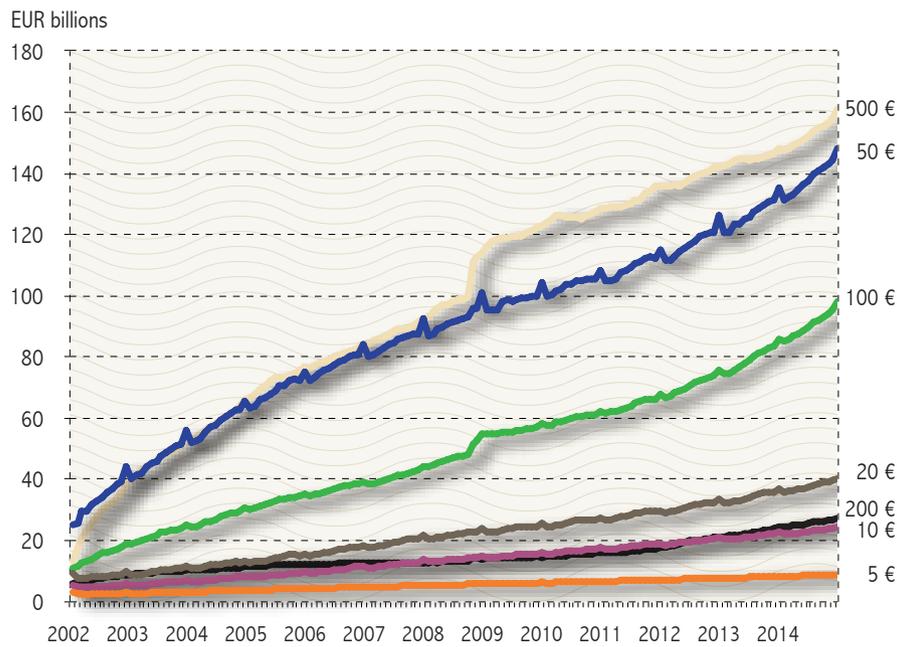
Source: Suomen Pankki.

Chart 13. Cash issued by Finnish central bank in proportion to GDP



Source: Suomen Pankki and Statistics Finland.

Chart 14. Value of euro banknotes issued in Germany, by denomination



Source: Deutsche Bundesbank.

rising demand for cash is explained by tourism, purchases of used cars from abroad, and other purchases from elsewhere in the euro area.<sup>6</sup> One additional explanation is probably that, because of the wider area where they can be spent, euro banknotes are a more popular store of wealth than national banknotes used to be. Moreover, while Finland was using national banknotes, some cash savings were probably in foreign currencies such as the US dollar or the German Mark, and most of this demand has now shifted to euro banknotes. Low inflation expectations and low interest rates have also played a part. Before the introduction of the euro, in the 1980s and still at the start of the 1990s, there was double-digit annual inflation in many countries that are now in the euro area.<sup>7</sup> This phenomenon was influencing inflation expectations in these countries even after low inflation had been achieved.

Country by country, Deutsche Bundesbank has issued the greatest amount of euro banknotes, so it is not surprising that its net issuance of different denominations reflects the demand trend for all euro banknotes (see chart 14). If seasonal fluctuations within a year are ignored, issuance of all denominations by Deutsche Bundesbank has shown a continuous net increase since the launch of euro cash. The chart also clearly records the steep increase, in autumn 2008, in demand for 500-euro banknotes from outside the euro area, which came mostly in the form of orders to Deutsche Bundesbank.

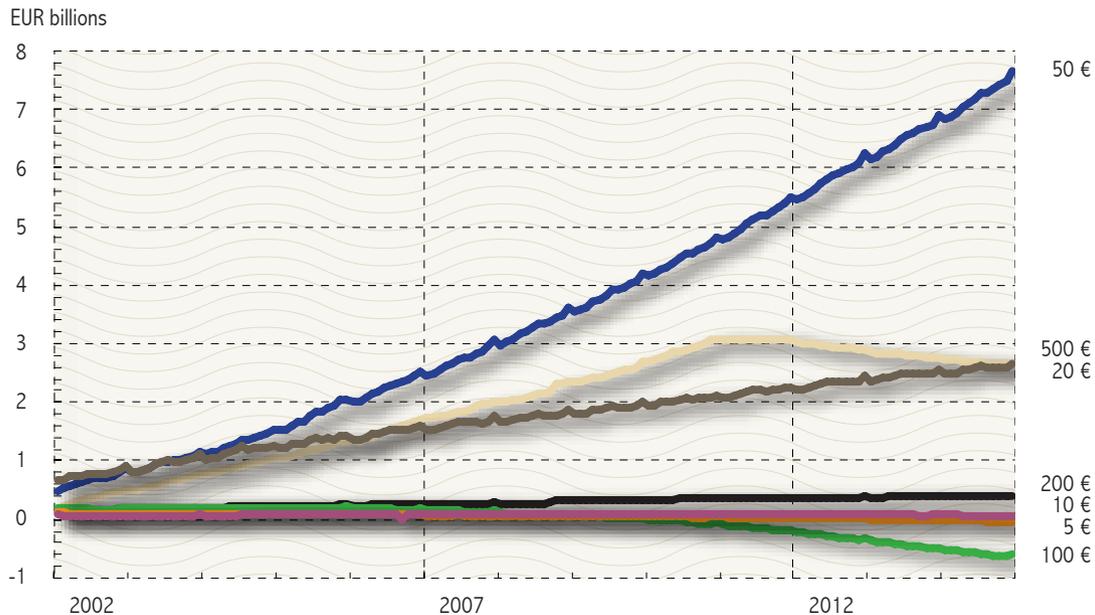
The picture is different when one looks at what has happened in a small country. The euro banknotes issued by the national central bank

and received back from tourist flows may show a different distribution of denominations.

In Finland, issuance of the 50-euro note, most commonly used in cash dispensers, has grown fastest by far (see chart 15). Initially, issuance of 500-euro notes also grew quickly, because it was widely used in large cash purchases in the euro area, but the rate has levelled out in the past few years. Meanwhile, Finnish issuance of 100-euro banknotes has become negative, meaning that Suomen Pankki accepts more 100-euro notes than it issues. This is explained by the income side of the tourism account, specifically Russian tourists to Finland. Russian banks obtain euro banknotes on the wholesale market, which is based mainly in Central Europe rather than Finland. 100-euro notes obtained elsewhere are then used for purchases in Finland and return to Suomen Pankki via the Finnish banking system, where they outnumber the 100-euro banknotes it issues.

Austria is also facing banknote flows that are caused by more than national demand. While foreign tourists carrying cash account for some of these banknote inflows, international wholesale trading of euro banknotes plays a much bigger role. A substantial share of these transactions is handled via the Oesterreichische Nationalbank, and the value of banknotes returned to the central bank every year exceeds that of the banknotes it puts into circulation.<sup>8</sup> In Austria, cash machines dispense 10 and 100-euro banknotes, which show positive net issuance (see Chart 16). The same is true of 500-euro banknotes, which are in strong demand, partly because of demand from outside the

Chart 15. Value of euro banknotes issued in Finland, by denomination



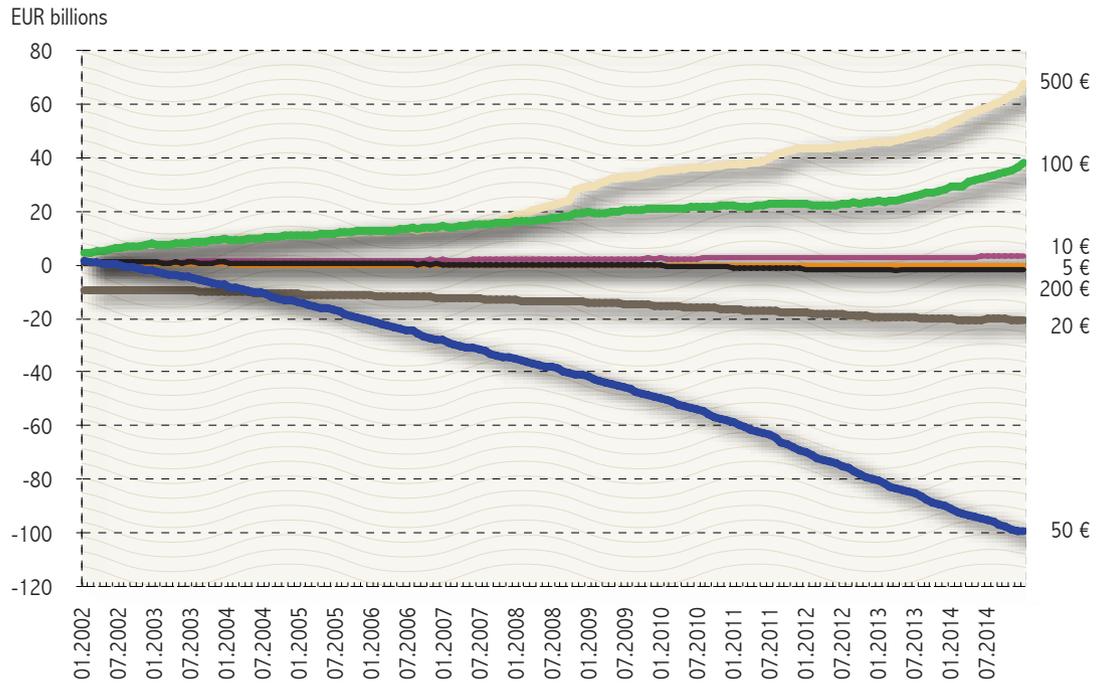
Source: Suomen Pankki.

euro area to the banknote wholesale bank. On the other hand, net issuance of 50 and 20-euro notes is negative because of the import of these denominations.

The contrast is even stronger in Portugal. The only net positive issuance by the national central bank is of 10 and 20-euro notes, used in cash dispensers, plus 5-euro notes (see chart 17). The net issuance of 50 and 100-euro banknotes is strongly negative because these are the notes that are brought in by tourists and move through the banking system to the Banco de Portugal.

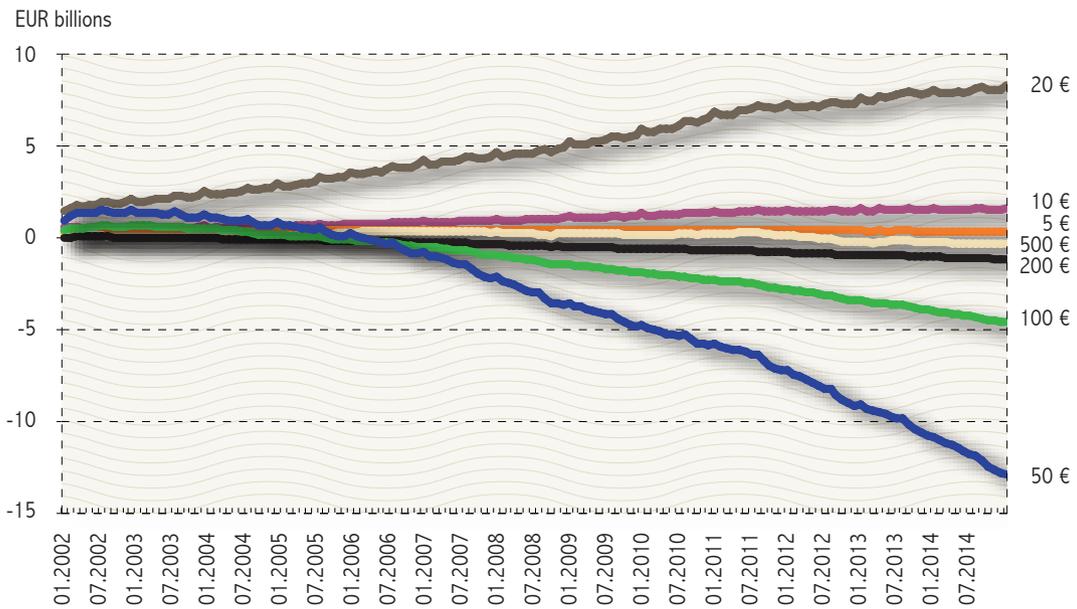
This transfer of euro banknotes from one country to another does not show in the accounts of central banks because 8 percent of euro banknotes in circulation are recorded on the ECB's balance sheet and the remaining 92 percent are divided between the national central banks of the Eurosystem in accordance with their shares of the capital of the European Central Bank. Their capital contributions are calculated using a key that reflects the respective country's share of the total population of the EU and of the EU's combined GDP.<sup>9</sup>

Chart 16. Value of euro banknotes issued in Austria, by denomination



Source: Oesterreichische Nationalbank.

Chart 17. Value of euro banknotes issued in Portugal, by denomination



Source: Banco de Portugal.

## Security features prevent euro counterfeiting

There is no such thing as a banknote from which a fairly credible-looking counterfeit cannot be made. What one person does, another can always copy. Banknote security features are merely a way of making the copying more difficult and increasing the time and resources required.

Counterfeiters are attracted to stable currencies and banknotes used over a large area. Because the euro could be expected to become the world's second most important currency after the US dollar, it was obvious that money counterfeiters would be interested in it. The Eurosystem took purposeful action from the outset to resist counterfeiting and support law enforcement officials.

In October 1998 the ECB Council adopted the principle of “thinking globally, acting locally” to combat counterfeiting. In line with its global tenet, it established a database to record, in a standard format, technical and statistical information about all euro banknote counterfeits. The database would be at the disposal of EU central banks and other organisations responsible for combating counterfeiting. It would contain a picture of each counterfeit and information about the technique by which it was produced and how the security features were copied.

Later, in April 1999, the Council decided to establish a counterfeit analysis centre where all new euro banknote counterfeits would be analysed, classified and recorded. The centre also plays a major role in the system for

communications and monitoring euro banknote counterfeits.

“Acting locally” means that the competent officials are physically nearby for every case of counterfeiting and that information is not distorted by lengthy communications channels. In line with this principle, the ECB's counterfeit analysis centre has been supplemented with a national analysis centre in each EU Member State, where national counterfeits of banknotes and coins are dealt with. In this way EU countries outside the euro area are involved in all the analysis and data exchange about euro counterfeits. A geographical data system has also been created as part of the counterfeit monitoring system. It is of particular value to the police in studying the spread of counterfeits and allows them to allocate their investigation resources effectively.

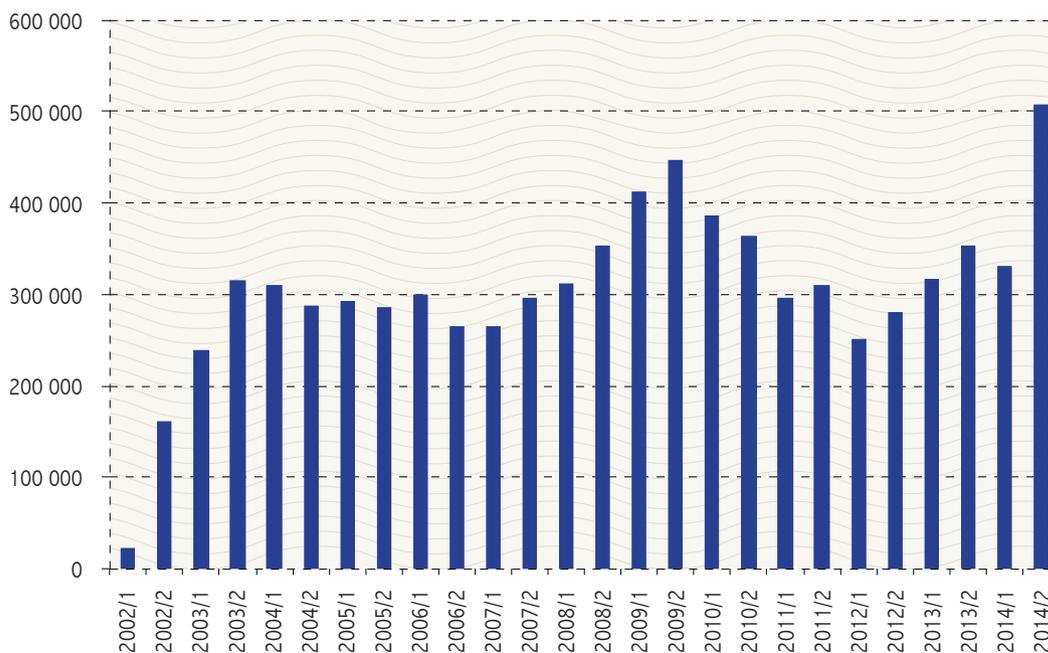
Legislation on the counterfeiting of euro banknotes has been harmonised to prevent the possible formation of a haven where the production and spread of counterfeits would receive only minor punishments. EU justice ministers agreed in December 1998 that counterfeiters of euro banknotes could be sentenced to at least eight years imprisonment in all Member States.

The arrangements for producing euro banknotes – fifteen printing works and nine paper mills – was regarded as conducive to large-scale counterfeiting.<sup>10</sup> In the same way, the unveiling of euro banknote security features more than four months before issuance of the banknotes unleashed worst-case conjectures

that false euros might appear right after the launch. Naturally police officials were also concerned about the intentions of organised criminal groups towards the changeover. This led to speculation about great clandestine stockpiles of counterfeits.<sup>11</sup> There were fears that even poor-quality counterfeits might be passed during the changeover period, when people were still unfamiliar with the new banknotes despite the information campaigns. During the changeover, however, hardly anything appeared

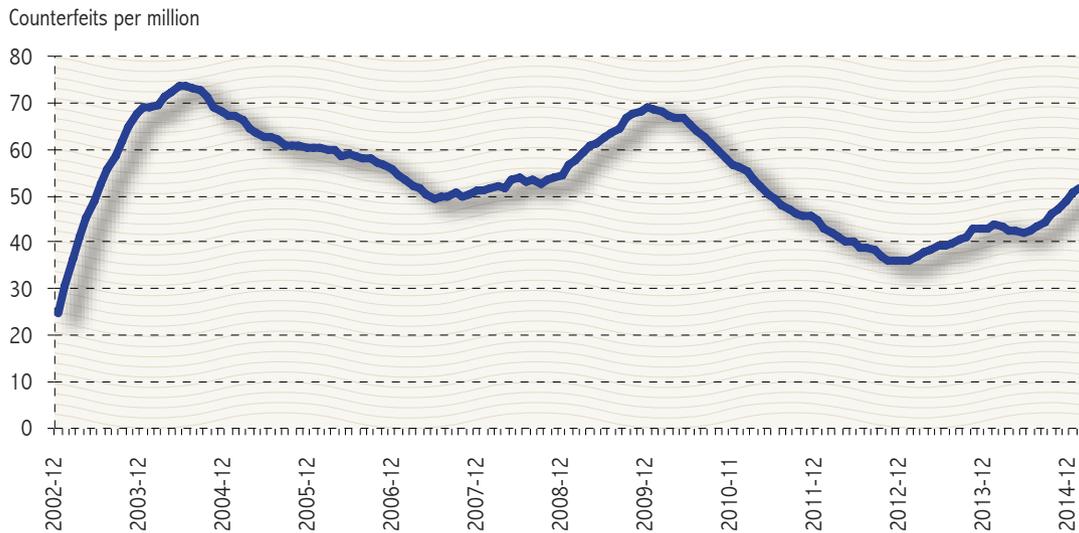
on the counterfeit front and the number of euro counterfeits remained low during the first six months. After summer 2002 the situation gradually changed and in the course of 2002 a total of nearly 170 000 counterfeit banknotes were found. During 2003 the number found in circulation went above 550 000. It levelled off after this and sometimes even declined until it turned up again during 2008. Since then the number of counterfeits has fluctuated. During 2014 it was heavily rising (see chart 18).

Chart 18. Number of euro banknote counterfeits, half-yearly 2002-2014



Source: European Central Bank.

Chart 19. Ratio of counterfeits to euro banknotes in circulation, 12-month moving average



Source: European Central Bank.

Although the number of counterfeits may seem large, it is still at roughly the same level as the number of counterfeits of national banknotes in 2000 and 2001 among the countries that have adopted the euro. It also puts the number into perspective if one takes into account that reproduction technology has developed significantly and made banknote copying less troublesome, at the same time as the number of euro banknotes in circulation has almost doubled. To adjust for the latter factor, one can compare the number of banknote counterfeits found with the number of genuine euro banknotes in circulation (see chart 19).

This indicator – parts per million, PPM – shows that about 30-70 counterfeits were found in the period under review for every million euro banknotes in circulation. A better picture of the likelihood of receiving a counterfeit banknote could be derived by comparing the number of counterfeits with the number of payments made in euro banknotes, but there is no reliable estimate for the latter.

PPM is often used in international comparisons to show the density of banknote counterfeits in various countries but it is problematic here because the speed at which counterfeits are identified varies greatly from country to country. In the euro area, bank-

Chart 20. Losses from euro banknote counterfeits



Source: European Central Bank.

notes are subject to constant automatic authentication, sometimes even at the retail end but no later than in the sorting centres of cash-in-transit companies and banks. Consequently counterfeits are rapidly found and have no time to circulate. In some other countries, banknotes circulate for long periods without being subject to automatic authentication and in such cases counterfeits may change hands several times before being identified.

Another way to measure the impact of banknote counterfeiting is to assess the actual monetary losses caused by it. Although the number of counterfeits has fluctuated significantly, the monetary losses have been

more stable since 2003 (see chart 20). Even the recent significant increase in the number of counterfeits has not been reflected in the monetary losses, because the major part of the counterfeits has been composed of €20 notes.

Although euro banknotes are used widely outside the euro area, the counterfeits are almost invariably found within it. In 2014 only around two percent of them were found in EU Member States outside the euro area and less than 0.5 percent in other parts of the world.

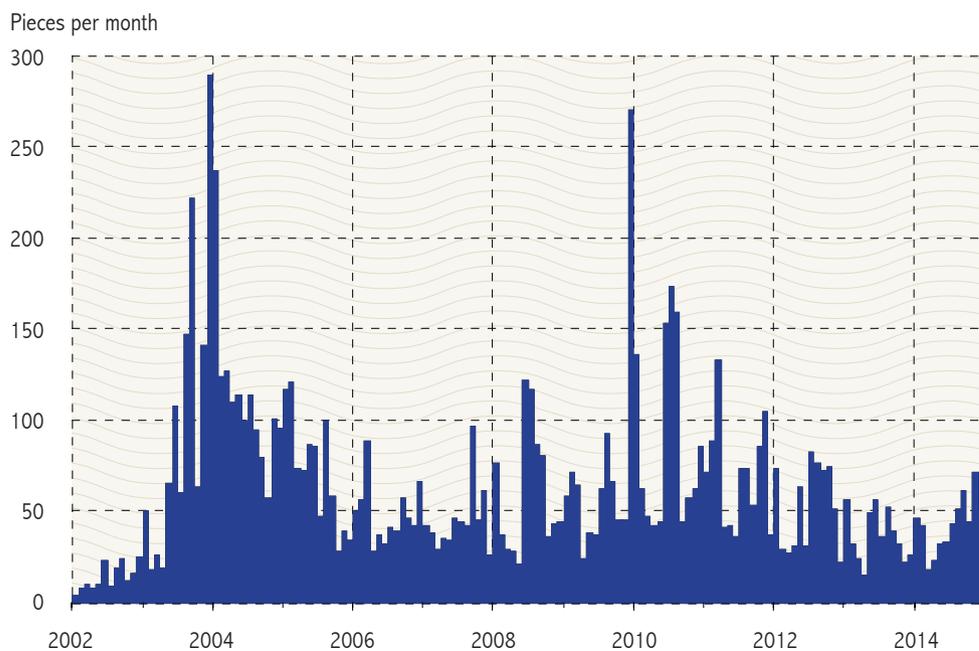
Within the euro area, the relative number of counterfeits varies from country to country. Some countries experienced few counterfeits of their national currency and the situation has

continued almost unchanged during the euro era. In Finland, for example, the number of counterfeit banknotes has traditionally been low. At the end of the period of a national currency, a mere 323 counterfeit markka banknotes were found annually,<sup>12</sup> and the annual number of counterfeit euro banknotes has never exceeded the 1343 found in 2004.<sup>13</sup> Although the number of counterfeits has increased since the euro was launched, it is

not ten times higher, as was feared before the cash changeover.<sup>14</sup> In recent years Finland has experienced on average 500 counterfeits annually (see chart 21).

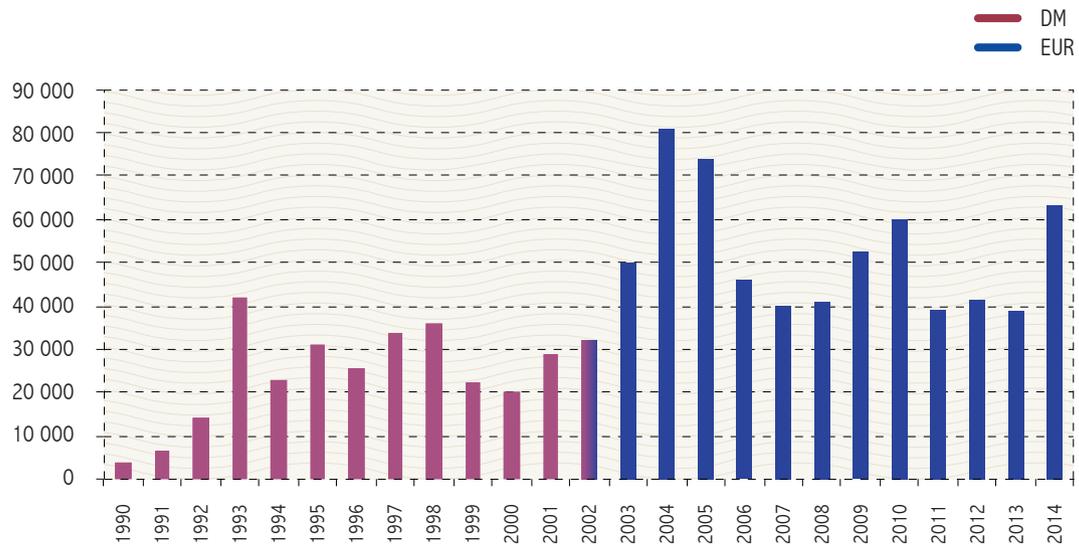
In Germany, too, the number of counterfeits has increased somewhat since the euro replaced the Mark (see chart 22). The annual monetary losses caused by counterfeits grew initially but, in the second half of the 2000s, the average returned to the pre-euro level (see chart 23).

Chart 21. Euro banknote counterfeits in Finland



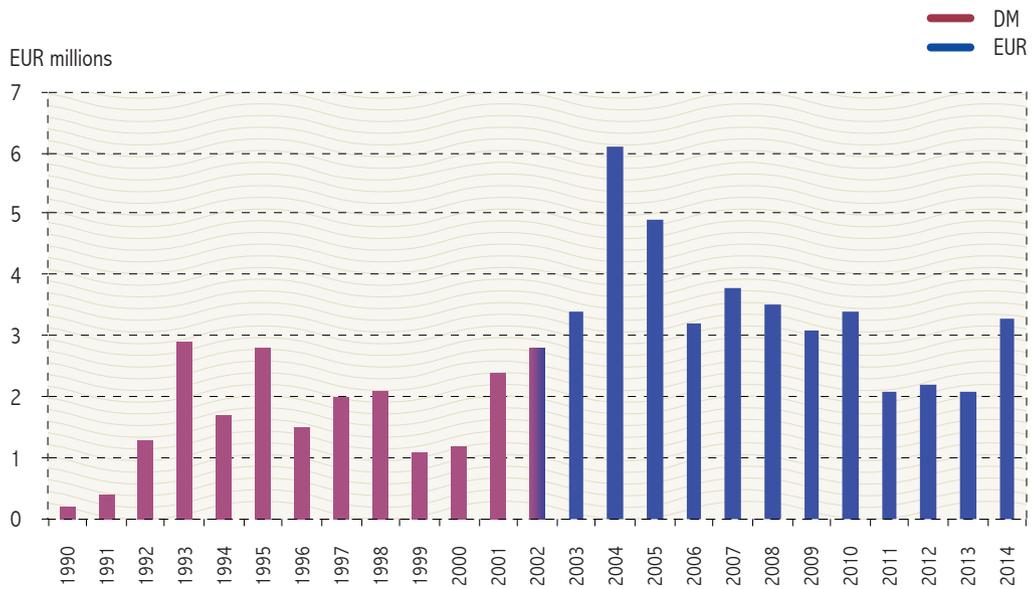
Source: National Bureau of Investigation, Finland.

Chart 22. Number of counterfeit national and euro banknotes in Germany, 1990 onwards



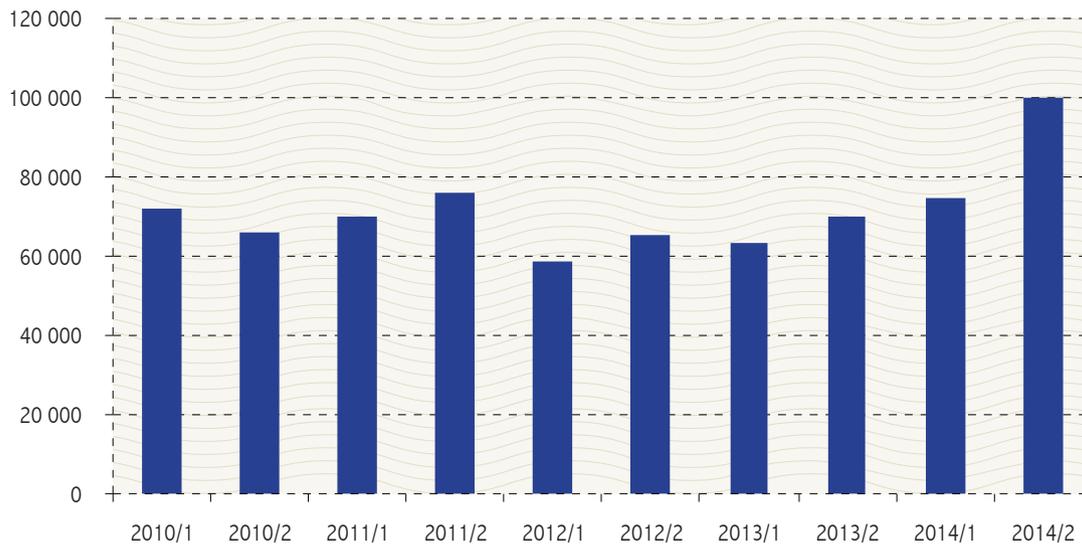
Source: Deutsche Bundesbank.

Chart 23. Losses in Germany from banknote counterfeits, 1990 onwards



Source: Deutsche Bundesbank.

Chart 24. Euro banknote counterfeits in Italy, half-yearly 2010–2014



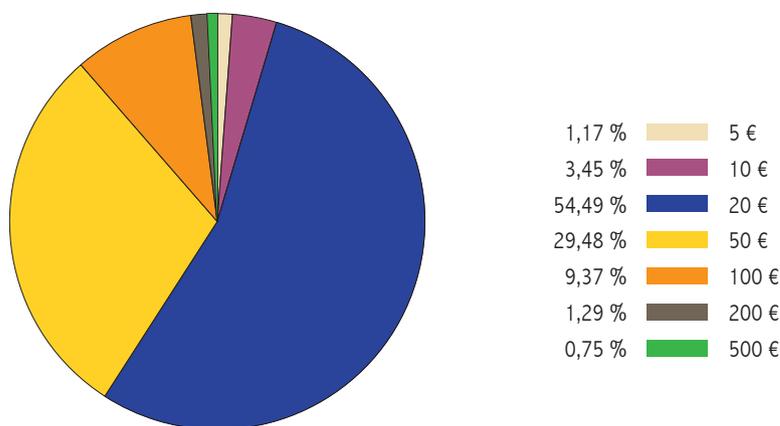
Source: Banca d'Italia.

The number of counterfeits in Italy is significantly higher than in Germany (see chart 24). This is explained by the major role of organised crime in counterfeiting banknotes.

The number of counterfeit euros found in circulation fluctuates greatly because most of them are produced and spread by organised crime. Unlike North America, where most counterfeits exploit modern photocopying technology and are consequently produced in numerous small batches, 70-80 percent of euro

banknote counterfeits are produced by offset printing. With offset there is no reason to print small amounts and most counterfeits are parts of large batches. For the same reason, each time the police shut down a major counterfeiting shop, the number of counterfeits declines for a while until the criminal groups start up again in a new place. The operations of counterfeiters are helped by the fact that banknote printing is now dependent more on digital files than on the physical printing plates used previously.

Chart 25. Euro banknote counterfeits by denomination, 2014



Source: European Central Bank.

The seizure of false plates used to have a more durable influence on counterfeiting operations.

Counterfeiters concentrate on 20 and 50-euro banknotes, which account for more than 80 percent of all counterfeits (see chart 25). Very few low and high-denomination notes are counterfeited. A low-value note is probably not worth counterfeiting, and a high-value one is inspected far more carefully at transaction time. Counterfeiters favour the notes that are most commonly used for cash payments, and which

till operators will often accept in a routine manner. Most counterfeits are of a quality that would not withstand close inspection.

The ease with which banknotes can be reproduced has increased the importance of information and training in preventing counterfeiting. Since the large-scale Euro 2002 information campaign, the Eurosystem has regularly produced new information and training material on euro banknote security features for various target groups.



◆ ————— ◆  
Fig. 53 “Anna and Alex take on the banknote forgers” was a leaflet published by the ECB in 2010, which used a fictional tale to teach children to identify the security features of euro banknotes.



◆ Figs. 54 Constant training in security features is never wasted. The fake above is play money that, despite its bizarre value and appearance, was accepted more than once as payment of 300 euros. Below, a 100-inti banknote from Peru, to which the EU flag and euro symbol has been added. This was accepted as a 100-euro note.



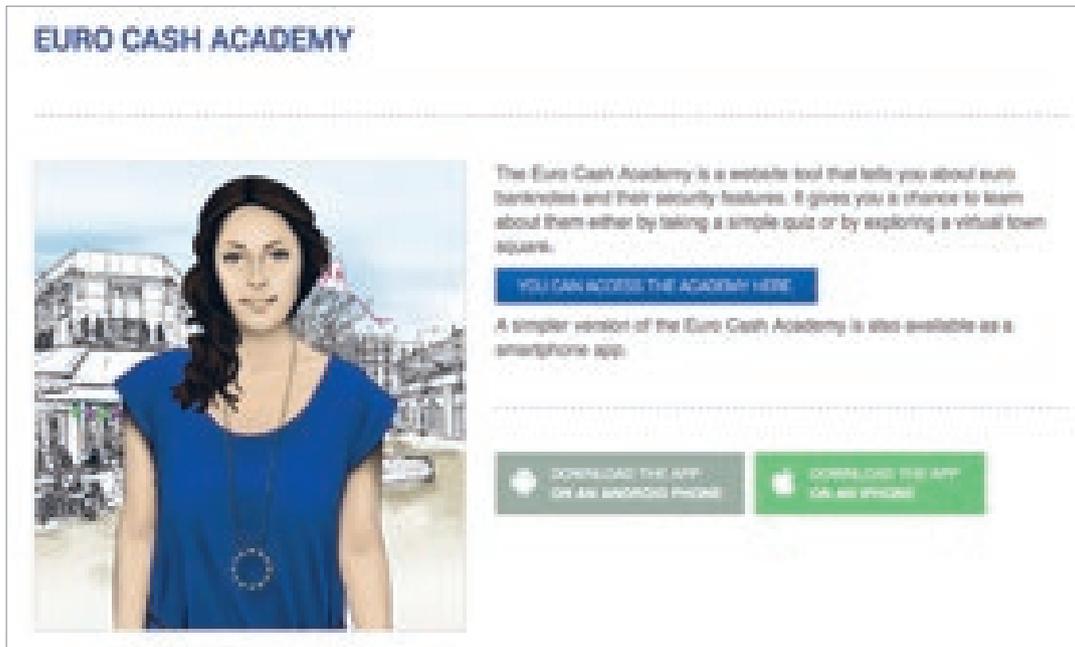


Fig. 55 In the past few years the Eurosystem has developed easy-to-use digital methods for authenticating banknotes, for use by the public as well as professional money handlers. The website tool Euro Cash Academy tells about euro banknotes and their security features. It is also available as a smart phone app.

Fig. 56 Using new media channels for spreading information. In connection with the launch of the new 10-euro banknote, people were urged to take a “selfie” and send it to the ECB.



## HUMAN INTEREST IN THE “ALCHEMY” OF COUNTERFEITING

The ECB and most national central banks publish half-yearly statistics and a press release on the state of euro banknote counterfeiting. The figures published in July for the first half of the year usually generate especially large press stories on the subject. From the perspective of readers and viewers, banknote counterfeits are an intriguing subject, a kind of alchemy that seems to fascinate the human mind.

The issuer sees counterfeits from a different perspective. The use of banknotes depends on public confidence in them, which can naturally be shaken by a distorted press article or TV programme. Counterfeits are usually found by the shops they are offered to; if not, by the authentication devices used in the sorting centres of banks and private cash-in-transit companies. Because of this, it is very rare for the general public to encounter a counterfeit. If it passes other tests, it is found in central bank sorting.

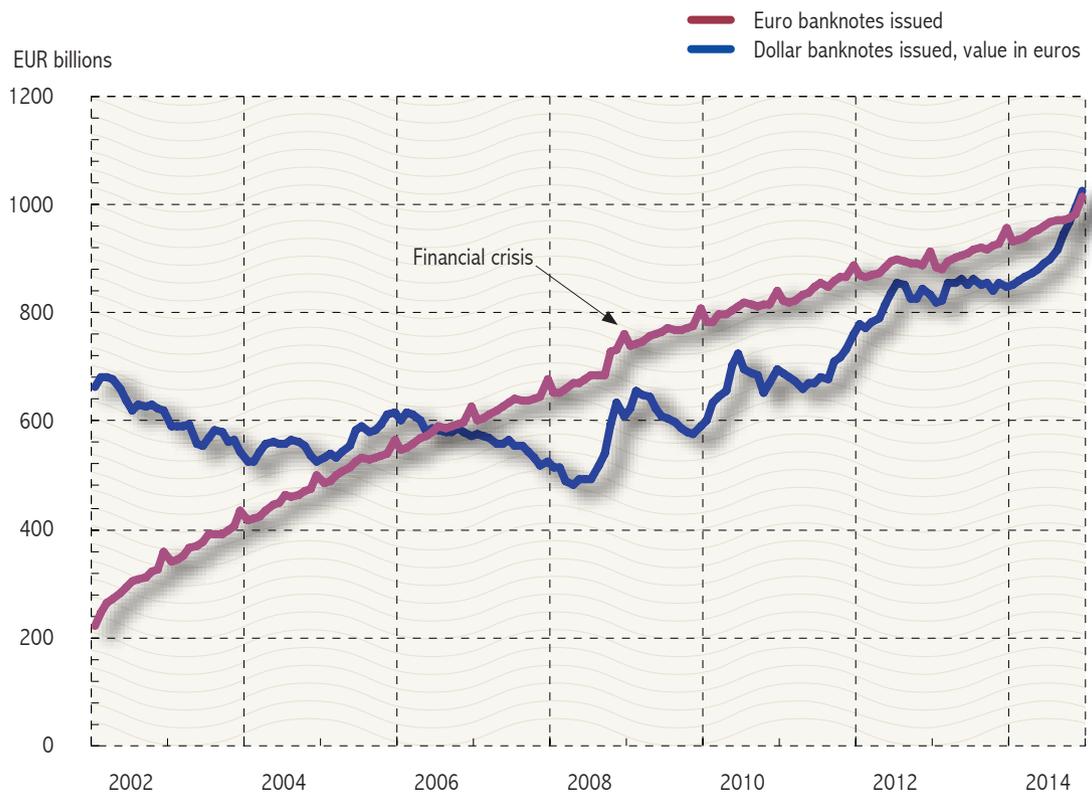
Although media exposure is an opportunity to encourage the public to examine banknote security features, central bank representatives always have reservations about requests for interviews on counterfeiting. One interesting case dates from December 2006, as the fifth anniversary of the launch of euro banknotes approached. Ralph Atkins of the Financial Times had contacted me and asked for an interview, less about issuance than about trends in

counterfeiting. The number of euro counterfeits had increased somewhat although Eurosystem indicators showed it was still little different from the number of national banknote counterfeits previously. There was no real reason to make a big issue out of it.

When Atkins arrived as my guest at Eurotower, I first talked about the development of euro banknote issuance, which helped to put the magnitude of counterfeits in perspective by contrasting it the number of genuine notes. As he looked at my graphs of the growing number of euro banknotes, he suddenly asked how the value in circulation compared with dollar banknotes. The matter had come up in internal discussions at the ECB so I was able to tell him that, if they were compared at the current rate of exchange, the euro banknotes issued had passed the value of dollar notes, partly because the dollar had fallen against the euro. Atkins next wanted to know if the information had been published, and I replied that I had seen no news on the subject. He asked for time series data of both currencies, which the ECB communications department gave him after our interview.

When the Financial Times later ran the report,<sup>15</sup> it was that the euro had overtaken the dollar in banknote value. It was a front page story, its news value outweighing euro counterfeiting (see also chart 26).<sup>16</sup>

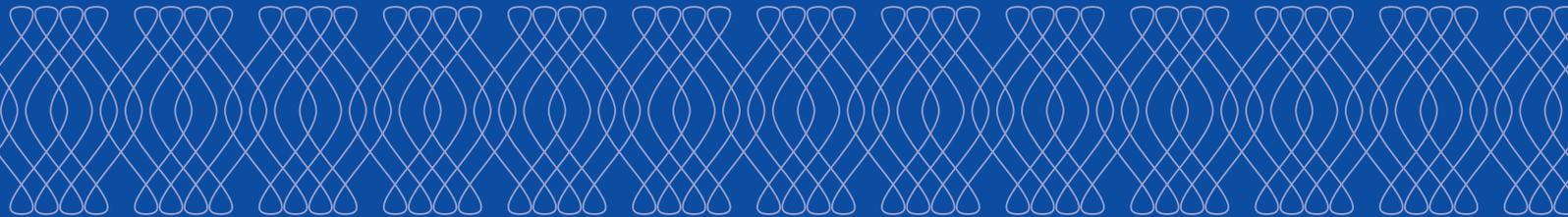
Chart 26. Values of euro and dollar banknotes issued, in euros



Sources: European Central Bank and Federal Reserve System.







13.  
*Events and  
challenges after  
banknote issuance*





The launch of euro cash in 2002 marked the conclusion, for 12 countries, of the part of the European integration process agreed in Maastricht in 1992. After the successful issue of

euro banknotes, the focus of cash management in the Eurosystem turned to making banknote production, distribution and handling more efficient.

## Common systems for Eurosystem cash management

The attitude to cash management has evolved greatly since 1991, when EEC countries began to consider the production and issuance of a common unit of currency. Initially, of course, their planning focused on the design of the new banknotes and coins and on creating the best possible conditions for a smooth changeover. At that time, it was assumed that although a set of countries would be adopting the same banknotes and coins, each country's way of managing the supply of cash would remain unaltered in other respects. No changes were in sight in the environment of national central bank operations or their role in the circulation of cash.

Soon the turn of the millennium was approaching and production of banknotes and

coins was already well underway. Many important decisions, such as the testing of vending machines and ATMs, were being implemented, and the rules for cash frontloading had been drawn up. Now the planners could start looking at how the operating environment might change once the common unit of currency had been issued. Some of these changes were related to the objectives of individual central banks, such as a decision to concentrate on core central banking functions, but there was also increasing interest in the opportunities for greater efficiency that a common currency would offer and in creating equal opportunities for competition in the euro area.

One of the early signs of a new attitude was the ECB Governing Council decision

in 2001 about the basic cash management tasks of central banks that were free of charge and the extra services that were chargeable. Another was the Council's guidelines on the business hours of central bank branches, and regulations on cash crediting and debiting. In the same year the Council reallocated euro banknote production from 2002 onwards, making each national central bank responsible for commissioning generally only one or two banknote denominations. By reducing the number of places that any given denomination was printed, the Governing Council sought to ensure uniform banknotes and to exploit economies of scale in their production. Moreover, national central banks were no longer responsible for commissioning banknotes in accordance with their requirements. Responsibility was now allocated according to each bank's share of the capital of the European Central Bank, which in turn was based on national GDP and population. The new model was adopted because national demand for banknotes is affected by their movement from country to country through tourism and other activities (see chapter 12).<sup>1</sup>

After extensive preparatory work, the ECB Council decided in September 2004 on a common method of tendering for euro banknote production for the Eurosystem. The aim was to ensure equal treatment for all banknote printing works that participated in tendering, and to create a transparent competition. The national central banks that had their own printing works or used a public sector printer were allowed to opt out of tendering and still continue producing their

share of euro banknotes. A long transitional period was planned. The tendering system was originally due to start up by 2012 but, noting that the market has become more competitive since 2004, the ECB Governing Council postponed the starting date and decided in November 2014 on a new model, called the Eurosystem production and procurement system. This consists of two pillars, a group of national central banks using in-house printing works and a group that procure their euro banknotes. The in-house printing works will not participate in any euro banknote tender procedures, whereas tendering central banks will align their tendering requirements. The new system entered into force from the beginning of 2015.

While a unified system of tendering has been under development, many central banks in the Eurosystem have developed their own. Eight central banks – Cyprus, Estonia, Finland, Luxembourg, Malta, The Netherlands, Slovakia and Slovenia – have formed a consortium that orders banknotes according to the results of a joint tendering competition coordinated by the Dutch central bank, which originally proposed the consortium. The Deutsche Bundesbank has also used open tendering since 2008, in place of the previous procedure where it divided banknote production, roughly half going to Bundesdruckerie and the rest to Giesecke & Devrient. Recently the Latvian central bank decided to order its banknotes within the Bundesbank tendering process.

A unified system has been created for managing euro banknotes and their stocks, designed to coordinate the logistical stocks of

central banks at the Eurosystem level and using a shared strategic stock. The strategic stock is intended for extraordinary situations when the logistical stocks of the Eurosystem are insufficient to meet an acute rise in demand or if banknote deliveries are disrupted.

A good example of the importance of a strategic stock came during the financial market

disturbance in autumn 2008, when demand for the highest denomination banknotes shot up, particularly outside the euro area. The strategic stock provided a flexible response.

In 2007 the ECB took its first step in creating banknote stocks outside the euro area, when it established two in Asia, provided by commercial banks in Singapore and Hongkong

◆ Fig. 57 Euro area countries have more in common than banknotes and coins: Suomen Pankki's governor Erkki Liikanen (at right) signing an agreement on a common cash management system with governor Guy Quaden of Nationale Bank van België/ Banque Nationale de Belgique. Other national central banks are also seeking greater efficiency in the production, handling and management of the common currency.



that operate in the wholesale banknote market. Later a similar stock was created in Miami in the United States. Banknote stocks outside the euro area are intended to promote the international distribution of euro banknotes and also to obtain statistical data from the non-euro area about circulation and counterfeits. The Deutsche Bundesbank operates as the logistical and administrative counterparty for the commercial banks that provide banknote stocks.

In the pursuit of efficiency, the Eurosystem has sought a division of labour that eliminates the need for all national central banks to offer every service. Efficiency can be promoted by specialisation or by combining resources. One model is the agreement between several central banks for a common cash management system for customers' orders and supplies, and a real-time cash and stock management system. CashSSP is an IT system for cash management that was originally developed by the Belgian central bank and initially used by the other Benelux countries, too. Over the years the number of users has expanded. By the end of 2014 it was used by nine national central banks in the euro area – Belgium, Cyprus, Estonia, Finland, Ireland, Latvia, Luxembourg, Malta and The Netherlands. The service providers are De Nederlandsche Bank and the Nationale Bank van België/Banque Nationale de Belgique, meaning that they develop, manage and operate the system.

Cash Electronic Data Interchange, a similar system based on the international GS1<sup>2</sup>-Standard, has been adopted by the Deutsche Bundesbank and is also used by the Banca

d'Italia, the Banco de España and the Banque de France.

Several central banks have also specialised in testing banknote handling machines on behalf of the Eurosystem and in studying the quality of euro banknote samples from the whole euro area.

The development and maintenance of IT systems for cash management has also been entrusted to specific national central banks in the Eurosystem.

◆ Fig. 58 A robot handling 50-euro banknotes at Suomen Pankki. ◆



## Better efficiency for all parties involved in cash circulation

In the 12 countries where euro cash was launched in 2002, the central banks had very different roles in the recirculation of money in their economies. Some had a large network of branches and played a very important part, such as by checking the fitness and authenticity of all banknotes destined for distribution in cash dispensers. In other countries, the central bank made arrangements that allowed commercial banks to do some of this inspection work. In order to promote competition in the euro area, a gradual process began to create common standards for the recirculation of euro banknotes. In 2005 the ECB published its banknote recycling framework, which defined general rules on banknote checking, as well as procedures for banknote handling machines and their testing. In 2010 this framework became legally binding with the ECB's decision on the authenticity and fitness checking of euro banknotes and their recirculation.

The framework and decision stated that companies handling money were not permitted to recirculate euro banknotes via cash dispensers or other machines used by customers unless the banknotes had been established as genuine and in good condition by means of an approved banknote handling machine. To be approved, the machine type has to pass tests by a national central bank and to be able to classify the notes intended for recycling as authentic and fit. The list of certified machines is published on the ECB website.

The testing procedure for banknote handling machines has been commonly agreed. Once the machine type has passed the test, the results are in force throughout the euro area for one year from the publication of the result, providing that the machine type retains its ability to detect all fake banknotes that are known in the euro area during that period. The list of certified machines on the ECB website is updated regularly. Over the years several hundred machines have been certified.

A similar measure aimed at creating a level playing field was the ECB Council decision that a national central bank in the euro area can offer cash management services to credit institutions operating within the jurisdiction of some other euro country if logistics justify the choice of a different central bank. This council decision has been in force since July 2007.

Central banks have traditionally required that banknotes being returned and lodged must be sorted by denomination and put into stacks where all notes face the same direction. However, when several central banks began using multidenominational sorting machines, the Governing Council decided that central banks throughout the Eurosystem must accept non-faced and non-oriented banknotes. This measure also makes it more efficient to check banknotes at various stages in their circulation, and unifies euro area practices.

## SYSTEMIC RISKS TO NATIONAL CASH MANAGEMENT: THE HEROS BANKRUPTCY

In February 2006, I was in Portland on the US West Coast at an international meeting on anti-counterfeiting measures when someone tried to call my mobile phone from Germany. I noticed the unanswered call during a meeting break and, although I didn't recognise the number, I called back immediately because it was already early evening in Europe. My call went to an answering machine, where I left a message explaining where I was and that, after the break, I would turn my phone off again.

The next time I turned my phone on was at lunch, and I saw that the same person had called again. I called back and again it went to the answering service. When lunch ended at 2 p.m., it was already an hour before midnight in Germany. I told the other meeting participants that I was expecting a call and so I would keep my phone on. In the middle of the session it rang and I left the room to answer it. A voice at the other end asked: "Have you heard what has happened to cash-in-transit in Germany?" It was ECB President Trichet.

Franz-Christoph Zeitler, the deputy governor of the Deutsche Bundesbank, who was responsible for cash

management, had called me about it earlier in the day. It had just become clear that Germany's largest cash-in-transit company, Heros, was insolvent. Zeitler had gone over the steps that the Bundesbank intended to take, so I could assure Trichet that I understood the situation to be under control.

Heros had been operating a snowball embezzlement scheme. A snowball scheme depends on constant growth so, to get more clients, it had offered cash-in-transit services at prices that were below cost. Naturally this could not go on forever but, by the time the scheme collapsed, the company was responsible for more than 30 percent of cash transport in Germany.

To keep German cash flowing, the Deutsche Bundesbank immediately introduced emergency measures, expanding its opening hours and making its own cash transport capacity available to Heros customers.<sup>3</sup> That Jean-Claude Trichet would call me in the middle of the night, European time, was a sign of his avid interest in everything connected with the euro. He also assumed that his different directors kept up to date with events and that he could turn to them at any time, wherever they were.

## Other central banks take note of euro banknote launch

The issuance of euro banknotes required a number of exceptional measures. Prior to the event, many of them seemed to contain significant risk elements. When the euro banknote launch went ahead without incident, numerous central banks outside the euro area adopted the same procedures. One example is the advanced banknote testing opportunities permitted to suppliers of cash dispensers and note-operated vending machines; another is the content and schedule of information campaigns about banknotes.

Previously, most central banks had allowed 2-3 months for the testing of new banknotes before they were launched. In the case of euro banknotes, testing was allowed as much as 20 months before issue without causing any problems, so many central banks outside the euro area began making an effort to allow early testing. Subsequently, the standard testing period has become 6-9 months before the launch of a new banknote. Machines are used for an ever-increasing amount of banknote payments and handling, so the testing equipment and their sensors have become more important for problem-free issuance.

Central bank practices regarding the information published about security features of banknotes have also changed. The publication of euro banknote security features four months before issuance did not lead to a flood of counterfeits or other complications at the time of issue. Now many other central banks start their campaigns earlier than before. Even the slogan used in the euro banknote campaign

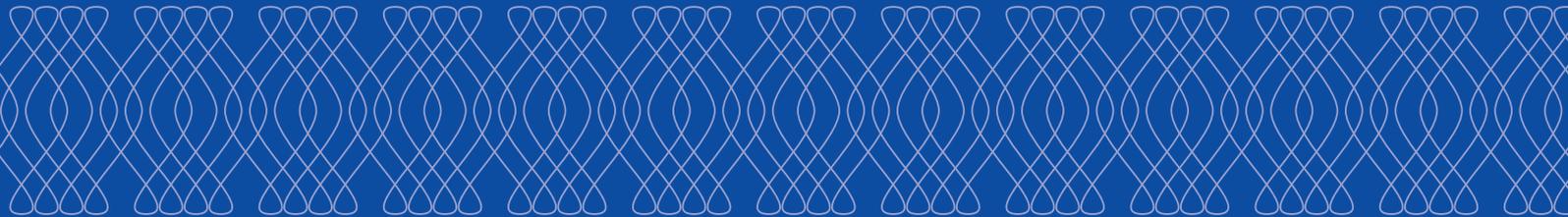
– “Feel, look, tilt” – has been recognised as a good way of identifying security features. So have many other ideas developed for the euro campaign.<sup>4</sup>

The launch of euro banknotes has also affected the importance that central banks attach to having their own printing facilities. A state-owned printing works used to be seen as a part of political independence, but euro banknote production proceeded according to the principle that the banknotes could be produced by any EU printing works that could do the job and meet the Eurosystem’s requirements for security, quality management, environmental standards, and occupational health and safety. This led many central banks, outside the euro area as well as in, to reconsider their core operations and whether having their own printing works was important. Subsequently the central banks of Finland, Great Britain, Norway and Sweden have either sold or closed down their printing works.

Suomen Pankki incorporated its printing works as Setec Oy in 1992 and sold off its last holdings of Setec shares in 2003. In 2002 Sveriges Riksbank sold both its printing works and its traditional paper mill Tumba Bruk to Crane Currency of the United States, which has been manufacturing US dollar banknote paper since 1879. The Bank of England sold its printing operations in 2003 to De La Rue, one of the leading banknote printing companies. In Norway, Norges Bank closed down its printing works in 2007.<sup>5</sup> Danmarks Nationalbank

and the Nationale Bank van België/Banque  
Nationale de Belgique have also decided to close their printing presses, Denmark in 2016,  
Belgium by 2020.





14.  
*Controversies  
over banknote  
materials and features*



## Environmental impacts of TBT and GMO cotton

The common banknotes of Europe have stirred up emotions and been the subject of many an argument. Most controversies have died down again, once the facts became known.

Euro banknotes and all the materials used in their production were tested before use in accordance with European occupational safety regulations. The tests were carried out by an independent research institute, the Netherlands Organisation for Applied Scientific Research, TNO. It confirmed that no health problems will result from normal use of euro banknotes.

Soon after they were issued, publications in various countries ran articles claiming that the banknotes contained TBT or Tributyltin.<sup>1</sup> This is an organic tin compound that has been used in the ink on food packaging, as a textile disinfectant and in primer painted on the hulls of boats and ships to prevent plants and animals growing on it. It has been observed to have damaging effects on marine organisms and its use has been restricted.

Following the press articles, the ECB asked GALAB, a German laboratory analysis company, to study the matter. It reported that the banknotes did indeed contain TBT in small quantities – 7.5 micrograms per kilo of euro banknotes. The maximum recommended daily dose of TBT is 0.25 micrograms per kilo of weight. In order to exceed the safe limit, a person of average size would have needed to swallow over 2 500 euro banknotes daily for a considerable period of time. GALAB also established that TBT is not transferred to the human body when the banknotes are used in cash transactions because the substance is not absorbed through the skin.

Nevertheless, because the studies showed the presence of TBT – even if the quantities had no impact on health – the manufacturers of banknote materials were asked to find an alternative. They were successful and, soon after the story broke, euro banknotes no longer contained any TBT.

A similar polemic arose in 2003 when press publications stated that euro banknotes were printed on paper containing a high concentration of genetically modified cotton fibres.<sup>2</sup> Although genetically modified cotton is not harmful to human health and allows farmers to produce higher yields or use less pesticide, it is controversial because of its possible impact on the environment. The cotton fibres used for euro banknotes are the same as those used for the production of textiles and clothing. All paper mills that make euro banknote paper use noil, the short fibres removed from cotton before it is spun. They buy their noil on the open market, either directly from textile producers or from waste collectors or brokers. It is possible that it contains genetically modified cotton fibres.

However the production process for euro banknote paper involves several chemical and physical treatments that react with the cellulose affected by genetic modification. Detailed laboratory analysis has shown that euro banknote paper and euro banknotes do not contain any detectable genetically modified structure.

In 2003 the ECB carried out an assessment to identify the environmental impact of euro banknotes, and whether the product or processes could be improved in that respect. Because euro banknotes are products for everyday use, they were compared with two other everyday products and services: driving a private car and lighting a 60-watt bulb.

The assessment concluded that the environmental impact of euro banknotes during their entire life cycle was equivalent to each European driving a car one kilometre or leaving a 60W light bulb switched on for half a day. The study followed the international standard ISO 14040 and covered the whole life cycle of banknotes, stretching from production, storage and circulation to their end-of-life treatment. The assessment was based on process data collected from 31 suppliers in the euro banknote supply chain.

Because of the importance of occupational safety and environmental issues, all euro banknote suppliers have been required since 2011 to meet the criteria OHSAS 18001 and ISO 14001 for occupational health and safety and environmental management.

## Persistent rumours about radio identification tags

The ECB coordinates extensive research and development into banknotes. In this connection it makes agreements with national central banks, banknote printing works, paper mills, other raw material suppliers and various research organisations. Every partnership is founded on confidentiality and contractual

agreements about intellectual property rights. Some research has a specific schedule, such as when it relates to a new banknote series, but some is long-term and consists of studying recent innovations and the scope for utilising them in future banknotes.

Sometimes a speculative story about a long-term research project refuses to die. One such story was the report, published at the end of 2001, that euro banknotes would be fitted with chips for radio frequency identification (RFID) by the end of 2005.<sup>3</sup> RFID is a technology for storing and transmitting data wirelessly. It is built into small tags that can be incorporated into a product when it is made, or glued to it afterwards. The tag contains an antenna that allows it to send and receive data as radio waves. The technology has many applications on the logistics side of retailing and industrial production.

The rumour of 2001 has resurfaced over the years in many articles claiming that future euro banknotes will include RFID tags to allow

their authenticity to be checked.<sup>4</sup> These articles in turn have stimulated science fiction-type stories about how the contents of your wallet can be spied on from a distance, and how it is no longer safe to carry banknotes around with you.<sup>5</sup>

Central banks are naturally interested in every new technical solution that could improve banknote security. But although some new security feature might be technically and economically viable, a central bank also has a duty to consider the effect on the privacy and safety of users. Although the idea of using RFID in banknotes keeps popping up from time to time, these tags are not a part of euro banknotes, nor so far any other banknotes in the world.

## European Parliament asks for one-euro and two-euro notes

The original composition of the euro banknote series was the subject of lengthy deliberations that sought to optimise the usefulness of banknotes and coins by taking into account the national cash units of all the countries adopting the euro. These comprehensive assessments did not stop the idea of small 1 and 2-euro banknotes being raised again soon after the launch of euro cash. The argument was that, in some countries, the shift from national to euro banknotes had meant that the lowest denomination banknote was now worth far more than before. The old Italian 1000-lire note, for example, was worth only 50 eurocents and the Greek 200-drachma note only slightly more. It was felt the people

regarded coins as less valuable than banknotes of the same denomination and were therefore less careful in how they spent coins. Among more general arguments, it was said that the 5-euro banknote was too large to give as a tip and that it would be nice if there were one-unit note like the US dollar.

Low-denomination euro banknotes were also widely supported in the European Parliament. In October 2005 the parliament even approved a declaration that the European Commission, the European Council and the European Central Bank should recognise the need to issue 1 and 2-euro notes. The declaration was repeated annually for several years in Parliament's report on the ECB.

Members of the European Parliament have also sent questions on the matter to the ECB President.

The ECB Governing Council decided back in November 2004 that there were no grounds for issuing low-denomination banknotes and published a press release on the matter.<sup>6</sup> It based its decision on a report by the banknote committee, which had examined the matter from as many angles as possible. The European Commission studied public opinion with a Eurobarometer survey in 2002 and 2003, which asked whether respondents would personally like a 1-euro banknote to be issued. The survey found that only 20-30 percent of users wanted one.<sup>7</sup>

When the ECB had also asked businesses for their views, the answer was emphatically negative. European-level associations for the banking, cash-in-transit, retail and vending machine sectors said that the dual use of low-denomination banknotes and coins would increase costs because companies would have to invest for both of them (for example cash boxes) even though there might be very few users of one or other – either the banknote or the coin. Very low-denomination euro banknotes would not be available from cash dispensers; even the 5-euro banknote was not used in cash dispensers in more than a couple of countries. Consequently, shops would be the main distribution channel for small banknotes,

## US CONGRESS SEEKS ADVICE ON LOW-DENOMINATION NOTES

After the ECB had announced its decision on 1 and 2-euro banknotes, it was contacted by the United States Congress. The U.S. Government Accountability Office (GAO) was interested in the reasons why the ECB Council had ruled out the use of low-denomination banknotes. For several years the GAO had been trying unsuccessfully to replace one-dollar banknotes with coins. As early as 1979 the United States had issued a one-dollar coin but it had not been accepted by a nation that was unwilling to give up its one-dollar banknote.

The GAO had done various calculations which, it said, showed there would be significant cost savings if

low-denomination banknotes were replaced by coins. They asked if I would come to a US congressional hearing on the subject but I said that I would have to check first with the ECB Executive Board. My own superior on the board, Domingo Solans, was in favour but when he took the matter up with his colleagues, they saw the danger of creating a precedent. The ECB was required to report to the European Parliament but, at that time, its representatives had not yet attended hearings by national parliaments. Although they did so later, it was thought at the time that the US congressional hearing would be a precedent. My visit to the US Congress was not to be.

so they would remain in circulation for long periods without recycling via the banking system. The quality of the notes would deteriorate very rapidly as a result.

The vending machine sector was most strongly opposed to the use of banknotes of tiny denominations, because the companies had already adapted their equipment to accept euro coins. Banknote sensors cost on average

three times more than coin sensors so the extra investment involved would be great.

Although the question of low-denomination euro banknotes still crops up from time to time, the Eurosystem is unchanged in its view that 1 and 2-euro banknotes would serve no useful purpose. The composition of the euro banknote series will remain the same during the second – Europa – series.

## The enigma of Berlin's brittle banknotes

Starting in summer 2006, a number of crumbling banknotes were found in Germany, mostly in Berlin and the surrounding district. Their paper had become frail and was starting to disintegrate. Initial studies showed that the problem was not due to an error in the production of the banknote paper, but came from subsequent exposure to sulphuric acid. By the end of 2006 more than 2000 disintegrating banknotes were found in sorting and about 100 people presented brittle banknotes at the offices of the Deutsche Bundesbank for replacement.

No obvious reason for the phenomenon was found but various hypotheses have been

presented along the way. According to some theories, the banknotes had been damaged by chemicals used for cleaning cash dispensers or vending machines; others blamed designer drugs. In any case, after a year had passed from the first cases no more brittle banknotes were found and the enigma remained unsolved. One last clue was an exhibition, opened in June 2007, that displayed banknotes made into works of art by treating them with acid. The artists claimed, however, that they had nothing to do with the original brittle banknotes. They had simply been inspired by a Deutsche Bundesbank press release.<sup>8</sup>





15.  
*Cash changeover  
planning for  
the EU's new members*





## Something old, something new

When ten new countries joined the European Union in May 2004, it meant that within a few years we could expect new cash changeovers. It was obvious that the new Member States would face a different situation because euro cash was already in existence. In many of the countries it was already possible to make purchases in euros, and opinion polls showed that their citizens were familiar with euro banknotes and coins. They even had holdings of them.<sup>1</sup> A kind of frontloading had already taken place, with sub-frontloading reaching down as far as the general public.

On the other hand, the composition of the national banknote and coin series in the new EU Member States differed greatly from the composition of the euro cash series. In Estonia,

for example, only the 100 and 500-kroon banknotes were worth more than 5 euros. It was clear that euro coins would replace most national banknotes, something that needed to be considered when planning the logistics of the changeover. The experiences of 2002 had to be assessed from new perspectives.

The euro cash changeover in 2002 had gone faster than expected. This was a reason for a significantly shorter period of dual circulation. But events had given new weight to the choice of the first day of the year for launching euro cash, although there had been concerns about it before 2002. As Finland and the rest of the euro area had shown, it was a good time because the historical changeover added to the spirit of elation felt at the start of the New Year.

One key precondition for success remained the same, however. The planning process needed to start by obtaining the commitment of banks, the retail trade, cash-in-transit companies, the automation sector and the other parties involved.

This time the adoption of the euro would take place in one country at a time so planning advanced on a mainly national level. To keep in touch with the plans of all the new nations, the ECB banknote department began to arrange regular accession workshops from September 2003 onwards, where the new Member States went over their plans for adopting the euro, by means of a standard questionnaire form. In this way the ECB could monitor national decision-making about the quantity of currency initially

required, the dates for formal frontloading and sub-frontloading, and other questions important for the launch of euro cash. At the same time it could tell about Eurosystem measures for coordinating cash management, which the new members could take into account as they prepared to join the euro area.

Planning among the new members for changing over to the euro followed the same pattern as in the run-up to 2002. One part of the preparations was teleconferencing just before the launch and in the first weeks. Slovenia began using euro cash from the start of 2007, Cyprus and Malta during 2008, and Slovakia from the start of 2009. Later came Estonia (2011), Latvia (2014) and Lithuania (2015).



◆ ————— ◆  
Fig. 59 The main building of Banka Slovenije, the Slovenian central bank, before its euro cash changeover at the start of 2007. Information campaigns among the countries that joined the European Union in 2004 used tried and tested methods, including billboards showing euro banknotes and coins.

## PLAYING A PART IN ESTONIA'S EURO DEBATE

I had often visited Estonia since the second half of the 1970s. Via sporting and cultural events I was old friends with many Estonians and I had learnt the language. In the mid-1980s, when Suomen Pankki came up with the idea of regularly inviting young Estonian economists to the bank as trainees for a couple of months, I was asked to serve as the contact person. This programme meant that I was present during the tutoring of young Estonians, many of whom rose to important positions after their country became independent.

When Eesti Pank, the central bank, restarted operations at the start of 1990, it had the support of Finland's Suomen Pankki from the very beginning. I participated in many meetings with Estonians at the bank under its first two governors, Rein Otsason and Siim Kallas. When Estonia began to consider changing over to the euro, the then-governor of Eesti Pank, Vahur Kraft, called me in Frankfurt. It was the first of many visits to the bank to discuss the matter.

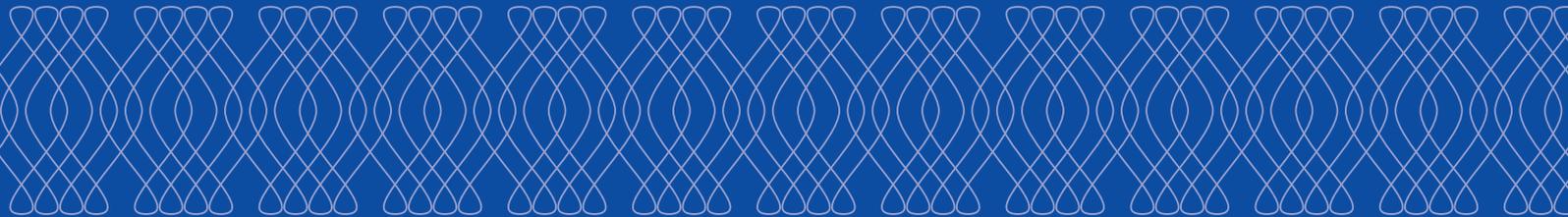
One such visit was during 2006. Estonia had set itself the target of joining the euro area at the start of 2007. The meeting was attended by Andres Lipstok, who had been appointed governor the previous

year, and three deputy governors. First we discussed the current situation in Estonia and then one of the deputies asked me what they thought in Frankfurt about Estonia's chances of changing over to the euro at the start of the following year. I answered as tactfully as possible that the situation looked very unpromising. The next question was whether this was a bottom-up or a top-down view. I said it was both. That's the same message that we have been getting from Brussels, they said. During the spring Estonia stopped aiming at a changeover from the start of 2007 and set its sights on a later date.

When the euro question returned to the agenda at the end of the decade, I started visiting Eesti Pank to discuss planning and, at the request of chief cashier Rait Roosve, to talk to central bank staff and those responsible for the changeover at commercial banks.

I met the Eesti Pank leadership again in early 2010. Prior to my trip I briefed ECB President Jean-Claude Trichet and asked if he had a message for me to take. He replied: "Estonians must remain vigilant." So they did, and Estonia successfully joined the euro area at the start of 2011.





16.  
*The making of  
Europa*



## The arduous path towards a second euro banknote series

It took ten years to design, produce and issue the first euro banknote series. As reproduction technology develops, the lifespan of a banknote series has been shrinking continuously for several decades, and many countries now talk of the need to renew their banknotes as frequently as every 7–10 years.<sup>1</sup> The Eurosystem began planning its second euro banknote series fairly soon after the launch of the first one. At the same time it began an extensive R&D programme intended to help provide the answers to possible new counterfeiting threats.

The banknote committee met in early 2003 to discuss what questions would be important to the planning schedule for a second banknote series. Some of the key issues were the themes of the new banknotes, the earliest date at which issuance could begin, and how it would be done. At that time, the choice of banknote themes was already important because it had taken about 18 months to plan the themes of the first banknote series and hold the design competition, a lengthy procedure that had

greatly affected the timetable for the whole planning process. We also needed, very early in the project, to specify how the notes would be issued, because if all denominations were to be issued at the same time, as in 2002, far more time had to be allocated to production than if the denominations came out gradually, one at a time.

The ECB Governing Council settled these questions in March 2003. It decided that the new series would have the same theme as before – Ages and styles of Europe – which would make the banknotes immediately recognisable as euros. The Council felt that the earliest issue date was the first half of 2008 but it was clear from the outset that the timing would depend, on the one hand, on what happened in euro banknote counterfeiting and, on the other, on the time frame in which it would be feasible to develop new security features. For the second euro banknote series the Council did not feel the need for the same kind of “Big Bang” as in 2002, and decided it could be issued gradually.

Discussions in the banknote committee continued onto the question of durability. Because it had been observed that the low denomination 5 and 10-euro notes lasted little longer than a year, the committee thought that the lifespan of these notes should be improved at the same time. It proposed this to the Council, which confirmed it in a decision in September 2003.

These Governing Council decisions formed the basis for banknote committee planning for the new series, and the master plan was ready for the Council's consideration at its meeting in April 2005. Under the master plan, the first banknote to be renewed was the 50-euro, which was the most commonly counterfeited at that time, although it was proposed that the plan should be reviewed regularly.

## COUNCIL DEMANDS QUANTUM LEAPS IN SECURITY FEATURES

The only people generally present at ECB Governing Council meetings are the members of the ECB Executive Board and the governors of national central banks, who are allowed to bring one accompanying person. Whether the person is a deputy or some bank expert is up to each governor. For exceptional reasons and at the discretion of the Council, its chairman – the ECB President – can invite a technical expert to attend the meeting. Because of the many technical questions connected with euro banknotes, I attended a few Governing Council meetings when banknote development and new security features were on the agenda.

When the Council was discussing the master plan for the second banknote series in April 2005 the main subject was what should determine its development. Many Council members said they did not think it was worth renewing the series unless it contained at least two significant new security features. At this point one of the central bank governors started talking about a quantum leap. The expression originates from quantum mechanics but has come to have a different meaning in everyday language, where it signifies a transformation or great leap forward. It subsequently became the guiding light of the banknote committee. There were many meetings when we considered what new security features could be called quantum leaps.

## Exploring new banknote features

After the Governing Council had approved the master plan for the second euro banknote series, the ECB established a project organisation and the banknote committee set up several taskforces to get planning underway. The mission of the task forces was to establish the technical and functional demands of different banknote user groups, the new security features that were available to meet the demands of users, and the materials that could improve banknote durability. To explore user needs, studies were made, questionnaires sent out and meetings held with representatives of European organisations for the banking sector, cash-in-transit companies, vending machine makers, retailers and consumers. Special groups also participated. We continued our fruitful work with the European Blind Union, begun during preparations for the euro cash changeover. Initially we were interested in how the visually impaired were managing with existing euro banknotes and what improvements they might want. This partnership helped us to develop and test new banknote features that made it easier to identify banknotes. The raised lines on the left and right edges of the obverse of the 5, 10 and 20-euro notes in the Europa series are results of these tests.

Similarly, we continued close cooperation with producers of machinery for handling cash. Over the years there has been a great increase in the use of banknotes in vending machines and in automatic handling at various cash centres. Bilateral meetings and information events were arranged with the automation sector, to which

we invited all manufacturers around the world that produced equipment that accepted or handled euros. These events and the feedback we received provided the basis for the new machine-readable security features developed, which the manufacturers were next allowed to test.

Once we had established the requirements of different user groups and the existing solutions for meeting their needs, we drew up a list of the possible security features of the new banknote series, both machine-readable and visual, and the banknote materials that were contenders. Then we moved on to study the industrial validation of the potential features, so as to identify any production problems at the earliest possible stage. At the same time we tested how well the different security features stood up to counterfeiting, by trying to reproduce them using various types of equipment and materials that were readily available.

During the stage of industrial validation, we also explored quality control requirements, costs, patent rights and the supply chain of each security feature, as well as related occupational health and safety questions and environmental issues.

The second strand of our research concerned materials that might make banknotes more durable. First we used research and surveys to establish what alternatives were available in the market, and the ECB then invited the leading producers to a meeting in May 2003. Next came laboratory testing of the range of materials, from polymer and various coatings



◆ Figs. 60 Sample notes were produced for laboratory testing, using various materials and coatings that were potentially suitable for low-denomination banknotes. ◆

to traditional cotton. A total of 16 different alternatives were tested using specially made sample banknotes. Each alternative was produced in two printing works and the results compared.

The Eurosystem was also interested in the experiences of others and sent a questionnaire to 155 central banks around the world.

After the tests had been completed, five options were chosen for further examination. We studied how well the sample banknotes

performed on central bank sorting machines and also simulated their performance in payment transactions as authentically as possible. These results were then checked by arranging field tests in 2007. Genuine euro banknotes were given various coatings and then issued in Ireland, The Netherlands and Portugal. Similar results were obtained in all three countries, so we could be confident that we were choosing the best coating to improve the durability of the Europa series.<sup>2</sup>

## The series receives its designer and its name

Although the ECB Governing Council had decided that the new euro banknote series would use the same *Ages and styles of Europe* theme as the first euro banknote series, agreement was still needed on how the new series would be developed. This was essential if only because the new security features would require some design modifications. The series was to be based on the first, with features like windows, doorways, bridges, the map of Europe and the EU flag, so there was no need to arrange the same kind of design competition as in 1996. Instead, each central bank in the euro area was asked to nominate a designer who would put forward proposals on how the appearance of euro banknotes would be altered. The ECB was not looking for a new design but new ideas, and wanted a moderniser, not a creator.

The designers nominated by the central banks were invited to the ECB on 28 June 2006 to receive a presentation on the present state of development of the second euro banknote series, the planning organisation, the criteria for choosing the series designer and a preliminary design brief. The event also provided responses to questions submitted in advance by the designers. Many of them had participated in the euro banknote design competition 10 years earlier so the subject was not new to them. The final design brief was sent out on 4 August 2006, with the request that they submit their proposals to the ECB by 13 October.

The competition was won by Reinhold Gerstetter, a resident of Berlin who had been nominated by the German central bank.

Until 2002 Gerstetter had worked for Berlin's Bundesdruckerei printing works as a designer of banknotes and postage stamps. He had designed banknotes for several countries; Germany's last banknote series denominated in Marks and Spain's last peseta series were based on his drafts. One of his ideas was to place Princess Europa in the watermark of euro banknotes, a face that later gave the series its name. Robert Kalina, the winner of the first design competition, did not participate this time but was a member of the task force that worked with Gerstetter to develop the Europa series.

When a draft proposal had been made on the security features for the series, Gerstetter began work on the details of the banknotes' appearance, together with the task force on design and origination. A survey conducted by the ECB had shown that cash users did not pay much attention to security features and generally remembered only a few of them. Moreover, very few people could say how they worked. The best-known were the traditional ones like the watermark, security thread and raised patterns produced by intaglio printing. It was therefore a challenge to find the right way of drawing attention to the security features. The appearance of the Europa series was intended to be more user-friendly in this respect.

It is easier to recognise security features when the banknote user knows what to look for. The name of the second banknote series, Europa, provides a clue. The watermark shows



◆ ————— ◆  
Fig. 61 Reinhold Gerstetter was the winner of the competition for ideas for the second euro banknote series. His proposal for the watermark gave the series its name, Europa.



◆ ————— ◆  
Fig. 62 ECB President Mario Draghi unveils the first Europa-series banknote, five euros, at Frankfurt's archaeological museum on 10 January 2013. On his left, the museum's curator Professor Egon Wamers; in the background, a vase on loan from the Louvre Museum in Paris, bearing a portrait of Princess Europa, the symbol of the banknote series.

a portrait of the mythological Princess Europa, and her face is repeated in the silvery hologram stripe. In Greek mythology Europa was a Phoenician princess, who was abducted to the island of Crete by the god Zeus, who had taken the form of a bull. To have added Zeus as a bull to the small space available in the watermark or hologram would have made the portrait very unclear, so it was decided that the face of Princess Europa would represent the story. Her portrait was added to the watermark, which also shows the denomination of the banknote

and a part of the image from its obverse, a window or doorway (see Appendix 3).

In addition to changes in appearance required by the new security features, the map of Europe on the reverse of euro banknotes had to be changed, because the banknotes of the first series did not show Cyprus and Malta, which joined the European Union in 2004. Malta is smaller than the minimum size for islands shown on the first series and Cyprus lies beyond the eastern edge of the map. This was remedied in the Europa series.

## Governing Council approves security features

When the study of industrial validation of individual security features was on the home-stretch, the banknote committee drew up a proposal about which should be incorporated in the series and the details of its design. At this stage the idea was still to begin by issuing a 50-euro banknote. The proposal was on the agenda of the ECB Governing Council meeting in October 2007 and was approved.

Not all the challenges had still been settled, however. When test printing was subsequently begun, it became clear that although the features were individually functional, their interaction created problems that made it impossible to print the banknotes efficiently. New solutions needed to be tested. As new banknotes are developed, many other central banks have experienced the same situation in recent years.

Because of the rapid advance in re-production technology, banknotes have had

to respond with solutions that are ever more demanding technically. The small tolerances in printing mean that the different elements can interact in unforeseen ways. In addition to the Eurosystem, the US Federal Reserve experienced this quite recently in the case of its new 100-dollar banknote and so did the Swiss National Bank when developing a new banknote series.<sup>3</sup>

My successor Ton Roos launched a new programme at the ECB to resolve the problems, and the multi-phase development process of Europa-series could be successfully concluded one denomination at a time.

Because the question of materials for the low-denomination 5 and 10-euro notes had already been settled, it made sense to change the order in which Europa series banknotes were to be issued, especially since the number of euro counterfeits had remained fairly stable. The first to be issued was the 5-euro note, and

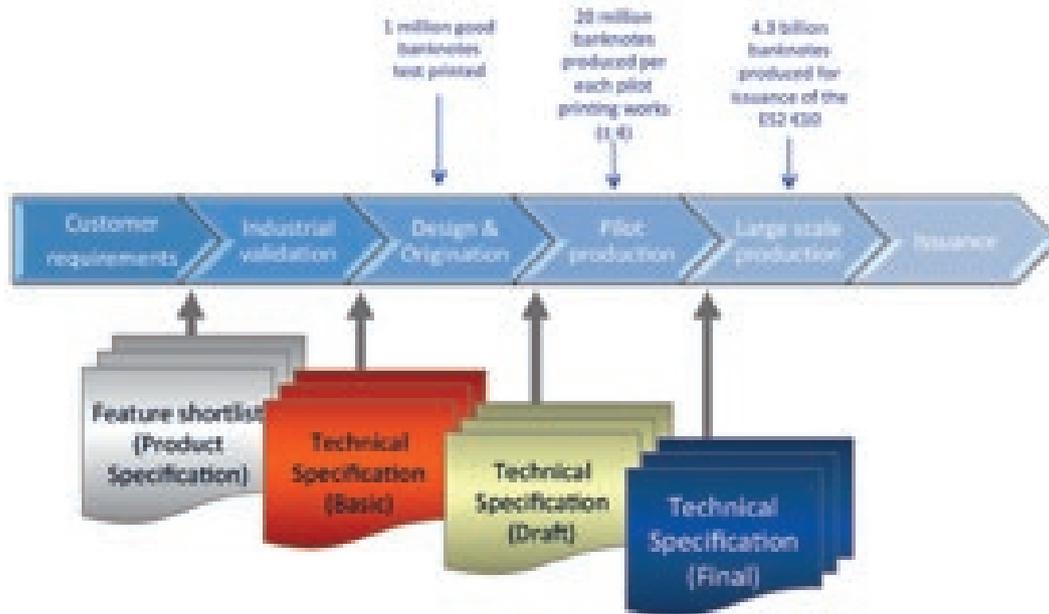


Fig. 63 The six-phase approach, used for the development of Europa-series.

◆  
 Fig. 64 Unveiling of the 10-euro banknote in the Europa series on 13 January 2014 by Yves Mersch, the ECB Executive Board member responsible for banknotes since December 2012.



not 50 euros as was originally planned. The next was the 10-euro banknote in September 2014. This left more time for the production

of 20 and 50-euro notes, which were needed in the greatest numbers. The 20-euro banknote will be issued in November 2015.

## Printing works and letters in the Europa-series

The serial numbers on the Europa series are the two numbers printed on the reverse of the banknote: a horizontal number printed in black and a vertical number printed in a different colour.

The horizontal number comprises two letters and ten digits. The first letter identifies

the printing works, as shown in the list below. The same letter appears in the plate number code on the obverse. The second letter does not refer to any printing works but simply makes more serial numbers possible.

Nationale Bank van België/

Banque Nationale de Belgique Z

Bank of Greece Y

Giesecke & Devrient GmbH (Munich) X

Giesecke & Devrient GmbH (Leipzig) W

Fábrica Nacional de Moneda y Timbre V

Banque de France U

Central Bank of Ireland T

Banca d'Italia S

Bundesdruckerei GmbH R

Joh. Enschedé Security Printing BV P

Oesterreichische Banknoten und

Sicherheitsdruck GmbH N

Valora M

Not assigned L, K

De La Rue Currency (Gateshead) J

De La Rue Currency (Loughton) H

Not assigned G, F

Oberthur Fiduciaire E

Polska Wytwórnia Papierów Wartościowych D

Not assigned C, B, A

## Growing role of banknote handling equipment

When preparations were being made for 2002, it was already clear that the conversion of cash dispensers and vending machines was crucial to the success of the cash changeover. In the dozen years since, the use of these machines has grown almost exponentially and so has their importance for the smooth launch of new banknotes.

The Eurosystem has responded by increasing its contacts with banknote equipment manu-

facturers and owners of these devices, and begun to gather data regularly on the devices and their conversion to Europa series banknotes.

In a survey carried out a month before the issue of the 10-euro Europa banknote, 88 percent of respondents expected their equipment to be ready to handle the new note from day one.

### Status of the adaptation of machines/devices for the Europa-series €10 by sector as reported by third parties one month before launch of the banknote

	Response rate (%)	Number of machines / devices used for €10	% that will be updated to €10 for the launch
Banks	79	111 559	98
Cash-in-transit companies	76	11 955	100
Vending industry	51	178 588	82
Retailers	73	49 079	88
Other	28	27 256	73
Total	55	378 437	88

◆ Fig. 65 The way banknotes are handled and authenticated has dramatically changed during the last 40 years. ◆



## FROM BANKNOTES DIRECTOR TO GLOBAL ANTI-COUNTERFEITING CHAIR

In 2006 the ECB had a programme to promote the internal mobility of its managers and directors, and I told José Manuel González-Páramo, the Executive Board member responsible for the banknote department, that I had been thinking about resigning from the position of Director of Banknotes at a suitable date in the near future. González-Páramo asked me to carry on, however, because there were many major projects at a critical phase. When we revisited the subject the following year, I added the argument that Thomas Schweikart, the head of one of my divisions, was over 60, and the head of the other division, Brian Dennis, was fast approaching 60. It seemed to me to be sensible to resign before my subordinates did, that my successor would be able to choose their replacements. González-Páramo felt that this was a valid point and we agreed that, when the security features of the second euro banknote series had been approved in the ECB Governing Council, I would initiate the process of finding the next Director of Banknotes.

That milestone was reached at the end of October 2007 and I started the process. In January 2008 the ECB Executive Board decided that the vacant position would be advertised. At the same time we agreed that I could stop working for the ECB when my successor was up to speed. The public application process was started immediately.

In February 2008 Philipp Hildebrand, then deputy governor of the Swiss National Bank and later its governor, called me and asked whether I was interested in becoming chairman of the executive committee of the Central Bank Counterfeit Deterrence Group – CBCDG – as the ECB’s representative. The CBCDG is a working group of more than 30 central banks, and operates under the central bank governors of the

G-10 western industrial countries. Its mission is to study new common threats to banknote security and to propose measures to central banks. It promotes solutions, mainly technical ones, that can prevent the use of digital equipment for banknote counterfeiting.

The G-10 central bank governors had just reviewed the governance structure of the CBCDG and concluded that one of the governors or deputy governors of a G-10 central bank should chair its annual plenary meeting, while an executive committee should be in charge of its everyday operations. The governors had picked Philipp Hildebrand to chair the plenary meetings, and he was now in the process of finding a suitable chairman for its executive committee. I told him that it was only a few weeks since the ECB Executive Board had approved my resignation as Director of Banknotes and that, interesting as his job offer was, it was not part of my plans. He asked me not to give a definitive refusal yet, and I agreed to this.

I imagined that he was still considering other options, so at first it seemed unnecessary to inform González-Páramo of the conversation. Later, though, I changed my mind: perhaps it would be a good idea after all to mention that Hildebrand had called. As soon as I raised the matter, González-Páramo interrupted me. He said that Hildebrand had called him too, and that the ECB Executive Board had already agreed to the proposition. The ECB was ready to continue my contract for the necessary period. All that was left for me to do was to work out how much of my time I would need for the CBCDG chairman’s job after I had ceased to be ECB Director of Banknotes. We agreed it would be a half-day job. This was my wish, because I also had other plans.

I began at the CBCDG in March 2008, initially while still working as Director of Banknotes. My successor – Ton Roos of De Nederlandsche Bank – had already been chosen after a lengthy application process, but he was not ready to begin until 1 November 2008. I continued to chair the banknote committee for another month after this, until the end of November 2008. Then finally did my term of office end in this job, too, after more than a decade.

I have one more entertaining reminiscence of the changeover to a new job. When the ECB Executive Board discussed banknote questions I was often present as a technical adviser, and I attended a meeting in this capacity soon after I had been appointed Chairman of the Executive Committee of the CBCDG. When I arrived in the boardroom, President Trichet welcomed me and

told the other board members that my appointment to the CBCDG had been on the agenda of a meeting of G-10 central bank governors on the previous day. He then turned back to me and said that it had been a great pleasure to represent the ECB when the matter was discussed because my candidacy had received such striking peer support. The other members of the board concurred, and someone commented: “I suppose you noticed that it was striking, not surprising.”

In the two last months of 2008, I eased Ton Roos into his new job. It was not until the beginning of 2009 that I properly started as Chairman of the Executive Committee of the CBCDG. As a half-time job, it also left some time available for my literary efforts. I continued representing the ECB at the CBCDG until the end of 2012.

◆ **Fig. 66** The new ECB Director of Banknotes (right) and the old one (left), photographed with President Jean-Claude Trichet at an event held in Frankfurt’s Town Hall Cellar in November 2009. ◆



## PRESIDENT TRICHET'S STRONG INTEREST IN EURO BANKNOTES

Jean-Claude Trichet was President of the ECB from the start of November 2003 until the end of October 2011. Although the main milestones in the process leading up to the successful issue of euro banknotes came during the term of his predecessor Wim Duisenberg, Trichet's eight years as president included many decisions on production, distribution and improved handling of euro banknotes, not to mention the technical specifications for the Europa series.

As chair of the ECB Governing Council, Trichet was responsible for the many difficult decisions relating to financial market turbulence at that time, but he also retained a strong interest in everything related to euro banknotes. This was clear from our very first meeting during his presidency. The ECB Executive Board used to arrange lunches once a month with the directors responsible for different ECB business areas; during Trichet's term, it even tried to arrange them twice a month. At his first such lunch as president, Trichet went around the room shaking the hand of each director present. When he reached me he immediately asked for my impression of the current state of euro banknote counterfeiting.

Trichet was keen to hear the views of experts but he also challenged them about the matters they were working on, and sometimes it was a tough argument to win. But he knew how to motivate the people who worked for him, as I experienced on numerous occasions. Perhaps the most illustrative came during an annual ECB reception.

The ECB and some national central bank arrange annual European Cultural Days in Frankfurt and the surrounding area, promoting the cultural diversity of the country in question. The opening concert is always arranged in Frankfurt's old opera house, at a time

that coincides with a meeting of the ECB Governing Council, thereby allowing the governors of national central banks to attend.

The concert is preceded by an ECB annual reception attended by representatives of the cultural and banking world in Frankfurt as well as the European central banking system. On one occasion, an issue that had required a lot of preparation by my department had been on the Governing Council agenda on the same day, and Trichet himself was strongly committed to its conclusion.

As usual, Trichet started by welcoming the invited guests and, while he did, he spotted me among the crowd. Immediately afterwards he came across and asked if I had already heard about the Council's decision. I said that Executive Board member González-Páramo had already told me. Trichet continued by saying that, as he had concluded the discussion by banging the chairman's gavel on the table, he had thought of me. This style and ability to motivate was one reason why I remained at the ECB in charge of banknotes for more than 10 years.

Another such conversation between us was not as heart-warming but it increased the esteem I felt towards Trichet. It was at a time when the programme of testing for the Europa series was taking longer than originally planned, and it had started to be clear that the preliminary production and issue schedule would overrun. On the positive side, euro banknote counterfeiting was still at a moderate level and there was no political imperative behind the deadline, as there had been for the issue of the first series. Even so, I thought it would be good to tell Trichet unofficially about the delay when a suitable opportunity arose.

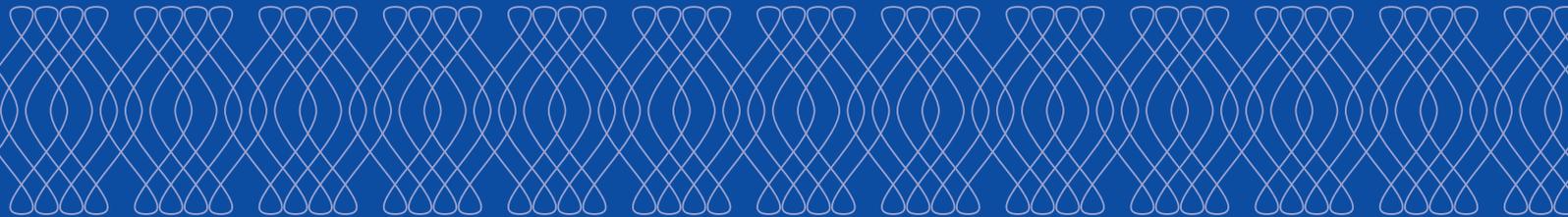
In September 2008 we were at a euro conference in Bratislava; Slovakia was to join the euro area on 1 January 2009. During a buffet lunch I saw that Trichet happened to be by himself, and not surrounded by the press as he ordinarily was. I asked if I could take a moment of his time and told him that the testing of the next banknote series seem to be taking longer than we had originally promised the ECB Governing

Council. Because of the delay, it would not be possible to issue the first Europa series banknote until after his term of office had ended in October 2011. He answered in his usual extremely intensive style that he expected project timetables to be observed, but that the end of his term of office was of no relevance to the schedule for issuing the banknote series. “What matters are institutions,” he concluded, “not individuals.”

◆  
**Fig. 67** ECB President Jean-Claude Trichet presenting the symbol of euro banknotes to Michael C. Bonello, governor of the Central Bank of Malta, in autumn 2007. Throughout his eight-year term of office, Trichet showed strong interest in euro banknotes.  
◆







17.  
*Looking back  
over two decades*





Although euro banknotes have not been in the hands of users for much longer than a decade, their history goes back more than twenty years. They were first discussed even before the Treaty on European Union was signed in Maastricht in February 1992.

The development of euro banknotes and how they came to replace the venerable national banknotes of so many countries is unique in banknote history. So was the production of banknotes of uniform quality in fifteen printing works on paper produced by nine mills. Many had doubted it would be possible.

There were many exceptional events on the road to euro banknotes. Machine producers were allowed to test them more than 20 months before they were issued; their security features were published long in advance, and they were frontloaded to commercial banks four months before €-day. Trailblazing measures like these smoothed their issue and speeded the withdrawal of national banknotes from circulation

Since their successful launch, euro banknotes have boomed. The number in circulation

doubled between February 2002 and the end of 2014, and their combined value has risen four times over, now being more than one trillion euros. Cash may have become a less important way of settling bills but, at a time of low inflation expectations and low interest rates, it is a better store of value. Now that society and especially banking have gone electronic, cash is a kind of personal contingency plan. Various crises have shown that it is also part of national infrastructure.

Even outside the euro area, euro banknotes are popular as a store of wealth. It is estimated that less than three-quarters of euro banknotes are held in the euro area. Confidence in the euro as a dual currency was highlighted by the financial market disruption in 2008, when much of the extra demand for euro banknotes came from outside the euro area.

Euro banknotes have changed the everyday life of Europeans and made it easier to travel in the euro zone and beyond, but they have also had great impact on currency management in the world. Many of the measures adopted at the time of the euro changeover, then regarded as

peculiar, have changed the thinking of central banks and become part of normal practice for the issuance of new banknote series.

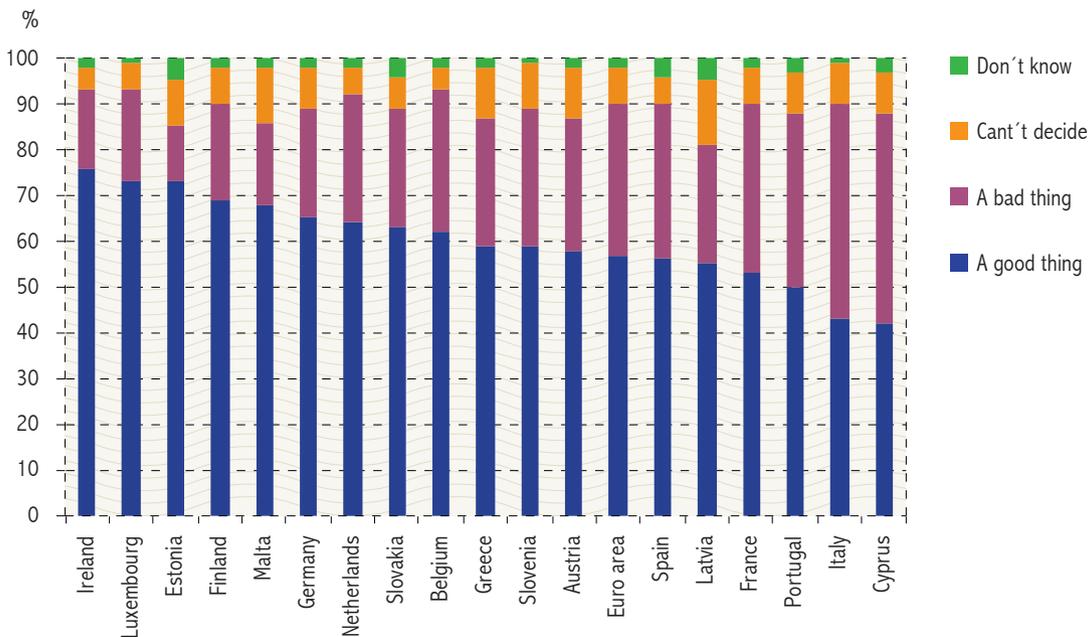
According to a Eurobarometer opinion poll in 2014, most of the people (57%) living in the euro area regard the euro as a good thing for their country (see chart 27).

A larger majority (68%) thought that the euro was good for the European Union. In polls about the banknotes themselves, the public said almost without exception (94%) that they were

extremely easy to recognise and handle.<sup>1</sup> These figures confirm that euro banknotes are seen as a positive example of European integration, and they have retained their popularity despite the unstable conditions of recent years.

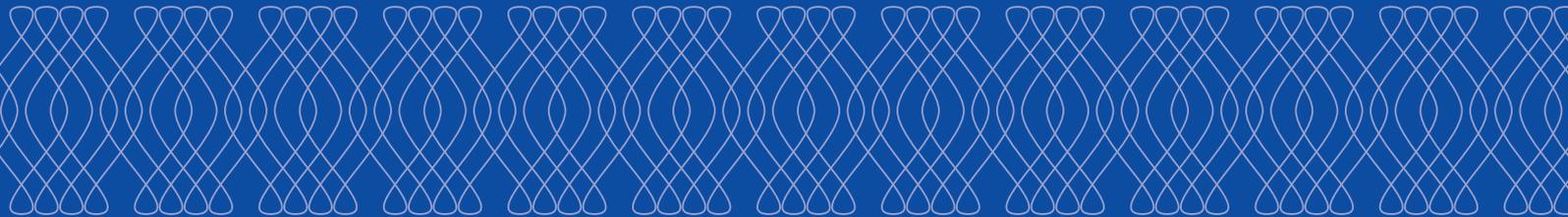
The replacement of the first euro banknote series with the new Europa series began in May 2013 with the launch of a new 5-euro note. In the years ahead the whole Europa series will gradually enter circulation, while series one takes its place in the annals of history.

Chart 27. Is having the euro a good or a bad thing for your country?



Source: European Commission.





# *Endnotes*



## Preface

- 1 Finland's central bank is called Suomen Pankki in Finnish and Finlands Bank in Swedish. Both are official languages of the country. This book uses the name Suomen Pankki.

## Preamble

- 1 European Monetary Institute (1995–1997), European Central Bank (1998–2013, 2001a and b, 2002a and b, 2003a and b, 2004, 2005, 2007b and 2011).
- 2 *How the euro became our money: A short history of the euro banknotes and coins* was published by the ECB in 2007. *The making of the Euro* was a book about the ECB's touring exhibition on the cash changeover to euros in 2002, which contained photographs by Claudio Hills. A similar book was published about another touring exhibition devoted to euro banknote design.
- 3 See Heinonen (1996, 1997a, b, c and d, 2000, 2001, 2002a, b and c, 2004, 2006, 2008, 2009a and b) and Heinonen & Negueruela (2011)
- 4 See, e.g., Augustin (2011), De Nederlandsche Bank (2002, 2006), Deutsche Bundesbank (2002, 2009, 2010, 2011a and b), Domingo Solans (2001), Fernández – Horcajada (2002), Gerstetter (2011), González-Páramo (2011), Kalina (2002 and 2011), Minichiello (2011), Mori (2000), Oesterreichische Nationalbank (2006), Radelet (2011), Rittgen (2011), Roos (2011), Talvio (2003), van den Kommer – de Heij (2008), Winter (2007) .
- 5 See e.g., [liste.eurobillets.free.fr/](http://liste.eurobillets.free.fr/) and [www.eurotracer.net/](http://www.eurotracer.net/), Kontiokari, 2011.

## 1. Questions to be resolved for Europe's common currency

- 1 The 12 countries that formed the European Community at the time were Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain and the United Kingdom,
- 2 See James (2012) on the committee of EC central bank governors. This work of history provides a detailed description of the committee's role in the creation of Emu and the process of economic integration.
- 3 The official name of the Belgian central bank is the Nationale Bank van België/Banque Nationale de Belgique.
- 4 See, e.g., European Commission (2005)
- 5 Representative of every then-member of the European

Community participated in the planning, regardless of exemptions allowing some to deviate from the demands of the Maastricht Treaty. Great Britain and Denmark were permitted to opt out of monetary union, with the proviso that they could opt in again at a later stage. It is indeed a curious fact that planning of the common currency was initiated at a meeting in Switzerland chaired by a Briton.

- 6 Setec Oy was the former banknote printing works of Suomen Pankki, which had been incorporated in 1992. It was one of the printers of euro banknotes until 2003, after which it concentrated on producing ultra-secure digital and ID products and applications. Since 2006 Setec has been owned by the international Gemalto group.

## 2. Denominations and design of a common European banknote series

- 1 In the new Europa series, the number of abbreviations for the European Central Bank is nine, now that the number of nations in the European Union has risen, following the accessions in 2004 and since.
- 2 For changes in how the banknotes of Great Britain have been signed, see Byatt (1994) and Hewitt – Keyworth (1987)
- 3 In September 1998, when the ECB's Governing Council confirmed the decision of the EMI Council that euro banknotes would have no national characteristics, it raised not a murmur in the eleven euro countries. In Britain, on the other hand, the press gave full-page coverage to the removal of the queen's portrait from banknotes, which was regarded as final proof that the ECB would also determine the future EU tax rate and the amount of government spending on public services. The outburst of emotion entirely ignored the fact that a portrait of the queen (or more frequently a king) had appeared on Bank of England banknotes for only 38 years during the period of over 300 years that the Bank of England had issued banknotes. See e.g., *The Sun* (23.9.1998) *Off with yer Head Ma'am!* *The Daily Telegraph* (23.9.1998) *Queen's head banned from euro*. *The Times* (23.9.1998) *Queen's head banned from euro notes, national symbols rejected as confusing*. *The Express* (23.9.1998) *Off with Her Majesty's head*. *The Guardian* (23.9.1998) *Sceptics up in arms as Europe's bankers cut off queen's head*. *The Daily Mail* (23.9.1998) *No room for the Queen on the euro*.
- 4 ECB press conference (8.6.2006).
- 5 The final size differences were not, therefore, finally settled until after the design competition had started (see

Chapter 3), and the sizes given in the competition rules were somewhat different.

- 6 See e.g. The Financial Times (25.7.2001) *Euro-enthusiast Finns worry about need for bigger wallets*. The Times (30.8.2001) *A nervous Continent gets ready for E-day*. The Finnish press also noticed the issue; see Kauppalehti business daily (11.12.1998) *Will euros fit wallets? Changeover affects wallet product range*. Ilta-lehti evening paper (14.12.2000) *Will the euro go in Finnish wallets?*
- 7 See Heinonen (2012a, pp. 66-67)
- 8 See e.g. Deutsche Bundesbank (1995, p. 39)

### 3. The choice of banknote themes and the design competition

- 1 Bruun (2007, p. 272).
- 2 In the new Europa series, the name of the currency is written also in Cyrillic alphabet (EBPO), following the accession of Bulgaria in 2007.
- 3 The Danish central bank made no nominations because Denmark had decided that it would not be part of the euro area. See Scheller (2006, p. 104).
- 4 The composition of the jury is given in Appendix 1.
- 5 No interviews were conducted in Denmark, which had already decided not to join the euro area.

### 4. Winning design finalised, details settled

- 1 Heinonen (2012b).
- 2 Helsingin Sanomat daily (14.12.1996) *Euro cash shows styles from different eras. Austrian series wins design competition. Pledge to reinstate missing parts of Finland*. Ilta-Sanomat evening paper (18.12.1996) *Finland not the only grumbler. Euro banknote designer promises to fix maps*.
- 3 The controversy began when Russ Swan, a journalist with Bridge Design and Engineering magazine, wrote an article on the similarities with real bridges and was interviewed in the BBC's Newsnight programme. See also Finland's Helsingin Sanomat daily (17.2.1997) *Euro bridge archetypes from as far away as India. British bridge expert upsets banknote design*.

### 5. ECB begins operations, ESCB banknote committee established

- 1 The ECB Council approved the mandates for ESCB committees and their chairs for three years at a time.

### 6. Planning logistics for the euro cash changeover

- 1 ECB Press release (13.10.1998). Further decisions on the euro banknotes.
- 2 The conversion rates of national currencies to the euro are given in Appendix 2.
- 3 Seitz (1995).
- 4 Keski-suomalainen daily (21.11.1998). *Suomen Pankki prepares for Russian euro rush*.

### 7. Banknote production from preparations to full-scale start-up

- 1 Jeff Stuart (Printing World 1999) *Against all Odds*. The former General Manager of Harrison and Sons banknote printing company refers to the use of multiple paper mills and printing works to produce banknotes and comments: "But, I believe, almost all of the basic rules of banknote printing are being violated."
- 2 ECB Press release (13.10.1998) Further decisions on the euro banknotes.

### 8. Production hiccups not entirely avoided

- 1 Frankfurter Allgemeine Zeitung (11.7.2000) *Serious Mistake in Printing 100-Euro Note*. The German journalist Klaus Bender had long been following the banknote printing market on and, using his sources, wrote regularly about the challenges of banknotes. Later he published a book (Bender 2006) about banknote printing.
- 2 ECB Press release (11.7.2000) Production of the euro 100 banknotes
- 3 Deutsche Bundesbank Press Release (11.7.2000), Giesecke & Devrient (11.7.2000) Giesecke & Devrient confirm problem with 100-euro printing.
- 4 European Central Bank Press release (31.8.2000) Production of the euro 100 banknotes, Deutsche Bundesbank Pressnotiz (31.8.2000) Produktion der Euro 100-Banknoten.
- 5 ECB Press release (15.3.2001) Outcome of the Governing Council meeting. See also Frankfurter Allgemeine Zeitung 19.3.2001.
- 6 Suomen Pankki Press release (4.1.2002).
- 7 Ilta-Sanomat evening newspaper (10.1.2002) *Euro scandal brewing in Finland*. Keski-Uusimaa daily (12.1.2002) *Embarrassment for Techno-Finland*.

## 9. Getting ready to issue euro banknotes

- 1 Der Spiegel (42/1999) *Concern about the Big Bang*.
- 2 For example the role of the central bank in currency management, the structure of central bank branches and the space available in their vaults.
- 3 Business Week (28.10.2001) *The Great Euro Robberies – During the changeover it's open season for criminals*. Newspaper of the Finnish Social Democratic Party (27.8.2001) *Currency changeover a golden age for criminals*. Helsingin Sanomat daily (30.8.2001) *Thousands of lorries start carrying euros to banks*.
- 4 Huchzermeier – Van der Heyden (2000) and Westerhof (2001). Financial Times (2.11.1999) *Retailers call for a speedier introduction of euro notes*. Kaleva daily (3.11.1999) *Euro may bring chaos*. Newspaper of the Finnish Left Alliance (29.12.2000) *Euro's arrival will cause chaos, cash dispensers will empty, shops will run out of change*. Aamulehti daily (12.1.2001) *Commerce wants advance distribution of euros*. Die Woche weekly (2.2.2001) *Nothing but trouble with the euro, checkouts without cash, banks face collapse, price wars in the supermarket: The euro will disrupt the economy*.
- 5 Kauppalehti business daily (15.7.1997) *Advent of euro may overwhelm vending machines that accept banknotes, rapid modification impossible*. The story said that they could not be adapted to euros in just a few months.

## 10. The Euro 2002 Information Campaign

- 1 For more details see Heinonen (2009c).
- 2 The security features of euro banknotes are presented in Appendix 3.

## 11. The cash changeover

- 1 Suomen Pankki (2012), p.46
- 2 Etelä-Saimaa daily (2.1.2002) *Hundred-metre queues at Suomen Pankki at midnight*. Helsingin Sanomat daily (2.1.2002) *Accordions play as euro fans wait in Helsinki*.
- 3 European Central Bank (2002c).
- 4 European Commission (2002)
- 5 Financial Times (4.1.2002) *Europe 'ready for fresh reform drive'*. Wall Street Journal (4.1.2002) *It's Official – the Euro is an Overwhelming Hit*. Neue Zürcher Zeitung (4.1.2002) *Great satisfaction with euro cash changeover. High readiness for economic reforms?* Financial Times

Deutschland (4.1.2002) *Euro cash changeover runs unexpectedly smoothly*. Dagens Industri (4.1.2002) *Euro a success. Changeover went better than expected*. Helsingin Sanomat daily (4.1.2002) *Common currency reinforces European commonality*.

## 12. Banknotes and counterfeits after the launch

- 1 Forecast from 2000 Q4 onwards using the model presented in Fischer, B., Köhler, P., Seitz, F, (2004). Figures for consumption for 2014 Q3 are forecast.
- 2 European Central Bank (2014), p.23.
- 3 Statistics Finland (2013b).
- 4 In an examination of changes in the value of Finnish banknotes since 1990, the bank strike of 1990, which lasted nearly 2 months, shows as an anomaly (see chart 12). The lockout ordered by the employers association of the banking sector began on 1 February 1990 and a strike was declared by the union of bank employees on 15 February. Strike and lockout ended on 4 March. During them, cash in circulation almost doubled but in the course of spring 1990 it returned to an almost normal level. See Suomen Pankki (1990, p.26) and Heinonen (2012a, pp.44-45).
- 5 Federation of Finnish Financial Services (2013). See also Levo -- Takala (2004).
- 6 Suomen Pankki (2012, p.45) and Syrjänen -- Takala (2010, p.45).
- 7 Statistics Finland (2013a).
- 8 See "The Cross-Border Movement of Euro Banknotes and Austria's TARGET 2 Liabilities" <http://www.oenb.at/en/Publications/Economics/Monetary-Policy-and-the-Economy.html>.
- 9 The key for calculating the allocation of ECB capital between central banks of the euro area is given in Appendix 4.
- 10 The Times (10.2.1999) *Counterfeiters are poised to cash in on arrival of the euro*. Frankfurter Allgemeine Zeitung (28.10.2000) *Counterfeiters await. Euro should incorporate new security features*.
- 11 International Herald Tribune (15.8.2001) *Euro Notes: Bonanza for the Underworld*. Etelä-Suomen Sanomat (11.6.2001) *Counterfeits already being printed*. The Guardian (14.12.2001) *Organised crime is ready to take note*.
- 12 Suomen Pankki (1998, p.55).
- 13 Suomen Pankki (2004, p.36).

- 14 Keski-suomalainen (4.3.2001) *Advent of euro set to multiply counterfeits in Finland.*
- 15 Financial Times (28.12.2006) *Euro notes cash in to overtake the dollar.*
- 16 In November 2014 the value of US dollar banknotes issued overtook the value of euro notes once more, mainly because of the weakening of the euro against the dollar.

### 13. Events and challenges after banknote issuance

- 1 The division of responsibility between central banks for euro banknote production is presented in Appendix 5.
- 2 Global Standards One
- 3 Deutsche Bundesbank Press release (21.2.2006).
- 4 When the United States issued a new dollar design in 2003 it used the slogan “Safer – smarter – more secure”. The Mexican central bank used the euro slogan in Spanish, “Toca – mira – gira”. The South African central bank used “Look – feel – tilt” when it issued the Mandela series in 2012, as did the Bank of Thailand on its website. Many central banks, including the Bank of Canada, have even adopted the practice of displaying an enormous billboard showing the new banknote on the wall of their headquarters.
- 5 See Heinonen (2011).

### 14. Controversies over banknote materials and features

- 1 BZ tabloid, Berlin (26.2.2002) *The 10-euro makes us sick.*
- 2 The Times (1.1.2003) *Euro notes are genetically modified, scientists reveal.*
- 3 EETimes.com (19.12.2001) *Euro bank notes to embed RFID chips by 2005.*
- 4 Handelsblatt (23.5.2003) *Chip to identify Euros.*
- 5 Bild am Sonntag (21.11.2004) *Come and get our banknote*

*mini-transmitters?*

- 6 The Governing Council of the ECB decides not to introduce very low denomination euro banknotes (18.11.2004).
- 7 European Commission (2003).
- 8 Frankfurter Allgemeine Zeitung (29.12.2006) *Cause unclear: So far, 2 500 euro bills are falling apart.* Frankfurter Allgemeine Zeitung (26.6.2007) *Appearances can be deceptive.*

### 15. Cash changeover planning for the EU’s new members

- 1 See e.g. European Commission (2004, 2006), Stix (2004).

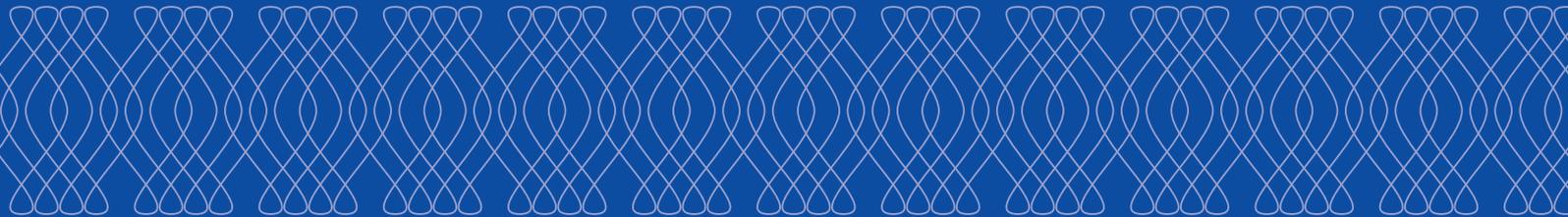
### 16. The making of Europa

- 1 In calculating the costs of its recent new polymer-substrate banknote series, the Bank of Canada assumed that it would have a life span of eight years. Spencer (2011, p.6). See also National Research Council Of The National Academies (2007).
- 2 See Meuer – Martin (2011).
- 3 Federal Reserve press release (1.10.2010) and Swiss National Bank, News Conference, Issuance of the new banknote series in 2015 at the earliest.

### 17. Looking back over two decades

- 1 European Commission (2004, p.7,8,9,11 and 30). Eurobarometers tell an interesting story about evolving public opinion in Estonia. Surveyed in 2011, the year after they joined the euro zone, Estonians were at the bottom of the table of euro countries, with only 46 percent believing it was a good thing for their country. Two years later the proportion had risen to 55 percent, and by 2014, 72 percent of Estonians thought the euro was good for their country.





# *Appendices*



# Appendix 1.

## The 1996 design competition jury<sup>1</sup>

**Nicholas Butler**, expert in industrial design: Professor at the Faculty of Royal Designers for Industry; Chairman and Managing Director of a graphic design company, London

**Gérard Caron**, expert in marketing and advertising; Chairman and Managing Director of a graphic design company; President of the Pan-European Design Association, Paris.

**Henrique Cayatte**, designer; member of the Association of Portuguese designers, Lisbon.

**Guido Crapanzano**, expert in communications; Rector of the Institute for Communication Sciences, Milan.

**Wim Crouwel**, expert in graphic design; former Director of the Museum Boijmans Van Beuningen, Rotterdam.

**Mary Finan**, communications expert; Managing Director of a public relations company, Dublin.

**Bernhard Graf**, Director of the Institute of the Museum Research, Berlin.

**Martin Hoffman**, Art Director of a television company, Luxembourg.

**Gunnar Jansson**, expert in communications; Professor at Uppsala University, Sweden.

**Mary Michailidou**, art historian; Director of Relations between Greece and the EU; President of the Greek section of the International Association of Art Critics.

**Baron Philippe Roberts-Jones**, art historian; Permanent Secretary of the Belgian Royal Academy of Science, Literature and Art, Brussels.

**Santiago Saavedra**, expert in design and graphic arts; President and General Manager of a publishing company, Madrid.

**Yrjö Sotamaa**, expert in industrial design and art; Rector of the University of Art and Design, Helsinki.

**Angelika Trachtenberg**, psychologist and communications expert; Managing Director of an advertising company, Vienna.

---

<sup>1</sup> EMI (30.6.1997) Press release.

# Appendix 2.

## Irrevocable conversion rates for the euro

Member state and currency	Conversion rate to €1	Date adopted
Austrian schilling (ATS)	13.7603	31.12.1998
Belgian franc (BEF)	40.3399	31.12.1998
Cypriot pound (CYP)	0.585274	10.7.2007
Estonian kroon (EEK)	15.6466	13.7.2010
Finnish markka (FIM)	5.94573	31.12.1998
French franc (FRF)	6.55957	31.12.1998
German Mark (DEM)	1.95583	31.12.1998
Greek drachma (GRD)	340.750	19.6.2000
Irish pound (IEP)	0.787564	31.12.1998
Italian lira (ITL)	1936.27	31.12.1998
Latvian lats (LVL)	0.702804	9.7.2013
Lithuanian litas (LTL)	3.45280	23.7.2014
Luxembourg franc (LUF)	40.3399	31.12.1998
Maltese lira (MTL)	0.4293	10.7.2007
Netherlands guilder (NLG)	2.20371	31.12.1998
Portuguese escudo (PTE)	200.482	31.12.1998
Slovakian koruna (SKK)	30.126	8.7.2008
Slovenian tolar (SIT)	239.64	11.7.2006
Spanish peseta (ESP)	166.386	31.12.1998

# Appendix 3.

## Euro banknotes and their security features

Euro banknotes have a set of security features that allow genuine notes to be distinguished from counterfeits more easily. It is wise to examine more than one feature if the authenticity of the note is in doubt.

Security features intended for the general public can be divided into three groups, depending on whether they are examined by feeling, looking at or tilting the banknote.

### Feel **1**

Banknote paper is made from pure cotton and a genuine banknote feels crisp and firmer than ordinary office paper. Intaglio is used in printing, which leaves a slightly raised surface and makes the banknote feel rough. Among other places, intaglio is used for the windows and doorways on the obverse, the large value numerals and the abbreviations for the European Central Bank (see p. 253, pictures 1, and 3, and p. 254, pictures 5 and 7, point **1**). On the 5, 10 and 20-euro notes of the Europa series, the short raised lines on the left and right edges are also printed with intaglio (see p. 253, pictures 1 and 3, point **1**).

### Look **2**

The banknote's watermark and security thread can be seen against the light on both sides of

the note. The watermark shows the image from the obverse and the note's denomination (see p. 254, pictures 5, 6, 7 and 8, point **2**). In the 5, 10 and 20-euro notes of the Europa series, the watermark shows the face of Europa, a window and the denomination (see p. 253, pictures 1, 2, 3 and 4, point **2**). The light areas of the watermark look darker against a dark surface. The security thread appears as a dark stripe (see p. 253, pictures 1, 2, 3 and 4, and p. 254, pictures 5, 6, 7 and 8, point **2**). In the 20-euro banknote of the Europa series, seen against the light, the window near the top of the hologram stripe becomes transparent and reveals a portrait of Europa which is visible on both sides of the note (see p. 253, pictures 3 and 4, point **2**).

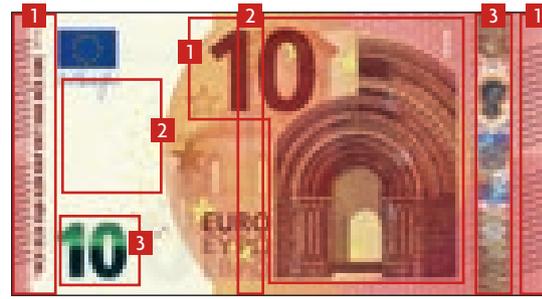
### Tilt **3**

The obverse of Europa 5 and 10-euro notes have a hologram stripe showing the same portrait of Europa, window and denomination as the watermark (see p. 253, picture 1, point **3**). When the 20-euro banknote of the Europa series is tilted, the face of Europa in the window near the top of the hologram stripe shows rainbow-coloured lines around the value numeral (see p. 253, picture 3, point **3**). On the back of the banknote, rainbow-coloured

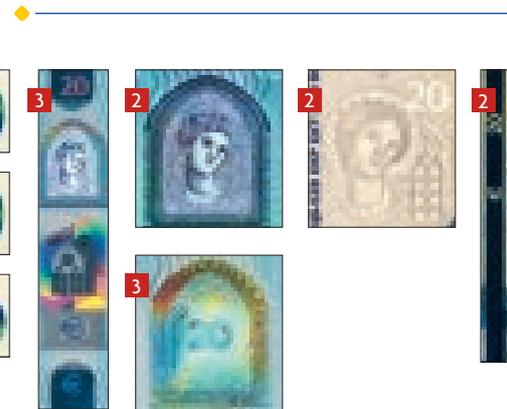
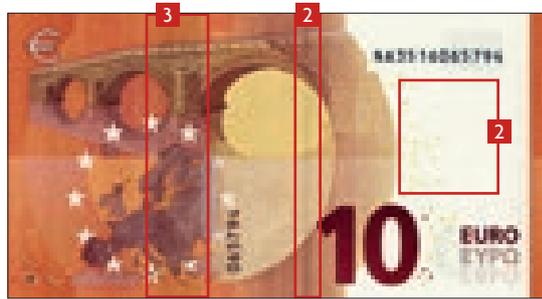
Figs. 68



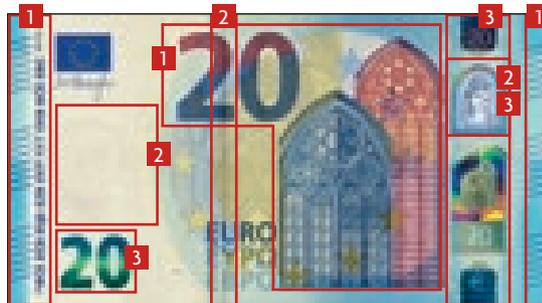
Picture 1.



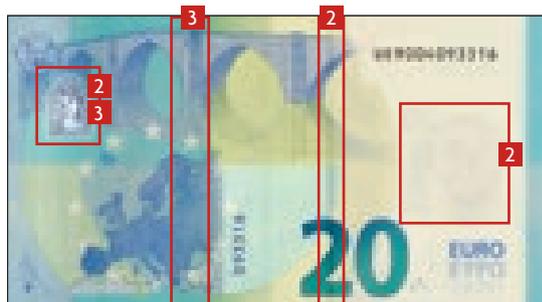
Picture 2.



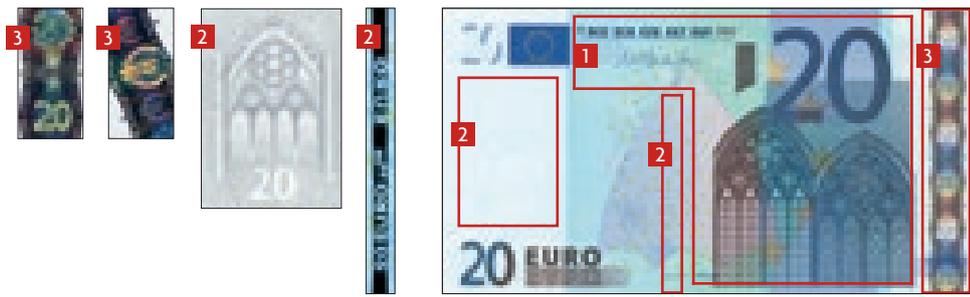
Picture 3.



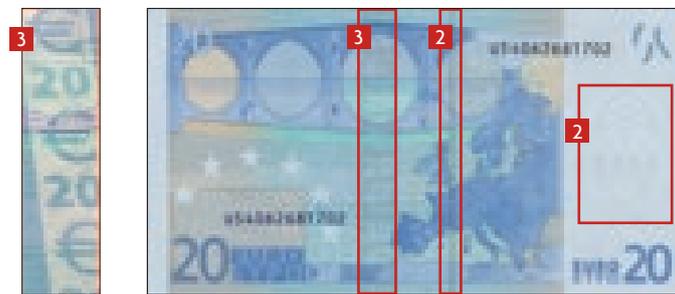
Picture 4.



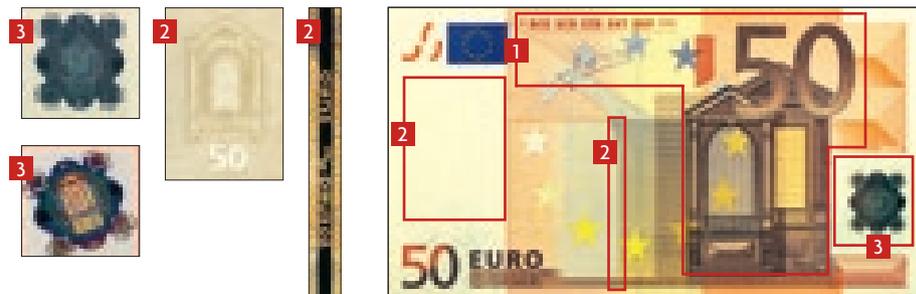
Picture 5.



Picture 6.



Picture 7.



Picture 8.



value numerals appear in the portrait window (see p. 253, picture 4, point 3). In addition, on the obverse of Europa 5, 10 and 20-euro banknotes, the shiny number on the lower left displays a light effect that moves up and down. At the same time, the number changes colour as it is tilted from emerald green to deep blue (see p. 253, pictures 1 and 3, point 3). The hologram on the obverse of 50, 100, 200 and 500-euro banknotes changes when tilted

between the value and a window or doorway (see p. 254 picture 7, point 3).

The glossy stripe on the reverse of 5, 10 and 20-euro banknotes alternates between the denomination and the € symbol (see p. 253, pictures 2 and 4, and p. 254, picture 6, point 3).

The value numeral on the reverse of 50, 100, 200 and 500-euro banknotes changes colour as it is tilted from purple to olive green or brown (see p. 254, picture 8, point 3).

# Appendix 4.

## The shares of the euro area national central banks in the ECB's capital key since 1 January 2015

	Shares in the ECB's capital key, %	Shares from the euro area total <sup>1</sup>
Nationale Bank van België/Banque Nationale de Belgique	2.4778	3.520
Deutsche Bundesbank	17.9973	25.567
Eesti Pank	0.1928	0.274
Central Bank of Ireland	1.1607	1.649
Bank of Greece	2.0332	2.888
Banco de España	8.8409	12.560
Banque de France	14.1792	20.143
Banca d'Italia	12.3108	17.489
Central Bank of Cyprus	0.1513	0.215
Latvijas Banka	0.2821	0.401
Lietuvos bankas	0.4132	0.587
Banque centrale du Luxembourg	0.2030	0.288
Central Bank of Malta	0.0648	0.092
De Nederlandsche Bank	4.0035	5.687
Oesterreichische Nationalbank	1.9631	2.789
Banco de Portugal	1.7434	2.477
Banka Slovenije	0.3455	0.491
Národná banka Slovenska	0.7725	1.097
Suomen Pankki – Finlands Bank	1.2564	1.785
Subtotal for euro area NCBs	70.3915	100.0000
Subtotal for non-euro area NCBs	29.6085	
Total	100.0000	

<sup>1</sup> Used in allocating responsibility for the annual euro banknote production.

# Appendix 5.

## Euro banknote production 1999-2015<sup>1</sup>

Abbreviation	Member State	Commissioning bank
AT	Austria	Oesterreichische Nationalbank
BE	Belgium	Nationale Bank van België/Banque Nationale de Belgique
CY	Cyprus	Central Bank of Cyprus
DE	Germany	Deutsche Bundesbank
EE	Estonia	Eesti Pank
ES	Spain	Banco de España
FI	Finland	Suomen Pankki
FR	France	Banque de France
GR	Greece	Bank of Greece
IE	Ireland	Central Bank of Ireland
IT	Italy	Banca d'Italia
LU	Luxembourg	Banque centrale du Luxembourg
LV	Latvia	Latvijas Banka
MT	Malta	Central Bank of Malta
NL	Netherlands	De Nederlandsche Bank
PT	Portugal	Banco de Portugal
SI	Slovenia	Banka Slovenije
SK	Slovakia	Národná banka Slovenska

<sup>1</sup> ECB Press release (5.10.2001) Euro banknotes to be produced until 31 December 2001. See also ECB banknote and coin production: [www.ecb.europa.eu/stats/euro/production/html/index.en.html](http://www.ecb.europa.eu/stats/euro/production/html/index.en.html)). For the cash changeover of 2002, the ECB ordered an additional 1.9 billion banknotes in 2001 as a precaution against production problems or unanticipated demand for some denomination (see chapter 6). The figures in the production tables consist of the amounts approved by the ECB Governing Council.

1999–2001	Number (billions)	Commissioned by	2002	Number (billions)	Commissioned by
€ 5	3.155	Eurosystem	€ 5	1.131	FR, NL, AT, PT
€ 10	3.221	Eurosystem	€ 10	1.045	DE, GR, IE
€ 20	3.406	Eurosystem	€ 20	1.555	ES, FR, IT, FI
€ 50	3.283	Eurosystem	€ 50	0.742	BE, ES, NL
€ 100	1.231	Eurosystem	€ 100	0.307	IT, LU
€ 200	0.224	Eurosystem	€ 200	-	-
€ 500	0.371	Eurosystem	€ 500	-	-
Total	14.890		Total	4.780	

2003	Number (billions)	Commissioned by	2004	Number (billions)	Commissioned by
€ 5	0.110	FR	€ 5	-	-
€ 10	0.999	DE, GR, IE, AT	€ 10	0.378	DE, FR, GR, IE, AT
€ 20	1.071	DE, ES, FR, NL, PT	€ 20	0.290	FR, PT
€ 50	0.657	BE, ES, IT, NL	€ 50	0.683	BE, DE, ES, IT, NL
€ 100	0.122	IT, FI	€ 100	0.124	IT, FI
€ 200	0.133	DE, LU	€ 200	-	-
€ 500	-	-	€ 500	0.104	DE, LU
Total	3.092			1.579	

2005	Number (billions)	Commissioned by	2006	Number (billions)	Commissioned by
€ 5	0.530	FR	€ 5	1.080	ES, FR, IE, AT, FI
€ 10	1.020	DE, GR, IE, AT	€ 10	1.780	DE, GR, FR, NL
€ 20	0.700	ES, FR, NL, PT, FI	€ 20	1.940	DE, ES, FR, IT, PT
€ 50	1.100	BE, DE, ES, IT, NL	€ 50	1.920	BE, DE, ES, IT, NL
€ 100	0.090	IT	€ 100	0.280	IT, LU, AT
€ 200	-	-	€ 200	-	-
€ 500	0.190	DE, LU	€ 500	-	-
Total	3.630			7.000	

2007	Number (billions)	Commissioned by	2008	Number (billions)	Commissioned by
€ 5	0.980	DE, ES, FR	€ 5	1.370	DE, ES, FR, PT
€ 10	1.280	DE, GR, FR, NL, AT	€ 10	2.130	DE, GR, FR, AT
€ 20	1.890	GR, ES, FR, IE, IT, PT, FI	€ 20	1.755	ES, FR, IE, IT, LU, NL, SI, FI
€ 50	1.730	BE, DE, ES, IT	€ 50	1.060	BE, DE, ES, IT, NL
€ 100	0.230	IT, LU, NL	€ 100	0.130	IT
€ 200	-	-	€ 200	-	-
€ 500	0.190	DE	€ 500	-	-
Total	6.300			6.445	

2009	Number (billions)	Commissioned by	2010	Number (billions)	Commissioned by
€ 5	1.118	FR, NL	€ 5	1.310	ES, FR, NL, PT
€ 10	1.353	DE, GR, FR, AT	€ 10	1.540	DE, GR, FR, IE, IT, AT
€ 20	4.228	DE, CY, GR, ES, FR, IE, IT, MT, LU, NL, PT, SI, FI	€ 20	1.898	DE, CY, FR, MT, LU, NL, SI, SK, FI
€ 50	2.958	BE, DE, ES, IT	€ 50	1.700	BE, DE, ES, IT
€ 100	1.044	DE, IT, AT	€ 100	0.500	IT
€ 200	-	-	€ 200	0.100	DE
€ 500	0.240	DE	€ 500	0.100	AT
Total	10.941			7.148	

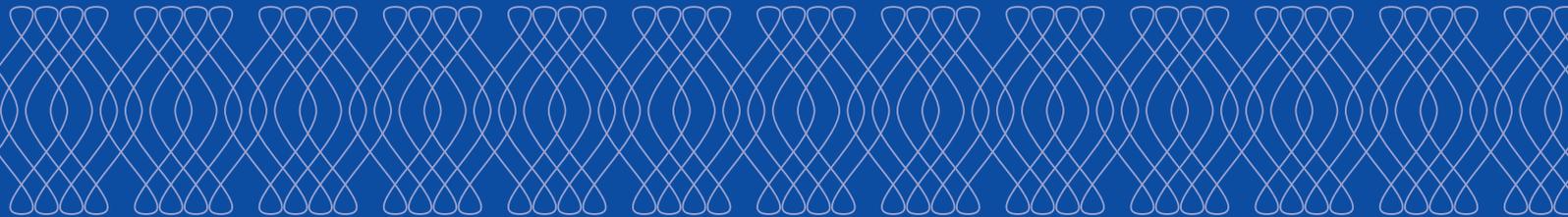
2011	Number (billions)	Commissioned by	2012	Number (billions)	Commissioned by
€ 5	1.715	DE, CY, ES, FR, IE, MT, LU, NL, SI, SK, FI	€ 5	2.915	BE, ES, FR, IT, AT
€ 10	1.541	DE, GR, FR, AT, PT	€ 10	1.959	DE, GR, FR, IE, PT
€ 20	0.537	CY, FR, MT, LU, NL, SI, SK, FI	€ 20	1.704	CY, EE, FR, IT, MT, LU, NL, SI, SK, FI
€ 50	2.169	BE, DE, ES, IT	€ 50	1.530	BE, DE, ES, IT
€ 100	-	-	€ 100	0.298	DE
€ 200	-	-	€ 200	0.050	DE
€ 500	0.056	AT	€ 500	-	-
Total	6.0179			8.457	

2013	Number (billions)	Commissioned by	2014	Number (billions)	Commissioned by
€ 5	-	-	€ 5	0.825	BE, GR, ES, IE
€ 10	4.500	DE, CY, EE, GR, ES, FR, IE, IT, MT, LU, NL, AT, SI, SK, FI	€ 10	0.094	GR
€ 20	2.500	DE, CY, EE, GR, FR, IT, MT, LU, NL, PT, SI, SK, FI	€ 20	3.994	DE, ES, FR, IT, AT, PT
€ 50	1.000	BE, DE, ES	€ 50	2.800	BE, DE, CY, EE, ES, IT, MT, LU, NL, SI, SK, FI
€ 100	-	-	€ 100	0.500	DE
€ 200	-	-	€ 200	0.047	DE
€ 500	-	-	€ 500	0.085	AT
Total	8.000			8.345	

2015	Number (billions)	Commissioned by
€ 5	0.600	BE, ES, PT
€ 10	1.200	EE, IE, GR, FR, CY, LU, MT, NL, AT, SI, SK, FI
€ 20	1.700	DE, FR, IT
€ 50	2.500	BE, DE, EE, ES, FR, IT, CY, LV, LU, MT, NL, PT, SI, SK, FI
€ 100	-	
€ 200	-	
€ 500	-	
Total	6.000	







---

## *Sources and literature*



## Archive sources

Memoranda and minutes of meetings

## Literature

- Augustin, Stefan (2011) The circulation of euro banknotes outside the euro area. BILLETARIA December 2011.
- Bartzsch, Nikolaus – Rösl, Gerhard – Seitz, Franz (2011) Der Auslandsurlaub deutscher Euro-Banknoten: Schätzung mit indirekten Ansätzen, Diskussionspapier, Deutsche Bundesbank, Reihe 1: Volkswirtschaftliche Studien Nr. 21/2011
- Bender, Klaus (2006) Moneymakers. The Secret World of Banknote Printing. Weinheim.
- Bruun, Erik (2007) Sulka ja kynä. Erik Bruunin julisteita ja käyttögrafiikkaa. Helsinki.
- Byatt, Derrick (1994) Promises to pay. The first three hundred years of Bank of England notes. London.
- De Nederlandsche Bank (2002), Getting used to the euro, Quarterly Bulletin September 2002.
- De Nederlandsche Bank (2006), Telling genuine banknotes from counterfeits – a study report. Quarterly Bulletin September 2006.
- Deutsche Bundesbank (1995) Von der Baumwolle zum Geldschein. Eine neue Banknotenserie entsteht. Frankfurt am Main.
- Deutsche Bundesbank (2002), Circulation of the Deutsche Mark - from the currency reform to European monetary union. Monthly report March 2002.
- Deutsche Bundesbank (2009), The development and determinants of euro currency in circulation in Germany. Monthly Report June 2009.
- Deutsche Bundesbank (2010), The use of cash and other payment instruments - a behavioural study using micro data. Monthly report March 2010.
- Deutsche Bundesbank (2011a), The banknote cycle and banknote recycling in Germany. Monthly report January 2011.
- Deutsche Bundesbank (2011b), Foreign demand for euro banknotes issued in Germany. Monthly report January 2011.
- Domingo Solans, Eugenio (2001), The Role of the ECB in the Launch of the Euro Banknotes and Coins. Kreditwesen 1/2001.
- European Central Bank (1998–2013) Annual reports 1998–2013. Frankfurt am Main.
- European Central Bank (2001a), The introduction of Euro banknotes and coins. Monthly Bulletin April 2001.
- European Central Bank (2001b), The Euro cash changeover in markets outside the euro area. Monthly Bulletin October 2001.
- European Central Bank (2002a) Euro banknote preparations: from cash changeover to post-launch activities. Monthly Bulletin January 2002.
- European Central Bank (2002b) Implications of the euro cash changeover on the development of banknotes and coins in circulation. Monthly Bulletin May 2002.
- European Central Bank (2002c) Recent developments in perceived and actual inflation. Monthly Bulletin October 2002.
- European Central Bank (2003a) The demand for currency in the euro area and the impact of the euro cash changeover. Monthly Bulletin January 2003
- European Central Bank (2003b) Early experience of the management of Euro banknote printing and issuance. Monthly Bulletin July 2003.
- European Central Bank (2003c) Euro banknote design exhibition. Frankfurt am Main.
- European Central Bank (2004) Euro banknotes: first years of experience. Monthly Bulletin August 2004.
- European Central Bank (2005) The euro banknotes: developments and future challenges. Monthly Bulletin August 2005.
- European Central Bank (2007a) How the euro became our money: A short history of the euro banknotes and coins. Frankfurt am Main.
- European Central Bank (2007b) Circulation and supply of euro banknotes and preparations for the second series of banknotes. Monthly Bulletin October 2007
- European Central Bank (2011) The use of euro banknotes – results of two surveys among households and firms. Monthly Bulletin April 2011.
- European Central Bank (2014) The international role of the euro. July 2014.

- European Commission (2001a) Commission communication to the European Council. First report on the preparations for the introduction of euro notes and coins.
- European Commission (2001b) Commission communication to the European Council. Second report on the preparations for the introduction of euro notes and coins.
- European Commission (2002) Euro Attitudes – Euro Zone. Flash Eurobarometer. March 2002.
- European Commission (2003) The Euro, two years later. Flash Eurobarometer. December 2003.
- European Commission (2004) Introduction of the Euro in the New Member States. October 2004.
- European Commission (2005) Economic and monetary union. Compilation of Community legislation on Economic and Monetary Union. Belgium.
- European Commission (2006) Introduction of the Euro in the New Member States. Flash Eurobarometer. November 2006.
- European Commission (2014) The Euro Area. Flash Eurobarometer. October 2014.
- European Monetary Institute (1995–1997) Annual reports 1995–1997. Frankfurt am Main.
- Federation of Finnish Financial Services (2013) Säästäminen, luotonkäyttö ja maksutavat Suomessa.
- Fernández, Ricardo – Horcajada, Nuria (2002) El Banco de España y la introducción del EURO. Madrid.
- Fischer, Björn – Köhler, Petra – Seitz, Franz (2004) The Demand for euro area currencies: Past, present and future, ECB Working Paper No. 330.
- Gerstetter, Reinhold (2011) New clothes for the euro. BILLETARIA. December 2011
- González-Páramo, José Manuel (2011) The first ten years of the euro banknotes. BILLETARIA. December 2011.
- Heinonen, Antti (1996) Yhteiset rahat ja rahahuolto. Euro – yhteinen raha. Toim. Paavo Peisa. Suomen Pankin tutkimuksia A:96. Helsinki.
- Heinonen, Antti (1997a) The challenges ahead in getting euro banknotes and coins into circulation. MOVING TOWARDS THE EURO – Strategies and practical solutions for a competitive advantage. EFMA. Paris.
- Heinonen, Antti (1997b) Eurosetelit ja metallirahat. EMU ja pankit. Suomen Pankkiyhdistys. Helsinki.
- Heinonen, Antti (1997c) Eurorahan valmistelu etenee. Numismaattinen aikakauslehti 1/1997.
- Heinonen Antti (1997d) Eurorahan valmistelut ovat pitkällä. Pankko. Suomen Pankin henkilöstölehti 8/1997.
- Heinonen, Antti (2000) The production and issue of the euro banknotes and coins. EURO. The European Central Bank. Special edition. ECU-ACTIVITIES. Bruxelles.
- Heinonen, Antti (2001) Suurmuutos muutamassa viikossa ja yhtä aikaa 12 maassa. Eurokäsikirja. Toim. Matti Mörttinen ja Leena Paldán. Jyväskylä.
- Heinonen, Antti (2002a) Eurorahat tulevat. Studia Generalia 2001. Hyvästi markka, tervetuloa euro. Helsingin yliopisto, vapaan sivistystyön toimikunta. Helsinki
- Heinonen, Antti (2002b) Käteisrahan vaihto onnistui. Chydenius 1/2002.
- Heinonen, Antti (2002c) The transition to the euro. The making of the Euro. A mosaic of history by Claudio Hils. Aachen.
- Heinonen, Antti (2004) Eurokäteisrahan vaihto ja euroseteleiden tulevat haasteet. Rahojen parissa. Toim. Tuukka Talvio. Suomen Numismaattinen Yhdistys 1914–2004. Jyväskylä.
- Heinonen, Antti (2006) Banking Sector; Cash Changeover. Conference on Experience with and Preparations for the Euro. Oesterreichische Nationalbank. Vienna.
- Heinonen, Antti (2008) How to manage cash policy in 15 countries? The development of cash management policies in Europe. BILLETARIA. March 2008.
- Heinonen, Antti (2009a) Euro cash is as popular as ever, Bank of Finland Bulletin 1/2009.
- Heinonen, Antti (2009b) Lisätietoja euroseteleistä. Numismaatikko 4/2009.
- Heinonen, Antti (2009c) Lessons in Banknote Communications. Currency News. December 2009.
- Heinonen, Antti (2011) Setelipainoista maailmalla. Numismaattinen aikakauslehti 4/2011.
- Heinonen, Antti (2012a) Viimeiset markat – Suomen markkamääräiset setelityypit 1945–2002. Helsinki.
- Heinonen, Antti (2012b) Seteleiden ulkoasun suunnittelun haasteista ja karikoista. Numismaattinen aikakauslehti 3/2012.
- Heinonen, Antti – Negueruela, Dario (2011) The singularity of the euro banknotes. BILLETARIA. December 2011.
- Hewitt, V. H. – Keyworth, J. M. (1987) As Good As Gold: 300 Years of British Bank Note Design. London.
- Hils, Claudio (2002) The making of the Euro. A mosaic of history. Aachen.
- Huchzermeier, Arnd – Van der Heyden, Ludo (2000) A preliminary scenario analysis of retailer cash transaction data for the introduction of the Euro currency in January 2002. Vallendar & Fontainebleau.

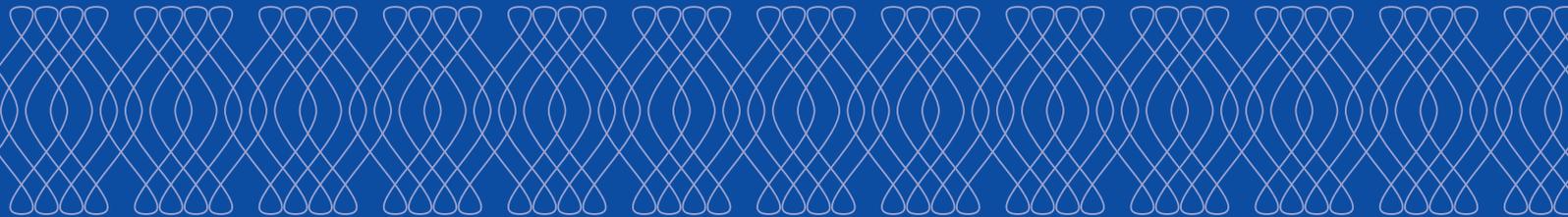
- James, Harold (2012) *Making the European monetary union*. Cambridge, Massachusetts.
- Kalina, Robert (2002) *Designing the euro banknotes. From the Schilling to the Euro. Continuity and Stability*. Edited by K. Liebscher and W. Seipel, Vienna
- Kalina, Robert (2011) *The design of the first series of euro banknotes*. BILLETARIA. December 2011.
- Kontiotkari, Tero (2011) *Koodinmurtajat*. Numismaatikko 4/2011.
- Levo, Urpo – Takala, Kari (2004) *Finland's currency supply system*. Bank of Finland Bulletin 2/2004.
- Meuer, Torsten – Martin, Jérôme (2011) *The Eurosystem's efforts in the search for a longer lasting banknote*. BILLETARIA. April 2011.
- Minichiello, Nunzio (2011) *Euro banknote production*. BILLETARIA. December 2011
- Mori, Roberto (2000) *Un biglietto per l'Europa. La progettazione della prima serie di banconote europee*. Roma.
- Mörttinen, Matti – Paldán, Leena (2001) *Eurokäsikirja*. Jyväskylä.
- National Research Council Of The National Academies (2007) *A Path To The Next Generation Of U.S. Banknotes: Keeping Them Real*. Washington D. C.
- Radelet, Olivier (2001) *Information campaigns for euro cash changeovers*. BILLETARIA. December 2011.
- Rittgen, Helmut (2011) *The ongoing harmonisation of the Eurosystem's cash policy*. BILLETARIA. December 2011.
- Rittgen, Helmut (2012) *Bargeld - ein Zahlungsmittel von gestern? Bargeldsymposium der Deutschen Bundesbank 10. Oktober 2012 in Frankfurt am Main*.
- Roos, Ton (2011) *The integrity of euro banknotes*. BILLETARIA. December 2011.
- Scheller, Hanspeter K. (2006) *The European Central Bank. History, role and functions*. Second revised edition. Frankfurt am Main.
- Seitz, Franz (1995) *The Circulation of Deutsche Mark Abroad*. Discussion Paper 1/95. Economic Research Group of the Deutsche Bundesbank.
- Spencer, Charles (2011) *Paying with Polymer: Developing Canada's New Bank Notes*. Bank of Canada Review. Spring 2011.
- Statistics Finland (2013a) *Consumer price index 1951:10 = 100*.
- Statistics Finland (2013b) *Finnish travel 2005–2012*.
- Stix, Helmut (2004), *Foreign currency demand since 2002 – Evidence from five Central and Eastern European Countries*, CESifo Forum 4/2004.
- Suomen Pankki (1990–2012) *Annual reports 1990–2012*. Helsinki.
- Syrjänen, Miika – Takala, Kari (2010). *The role of the central bank in the cash cycle*. Bank of Finland Bulletin 2/2010.
- Talvio, Tuukka (2003) *The Coins and Banknotes of Finland*. Second edition. Helsinki.
- van den Kommer, Esther – de Heij, Hans (2008) *The roles of de Nederlandsche Bank in euro banknote circulation*. Amsterdam.
- Westerhof, G. P. (2001) *Effects of cash payments in national currency per 1-1-2002 on the sales process of the Dutch Railways*. Utrecht.
- Winter, Heike (2007), *The design of euro banknotes, Drafts and decision process. Money and Identity. Lectures about History, Design, and Museology of Money*. Edited by Reiner Cunz. Hannover.

## Newspapers and news reviews

- Finland: Aamulehti, Etelä-Saimaa, Etelä-Suomen Sanomat, Helsingin Sanomat, Iltalehti, Ilta-Sanomat, Kaleva, Kansan Uutiset, Kauppalehti, Keskisuomalainen, Keski-Uusimaa, Savon Sanomat, Suomenmaa, Uutispäivä Demari
- Germany: Bild am Sonntag, BZ Berlin, Die Woche (defunct), Financial Times Deutschland, Frankfurter Allgemeine Zeitung, Handelsblatt, Spiegel
- Great Britain: Daily Mail, Daily Telegraph, Express, Financial Times, Guardian, Sun, Times
- Sweden: Dagens Industri
- Switzerland: Neue Zürcher Zeitung
- Others: International Herald Tribune, Wall Street Journal







*Name index*



- Andrade, Roberto p. 52
- Atkins, Ralph p. 195
- Bender, Klaus p. 245
- Blair, Tony p. 102
- Bonello, Michael C. p. 168, 237
- Bolten, Jaap p. 59
- Bruun, Erik p. 57
- Bruun, Daniel p. 63, 65, 74
- Bruun, Johanna p. 63, 65, 74
- Butler, Nicholas p. 250
- Caron, Gérard p. 250
- Cayatte, Henrique p. 250
- Comastri, Claudio p. 101
- Crapanzano, Guido p. 250
- Crouwel, Wim p. 250
- Degryse, Maryke p. 63, 64, 82
- Delors, Jacques p. 28
- Dennis, Brian p. 234
- Domingo Solans, Eugenio p. 100, 101, 104, 105, 143, 150, 162, 163, 168, 214
- Draghi, Mario p. 47, 229
- Duisenberg, Gretta p. 103
- Duisenberg, Willem (Wim) p. 24, 28, 29, 30, 45, 46, 47, 88, 90, 101, 103, 149, 150, 152, 154, 236
- Finan, Mary p. 250
- Gerstetter, Reinhold p. 228, 229
- González-Páramo, José Manuel p. 105, 234, 236
- Graf, Bernhard p. 250
- Greif, Armin p. 162
- Heinonen, Juha p. 100
- Hildebrand, Philipp p. 234
- Hils, Claudio p. 244
- Hoffman, Martin p. 250
- Honecker, Erich p. 60
- Howard, Michael C. p. 168
- Hämäläinen, Sirkka p. 101
- Issing, Ottmar p. 101, 102
- Itten, Johannes p. 59
- Jansson, Gunnar p. 250
- Jarvis, Alex p. 32, 33, 36, 52
- Juncker, Jean-Claude p. 47
- Jünger, Ernst p. 63, 65, 70
- Jünger, Lorli p. 63, 65, 70
- Jünger, Sanne p. 63, 65, 76
- Kalina, Robert p. 63, 64, 68, 80, 88, 89, 92, 93, 228
- Kallas, Siim p. 221
- Kohl, Helmut p. 102, 103
- Kraft, Vahur p. 221
- Lamfalussy, Alexandre p. 28, 35, 88, 90
- Liikanen, Erkki p. 105, 202
- Lipponen, Paavo p. 102
- Lipstok, Andres p. 221
- Madlé, Inge p. 63, 64, 72
- Meister, Edgar p. 162
- Mersch, Yves p. 231
- Michailidou, Mary p. 250
- Michel, Klaus p. 63, 65, 76
- Neumann, Balthasar p. 102
- Newton, Isaac p. 59
- Niinistö, Sauli p. 163
- Noyer, Christian p. 101
- Otsason, Rein p. 221
- Padio-Schioppa, Tommaso p. 101
- Pfund, Roger p. 63, 65, 78
- Pöhl, Karl Otto p. 28, 30
- Quaden, Guy p. 202
- Quiros, Gabriel p. 104
- Raymond, Robert p. 35
- Rehn, Olli p. 47
- Rittgen, Helmut p. 177
- Roberts-Jones, Baron Philippe p. 250
- Roos, Ton p. 230, 235
- Roosve, Rait p. 221
- Saavedra, Santiago p. 250
- Scheller, Hanspeter K. p. 62
- Schüller, Regina p. 178
- Schweikart, Thomas p. 234
- Sims, Thomas G. p. 155
- Sotamaa, Yrjö p. 250
- Stuart, Jeff p. 245
- Swan, Russ p. 245
- Tarvainen, Veli p. 36
- Thorn, Terry p. 63, 84
- Tornare, Roland p. 52
- Trachtenberg, Angelika p. 250
- Trichet, Jean-Claude p. 33, 47, 178, 205, 221, 235, 236, 237
- Van Droogenbroeck, Jacques p. 30, 32
- Waigel, Theo p. 30
- Walter, Peter p. 162, 163, 165
- Wamers, Egon p. 229
- Werner, Pierre p. 28
- Zeitler, Franz-Christoph p. 205
- Zimmermann, Yves p. 63, 64, 66









From the conception and development of Europe's first common banknotes in the early 1990s, to the creation and launch of the second series, Europa. The book gives a detailed analysis of the choices faced at the different stages of design, production and issuance, and the reasoning behind the decisions ultimately made. The author's personal recollections and experiences enliven a richly illustrated narrative.

*Antti Heinonen* was a central figure in developing euro banknotes and planning the changeover. For more than a decade, until 2008, he was the Director of Banknotes at the European Central Bank. Currently he is the chairman of the Banknote Ethics Initiative, established to provide ethical business practices within the banknote industry, with a focus on the prevention of corruption and on compliance with anti-trust law.

The book has previously been published in Finnish and German. This international edition in English, containing additional details, photographs and diagrams, has been produced in a collaborative project between Suomen Pankki and the European Central Bank.

ISBN 978-92-899-1509-0  
10.2866/818136

