

**On a Blank Slate: Cash and Cash Requirements for Future Currency Unions –
*Background Paper***

Russell Krueger¹

The usage, costs, and benefits of cash: Theory and evidence from macro and micro data
Bundesbank International Conference
Eltville, Germany
February 27-29, 2012

Abstract – This note is an expanded background paper for the conference paper “*On a Blank Slate: Cash and Cash Requirements for Future Currency Unions in Africa and the Gulf*”. It discusses the process of creating currency in new monetary unions being constructed in Africa and the Gulf. The experience in the European Monetary Union (EMU) is reviewed to provide guidance on issues that must be addressed in the new unions. The design and usability features of the new union currencies are reviewed. It is concluded that there are many differences between conditions in Europe and the new unions that will require that innovative solutions need to be found in the future unions.

Among other issues covered are security and anticounterfeiting measures. Currency policy related to cross-border currency flows. How e-money innovations and physical currencies will interact at the start of a union. And how should the conversion from national currencies to the union currency should be handled.

¹ Russell Krueger is an independent consultant, retired from the International Monetary Fund.

Contents	Page
A. Introduction.....	4
B. Currency Usage in Europe and the Future Unions.....	4
Conditions surrounding introduction of the euro.....	4
C. Creating the euro.....	10
Designing euro banknotes and coins.....	10
Security features.....	12
Usability features.....	12
Legal specification of the banknotes.....	16
D. Production of Euro Banknotes and Coins.....	16
Printing facilities.....	16
Production of the currency.....	17
E. Converting National Currencies into the Euro.....	19
The conversion problem.....	19
Setting the irrevocable conversion rates for the euro.....	21
F. Currency Demand and Usage.....	26
Currency usage patterns.....	26
Stock of union currency.....	27
Currency demand.....	30
Currency retirement.....	33
Currency lifespan.....	35
Seasonality.....	37
Currency flows within the union.....	39
G. Currency Design.....	40
Name of the currency and its symbols.....	40
Security features.....	42
Special currency design issues.....	46
Commemorative coins.....	48
Gold or other precious metal coins.....	48
H. Production.....	49
Production capacity.....	49
Printing schedule.....	50
I. Counterfeiting and Copyrights.....	51
Legal protection of banknotes and coins.....	56
J. Legal Issuance of Banknotes and Coins.....	57
K. Electronic Money (e-money).....	58
<i>Box: M-Pesa digital money system in Kenya</i>	65
L. Introduction of the New Currency.....	66
Legal framework for common currency.....	71
M. Retiring Currency.....	71
N. Timeline.....	74
O. Appendix I - Conversion Rates from National Currency to the Union Currency...76	
Euro area Method.....	76
Dollar Peg of the Gulf Cooperation Council (GCC).....	76
Krueger/Kamar/Carlotti (KKC) Methodology.....	77

Cross-Country Price Comparisons.....	81
P. Appendix II - ERM bilateral central rates	83
Q. Appendix III – Impacts on the banknote printing and minting industries	86
R. Appendix IV – E-money and the changeover to union currencies	88
Bibliography	89

A. Introduction

Since the mid-Nineteenth Century, a country's currency has been a symbol of the country's sovereignty. It is used to carry out commerce, to denominate values, and serve as a store of value. However, a currency can be threatened by inflation, exchange rate depreciation, and counterfeiting. In establishing a union, a single new currency will replace the currencies of each of the member countries. Successfully launching the currency depends on creating conditions that prompt the population to accept the new currency as its own. This can be done by creating a currency useful for business, creating demand for the currency through policies that support growth and a strong exchange rate, and building trust that the currency is genuine. This chapter covers the process of creating the physical new currency and defending it against counterfeiting.

The background note covers the usability features of the euro versus other currencies, creation of the euro as a physical currency, technical aspects of the design and printing of the euro, and the process of circulating a new union currency.

B. Currency Usage in Europe and the Future Unions

In considering the development of currencies in future unions, it is critically important to recognize that the conditions to produce, distribute, and use currency differ greatly between Europe and any of the future unions. This section reviews conditions for currency design, production, and use in Europe compared to what is expected to prevail in future unions. It will be seen that the conditions in Europe in general facilitated the acceptance and use of the euro – In future unions, the conditions on the ground, currency usage patterns, and how they interact with currency design, production, and cash management can be expected to be very different. New solutions must be found to best integrate the new currencies into union conditions and needs.

Conditions surrounding introduction of the euro

This section lists key advantages (and some disadvantages) faced when the physical euro was designed, produced and introduced during the 1990's.

- The Euroarea began with many advantages – high income, relative compactness, a large and competent bureaucracy, and high literacy. Europe's high income provided the collective wealth for governments, banks, businesses, and households to easily absorb the costs of transition to a new currency.
- Europe's dense population and compact area provided efficiencies in introducing a new currency.

- Europe's many languages created costs in communicating information about the new currency.
- The Euroarea is part of the larger European Union which handled heavy lifting in terms of setting the overarching legal and regulatory framework and promoting regional integration.
- The Euroarea economy is highly integrated and thus cash flows readily across national boundaries. Likewise, (although there was some fencing into national boundaries) financial institutions can operate freely across national boundaries to support free capital movement within the zone.
- A strong financial infrastructure existed that provided the broad range of financial services, including cash processing. The public had easy access to banks and other formal financial facilities. ATM use was very heavy.
- The economies were highly integrated prior to the union start-up due to application of "convergence criteria", which minimized prospects of disruptions due to introduction of the new currency.
- The deutsche mark was the lead currency and was held for safekeeping or speculative purposes throughout the future Euroarea and outside the zone.
- Compactness, travel patterns, and vacations created large intra-zone currency flows, as well as flows outside the zone. In some cases, clear seasonal patterns of flows and return flows could be identified.
- Prior to the Euroarea, currency crises were regular features in Europe, which resulted in some speculative currency holdings.
- Advances in payments technology, including EU-mandated cross-border facilities, changed payments patterns and probably reduced the need for cash holdings.
- E-money was in its infancy and did not have a significant impact on the demand for physical currency. During the past decade, the availability of many alternative payments vehicles in Europe appears to have retarded the penetration of e-money, and thus physical currency usage patterns have not been greatly affected.
- Anticipation of expansion of the Euroarea fostered holdings of euros in potential future members. In some cases, such as Poland, the euro supplanted dollar holdings to a large extent.

- High quality national printing presses and mints existed.
- Counterfeiting was an important, but not overwhelming problem. National programs to deal with counterfeiting were in place and partly successful. (Counterfeiting of the euro has been limited and thus a new version has not had to be introduced.)
- Underground and criminal activity existed, which gave rise to unrecorded cash flows that often favored use of relatively high denomination banknotes.²
- Hoarding existed for various purposes. Demand for very high denomination euro banknotes was strong, much of which may have gone into hoards to replace national currencies (especially the DM), the dollar, and other favored currencies. Demand for high-value notes increased significantly during the financial crisis.
- Cocirculation of non-eurozone currencies was limited.
- The euro existed for three years as a “virtual currency” used for government accounts, bank deposits, financial accounting, statistics, etc.. This transition period allowed banks, businesses, and the public to become familiar with the purchasing power of the euro prior to emission of physical currency.
- A modest upward spike in consumer prices occurred when physical euros were introduced, producing some negative public reactions.
- Conditions described above permitted the introduction of physical euros in a “Big Bang” that replaced national currencies within a short period, which minimized costs and confusion that would have been caused by use of two currencies simultaneously.
- Finally, countries adopting the euro after the start of the union easily adopted it because they were very familiar with it due to tourism and other cross-border flows and already had working stocks.

The long list of conditions above contributed to successful and rapid introduction of the euro. Glitches were minor and the public quickly accepted the new currency and adjusted to it. However, as will be discussed in the next section, many of these conditions are absent in future unions. Many new solutions will need to be found and introduced simultaneously with

² Issuance of €200 and €500 banknotes has been frequently criticized as decisions that facilitated underground transactions. On the positive side of the ledger, the purchase of such large denomination euro banknotes was profitable for the national central banks.

the introduction of the new union currencies and all the changes in economic behavior that will accompany the start-up of a monetary union.

Conditions surrounding currency in future monetary unions

This section looks at issues associated with creation on new currencies in future monetary unions, where conditions differ greatly from those surrounding the euro. There are important implications for the design, production, and use of the new currencies.³

The cash usage conditions of the four monetary unions now being formed differ greatly from those in Europe and indeed often from each other.

- **Income and wealth** – The three African unions include some of the poorest countries in the world, with high illiteracy, inadequate infrastructure, and under-trained and under-staffed bureaucracy. The costs of the transition to a new currency could be a major hurdle for central banks, governments, banks, businesses, and households. The Gulf region is a major exception where ample funds are available in total, but which might not be distributed in ways that can support the union project. In the GCC, subsidies may be possible for communities not able to easily absorb transition costs; subsidies in the other union projects are unlikely.
- **Compactness** – The EAC and GCC are compact and contiguous entities. The SADC and WAMZ areas in contrast are very widely dispersed, and in the case of WAMZ not even contiguous. Reaching rural populations will be an issue in all cases and a major problem for SADC and WAMZ.
- **Languages** – The EAC and GCC have simple language situations: information about the currency can be conveyed in English and Swahili and Arabic and English, respectively. The WAMZ might be able to operate only with English, but French and some native languages might also be considered. The SADC situation is very complex with English, French, Portuguese, and Afrikaans as official languages and with many native languages, some of which are quite widely used.
- **Overarching frameworks** – Each of the planned monetary unions exists within the context of more encompassing economic, political and social organizations. In all cases, institutions are less developed than in the EU and the powers of the regional

³ To take one salient example, E-money has become very important in some future union areas and thus new unions will need to directly consider its relevance to their overall cash policies. This issue is sufficiently important that e-money is discussed in a separate section.

bodies are less than those of the EU – whether the frameworks are sufficient to handle the full range of cash and currency issues remains to be seen. The GCC has deep political interrelationships and *de facto* leadership of Saudi Arabia in some areas could promote policy convergence.

- Economic and Financial Integration – The GCC countries have many economic and financial similarities, and economic convergence is well advanced. Formally, the national currencies can be used interchangeably, but actual cross-border use lags. The EAC has numerous areas of potential economic integration, but much more can be done. Excepting the SADC countries within the existing Common Monetary Area (where currencies trade at par, labor migration is extensive, and commerce flows via South Africa) integration within the SADC and WAMZ is very limited.
- Convergence criteria – All regions have convergence requirements. Convergence in the GCC is well advanced⁴, is incomplete but progressing in the EAC, and a remaining challenge in the other two areas.
- In the new regions, much financial infrastructure remains to be built. For example, payments system development is underway, much supported by international assistance. As new systems will be up to date with international standards, but systems are mostly national oriented and a transition to a regional basis will be needed.
- Public access to banks and other formal financial facilities such as ATMs is good in many areas of the GCC, but limited in rural areas. Access is a major problem in the other regions – a gap being filled by E-money.
- Regarding cocirculation, in the GCC and SADC, the Saudi riyal and South African rand respectively might serve as lead currencies and be held for transactions, safekeeping, or speculative purposes throughout their regions. The Nigerian naira is clearly the dominant currency within its region, reflecting the size of Nigeria's economy within the zone, but it does not penetrate the other economies deeply.
- Intraregional labor travel is extensive in all the African unions, which generates substantial flows of cash across borders.

⁴ See Kamar, B. and S. Ben Naceur. "GCC Monetary Union and the Degree of Macroeconomic Policy Coordination," IMF Working Paper 07/249, International Monetary Fund. 2007.

- E-money will affect future cash requirements and usage patterns. One issue will be whether systems will be privately operated but regulated, or integrated into the official monetary system. Use of debit cards, credit cards, and prepaid cards for goods and services will increase – in some cases they will be in competition with e-money and in other cases will serve different purposes.
- Production of banknotes and coins will be largely outsourced to European or Asian firms, which may increase costs and restrict capacity in comparison to the situation in Europe. A lack of redundancy is also a threat. Banknote printers exist in Nigeria and Kenya, and coins are produced by the South Africa mint. This is much more restricted than in Europe, but it does provide a basis for limited production of the new union currencies. Capacity can be built, both to produce mass quantities of low value banknotes and coins, but also to gradually incorporate high quality production and security features needed to produce top quality high value instruments.
- Counterfeiting will be a problem in all areas, but might be controllable. Contributing to the problem is that lower value banknotes will be heavily used largely outside the formal banking system, which means that they will deteriorate in use and thus security features will be obscured. Poor communications and illiteracy will make it hard to educate the public about currency security features.
- The role of underground and criminal activity affecting use of the new union currencies is unknown. Initially, it is possible that hoards of high denomination banknotes will be in foreign currencies, which would deny new unions of the substantial seignorage income that the countries issuing the euro were able to capture.
- For a variety of reasons, (like the euro) the new union currencies might have initial periods as “virtual currencies” used for government accounts, bank deposits, financial accounting, statistics, etc.. This transition period allowed banks, businesses, and the public to become familiar with the purchasing power of the euro prior to emission of physical currency.
- Conditions in Europe that permitted the introduction of physical euros in a quick “Big Bang” may be absent in future unions that may face limited production capacity, large rural and isolated populations, limited access to formal banking institutions, illiteracy, etc.. Future unions may need to seriously consider gradual introduction of the new currency on a cocirculating basis.
- The underlying real conversion rates of currencies into the new currencies will be less certain than in Europe where currencies were tied (although with some flexibility) to the ECU for long periods, which permitted the European economies to integrate their price structures.

In summary, currencies of future unions potentially face harsher usage conditions, have less resources to bring to bear, and have greater challenges in educating the public about their currencies and introducing it. The future unions can learn much from the European experience, but ultimately can often be expected to move in different directions.

C. Creating the euro

The EMI recognized that creating a new currency would be a long process and work began early. The process from the beginning to circulation of the new currency took about nine years.

Designing euro banknotes and coins

The physical design and production of the new euro banknotes and coins was recognized as a long-term development project. Work began in 1994 with the set up of the “Working Group on Printing and Issuing a European Banknote” (later called the Banknote Working Group - BNWG).

Quality

A decision was made that the euro banknote should be extremely high quality and that banknote production should be continually monitored and improved. This had many advantages – it encouraged acceptance, counterfeiting was discouraged, and use in vending machines and money handling machines was improved.

Development of high quality notes also facilitated the production of banknotes within a union in which most countries produced their own banknotes. Prior to launch of the euro, each country applied its own quality standards and security features. The purchasing power of each unit of national currency differed; denominations varied; and size, color, and design differed. In contrast, the euro would be a common currency produced in multiple sites and the features and quality standards had to be specified in detail and tightly monitored. Thus, strict production standards were needed and the output of each of the printing facilities in different countries was monitored to ensure quality. This quality assurance process was challenging given the tight production schedule of production of euros and massive number of banknotes to be produced – there was little time to recover in the event of errors.

Name

A decision was made that the new currency should be free of national symbols or references and instead capture the spirit of a new continent-wide entity.⁵ The decision reflected an urge to convey the unity of the continent under the new currency and also avoid potential problems using banknotes in an economy other than where they were issued. The name euro was selected because of its applicability in all member countries and because it was not named after any current or historical European currencies.

Visual design

A deliberative, inclusive process was followed to design the new currency.⁶ The BNWG held a competition for design themes for the new currency. It collaborated with a group of central bank experts and external experts and set up a Theme Advisory Group. The Group's terms of reference included evaluating themes that cover the family of seven planned banknotes and ensuring that each theme can provide maximum protection against counterfeiting. The BNWG retained the right to modify or reject any recommendation. The Advisory Group was given 6 months to make recommendations so that the BNWG would have time to reach agreement within a one year time frame.

The Advisory Group was mandated to create themes that symbolize Europe and its unity in a visual presentation, be aware of sensitivities of EU countries that remain outside the euro system, meet legal requirements, and serve as a means of payment acceptable to the public. Moreover, themes had to be broadly acceptable throughout the EU, be legible and widely understood, avoid national or gender bias, and have an aesthetic appearance. Finally, because there would be a period in which the new currency would cocirculate with the national currencies, it would need to be immediately recognized and acceptable to the broad public. The European Union flag and stars were chosen as widely recognized symbols that should be included on the banknote.

The Advisory Group reviewed 18 different themes of which the most favored was "Ages and Styles of Europe", which featured portraits of ordinary Europeans on the obverse and architectural styles on the reverse. The "paired comparison" method, which each of the Group members ranked each pair of themes on various criteria, was used to rank the top ten choice of theme. In 1996, a design competition was held. Entries were solicited for a

⁵ Design of the new euro banknotes began prior to the decision that they should not carry national identification or references. The euro banknotes design included a space to the lower left of the map of Europe where national identification could have been made. However, the first position on each note's serial number is an alphabetic character that indicates the country that issued the banknote, but the public is generally unaware of this.

⁶ See EMI Theme Selection Advisory Group. "Interim Report on the Selection of a Theme for the European Banknote Series" 1994.

common design theme that would run through all denominations of bills. Forty-four entries were submitted, and presented anonymously to a jury of marketing, design, and art history experts, followed by a public consultation. The final design decision was made in 1998, after which the technical production of the banknotes began.

Security features

Parallel to the work on visual design of the banknotes, a great deal of work was needed on the security or anti-counterfeiting features of the banknotes. The sophistication of counterfeiters and the availability of technology capable of producing very high quality reproductions required that multiple security features be built into banknotes. Some security features must be available for use by the public to make routine inspections that the banknote is genuine. Other features are needed by vendors and cash handlers to verify currency for automatic processing. Some features based on sophisticated technologies may be known only to authorities and can be used to as ultimate tests of the authenticity of the currency.

A general rule is that regardless of the precautions taken ultimately counterfeiters can develop passable fake banknotes. However, this may take time, money, and involve risks. Banknote designers must take extra steps to make the counterfeiting process as difficult and costly as possible so that the cost of producing passable counterfeit banknotes is high enough to be discouraging.⁷ Over time, the number of bad notes may gradually increase and it may necessary to introduce a new version of the currency.⁸ New versions provide an opportunity to introduce new security features, which are continually advancing.

Usability features

The EMI investigated the usability features of the currency in great detail, which included aspects such as color, size, feel, and machine acceptability (mechanical or electronic sensing, etc.). The EMI considered usability in terms of usefulness for the conditions that existed in Europe; usability features appropriate for other regions could differ.

Coin-banknote boundary and gap

An important decision affecting currency use is the coin-banknote boundary, which is the where the break is made between the largest value coin and the smallest value banknote. The size of the gap between the largest coin and the smallest bill is also an important variable.

⁷ Counterfeiting is sometimes used as a type of economic warfare to undermine the acceptability of a currency. This practice might continue regardless of steps taken to attempt to make counterfeiting difficult, but it still remains worthwhile to force the counterfeiters to incur high costs.

⁸ Plans are underway to introduce a new version of the euro, but the release date and the features are unknown. The initial internal schedule for release of the new version has been pushed back, partly due to the success of the current euro being difficult to counterfeit.

Globally, the boundary varies considerably. In the United States, for example, the largest coin normally used is the quarter, or twenty-five cent coin, which has low purchasing power. (Fifty cent and one-dollar coins exist, but have very limited circulation.) In contrast, the two-euro coin is widely used and has purchasing power about ten times that of the quarter. The Japanese 500 yen coin has about twenty times the purchasing power of the quarter.

The size of the gap between coins and banknotes also matters. One U.S. dollar banknote is four times the value of the quarter; the 5 euro banknote is 2 and one-half times the value of the 2 euro coin; and the Japanese 1000 yen banknote is twice the value of the 500 yen coin. The banknotes are small multiples of the coins, but have a large range depending on usage patterns and public preferences. If the gap becomes too large, such as setting the smallest banknote to be ten times the size of the largest coin, large amounts of coins need to be carried about for transactions and it is difficult to make change for banknotes. A gap that large could actually inhibit making transactions.

The choice of the boundary depends on the intrinsic character of coins versus banknotes, patterns of use, and public preferences.

- Coins have many advantages for small purchases, including ease in use in vending machines and durability that allows them to be used indefinitely which saves on production costs. On the other hand, they can be heavy and bulky that can make handling difficult. Also, the intrinsic value of the metal in the coin varies based on market prices, and where the intrinsic value exceeds the face value of the coin, they might be hoarded or melted down for the ore value. This could be an important concern due to rising metals prices in recent years. Also, coins are relatively easy to counterfeit. If inflation is rapid, the coins may lose their useful value and will be abandoned. Given this mix of characteristics, authorities may have an urge to make the largest value coin have a relatively large value, but subject to constraints of complaints by the public about having too many coins, expense to money handlers, or increased danger of counterfeiting.
- Banknotes are clearly favored for high-value instruments. They are easily used for large purchases or for storing value, but wear out and high denominations are targets for counterfeiting. Thus, there is a regular cost of replacing worn out banknotes, and a major cost every decade or so to introduce a new version of the currency. Small denomination banknotes have a high turnover that make them subject to wear, damage, and dirtiness, and thus must be frequently replaced at a high cost compared to the face value. Thus, there will be an incentive to make the value of the lowest denomination bank note fairly high.
- The boundary is also affected by the usage patterns in specific economies. For example, in economies with large low-income populations there may be many cash transactions daily, but most of them quite small. Given the constant handling of the

currency, coins have an advantage in terms of durability, but market traders may prefer small value banknotes that are lighter and easier to handle; conversely, if only large value banknotes are available, traders are forced to use coins. In contrast, in Europe and Japan, use of high value coins makes it relative easy to use coins for fairly large retail transactions. In economies where much currency is dispensed in automatic teller machines, banknotes may be used very commonly with coins used primarily for making change.⁹

The coin-banknote gap in the Euroarea has been strongly criticized. At least four countries have requested a one euro banknote, and a majority of the European Parliament has also made this request. These criticisms may grow as more lower income countries in East Europe join the Euroarea. The ECB is seemingly resisting the idea because of the costs involved. In the euro area, the coin-banknote gap affects the legal issuance of the euro, because the ESCB is the legal issuer of euro banknote, but national governments issue euro coins. This affects the balance sheets of the institutions, but more importantly affects the amounts and distribution of seignorage.

Thus, a variety of trade-offs affect the boundary. For unions, the choice of the boundary is especially difficult because the member countries will have differences in income, average purchase size, usage patterns, and preferences. A choice suitable for a large urban population or tourist zone may be inappropriate in another union member country with large, low income rural populations. Use of e-currency could also affect the boundary. In the extreme, the need to set the boundary at a level suitable for all union countries could mean that the boundary and gap are set very low or even eliminated by overlapping one or more coin and banknote sizes.

It can be concluded that the decision of where to set the boundary is important and member countries could often disagree. For example, some lower income countries within the Euroarea have complained that smaller banknotes are needed to fit local usage patterns. One of the important tasks of the banknote design group for the union currency will be to gather information on the range of uses and preferences within the potential union to support the decision about where to set the coin-banknote boundary.

⁹ Press stories indicate that residents of Slovakia were concerned about the need to use very large amounts of euro coins for transactions, reflecting their low income situation and in their view high value of the lower value euro banknote. The lowest value Slovak koruna banknote (20 koruna) prior to the changeover was equal to only 2/3rds of one euro, and thus the lowest value euro banknote (€5) is equivalent to about 150 of the old korunas. That is, the banknote threshold is over seven times higher than previously. (Kubusova, 2009) This type of issue will face new unions with countries with highly varied incomes.

Unit size

The purchasing power of one unit of the union currency needs to be decided. This will provide the nominal base from which all other banknotes and coins will be set. The level needs to be set at a point that avoids heavy use of coins for everyday purchases which is inconvenient for consumers, and also avoids having to use high denomination banknotes for small purchases, which will incur high costs to replace worn-out low value banknotes. There is also some prestige in having a unit currency that has a comparatively high purchasing value compared to other currencies.

Setting the level is particularly difficult if there are wide income differences between union member countries – a comfortable level in one country could be a nuisance in others. Several methods could be used; calculate the unit value for each pre-union currency in terms of a major external currency then look where values cluster, set the unit to be approximately equal to common consumer purchases such as bread or trolley fare, or adopt the unit value of a major currency that will join the union and which is used regionally.

*Text box -----***Surcharges or overprinting of existing currency**

Producing enough new union currency to support the start-up of the union could be difficult. Future unions will not have the extensive own-production facilities found in Europe, but mostly will have to arrange for production from a limited number of international banknote printers. These printers have limited capacity and might not be able to design and produce the entire stock of banknotes for multiple countries within an acceptably short period. (One future union has inquired and was informed that production of the volume of banknotes would take several years.) Production limitations could cause difficulties in the start-up of the union. Also, a rapid exchange of the entire stock of a currency with a new currency is logistically challenging, especially for regions less urbanized and automated than Europe. A “Big Bang” changeover is preferred but might not be feasible everywhere, in which case alternatives should be considered.

One option could be to modify existing banknotes to temporarily serve as the new currency by applying a surcharge stamp, overprint, or other device to existing national banknotes to indicate that they constitute a form of new banknote. For example, an existing national banknote could be stamped with the new union currency value and a hot glued hologram added as a security device to certify that the bank note is genuine redenominated union currency. The surcharged notes should be temporary and be retired when they wear out or when sufficient new union currency is available.

There are advantages and difficulties with this approach. Among advantages are that costs of producing the new currency are spread out, the currency production schedule may be better, modification of the existing banknotes could be relatively inexpensive, existing usable currency is not destroyed, the costs of a single large-scale changeover are reduced, and existing identification and security features used by vending machines and money processing

machines can continue in use. Conversely, there are important disadvantages, such as explaining the concept to the public, possible confusion between the old national currency and the new union currency, having new currency denominations on diverse national currency banknotes might inhibit cross-border use, inability to set the new denominations until several months before the changeover, and dragging out the changeover process and expenses, etc.

End of Text box -----

Legal specification of the banknotes

The ECB copyrighted the euro banknotes to prevent a possible range of misuses. It legally defined the banknotes in 2003, which described characteristic features, including the denominations with size, color, and type of design, the symbol of the European Union, the name euro in the Roman and Greek alphabets, the initials “ECB” in all relevant variants, the copyright symbol ©, and the signature of the ECB President.

The copyrighting and legal specification tightened ECB control over the banknotes and allowed it to better regulate its use, intervene against bad practices, and pursue civil complaints against counterfeiters if criminal evidence is lacking.

D. Production of Euro Banknotes and Coins

Printing facilities

A key decision regarding printing was to use existing printing facilities to produce the euro. Eleven sites were used, with each site specializing in production of a limited number of denominations. Concentrating production in a limited number of centers made controls easier, helped coordinate production, helped ensure quality, was more secure, and helped keep costs down because of efficiencies of scale. These advantages were needed to produce the needed number of banknotes under a tight production schedule.

Printing was complicated because tolerance standards were set higher than usual. For example, in mid-2000, the ECB found that €100 banknotes printed in one of the national printing centers had a slight discrepancy in one of the security features, a slight difference in color of one feature that affected millions of banknotes. The ECB issued a press release stating that no deviation from quality standards would be tolerated and therefore the banknotes would not be put into circulation. However, the problem was corrected and the banknotes were later reprinted to bring them up to quality and were allowed to be put into circulation.¹⁰

¹⁰ ECB. “Production of the Euro 100 banknotes”. Press Release. July 11, 2000.

In contrast to the EMU where many countries had their own high-quality printing presses and mints and it was politically necessary to use the national printing operations and mints, future unions will have few or no facilities of their own. Instead, most countries in future unions contract with international printing companies or other national printers and mints to produce their currencies. A key decision for future unions will be whether they will continue to rely on facilities outside the union or attempt to develop their own capacity. Given the technical sophistication of modern currency printing and minting this would require a long-term developmental effort.

Production of the currency

Following the design process, described above, final designs and technical specifications for the euro were set in February 1998, almost four years prior to circulation of the currency. Production of the printing materials began, including creating dies, films, holograms, and software files, based on manufacturing of printing plates from a single source. Arrangements were made in parallel to obtain raw materials and security devices. Materials were needed to be continuously available and multiple sources were sought to avoid potential bottlenecks. Forty different suppliers of raw materials were involved.

By September 1998, materials were gathered for test printing of several million banknotes under standard operating conditions. This test established the flow and quality of raw materials, tested the quality management system, and allowed examination of the output.

The initial production phase rested on efforts of the national central banks, applying the principle of subsidiarity. It also recognized that many of the countries would continue to use their own national printing operations. Each country was responsible for producing or obtaining in own stock for the launch of the union. Banknotes could be obtained from other countries, or countries could pool efforts. The ECB indicated that the initial production should be 13 billion banknotes, representing about €600 billion in value.¹¹

In 2001, this production model was altered to permit decentralized production, but with pooling of operations. Each national printing office would handle no more than two denominations. This change permitted savings due to economies of scale, and also improved quality controls by reducing the number of production sites. The allocation of production was made by the ECB.

¹¹ Estimates of the production run in total and by denomination depended on calculations to convert the stocks of national currencies into a common measure of value, which was possible because of the existence of the European Monetary Unit (EMU) (which provided conversion rates from national currencies into a common value) and an implicit assumption that the euro would be set to be equal to one EMU. The setting of the euro at par with the EMU was not formally agreed until just before the start of the union, but a rate at par or near to it had to be in mind well before then in order to produce the stock of banknotes and coins prior to the start of the union. Neither of these conditions will necessarily hold for future unions.

After the initial launch, the total volume to be printed is decided by the ECB, based on outstanding stock, the estimated amounts for replacement, estimated growth in circulation (including flows outside the Euroarea), and the need to stocks to accommodate seasonal movements and all other demands. An Eurosystem Strategic Stock (ESS) was also set up to cover exceptional demand or interruptions in supply. The ESS covers 30 percent of the total value of euros in circulation, and 20 percent of the low-value denominations.

Once printed, the banknotes are sold to other NCBs, as needed, with the financing arranged directly between the banks involved.

As an example of the production schedule and allocation of production for euros, Table ___ shows the approved allocation of the production of euro banknotes for 2009.¹² The schedule was announced in May 2008, and thus presses had 8 months to gather materials and adjust production to the levels for the upcoming year.

Table 1: Euro banknote production in 2009

Denomination	Quantity (millions of banknotes)	Value (€million)	Producing Countries
€5	930.00	€4,650	France; Netherlands
€10	1,170.00	€11,700	Germany, Greece, France, Austria
€20	4,228.28	€84,565	Cyprus, Estonia, France, Germany, Ireland, Greece, Luxembourg, Malta, Netherlands, Portugal, Slovenia, Finland
€50	2,700.00	€135,000	Belgium, Germany, Spain, Italy
€100	700.00	€70,000	Italy, Austria
€200	none	n.a.	n.a.
€500	none	n.a.	n.a.
Total	9,728.28	€305,915.60	

The current system is based on an allocation to existing presses run by national authorities. At least two presses are used for each denomination for back-up.

¹² Note the relatively limited production of €5 and €10 banknotes, despite the likelihood that they will be heavily used and thus will wear out quickly. This might reflect some substitution of coins for smaller banknotes.

Future unions will need to make decisions on who will serve as printer and the production schedules. Existing presses and mints should be used if available, with due consideration for guaranteeing the output quality of each facility. If the region has limited or no facilities, an option is to recognize that banknote and coin production will be ongoing functions of the union, and that production runs will be much larger than under preunion conditions, and thus build production capacity within the region. Initial work could be with small value banknotes or with a few coins. This could save money and help build local expertise and capacity.

A final note regarding printing is that the euro banknotes each carry a code that identifies the printer, the printing plate, and the individual locations on each production plate. If one of the plate locations is discovered to be defective, it is possible to delete those banknotes from production runs. It is recommended that new unions follow this practice.

E. Converting National Currencies into the Euro

An important issue in creating a new union currency is setting the rates to use to convert national currencies into the new union currency. This rate will be used for converting currency and currency values in all forms into the new union currency. For example, physical Belgian francs were converted into euro, but also every contract denominated in the franc had to be converted over to euros. Setting the rate at the wrong level can have serious consequences for the country and the union. This section covers the method used for setting the conversion rates for the euro.

The experience of the European Monetary Union (EMU) described below presents one model but *a priori* it is unclear how much guidance it can provide to other regions. In essence, the European system was based on decades' long experimentation with the European Currency Unit (ECU) that allowed market forces (operating within certain bounds and with occasional resettings of individual rates) to affect the evolution of exchange rates, leading up to the euro. Future unions may not have the inclination or luxury to emulate the method used in Europe. Appendix I discusses an econometric method to set the conversion rates that may have advantages for new unions, and in fact has been applied to the proposed GCC union. (Krueger, Kamar, and Carlotti, 2009)

The conversion problem

The creation of a currency union involves the creation of a new currency for the union that becomes the legal currency for all member countries. All preexisting national currencies are absorbed into the new union currency. With a single currency for all member countries there will be only one monetary policy and only one exchange rate for the union.

A critical step in the process is converting the individual national currencies into the new union currency. A conversion rate must be set to redeem the national currencies for the union currency and to redenominate all values expressed in the old national currencies into the value of the union currency.

- Redemption of national currencies for the union currency involves turning in the national currency at banks or other exchange stations in exchange for the new union currency. A rate of exchange must be agreed that applies to all residents. For example, (in a union of countries known for their trees) citizens of Alder turn in 2 of their Alder dollars to receive one unit on the union currency; whereas citizens of Banyan pay 3 Banyan dinars to receive one unit. The conversion rates are thus; Alder: 2 to 1, and Banyan: 3 to 1.
- Redenomination of currency values must also occur at the same rate. Alder must redenominate all Alder dollar values used on boxes of cereal, contracts, deeds, wage agreements, tax schedules, securities, and so on into the new union currency, using the 2 to 1 rate. Banyan must do the same using a rate of 3 to 1.
- The rate for each currency must be set and must apply to all relevant transactions. It should be set by law so that all parties involved know the value they are receiving in exchange for the value they are giving up.

It matters what conversion rates are used.

- The rate should be set so that the conversion itself does not create gains or losses in value for any party involved. For example, the relative value of domestic versus cross-border investments prior to the conversion should not change post conversion.
- The conversion establishes relative prices of goods and services between member countries of the union, which affects competitiveness. For example, a shirt valued originally at 20 Alder dollars would be valued at 10 units of the union currency, the price at which a consumer in Banyan could buy it. However, if the conversion value for Alder was set at a lower value of 2.5 to 1, the same shirt would then be valued at 8 units, making it cheaper for Banyan to purchase. This directly affects the competitiveness of goods and services between the two economies.¹³
- The conversion rate affects the relative wealth of the economies and estimates of the size of the economies. Suppose, for example, that at conversion rates of 2 to 1 and 3 to 1 two citizens of Alder and Banyan, respectively, find that they have equal net worths in the union. But if the rate for Alder is 2.5 to 1, the citizen of Alder discovers he is 20 percent less wealthy than the fellow in Banyan. Applied to macroeconomic statistics, the conversion rate will determine whether Alder and Banyan are estimated to have the same size GDP or GDPs that are 20 percent different. Applied to financial accounting, the conversion rates similarly affect the value of consolidated cross border investments. Another important area affected is the value of government debt

¹³ Prior to the start-up of the European Monetary Union, there was widespread concern that a country might suddenly devalue its currency just prior to the launch of the union in order to gain competitive advantages. (De Grauwe; 1997 pp.156-7) In fact, one of the first acts of the European Central Bank when set up in May 1998 was to set the members' bilateral rates at that point to prevent such competitive changes prior to the Union's formal launch on January 1, 1999.

converted into the new union currency. The list can be extended to numerous other important issues, such as the sustainability of external debt positions.

Finally, the conversion rates should not create shocks between the member economies of the union. Countries within unions will have long-standing cross-border trade and investment relationships. They are adjusted to a certain configuration of exchange rates – if a conversion rate is set out of line with the configuration it could unfairly advantage or disadvantage countries, and trade and investment relations for the entire union could be affected.

Thus, it can be seen that it may matter a great deal what conversion rates are used. A method needs to be found that is methodologically robust and can deliver estimates of conversion values that all parties involved find equitable. Serious imbalances can result if the rate is not set in line with economic fundamentals.

The method used in creating the euro is described immediately below. It is a solid option based on the operation of market forces to build the configuration of the exchange rates between the pre-union countries into the macroeconomic environment of all the potential union members, and thus the conversion of that configuration into the union is straightforward and not disruptive. However, new unions will not face the same market conditions as in Europe and may choose other methods. Appendix I covers an alternative econometric-based method that can be applied to other unions.

Setting the irrevocable conversion rates for the euro

A rate was needed to convert each of the national currencies into the euro. For example, Portuguese escudos had to be converted into euros. The rate for the conversion had to be chosen in ways that did not distort economic conditions or affect the relationships between the economies within the union. Moreover, well-established and clear procedures were needed so that the process could proceed smoothly, procedures were harmonized for both creditors and debtors, artificial gains and losses were not created, disputes over values would not arise, and values were legally enforceable.

Multiple channels for conversion existed that had to be covered by the rules. To cite only a few examples; physical euro banknotes could be purchased with the national currency; banks could redenominate deposit accounts into euros and pay physical euros when withdrawals were made; securities and contracts written in terms of the national currency had to be converted into euros without replacing the millions of contracts involved; and banks, corporations, and governments needed to convert their full set of accounts into euros. Moreover, the conversions had to apply to instruments held outside the union, or which involved contracts with nonresidents of the union. All these steps required legal rules that established the timing, the mandatory nature of the conversions, the legal status of the euro as the successor for the national currencies in all contexts, and described the procedures for the conversion.

Procedures for the conversion, as set by the EU finance members and the governors of the central banks follow.¹⁴

- In 1997, the EU Council passed a Regulation (hence applicable to all EU countries) on aspects of the introduction of the euro.
 - Conversion rates were officially expressed as 6 significant digits for all purposes. This meant that the euro value of all converted currencies would be the same for all parties (creditor and debtor) and there would be no gains or losses because of rounding, truncation, or additional precision.
 - Inverse rates should not be used because there is implied rounding that creates inaccuracies.
 - When converting between two national currencies (for example, in a contract between France and Spain), the amounts in one currency should be converted into the euro equivalent and not rounded to less than three decimals, and then converted from euros into the other currency.
 - Rules for rounding conversions into euro were to round up to the nearest cent when the result is exactly half way or above, and round down otherwise. Rounding for conversions from the euro to national currency applies this same rule for the lowest sub-unit of each currency, such as the pfennig for the Deutsche mark.
- In May 1998, the list of initial members of the monetary union was announced, which established which currencies would be converted. Until this announcement, work on conversion could not really proceed and banks, corporations, and the public would not commit substantial resources to the conversion process. After this announcement, the conversion became mandatory for the countries adopting the euro and major steps were introduced to make the changeover. This permitted only a short time to undertake all the steps needed to introduce the new currency, which resulted in the public and businesses incurring large costs in the short time before the union was created.

¹⁴ The steps described above were set out in Council Regulation 1103/97 on June 17, 1997; a September 1997 meeting of EU finance ministers and central bank governors that agreed on how to implement the Regulation; and the Joint Communiqué of Finance Ministers and Central Bank Governors of the Member States adopting the euro on May 2, 1998.

At the time of the 1997 agreement on procedures in September 1997, the list of member countries and the conversion rates were unknown; In contrast, the 1998 Communiqué involved only the countries that would adopt the euro on January 1, 1999.

- The procedures to set the bilateral conversion rates were announced at the same time. The conversion rate was based on the bilateral central value of each participating currency in the ECU basket. All countries joining the euro area agreed to this procedure.¹⁵
- A Joint Communiqué was published that included a parity grid (shown in Appendix II) that provided the irrevocable conversion rate for each pair of currencies within the union – for example, the rate between the Spanish peseta and Finish markka was irrevocably set at 3.57345 pesetas per markka. The most widely used market rates were used for each currency pair. This step established the interrelationships between all the currencies that would be converted into the euro, but did not establish the external rates for the euro.
- However, between May 1998 and January 1, 1999, national currencies continued in use as legal tender and their value against external currencies fluctuated as a result of movements of the ECU against external currencies.¹⁶
- The bilateral central rates against the ECU had a long history, which had two important effects.
 - Over time, they had moved to be compatible with the underlying economy. Thus, their adoption would not influence the macroeconomic conditions in each economy.
 - They were essentially market rates. They reflected the consequences of market dynamics and the possibility of overt manipulation of the rates prior to entering the euro was removed.
- The central bank governors announced that they intended to ensure, through intervention if necessary, the convergence between the announced conversion rates and the market rates on December 31, 1998. That is, the bilateral cross rates calculated from each currency's U.S. dollar bilateral rates will be equal to the pre-announced bilateral central rates, on a six-digit basis.

¹⁵ By agreeing on this procedure, the countries could not suddenly change their exchange rates prior to the start of the union in order to gain economic advantages. A number of studies had questioned whether countries would unilaterally adjust their exchange rates in order to unfairly gain advantages over their neighbors. This pre-agreed stability is a good precedent for future unions.

¹⁶ The ECU basket included currencies of countries that were not in the initial group of countries adopting the euro (Denmark, Greece, Sweden, and the United Kingdom). Thus, the external value of the ECU against nonEU currencies continued to fluctuate somewhat independently of the values of the currencies of the entering currencies. Thus, the actual conversion values against external currencies could not be set until the end of 1998, on the close of the day before the introduction of the euro. However, the currencies of the future euro area currencies comprised an 84 percent share of the ECU basket, which limited the size of such fluctuations.

- On January 1, 1999 the ECU was replaced by the euro on a one-to-one basis. Legal language stipulated that every reference to the ECU should be placed by a reference to the euro on a one-to-one basis. Although the external exchange value of the ECU was unknown, the exchange rates were highly stable prior to the announcement and thus approximate conversions factors could be informally calculated, which helped the public in its preparations.¹⁷
- The euro conversion rates were activated and mandatory on January 1, 1999. All transactions and accounts had to be denominated into euros from that point on. On January 1, 1999, the irrevocable conversion factors established;
 - The conversion rate used to substitute the euro for the national currencies, and
 - The conversion rate between the currencies of the euro member countries, which were the bilateral central rates published in the parity grid in May 1998.

-----text box

The strange case of the Italian lira

The lira left the ERM in September 1992, when a wave of speculation led to a 7% devaluation. Although the political commitment to the exchange rate target was strong, markets viewed the central rate of 760 lira/DM as unsustainable given the Italian employment situation and inflation rate. The lira/DM rate fell as far as 1239 per DM before recovering to around 1000 per DM by late 1996.

Membership in the ERM for at least two years was a requirement for entry into the Euroarea, which was scheduled to begin on January 1, 1999. The Maastricht Treaty requires "*the observance of the normal fluctuation margins provided for by the exchange-rate mechanism of the European Monetary System, for at least two years, without devaluing against the currency of any other Member State.*" Therefore, the lira had to re-enter the ERM before the end of 1996 to be eligible to adopt the euro.

Negotiations opened on the rate at which the lira should rejoin the ERM. The lira traded at about 996 per DM at the time. The Italian government and manufacturers sought a rate above 1000 per DM, but the Bundesbank sought a rate as low as 970 per DM. Germany and France

¹⁷ Several factors contributed to stability in the rates between the exchange rates for currencies entering the euro area. Countries accepted into the union still had to adhere to the formal convergence criteria, and they remained part of the European Monetary System, which was intended to support such stability. Also, the ECB was created in May 1998 and took over the functions of coordination of monetary and exchange rate policies, which provided a mechanism for supporting exchange stability. Finally, interest rates were converging during the run-up to the union, which tended to remove the influence of interest rate differentials in driving exchange rate changes. These factors resulted in little change in the exchange value of ECU during the interim period between the May 1998 announcement and the introduction of the euro in January 1999.

reported fought for a rate to reverse the Italian export advantage gained when the lira depreciated. A rate of 990 per DM was agreed and the Italian lira was readmitted in November 1996.

Political considerations were strong in setting the conversion rate for the lira. The Italian case stands as a sharp exception to the reliance of other countries on the ERM central rates as a reliable, market-based, and time-tested basis for setting the conversion rate.

(New York Times. *Italian lira re-admitted into European Union*. November 25-26, 1996.)

End of text box-----

Text box -----

Setting the irrevocable conversion rates for the euro on December 31, 1998

The irrevocable conversion rates were set based on market rates on December 31, 1998. The method followed the existing method used for calculating the value of the ECU, which was called the “concertation procedure”.

At 11:30 a.m., December 31, 1998, each NCB recorded the exchange value of its currency against the U.S. dollar and communicated the value to the other NCBs. Cross rates were calculated – for example, the peseta/markka cross rate is calculated as (peseta/dollar) / (markkaa/dollar). Each rate was based on the most liquid markets available and was within the market bid-ask spread, but was not necessarily centered within the spread.

The bilateral rates obtained by crossing the U.S. rates were set equal through market intervention to the bilateral central rates announced in May 1998, to six significant digits.

The rates were used to calculate the exchange rate of the official ECU. The overall dollar/ECU exchange rate is calculated as the sum of the U.S. dollar equivalents of the national currency shares within the ECU. The final step is to multiply each of the bilateral U.S. dollar exchange rates by the overall dollar/ECU exchange rate to obtain the irrevocable conversion rate into for each currency into euro.

A special meeting of the European Council on December 31 formally adopted the rates.

Based on this procedure, the irrevocable conversion rates for the eleven countries adopting the euro in 1999 were;

Currency	Six-digit conversion rate
Austrian schilling	13.7603 per euro
Belgian franc	40.3399 “
Dutch guilder	2.20371 “
Finnish markka	5.94573 “
French franc	6.55957 “

German mark	1.95583	“
Irish pound	.787564	“
Italian lira	1936.27	“
Luxembourg franc	40.3399	“
Portugese escuda	200.482	“
Spanish peseta	166.386	“

Countries adopting the euro later used the same procedures, based on the information needed to set the central rate for their currencies within the EMS II. Thus, for example, the rate for Greece was set based on market rates on December 31, 2000 at 340.750 drachma per euro.

End of text box -----

F. Currency Demand and Usage

Currency usage patterns

The patterns of usage of banknotes and coins will influence the features of the union currency and its look and feel. The currency must effectively serve many different uses as a means of transactions and store of value. The designers of a new currency need to have a good sense of currency usage patterns within the union so that the new currency can meet those purposes. For example, in the Euroarea 70 percent of the banknotes are put into circulation through ATMs. (Solans 2000) This meant that euro banknotes had to have denominations and features suitable for machine processing. It also highlighted the need to maintain high standards for the quality of banknotes in circulation so that cash handling machines can process them. In contrast, in low income regions with limited commercial banking networks banknotes will mostly be processed by hand and the stock of banknotes may consist largely of lower value denominations that must be especially durable in order to circulate for long periods outside of the banking system. For another example, in some countries very high denomination banknotes are used as a store of wealth or to make high value transactions.

As discussed in the first pages of this note, the pattern of usage in the Euroarea reflected the high income of the region, its compactness, and dense and well-developed commercial banking system. Different conditions will prevail in most other regions which may lead to different conclusions about the design of the currency.

The currency usage patterns of individual countries within a union may differ. Information must be collected on usage patterns and currency needs in the countries so that the currency serves the diverse economies of the member countries. For example, the currency might need to provide information in multiple languages. Early in the process, the union's currency committee will need to collect such information from members, such as

- Total stocks in each country
- Denominations, and volume of each
- Life of bills
- Coin usage patterns
- Banknote usage patterns, including border and international uses.

Based on such information, the currency committee will need to make specific decisions about the usage patterns affect the physical currency and how the currency will be managed. The usage pattern of the union currency will differ from the patterns in any member country before the union – an obvious example is that holdings of currency stocks for cross-border transactions will no longer be needed. Also, new seasonal patterns will emerge requiring transfer of currency stocks across borders to meet seasonal demand changes.

Stock of union currency

Central banks must supply currency where and when demanded. This section covers several aspects of this process; assessing the total demand for the currency and its distribution between countries; seasonal changes in the demand for currency; the movement of currency across national borders within a union; and demand for the currency outside the union.

A key task of a new union's currency policy is estimating the total stock of currency that will circulate within the union. This of course is approximate because the public will adjust holdings upward or downward to meet needs and conditions, but a reasonably accurate estimate must be made of the total internal demand for currency, with some margin also for flows of the currency outside the union.

The total stock of currency can be estimated by taking the total currency stock in each member country and converting it into the union currency equivalent by using approximate conversion factors from each national currency into the union currency. In cases where the preunion currencies are not pegged to an external anchor currency, the conversion factor is not known and must be estimated. In Europe, the ECU and the individual currency parity bands provided the conversion values. However, some of the future unions do not currently have a set of conversion rates. (See Appendix I on methods to estimate conversion values.) Also, ultimate membership of the union might not be set. If the weighting of the conversion factors is based on the future actual membership in the union, this could potentially cause large errors if membership is decided close to the actual start of the union. Thus, the total

stock of currency that must be produced must be estimated, and a substantial extra reserve should be produced because of the uncertainty.¹⁸

The Eroarea set a target for banknote production of 763 billion euro. This total is to provide an ample supply to be taken up by the public (and thus part of the money stock) and reserve stocks distributed throughout the union to meet unexpected demand and normal growth during the first months of the union.

Thus, an early task of future unions will be to estimate the total demand for the future union currency, perhaps up to 3 years before the union start-up date so that the total print order for banknotes and coins can be completed by the time the union starts. The information on the total expected demand for currency will also be needed for analysis of currency demand for the future union as part of the monetary policy process of the union.

Stock of union currency by denomination

As described immediately above, production of the union currency must be sufficient to meet demand for the full union, with additional reserve stocks. A more complex process is used to set the quantity for each denomination of banknote and coin. .

- The first step is to set the steps for denominations. For example, in the EMU the sequence is 1 – 2 – 5. One cent, two cents, five cents; Ten cents, twenty cents, fifty cents; One euro, two euros, 5 euros; Ten euros, twenty euros, fifty euros; 100 euros, 200 euros, 500 euros.¹⁹ The table below shows for each denomination the number produced and total value in 1998.²⁰ In contrast, in the United States coins effectively

¹⁸ For example, a year before the start of the EMU it was unknown whether the large countries of Spain and Italy would qualify for membership. However, currency had to be produced for them because it was not possible to print enough banknotes and mint coins for their needs in the short time after they were qualified for membership. Had they not qualified, there would have been a very large and expensive hoard of unneeded banknotes and coins, which would have also created storage and security problems.

¹⁹ An important policy issue is whether the top end of the denomination ladder should be truncated because of concerns that high denomination notes could be used in the underground economy, for tax evasion, or criminal activity. For example, the United States caps its denominations at \$100 because of such concerns. (Depending on exchange rates, the €500 banknotes have been valued as high as eight times larger.) The large denomination euro banknotes were also criticized on these grounds. As shown in the table above, for whatever reasons the demand for €500 and €200 euro banknotes has been very large and has pulled in €300 billion in assets into the Eurosystem, which is an important fiscal plus for the member countries.

²⁰ Note that the €200 banknote is relatively little used relative to the €100 and €500 banknotes. It might be economical to eliminate future production of the €200 banknote and let people needing large value notes to make do with €100 and €500 banknotes.

jump from the 10-cent dime to the 25-cent quarter to the one dollar banknote – in effect, the quarter takes the place of both the euro 20-cent coin and 50-cent coin.²¹

- In new unions, the ladder of denominations should be set to allow for small value transactions in low income areas and also provide large value banknotes suitable for large purchases or for stores of value. Setting the steps in the ladder too far apart will create problems with transactions; setting them too close together is wasteful and will create problems for businesses and consumers in handling too many different denominations.

Table 2 - Number and value of euros, by denomination

Euro quantities (millions), outstanding amounts, end of period 2008								
	Total	€500	€200	€100	€50	€20	€10	€5
	13116	530	170	1381	4912	2618	2030	1476
Euro value (EUR billions), outstanding amounts, end of period								
	Total	€500	€200	€100	€50	€20	€10	€5
	763	265	34	138	246	52	20	7

- The second stage is to estimate the demand for each denomination coin or banknote. This involves redenominating into a common base the value of each coin and banknote in circulation in all potential union countries then slotting the resultant values into the closest denomination. Values will be approximate because the final conversions rates are unknown and values may not obviously fall into the common denominations. For example, a coin from a member country may be converted into a value of 34 cents, which does not easily slot into a 20-cent coin, 25-cent coin, or a 50-cent coin. (If this process results in a clustering of values that do not easily correspond to the common denomination ladder, an adjustment to the ladder may be needed.)
- The third step is to estimate the total amount needed for each denomination by translating the total amount for each banknote or coin for all countries into the common ladder. The total for all countries for each denomination coin or bill will give a first estimate of the total amount of the union currency for each denomination that should be produced.

²¹ A fifty-cent coin exists in the United States, but is little used.

- The estimate produced as the sum of currencies of each country translated to a common value may not reflect the actual conditions that will develop in the union. Initial union demand may fluctuate while the public and businesses adjust to the new market situation. For example, prior to the union, some Euroarea countries did not circulate large value banknotes, and hence their potential demand for €200 and €500 banknotes was not considered in the calculation of demand by denomination above. The demand for large value banknotes has grown strongly every year since 2002. The demand for € 500 banknotes, for example, has grown about five times its initial circulation in 2002, while €100 banknotes have more than tripled from its initial level of circulation. This large increase in demand may represent new behavior of households to hold previously unavailable large value banknotes, or part of the demand increase may reflect holdings outside the euro area as foreigners purchase euro banknotes as a form of secure savings.
- Foreign demand may be difficult to estimate. Before the union started, the amount of each country's currency held out of the country may be limited by small markets for each individual country's currency and greater risk in holding individual country currency. In contrast, the demand for the union currency could be greater than the sum of demand for individual country currencies because of wider usefulness and confidence in the strength of the union currency.

Currency demand

Monitoring currency demand

Central banks within a union are obligated to provide businesses and the public with sufficient currency and the right denomination to meet demands for transactions and holdings. This is a greater burden in a union than in single countries because distances to obtain currency may be greater, different institutions may be involved in different countries, accounting standards may differ between countries, and there may be extra formalities in crossing borders. Whereas in an individual country it may be possible to assume that cash supply will easily adjust to changes in demand, this assumption may not hold within unions and therefore the union may need to take greater responsibility to monitor demand and anticipate large movements of currency within the union.

A statistical system is needed to track changes in currency supply and demand, in total and by denomination, into national offices of the union system. Potentially, tracking may need to be done on a sub-national level. This will allow for the system to anticipate demand and stock currency where needed and to efficiently move currency where it is most needed. In the initial years of a union there will be little experience regarding cross-border currency movements to draw on. Thus, there is need for large reserve stocks distributed throughout the region and to have reporting systems that can rapidly identify sudden shifts in demand or build-ups of excess supply.

Cross-border cash operations

Shifts in demand can take the form of large scale currency movements between union countries. For example, in tourist areas prior to peak periods large quantities of coins may need to be imported in order to make change for customers, but following the vacation period there may be a massive oversupply of coins. NCBs may need to facilitate large movements of coins and banknotes.

The ECB found difficulties in large-scale cross-border currency movements that in 2007 led it to take a number of steps to improve cash management. It published a “roadmap” to gradually foster more convergence in cash operations of NCBs and the services they offer to the public and businesses. The roadmap recognized that different economic and geographic conditions required that operations be adjustable to reflect local conditions.

Key elements of the roadmap are that banks can get access of services of NCBs in other countries, common packaging standards are used (which implies investment in new machinery), common data communications are used, and greater convergence on opening hours. The ECB found that a key problem was different rules related to cash transport, especially related to the use of guns, but this dealt with matters outside the Eurosystem’s area of competence and could not be covered in ECB rules.

Demand outside the union

The union currency is also be used outside the union countries. Part may reflect the need for working balances at businesses or small amounts carried out by travelers. Part may also reflect transactions or savings use of the currency in other countries.

- Transactions use means that the union currency is used to carry out business in countries outside the union. This could occur in countries bordering on the union where economic links with union countries are strong and it becomes convenient to use the union currency for a range of purposes. In other cases, for a variety of reasons (including failure to establish a credible monetary regime) countries may use a foreign currency as a circulating currency alongside the national currency, or in some cases as a replacement for a national currency. Both these cases are called “Cocirculation”, the use of two or more physical currencies in a country.^{22 23} Both cross-border use and cocirculation use

²² Cocirculation is a special case of the phenomena called “dollarization”. However, dollarization is often used to describe cases where bank deposit accounts and loans are denominated in a foreign currency, but where the physical foreign currency is not used in transactions. The term is also used anomalously to describe situations where the dollar is not involved, or even more bizarrely to cases such as in Eastern Europe where the cocirculating dollar is being replaced by the euro – a case in which the term “euroization” is also used. (Krueger and Ha; 1995).

can result in significant increases in demand for the union banknotes and coins. This demand may have regular seasonal patterns, as has been shown for euros, which raises issues of the management of regular currency outflows and inflows.

- The union currency might also be used as a store of value in countries with unstable monetary conditions, where there is distrust of the formal banking system, as speculation that the exchange value of the union currency will rise, or as a means to hide wealth. The steady increase in demand for €100 and €500 may partly reflect these types of demand. Moreover, the sharp step-up in demand for these banknotes in late 2008 during the financial markets crisis suggests that there probably is hoarding demand for the large denomination banknotes.
- Because currency can easily cross borders anonymously, it may be unclear how to separate the demand from outside the union from the demand within the union. However, a variety of accounting, statistical, and econometric methods have been developed to do so. See Krueger and Ha (1995) and the subsequent literature on measuring cocirculation for more information on such methods.

Pre-ins

A special case of the demand for currency outside the union occurs for countries that hope to join the union in the future. The government and public may actively seek to acquire the union banknotes and use them in transactions and savings in anticipation of adoption of the currency as the sole legal tender. The accumulation of these currency balances will also make the ultimate transition to the new currency easier because of familiarity with the features of the union currency, preexisting partial infrastructure to handle the new currency, and a preexisting stock of currency that minimizes the logistics of the changeover. This could be an important additional demand for the union currency. Often the union and the pre-in countries will have a number of arrangements that help in estimating the amount of union currency in cocirculation.

Unilateral adoption of a union currency

A special case that arises from the global financial turmoil is the possibility that countries outside a union unilaterally adopt the union currency. Ultimately, this strategy was not pursued, but during the financial crisis, the strategy was suggested for small Euroarea candidate countries as a way to benefit from the exchange rate stability of the euro. (Financial Times; 2009) This obviously could affect currency demand for the euro. The union may be

²³ A number of policy situations can arise in cocirculation situations, possibly including sharing of seignorage, logistics of currency supply and retirement, and counterfeiting. The ECB monitors use of the euro outside the Euroarea and EU, and has also set up arrangements called the Extended Custodial Inventory (ECI) scheme with banks in several international centers such as Hong Kong for handling of euro banknotes in the region.

faced with a number of issues of whether or how it should support such unilateral adoption of its currency, which might well violate membership rules.

This issue came to the fore during the financial crisis when it was suggested that several EMU candidate countries would benefit from early adoption of the euro without waiting for formal approval. The economy adopting the euro would experience greater financial stability because of the exchange stability, the depth of euro markets, and access to euro interest rates. Also, organized but unofficial adoption of the euro could be less disruptive than unorganized use of the euro. (See Krueger and Enoch, 2009)

Conclusions for new unions

New unions need to make estimates of the demand for their banknotes and coins, in total and by denomination. The process will not be exact and much will depend on which countries initially enter the union. Also, reserves of currency should be distributed throughout the union for contingencies, which creates the possibility that the initial printing and minting of the currency will be too large, which is expensive.

This situation could exist regardless of whether the currency is introduced in a “big bang” or as a parallel currency that initially cocirculates with national currencies. The initial production needed in the parallel currency case will be smaller and thus expensive overprintings may be avoided, but it will still be important to have enough currency on hand to meet demand – long-run prospects for the union may be damaged if there was demand for the currency, but insufficient amounts to meet the demand.

Demand for the currency from outside of the union will also need to be considered. The range of uncertainty of course will be larger.

Currency retirement

Individual banknotes and coins damaged in circulation must eventually be pulled out of circulation and replaced. Banknotes wear out much faster than coins, some of which may survive indefinitely. Arrangements must be made to replace worn out or damaged banknotes and coins, but banknotes are by far the bigger issue.

Good statistics on the average lifespan of each denomination banknote will be needed to plan production schedules and deliver the currency where needed. The information should be broken down by country or region because usage and damage patterns may differ. For example, damage to banknotes may be greater in humid or rainy regions.

The retirement of each denomination banknote may depend on the size of its monetary value. Low value instruments may be frequently traded hand-to-hand and suffer wear as a result, but they may not be machine processed and there is little danger of counterfeiting. In these circumstances, worn and dirty money may not be a major issue. However, for denominations

that are machine processed or are used as stores of value the quality of the notes may be more important – machine processing requires high quality banknotes and the danger of counterfeiting makes it important that high value banknotes be in good condition to allow inspection of security features. For example, in the early 1990's in Russia cocirculating U.S. \$100 bills were rejected or deeply discounted by the public if there was very minor damage to the bills because of fear that the damage was hiding evidence of counterfeiting.

The ECB made a decision that the circulating euro banknotes should be of very high quality and that damaged currency should be removed from circulation. Specific standards were needed to assess the degree of damage requiring removal in order to maintain the quality of the bills in circulation and to avoid situations where member countries used different standards to withdraw currency. A regulation²⁴ was enacted in 2001 requiring all banks and professional cash handlers to inspect currency received and withdraw it from circulation if there was evidence it was counterfeit or if it was too damaged. Banknotes that are reissued in ATMs must be checked using machines tested and certified by the Eurosystem.

The Framework has the following key features:

- It recognized that national practices differed about which bills could be put into circulation using ATM machines. Some countries required that all notes be sent back to the NCB for inspection and reissuance, while other countries allowed the banks to recycle the currency on their own with various degrees of strictness of oversight.
- The goal is to create a common cash area in which cash is treated equally throughout the union. A common policy for recycling or withdrawal of banknotes can prevent creating competitive distortions.
- Ensure that cash handlers remain diligent to search for counterfeits and help maintain the quality of the banknotes in circulation.
- Despite serving the public purpose of maintaining the quality of the money stock, cash handlers are not paid for any costs for implementing the framework.
- Inspection of banknotes must be done by machines certified by the Eurosystem or by trained personnel. Staff making inspections were provided information on genuine banknotes during 2000 and 2001 as part of the test runs for the euro.
- Banknotes inspected by trained staff cannot be issued using ATMs, but only by hand over the counter.

²⁴ *Recycling of Euro Banknotes: Framework for the detection of counterfeits and fitness sorting by credit institutions and other professional cash handlers.* Council Regulation No. 1338/2001. June 28, 2001.

- The low denomination €5 and €10 notes are subject to high wear and therefore NCBs should regularly supply them to banks and cash handlers in order to maintain the quality of the money stock.
- Suspected counterfeits must be immediately handed to authorities. The account of the presenter of the banknote should not be credited.
- Banknotes that appear genuine but which cannot be fully authenticated because of quality or damage must be presented to the NCB for inspection, but the customer's account may be credited.
- Genuine banknotes unfit for recirculation must be presented to the NCB for replacement; the customer's account is credited.

The standards for rejecting soiled or damaged banknotes are strict. Bills with any of the features listed below must be turned over to a NCB for inspection. It is a criminal offence for the cash handler to put a banknote believed to be counterfeit back in circulation.

- Dirt across the entire banknote.
- Stain covering at least three square millimeters. This is a very small area, but this requirement is in place to prevent counterfeiters from using stains to cover flaws that could identify the banknotes as being counterfeits.
- Graffiti or other markings on the bills.
- De-inking on part or all of the banknote. This might have the appearance of being bleached or washed.
- Mutilation or physical defeat, such as tears, holes, missing parts, or damaged security feature.
- Repaired, taped, or glued notes.

Currency lifespan

Each currency has a limited lifespan. A currency released into the economy typically circulates for only a limited number of years before there is reason to call it in, cease new production, and issue a replacement currency. The new currency becomes the legal tender for the country, and the old currency is retired – sometimes very quickly, sometimes slowly. There are many possible reasons for retirement and replacement of a currency;

- A monetary union is created and old national currencies are retired.

- Counterfeiting of the old currency has become a major problem. New security features are needed.
- The central bank has been reorganized or recapitalized, and the new currency is issued in the name of the new institution.
- Inflation or a financial crisis has destroyed the usefulness and public trust in the old currency, and a replacement is demanded.
- Inflation has increased the need for higher nominal denomination notes.
- Countries merge or break up, or other significant political changes have occurred.
- Requirements for ATMs, cash-handling machines, and vending machines.

Eventually, all currencies must be redesigned and replaced, to incorporate new features that enhance security or usability, and to remove counterfeits from the system. The euro area is currently developing a new series of euro banknotes (called ES2). The schedule for the new series provides an useful summary of the steps and schedule that future unions could follow in creating and issuing their union's currency;

- Approval for the new euro series was made in April 2005, and initially issuance was planned for 2012 at the earliest, a lag of over six years. (ECB 2007e)
- The new euro series will be issued sequentially one denomination at a time. The schedule will be affected by the process of incorporating new security features into the design and by the degree of the pressure from counterfeits. However, the semiannual ECB reports on counterfeiting have not shown evidence of extensive counterfeiting that would force a changeover to the new series, and in fact showed marked decline in 2011 from 2010 levels. (ECB 2011)
- The design work involved extensive consultations with "stakeholders" in the use of euros. Among communities consulted were the European Payments Council, European Security Transport Association, Eurocommerce, consumer associations, and the European Blind Union, the vending machine industry, commercial cash operations centers, and manufacturers of cash operating machinery and sensors. These consultations focused on the usability, functional and technical requirements of stakeholders, and security features of the new banknotes.²⁵

²⁵ The consultations for the euro series II contrasted to the situation for the initial euro. In that case, consultations were held with representatives of the blind, but otherwise the EMI basically simply informed banks and cash handlers about the features of the new currency.

- The design work, development of technical specifications, and the implementation of the production process begins after that.
- Pilot production will test and analyze all processes involved in production. Adjustments will be made as needed
- Large-scale test printing using multiple presses will begin. At least fifteen printers will be accredited to prepare the new euro banknotes, which will make it important to verify the quality and comparability of the results from the different operations.
- The new issues will be issued sequentially and will circulate alongside the old issues. An extensive public education campaign will be used.²⁶
- Old series notes will gradually be withdrawn from circulation and will fall to low levels of usage. At some point, the ECB will inform the public with ample warning that there will be a date when the old series will lose legal tender status. However, the old banknotes would continue to be redeemed by NCBs for an unlimited period of time.

The introduction of a new version of a currency will involve the same types of issues about how to retire the old banknotes and introduce new notes as the initial issuance. Parallel issuance of both versions of the euro avoids massive production of the new issue needed for the big bang approach. The introduction of a new version of a currency that has distinctly different design, denomination, or security features can create many problems in distribution, handling, and counting banknotes. For example, changes will need to be made to automatic teller machines, vending machines, money counting machines, etc. Introducing these changes can take a long time to establish and publish specifications for machines; design, build, and test machines; and install the equipment. A shorter transition time by introducing a new version currency under the “big bang” approach can make sense and save expenses. In contrast, where most banknotes are small denomination and machine processing is limited, it may be possible to gradually introduce a new currency by a parallel currency strategy.

Seasonality

Demand for currency changes by season as economic activity and incomes change during the year and as special events occur during the year. Seasonality in a currency refers to regular intra-year changes in the demand for a currency above or below the trend in the growth of the

²⁶ The ECB has conducted research that concluded that most users of euro banknotes relied on only a few security devices to conclude whether banknotes are genuine. Features most commonly used were feel, watermark, and security thread. Most users were found to hardly check security features. Therefore, the ECB feels that there is a continuing need to educate the public about security features, especially when the new series of euro banknotes are issued.

currency. For example, currency demand may reach a peak during the harvest season as farmers sell their crops for cash, but there may be less than average demand during winter months when economic activity slows.²⁷ Demand changes can be regular, such as peaks in demand during New Year's celebrations, but can also be affected by holidays or events that move throughout the year, such as an increase during Ramadan. Adjusting the stock of currency to meet these changes in demand is part of the currency management function of central banks. All future unions will need programs to measure seasonal demand for money and build a currency management system. Demand outside the euro area

In the same way in which the German mark was extensively used outside Germany, the euro is widely used outside the euro area. This increases the total demand for the currency. Estimates of the demand for marks indicated that up to 30 percent of the marks may have circulated outside of Germany. This provides a floor estimate of the demand for euros outside the Euroarea, but the amount could be much more because of the much wider use of the euro compared to the mark, and also the potential to hold the euro as a investment instrument reflecting the global importance of the euro. This means that more euros must be printed than needed for demand within the euro area. Over time the ECB will gain a better idea of the overall external demand of the euro, the denominations involved, seasonality of currency movements out of and into the EMU, and channels for movements. This will allow the ECB to more precisely adjust their response to external demand. Future unions will need to monitor external flows of currency, for example to monitor cash flows of migrant workers which are known to be large in some cases.

Extended Custodial Inventory (ECI) scheme

In order to effectively supply the external demand for physical euro banknotes, the ESCB created the Extended Custodial Inventory (ECI) scheme, under which a banknote wholesale bank outside Europe can stock, distribute, and process euro banknotes on behalf of the Eurosystem. A one-year pilot program was undertaken using two large banks in Hong Kong and Singapore selected through open tenders. Based on the success of the pilot program, a three-year program was launched in Asia in 2008.

In the ECI, the Eurosystem provides banknotes to an ECI bank under favorable conditions in order to supply the local market. ECI banks are allowed to hold banknotes in custody prior to sale to customers. When sold, the bank is debited and the euros can be considered entered into circulation. Conversely, the ECI bank is credited when it purchases euros from customers. This reduces the cost of the ECI bank of holding banknotes, and thus they can hold large unissued stocks to meet potential customer demand. In return, the bank must provide statistics about patterns of purchases and sales. The information helps the ECB trace and quantify developments in euro cash holdings outside the euro area, which is useful in

²⁷ The offset to changes in currency demand is often in bank deposit accounts.

understanding the international role of the euro. The Bundesbank handles the arrangements for the ESCB in providing and receiving euros and holding accounts.

Currency demand in gateways

Travelers to new currency unions will often seek to hold working balances in the new currency prior to travel. It is convenient if supplies of currency are available in key gateway cities to the union – Paris for francophone African unions, London for SADC or EAC, or Mumbai for the GCC, etc. Officially-promoted exchange points may be more important in smaller gateways or gateways from lower income countries where the formal banking systems might be less well developed and less likely to be well served by banks and money traders.

Unions might take steps to encourage money traders in a selection of major gateway cities to carry the union currency, and ideally should exercise some influence to ensure that fees charged for the new currency are not excessive. Also, an official arrangement can help respond to fluctuations in demand and prevent spikes in demand that could create exchange volatility. An official arrangement might also help in reducing the costs of holding the union currency. An alternative to setting up exchange points in external gateway cities, the union could guarantee ready availability of the new currency at major entry points, perhaps at official exchange sites. If these arrangements are set up, it would be useful to advertise the availability of the new currency and exchange locations on the central bank web site.

Money traders will deal in a currency only when there is sufficient volume to generate enough income to make it worthwhile. The pre-union historic patterns for the currencies of union members might *not* provide good guidance on the activity in the union currency because demand for the union currency could be a multiple of the demand for the individual pre-union currencies. That is, trade in the union currency could be profitable for traders, whereas trade might not have been justified in any of the individual pre-union currencies.

Currency flows within the union

The common currency will move across all member economies, due to tourism, business travel, remittances, repatriation of earnings by cross-border workers, and cross-border depositing in the banking system, among other reasons. The currency is intended to be used by residents for such purposes without incurring the costs of converting national currencies. Also, the central bank or the banking system will move currency across borders to deal with local surpluses and deficiencies of the currency. Cross-border currency flows create issues related to the patterns of flows, accounting, and payment for the flows.

Strong currency movements are likely within a union. These movements will not be random. For example, in the EMU residents of the colder countries in Europe withdraw cash in their countries and spend it on vacations in southern countries. The issuance of currency in a country such as Finland creates increases the assets and income of the Finnish central bank,

but conversely increases processing costs and depletes assets of the central bank in countries such as Italy when the currency earned from tourism is retired. In the EMU, these flows are large enough to significantly affect the finances of the central banks involved.

If future unions treat currency issued to be a liability by the central bank of the country where it was physically issued, then the central bank of a country that redeems the currency has an intra-union cross-border claim on the central bank of the issuing country. The receiving central bank will need to count how much currency is received from each other member's central bank, which requires that the currency can be physically identified by issuing country.²⁸ The accounting, creating of claims, settling of payments must be timely basis to avoid favoring or disadvantaging individual member countries.

Because of cross-border movements and the implications on finances of the ESCB, in the euro area a decision was made that the ESCB as a whole will be the issuer of the currency rather than the country where the currency was actually demanded. This has many implications for accounting and financing of the central banks. This decision also affects currency management procedures, for example requiring similar standards in all members for handling counterfeit currency or withdrawing damaged currency. Future unions that choose to have currency issued by the union as a whole will need to create appropriate accounting, financial, and currency management rules.

G. Currency Design

This section looks at elements of the design of union banknotes. Many technical features of the currency must be decided. The design process can be long and arduous, and will require several years of work. This is one reason why the preparations for a union can take five years or more to complete.

Name of the currency and its symbols

As simple as it might seem, the selection of the name of the new currency is a sensitive issue. Each country has emotional ties to the imagery and names of its currency and coins, and conversely is resistant to adopting a currency with a name used in another country. If a planned union shares a currency name derived from common political or social histories (dinar, franc, peso, pound, ruble, schilling, etc.), that name is a logical choice. If not, as in Europe, the choice is more difficult.

In Europe, a decision was made that the new currency should not have national symbols or references and instead should capture the spirit of a new continent-wide entity. The decision reflected an urge to convey the unity of the continent under the new currency, and to also

²⁸ The identification can be overt and clearly seen by the public, or could consist of coded messages that are not readily identified by the general public. Machine-readable identifiers are recommended.

avoid potential problems using banknotes in an economy other than where they were issued. The name euro was selected because of its applicability in all member countries and because it was not named after any current or historical European currencies. The name of the predecessor monetary unit to the euro, “European Currency Unit” or ecu, was rejected because it was the same as an ancient french coin.

In planned unions, the name of the currency should follow this pattern – the name should reflect a positive tone related to the new union, and should avoid national symbols references. Names must be selected for the basic currency unit and its subdivisions or coins; dollar – cent, etc.

Where the base name is used in countries outside a union, a modifier should be added to distinguish the union currency from similarly named currencies of other countries – East Caribbean Dollar, or East African Schilling, etc.

The symbols²⁹ and grammatical rules for the currency need to be decided. If a common historical symbol is not used, selection of the symbol could be a difficult task. The symbol will need to be simple and unambiguous, yet capture some sense of the currency name or origin. It must be easily produced in text, computer transmissions, writing, and graphics. Rules are needed on writing out currency values such as whether decimal points or commas should be used, and the number of decimal places, (\$6.26; 3,13; 3/04, etc), but these might be established quickly through market practice.

The grammatical usage of the new word “euro” had to be set in each official language, as a noun, adjective, verb, etc.. For example, in some languages nouns have a cases or gender described as masculine, feminine, or neuter. It was decided that the noun for euro would be masculine – “der Euro”, and not “die Euro” or “das Euro”.

The selected name should be tested in each potential union member country, to be sure that it is easily pronounced, has no awkward meanings, is not accidentally associated with a person, political party, church, etc. The symbols for the currency and its coins (€ sh, \$, etc.) also need to be tested. A survey of major currency handlers (banks, vendors, currency dealers) or a more general public sampling should be made, in preference to simply requesting approval by the national central banks or governments.

The selection of a name needs to be early and announced in advance as advertisement for the coming union

²⁹ In the case of the euro, the symbol “€”, which refers to the first letter in Europe, was inspired by the Greek letter epsilon. The parallel lines were intended to represent stability.

Security features

The design of currency has become a highly sophisticated exercise in incorporating hard to duplicate elements in the bill. For example, highly detailed and hard to copy elements are built into each bill, and paper supplies and security threads may be available only from a limited number of suppliers worldwide, where they are closely guarded. Counterfeiters may seek to copy the features, but this may be expensive and the results are often detectable as counterfeits. Some features are typically kept confidential (such as the chemical composition of inks) so that even counterfeit bills that are visually identical to real bills can be identified by counterfeit detection laboratories.³⁰

The ability to use the security features to detect counterfeits requires that printing be high quality and that only good quality bills be allowed to remain in circulation. The EMU was therefore very strict in ensuring that banknotes produced in each of the printing centers were identical and also that strict requirements were in place to withdraw notes that were damaged, worn, or dirty. Maintaining the high cleanliness standards useful for detecting counterfeits could be a major challenge in some future unions where much currency will be used by rural or low-income populations with limited access to banking facilities.

Modern technology allows producers of high-quality counterfeits an ability to ultimately duplicate almost any feature of genuine bills, and thus the process of producing currency is to keep ahead of the counterfeiters by incorporating new features, and making it difficult and expensive to duplicate a feature or make adequate copies of all the security features of a currency. Higher denomination bills may have many more security features than low value notes. Also, obtaining materials or expertise to produce a complex counterfeit exposes the counterfeiter of greater risk of arrest. Thus, for example, if it costs a counterfeiter €60 to produce a passable counterfeit €100 bill, with heavy sunk fixed costs in gathering the machinery, paper, designs, and expertise, the counterfeiting will be considered a very high risk business venture that may not produce enough profit to be worth the effort.

Conversely, technology has also increased the ability to produce low quality but passable counterfeits. Color photocopy machines are widely available, and can produce counterfeits that may be passable in limited quantities to unsuspecting recipients. Many of the features of modern currency notes are explicitly introduced to prevent this type of counterfeiting. Counterfeits from photocopy machines often are easily detected because the paper has the wrong look and feel, some colors do not reproduce easily, watermarks cannot be photocopied, metallic strips or holograms cannot be copied, and microtext cannot be picked

³⁰ The ECB announced that the euro would have more security features than any other currency. It said that there were up to 90 security features built into the euro banknotes, many of which are not observable by the public, but were incorporated into devices used by vending machines, by money processing centers, or by central banks or anti-counterfeiting labs.

up given the resolution of the copying machine. Also, certain patterns can be printed onto the face of banknotes that can be detected by many color copiers and provide a signal that no copies should be made. Thus, although it may be easy to produce copies of genuine bills, these amateurish attempts at counterfeiting are often easy to detect and shut down.

Aging of bills make it harder to detect errors in counterfeit bills, and therefore in countries with problems with counterfeiting the public may be hesitant to accept bills that are aged or dirty. In some cases dirty bills have traded at a discount from their face value. Unwillingness to accept aged or dirty bills can create problems in managing the money stock because usable but somewhat smudged or torn bills might need to be retired early, thereby increasing the costs of maintaining the money stock.

It is critical that public and retail users of currency be well aware of security features, and thus they must be readily observable with a good education program to make users aware of the features and how to use them. For areas with large poorly educated populations, it has been suggested (de Heij 2010, p. 107) that in addition to public education the banknotes themselves direct the users to the security features (such as prominently numbering several security features to check).

Text box

Common banknote security features

Some common security features of banknotes are described below. Most of the descriptions are provided by the Central Bank of the Slovak Republic, which has provided a nice summary of security features of pre-euro Slovakian koruna.³¹

- *Paper.* The use of high quality banknote paper is often the main feature used by the public to distinguish genuine bills from counterfeits. The Slovakian bills used a natural color paper with visible threads of three colors. The paper had a watermark and fibers that were florescent under ultraviolet light.

- *Polymer substrates.* Banknotes can also be printed on transparent polymers in which printing and other security features can be embedded. Plastic banknotes are hard to copy and the

³¹ See <http://www.nbs.sk/mena/bankovky/oza.htm>

technology involved is complex and tightly controlled, which limits the potential for counterfeiting.

- *Watermarks.* Watermarks, which have been used since the 13th Century, are designs pressed into paper when it is made. Different thicknesses of paper show up as lighter or darker fields when light is shown through the paper. Watermark designs printed into the paper often duplicate some of the key visual features of the bill.

- *Printing techniques.* Different printing techniques can impart a different look and feel to the bill. Genuine bills sometimes use several different techniques to complicate the job of counterfeiters. The Slovak currency used up to four different methods – intaglio, lithography, letter press, and silk screen.³² The most important for security purposes is intaglio printing which presses ink under high pressure onto the bill, resulting in a raised surface for the ink that can be felt by touch.³³ Counterfeits made using other printing techniques do not have the same feel as real bills made by the intaglio method.

- *Security threads.* These are narrow polyester threads embedded into the paper that are visible when the bill is held up to light. Text, either legible or microtext, such as the denomination of the bill, is often embedded into the thread.

- *Windowed threads.* This is a more complex version of security threads. These are short visible metallic threads interspersed across the bill that are embedded into the paper. Separating the bits of thread is more difficult to counterfeit than straight security threads, and the metallic surface is hard to photocopy. Microtext visible under certain lights can be embedded into the thread.

- *Bar codes.* Metallic bars are embedded into the paper, serving as a binary code of the value of the note that can be scanned and turned into an electronic signal called Manchester code, which can be used for processing the note.

³² *Intaglio* printing cuts designs into a metal plate, which are filled with ink that adheres under high pressure to paper placed on the plate. This results in the ink having a raised surface detectable by touch. *Lithography* uses a completely smooth surface in which oil is used to divide the surface of the plate into areas that accept the ink and areas that reject the ink. *Silk Screen* printing uses a fine weave screen through which ink is forced to make an image on paper. A stencil is created by using an impermeable material to cover areas that should not receive the ink. *Letter press* printing uses movable type with raised letters or other types of raised images that are inked and then pressed against a paper to get an image in reverse. *Ink jet* printers propel droplets of liquid ink onto the surface of the bill. This is a low cost, digital method that can produce the fine detail and microtext needed for production of bills. *Laser printing* applies negative charges across a page, then uses a laser to scan across the page to neutralize the negative charges as needed to create a pattern, then uses toner attracted to the negative charges to create the image on the page.

³³ The raised surfaces can help the blind identify bills.

- *Check sum.* The euro uses a check sum within the unique serial number on each banknote. The formula adds each number in the serial number to see if it adds to the check sum. Many counterfeit banknotes are likely to fail this test.
- *Latent images.* This is an optical effect produced by special arrangements of lines printed by the intaglio technique that is visible only when the note is held horizontally at eye level.
- *Microtext.* Very small text can be integrated into the design of the currency that is too small for photocopiers to read and reproduce. The text also may be too small to read with the naked eye. If the microtext is generated by digital means, it is possible to embed serial numbers or information about where or when the banknotes were produced.
- *Reflective and iridescent surfaces.* These are hard to produce and cannot be copied by photocopy machines. The Slovakian high-value denominations used highly reflective gold foil hot-stamped into the paper and a gold-colored strip with an iridescent coating on the back.
- *Metallic luster ink.* Special inks can be used that have a metallic luster. This is hard to photocopy.
- *Optically variable features or color shifting ink.* Intaglio printing using special pigments can produce fields that change color when viewed from different angles.
- *See-through images.* Portions of a single image are printed on opposite sides of the bill, so that the total image can only be seen by holding the bill up to the light.
- *Metallic foil.* Pieces of foil with text or images can be hot-stamped onto the bill. In Slovakia, the foil was subsequently partially printed over. If photocopied, the result will be a black surface.
- *Holograms.* A metallic image attached to the banknote that changes design or color as the note is tilted.
- *Kinegram.* This is a proprietary product like a hologram that uses metal foil with images formed by microscopic lines of different thickness and shape. Changing the angle of light changes the image with an effect of a moving picture. In Slovakia, it was used on the highest value bill, where elements of the design moved and transformed.
- *Security line structure.* Fields of lines used as background can be broken up by interspersing lines of different size or character that form a recognizable image.
- *Eurion constellation.* A configuration of five small yellow or orange circles similar in shape to the constellation Orion that tells color printers to not make copies. This feature is used on euros and U.S. dollars.
-

End of text box

Special currency design issues

This section deals with several special issues or problems in designing a currency that meets general and special usability needs, such as durability, waterproofing, weight and size, fading, durability, or toxicity, etc..

Plastic money

Australia has introduced banknotes printed on transparent plastic. It is hard to counterfeit, and is much more durable than paper banknotes. These bills use a nonporous plastic base with a polymer substrate that behaves like paper for printing purposes. It is covered with a protective coating that does not absorb moisture and stays clean longer than paper bills. The special plastic used for the bills is produced by the Reserve Bank of Australia in joint venture with a private firm to produce “Securrency”. De la Rue has recently developed “Flexycoin”, which uses a highly durable polymer substrate that potentially can allow banknotes to substitute for high-denomination coins. The official printer Note Printing Australia has printed plastic banknotes for seventeen countries, and seven countries are known to have used Securrency. An important factor for African unions will be the durability and usability of polymer notes under challenging conditions in Africa – some denominations of the Nigerian naira use polymer substrates and the experience with them will provide good guidance for other unions.

Currency for the visually impaired or blind.

In Europe, consultations were held with the European Blind Union. Euro banknotes are in different sizes - from smaller to larger as the denomination increases, use large numbers, and are in different colors (with high contrast between consecutive denominations) to assist the visually impaired or blind. Also, raised surfaces created by intaglio printing provide information including “tactile marks” on the two largest denomination bills (although “tactile marks” would be more useful on lower value bills that are much more commonly handled). For coins, each differs in size, weight, thickness, and milling around the edge, permitting identification by the blind.

Toxicity

The ECB investigated whether the banknotes met the most stringent European health and safety regulations. Tests were made on all denomination banknotes, all printers were investigated, and production materials were tested. This included some special investigations of the use of Tributyltin (TBT) as a possible danger to health of users. The investigation found that TBT was present in euro banknotes but at far too low levels to pose any threats. The ECB has maintained a continuing investigation of health and environmental issues related to euro banknotes. Several studies have suggested that the one and two euro coins release

amounts of nickel that exceed EU standards and can cause skin reactions. It is posited that the cause is the use of two metals in the coins which can create corrosive reactions. Another study found that excessive amounts of nickel can be found on the surface of both the center and ring parts of the coins.

Both examples above suggest that future unions should consider possible toxicity problems with their banknotes and coins. Fortunately, the properties of many different features of banknotes and coins are known scientifically, and problems can usually be avoided.

Composite metals (Pill and ring coins)

A feature that can help easily distinguish coins is to use two or more different metals. This can be done by using a center (called the pill) surrounded by a different metal (called the ring), or by using layers of different metals that can be seen by looking at the edge of the coin. This makes coins harder to counterfeit. The magnetic properties of the coins can also be changed, which can help in vending machines. Disadvantages include higher costs of production and possible corrosive reactions between the two metals. The €1 and €2 coins have pill and ring arrangements. Euro coins have internal layers that affect their magnetic properties.

Center holes and stringing

This is a rather unique feature, but may be relevant in some countries – whether coins have holes in their center for use in stringing together coins or stacking on posts. This can be important for transportation of coins in some settings, such as nomadic tribes. The holes also can be uniquely designed for identification by the blind. The holes also save materials and reduce the intrinsic value of the coin to save money, and are lighter which makes handling easier. Also, as commodity prices rise, lowering the intrinsic content of low value coins by using holes could be a practical necessity. Adjusting weights through use of holes can also facilitate identification of coins for vending machines and coin handling machines. Drilling holes and making them difficult to reproduce can also serve as a security device. The potential advantages of designing coins with center holes should be seriously considered by future unions.³⁴

Routine changes to banknotes and coins

As time passes, minor changes will need to be made to banknotes and coins to reflect current information. Typical cases that could affect unions could include;

³⁴ Currently, all coins with holes use center cuts, but other possibilities exist – hard to produce irregular holes, or holes integrated into the design on both sides of the coin. This latter feature, for example, would prevent a problem with numerous counterfeit U.K. pound coins, in which the two sides of the coin are askew from each other.

- Changes in signature of union central bank or other officials with signatures on banknotes.
- Expansion of the union in maps. Changes were made to banknotes and coins to reflect the expansion of the euro area and the EU.
- Use of new official languages.³⁵ Different alphabetic and numeric characters may be needed because of introduction of new countries using different systems. At minimum, these could reflect the name of the central bank, the name of the currency, and the numbers used. For example, the original euro used the Latin and Greek alphabets for the abbreviation of the ECB, but cyrilic characters became necessary when Bulgaria joined the EU in 2007. In other areas, Hindu-Arabic numerals might need to be added. Any other text on the bills or coins may also need to be changed.

Commemorative coins

The Eurosystem allows member countries to mint commemorative coins bearing the name “euro”. Most of these are intended to commemorate a special event or national feature and also to sell at a profit. They have an euro value minted into the design of the coin, which often is a high value such as €50, but they are not intended for general circulation and must be designed so that they will not be confused with regular € coins in circulation. If their design is such that they could reasonably be construed to be an euro coin and might be accepted by the public as such³⁶, the design would violate the copyright for the euro and could be acted against.

For the tenth anniversary of the union in 2009, a special €2 coin was minted. A competition was held in which the public was allowed to vote for the design. The winning design expressed the idea of evolution of trade from prehistoric barter to the euro. All member states were permitted to issue the coin during 2009.

It is recommended that commemorative coins not be issued in new unions for several years in order to avoid confusion with the legal tender coins.

Gold or other precious metal coins

New unions could decide to issue coins in gold or other precious metals, or they may simply choose not to do so. This is not done by the Eurosystem. Precious metal coins could be used

³⁵ In addition to official languages, use of languages for important minority communities might also be useful to increase usefulness of the currency and enhance its acceptance.

³⁶ This could be a situation if, for example, someone attempts to market a €10 coin. It is not a counterfeit of a real coin, but it could be acted against as a violation of the copyrights or other statutes.

as savings, gifts, or speculation. A key advantage of gold coins is that they can earn substantial income for the country or union that issues them while creating steady production demand for domestically available ores.

The first question is who is the legal issuer of the currency and thus pockets the income. The country producing the metal might be the legal issuer of the coin, in which cases the union does not benefit, or the union could be the issuer which allows it to control the issuing conditions and denomination and creates income for distribution throughout the union. Given the amounts involved, this could be a contentious issue.

Two pricing strategies could be followed.

- The coins could be minted on the basis of weight (such as one troy ounce of fine gold) and sold for the market value of the gold (and sometimes a small premium for the artistic merit of the coin). This makes them suitable for savings or for speculation based on the price of the gold content. Coins sold this way are made through an arms-length sale by the government that frees it from any future obligation, although it may wish to take steps to prevent counterfeiting that could ruin the sales potential of the coin.
- The coins could be sold at a fixed price in the union currency that exceeds the intrinsic value of the metal content, but with a guarantee that the coin can be resold for the national currency at its face value. For example, the coin could sell at 100, but only have ore content 60. It could be resold to the central bank at anytime for 100. This strategy increases the profit for the government, but increases the danger of counterfeiting of the coin, and creates an obligation of the central bank to accept the coins in exchange for national currency and will also create an accounting liability for the premium on the coins. The central bank also might issue a guarantee that it will redeem the coin for national currency at market price if it rises above the face value.

H. Production

Production capacity

The production of euro banknotes and coins was handled by preexisting facilities used to produce national currency. The capacity existed and it was politically necessary to use the national facilities, which had long-standing status within each country.

Most future currency unions will not have extensive production facilities. While there may be some regional capacity, much or all of future production will need to be handled on a contract basis with suppliers in other countries. Suppliers could be private firms or public printing offices and mints.

One problem will be that the demand for banknotes for a union will be large and may exceed the capacity of many individual printers and mints – private or public. One planned union

contacted a major private banknote printer and was told that the demand for union banknotes would require the entire production capacity of the firm for several years. In such a case, the choices are to gradually introduce the currency (i.e., abandon the “big bang” approach), or involve more than one supplier. Having multiple suppliers provides necessary redundancy – union planners should ensure that the production arrangements for their currency provide backup capacity to ensure that the supply of banknotes cannot be cut off. (The EMU has a rule that each denomination euro must be produced by at least two facilities.) On the other hand, using multiple suppliers can create quality control problems, and potentially problems with patents or trade secrets in what is a competitive and secretive industry.

Similar capacity problems may also exist at the level of the suppliers of specialized paper, ink, printing presses, and security devices of various sorts. An issue for future unions is whether these matters will be part of the union decision-making process, or whether the union will leave decisions on technical aspects of the currency production to contracted printers.

Printing schedule

Printing and minting the banknotes and coins of the union is a meticulous and time-consuming job. Modern banknotes and coins must be produced to high standards and involve complex raw materials and components and security features. Some of the features are deliberately hard to achieve to thwart counterfeiters. The printing and minting will involve three major stages;

- Gather materials and lay out the prototypes, Produce sample banknotes and coins, and evaluate the results.
- Conduct a limited run under real life conditions. This tests the durability and reliability of systems and also provides a sample of the currency for testing purposes and education of currency handlers. All facilities must be put through common tests and the results compared between facilities.
- Begin production.

The production schedule will be lengthy. It will be necessary to work backwards from the expected union start-up date to calculate the schedule. Steps in this process are;

- Set the amount of each denomination needed at start-up, including at least a 15 percent reserve.
- The stock of currency must be in place at least one month prior to the union day.
- Add to this the amount of time needed for distribution to primary handlers (banks, vending machine companies, currency traders, etc.) and for preliminary stocks by the

public and businesses. This could be two to six months in length. The full stock and reserves must be ready by this time before the union date.

- Add the time needed to produce the needed stock *of all denominations*. In the euro area, the €50 banknote was twice as heavily used as any other denomination, and thus would require more printing operations or longer to produce. Production of the initial stock in Europe took several years. Thus, it can be expected that the initiation of production must begin at least 2 ½ to three years before the start of the union.
- Once the stock is produced, steady production of bills is needed. The pace will differ from that used for production of the initial stock because the smaller denomination banknotes will wear out more rapidly and need earlier replacement.
- Add four to eight months for the pilot run and evaluation of results and making adjustments.
- Add four to six months to gather materials and set up the production operation. This stage must begin at least 3 ½ to four years prior to the start of the union. If there are constraints on printing capacity, more delays could occur.

The schedule will be similar for unions that plan on using a parallel currency approach to introduce the new currency. All times allocated for each step above will be the same except for the main production run which will be shorter for parallel currency because only part of the currency stock will be introduced at the start of the union. An estimate of the amount needed will need to be made and the production run adjusted accordingly. However, given the possibility of more rapid take-up of the currency than expected, a larger reserve stock such as 30 percent should be included.

The period during which a union currency exists as a virtual currency provides time for production of physical currency. Moreover, because the union already exists printing expenses are not speculative and will be recovered.

I. Counterfeiting and Copyrights

This section deals with steps to deal with counterfeiting of the union currency and protection of the image of the currency which is considered important to promote acceptance of the currency and avoid damage to its reputation.

Anti-counterfeiting procedures

Prior to the start of the union, the ECB issued a report (1999b) that warned that counterfeiting could increase in a union. Among reasons cited were widespread circulation outside the euro area, new widely available reproduction equipment, differences in countries' detection and policing capabilities, different legal structures controlling counterfeiting, and

lack of familiarity of the new currency and its security features. Future unions will need to follow similar practices, especially because some countries in new unions may have limited capabilities to investigate, police, and prosecute counterfeiting.

Based on these reasons, the ECB set up the Counterfeit Analysis Center (CAC) as a common investigation center and database and laboratory on counterfeit banknotes and coins. Initial investigation done at the national level would determine if a counterfeit was a known variety. The CAC handles possible counterfeits from outside the EU. If a new version counterfeit banknote is found it is forwarded to the CAC which will investigate then provide the information to all NCBs, mints, and the police. A separate center was established for possible counterfeit coins. In addition to the need to create a centralized entity for the technical work on counterfeiting and to support national efforts, there was also a need for coordination of police work at the EU level. Much of this activity goes through Europol, which has been given authority to deal with counterfeiting and forgery of other means of payment that can support anti-counterfeiting activity of national authorities.

Europol requires that each country set up a single liaison office to deal with it. Moreover, the Geneva anti-counterfeiting convention requires that a central office coordinate investigation in each country. Thus, both requirements contribute to centralization of information on counterfeiting, which contributes to centralization of information within a currency union. This was backed up in the EU by rules that the police or the NCB must forward counterfeits and a complete set of information to national analysis centers and the ECB analysis center. These arrangements are supplemented by a system that provides information on whether arrests or convictions have been made and thus whether a specific episode of counterfeiting has been closed.

The report also reviewed national rules covering obligations of banks and other money handlers to hold counterfeits and surrender them to authorities. It was found that ten countries did not have any requirement to hold counterfeits and surrender them to authorities. The ESCB felt that there should be a legal obligation to surrender counterfeits to prevent them from continuing in circulation. This ultimately led to introduction of rules describing obligations of banks and money handlers to scan for counterfeits as part of its regular money handling operations and to prevent them from going back into circulation. (New unions should also enact “hold and surrender” rules, although possibly with some incentives to compensate lower revenue firms.)

Copyright protection and legitimate reproduction

Copyright protection for euro banknotes was also sought. The ECB sought a copyright to prevent possible misuse of the currency and its designs and other steps that might “adversely affect the standing of euro banknotes.” The copyrighting of the euro banknotes allows civil proceedings to be initiated, including the possibility of taking action against counterfeiters when criminal evidence is weak. The ECB established a rule covering the copyright of the

euro, but it was felt that comparable legislation was also needed at the national level to ensure application throughout the union. A legal opinion was provided that the copyright was valid even though the © copyright symbol was not used on the euro banknote, but it was agreed that it was useful to use the symbol to warn the public about reproduction. It was agreed that NCBs could exercise enforcement actions against parties violating the copyright on euro banknotes. This could include legal sanctions and seizure of unauthorized reproductions.

There are cases where reproduction of the image of the euro banknote or parts of the euro could be made for innocent purposes, such as informing the public about the bills prior to circulation or providing information on security or usability features. In principle, this would violate the copyright or perhaps could be construed as counterfeiting. Thus, rules were needed to distinguish between innocent use of the image and cases where the purpose was illegitimate or criminal. Common rules were sought for all countries. This led to a set of rules (ECB 2003) covering permissible reproduction of the euro image. Reproduction was permitted if the result cannot reasonably be mistaken by the general public for a real banknote. This could be through actions such as changing the size of the image, printing it on material with a color or material not representative of real banknotes, printing a specific feature but with a background not resembling a banknote, and electronic images can be used provided the word specimen is prominently printed and the resolution is not greater than 72 dots per inch.

New unions should copyright their currency. The ECB rules establish a reasonable basis of protection of the image of a union currency and they are recommended for new unions. Actions to defend the copyright and use of the image of the currency will be needed, both within the union and outside the union.

Anti-copying devices

The report stated that it would be useful if photocopying machines not be permitted in the EU if they do not include devices to prevent the copying of banknotes. Singapore forbids such machines. At the time of the report, no EU countries had such prohibitions.

An international Central Bank Counterfeit Deterrence Group (CBCDG), which includes the ECB and many other central banks, promotes voluntary adoption by hardware and software producers of use of counterfeit deterrence systems that prevent their devices from being usable to make counterfeits. This effort has resulted in a significant drop globally in the volume of counterfeits produced by computer and copy-machine methods. (See “Eurion Constellation” in Security Features section, above).

Anti-theft devices/Replacement of damaged banknotes

Banks and other professional money handlers can use anti-theft devices that can discolor or mutilate banknotes if a robbery is attempted.³⁷ This either prevents the thieves from obtaining the cash or prevents putting the cash back in circulation. The ECB (2003) devised rules to distinguish between damaged cash retrieved after a robbery or attempt, and damaged cash actually stolen. In the former case, the cash will be replaced with new currency to the legitimate owner; in the latter case, the cash is seized and legal actions taken.

If a bank has or receives damaged or mutilated banknotes it is required to present them to its NCB for replacement. The NCB receiving the banknotes will inspect and analyze the causes of the damage and judge whether the legitimate owner is requesting replacement. More than 50 percent of the original banknote must be presented for replacement, or proof provided that missing parts were destroyed. Replacement is made without charge if damage stems from robbery or attempted robbery. However, to minimize the possibility of the money handlers damaging the banknotes through misuse of the anti-theft devices, NCBs may charge a fee for such damaged banknotes when they are presented for replacement.

Counterfeiting of coins

Anti-counterfeiting work was also undertaken for coins. The European Technical and Scientific Facility has a Counterfeit Coin Experts Group (CCEG) that reviews suspected counterfeit coins. Procedures similar to those for banknotes are used to collect suspect coins, test and catalog them, and report information to cash handlers and police. An annual report (“Euro Coin Counterfeiting in 20xx”) is published by the European Anti-Fraud Office. The report covering 2011 noted a 15-percent decrease in coin counterfeiting compared to 2010, which was attributed to a variety of preventative and detection measures operating in an effective law enforcement and judicial atmosphere. (European Anti-Fraud Office, 2012)

The Group has found that there have been numerous efforts to counterfeit the 50 cent, 1 euro, and 2 euro coins, with 2 euro coins by far the most common. The total amount of counterfeit coins has not been large in the total volume of coins in circulation. A recorded increase in detected counterfeits may partly reflect increased detection efforts so the trend is uncertain. However, the number of detected counterfeits is significantly lower than the counterfeits circulating in the euro area countries prior to the union.

³⁷ For example, an anti-theft system might be designed as a currency pack with embedded electronics and a chemical pack. If the pack is given to a robber it can transmit information on location or to initiate emergency calls or take other actions. For example, it could also set off the chemical pack that could release dyes, colored smoke, or tear gas. This can help identify the criminal, make the currency unusable, or cause the cash to be abandoned.

When a counterfeit coin is identified, it is put into a specific “class”, where each class represents an identifiable individual illegal mint. Each class may have variants, representing different national sides, denomination, or year. This research reveals that there are at least 75 independent illegal operations in business. Six operations that account for about 80 percent of all counterfeits have been long-term problems. Thus, although illegal minting operations are closed each year there is a continuing problem that reflects “intense and continuing activity of counterfeiters” (ibid, p. 7).

The CCEG works with mint directors and international technical and legal groups and cash users to try to prevent counterfeiting of coins. A special effort is being made with operators of coin operating machines. These include running tests with manufacturers to improve methods to detect and reject counterfeit coins. As a result of such work, technical means have been found for machinery to reject all known types of counterfeit euro coins. Moreover, a proposal has been made for mandatory inspection for counterfeit coins be made by cash handlers.

The experience in Europe shows that counterfeiting of coins is a real problem, especially for high value coins. Thus, planned unions will also need to develop facilities to deal with counterfeit coins, create machines to detect and reject them, and initiate law enforcement. The problem will be exacerbated if some regions of the union have limited access to detection equipment or if illegal minting is done outside the region. Like the EU experience, there may be a need to establish common rules for detecting counterfeits and handling them, which may require changes to national laws.

Substitution of foreign coins

The use of foreign coins in vending machines raises an additional problem. With so many different types of coins in the world, it is possible that coins can be found that can substitute for genuine euro coins in vending machines. This could lead to situations where inexpensive foreign coins could be imported in large quantities for use in machines, causing large losses for businesses. The Eurosystem for example found that a planned series of Turkish coins could pass for the 1-euro and 2-euro coins. Negotiations and tests resulted in slight changes in the Turkish coins and adjustments to coin processing and coin validation machines so that they could identify the Turkish coins and reject their use in euro machines.

Withdrawal of banknotes

An extension of the sole authority of the Eurosystem to issue banknotes, it may also establish rules for withdrawing currency. This will cover rules for withdrawing damaged or worn currency, and for replacing the union currency with new versions.

Legal protection of banknotes and coins

Prior to the issuance of the euro, the ECB undertook surveys and prepared reports on the legal status and protection of banknotes in the EU. (ECB 1999b) This was a joint project of the Working Group on Banknotes and the Working Group of Legal Experts. Among issues addressed were counterfeiting, copyright protection, and reproduction of images of banknotes and coins, introduction of anti-copying devices, redemption of damaged or worn banknotes, rules for withdrawals of banknotes, and the status of banknotes not issued by the ECB or NCBs including issuance of non-legal tokens or banknotes denominated in euros (called “fancy banknotes”). The review was made on an EU-wide basis, recognizing that the euro would be expected to be widely used throughout the union and all countries are required to protect the banknotes of other member countries.³⁸

The first issue was surveying national standards against criminal counterfeiting. The intent was to obtain a complete picture of the anti-counterfeiting framework within the EU. Specific matters surveyed included the types of activities deemed punishable, legal descriptions of crimes, burdens of proof, methods of prosecution, interpretation of legislation by courts, and strictness of penalties. Both criminal and administrative offenses were covered.

The reports found that counterfeiting and falsification (creating a high value banknote out of a low-value note), and procuring, possessing, transporting, and transacting in counterfeits were all punishable offenses. A number of countries had laws against importing counterfeits. Most countries had laws prohibiting production and the holding or sale of machines used for making counterfeits. In some countries, adapting machines so that they could be used for counterfeiting constituted attempted counterfeiting.

Counterfeiting was subject to long-term imprisonment, and some countries also impose fines. The range of penalties varied, but in some countries counterfeiting was among the most severely punishable crimes. In some countries, the laws state that punishment will be less severe for less serious cases.

The review concluded that the differences in national practice (including the application by the courts) are not fundamental and thus the matter is being handled by national practice. However, the report concluded that there was scope for a common convention for EU countries to set the minimum elements of anti-counterfeiting practice and to also deal with developing common criminal law to deal with technological innovations in counterfeiting.

In future unions, a similar survey of practices should be made, and a reasonable degree of uniformity in restrictions and their application needs to be assured. This might be through

³⁸ The International Convention for the suppression of Counterfeiting Currency of 1929 states “No distinction should be made in the scale of punishments for offenses...between acts relating to domestic currency on the one hand and foreign currency on the other.”

de facto convergence of practice between countries, designing minimum standards as proposed in Europe, or by fashioning a common legal code.³⁹

Some countries had laws forbidding mutilation of banknotes or stamping or writing on them, which is a practice that new unions should adopt. Cutting coins to serve as a lower denomination currency should also be outlawed.

The mandate to protect the integrity of the euro banknote as a means of payment implies that it is in a condition that permits its use, such as for purchasing train tickets from a machine. Thus there should be “competence to adopt a common regime under which the NCBs are prepared to exchange mutilated or damaged euro banknotes.”⁴⁰

J. Legal Issuance of Banknotes and Coins

A union must decide who is the legal issuer of its banknotes and coins. The issuer incurs a legal liability for currency issued and is responsible for redemption of currency. The legal issuer will record currency issuance on its balance sheet as a liability, and each holder has a legal claim on the issuer.

In the euro area, the ESCB is the legal issuer of banknotes but the national governments are legal issuers of coins. This has important financial implications, including the amount and distribution of seignorage, and production and retirement expenses.

Because the euro is the currency of the union as a whole and circulates freely in the union, special procedures are needed to adjust the legal liability for euro issuance and the distribution of seignorage.

- For banknotes, issuance is allocated based on each country’s capital share in the ECB, with an adjustment that 8 percent of total issuance is allotted to the ECB. The amount calculated by the formula is entered as a liability of each NCB, regardless of the actual amount of currency put into circulation by the NCB.⁴¹

³⁹ Because counterfeiting in any union member country is a crime against the union as a whole, there is a case for centralized prosecution of counterfeiting related crimes. Also, some countries with limited infrastructure might need investigative and prosecutorial assistance from the union.

⁴⁰ Creating a uniform standard also prevents situations where different NCBs face unfair burdens and expense in terms of retiring damaged banknotes.

⁴¹ However, the IMF felt that information on the actual amount of currency issued in each country is useful for analysis of overall conditions and therefore it requested that this information be provided to the IMF. The data are regularly published in the IMF’s *International Financial Statistics*. Future unions can also expect to be required to provide these data to the IMF.

- For coins, the amount each NCB is allowed to mint each year is decided by the ECB, based on its analysis of needs. This limits the amount each country can issue.

K. Electronic Money (e-money)

In the mid-1990's, central banks began taking interest in the development of electronic money, which could be defined as encoded measures of value that could be used by computers or other electronic devices to store value and make transactions. There was concern about how various proposals for electronic currency worked, the regulation of electronic money and electronic money companies, the impacts on monetary policy⁴², and implications for law enforcement. In 1997, the EMI reviewed the state of work on electronic money and provided an opinion to the European Commission in March 1998 that concluded that electronic money would significantly affect monetary policy in the future and that rules governing its issuance are needed.⁴³

Electronic money was defined by the EMI as an electronic store of monetary value on a technical device that may be widely used as a prepaid bearer instrument for making payments for undertakings other than with the issuer without necessarily involving bank accounts in the transactions. In order to be considered e-money, such devices must operate as general purpose payment instruments. The definition excludes instruments that involve one-time prepayment for specific goods and services, such as a card that stores value only for use on a transportation system. Another important difference is whether the value on the card debits the value from the system and must be recharged, or whether the value can be transferred between electronic money systems without involving banks to debit and recharge value to the device. There are many prepayment systems in existence and some of them can be used by a wide range of vendors, so the differences between them and e-money systems is not always clear cut. And both types of system can have monetary policy impacts – for example, either could substitute for use of physical currency and thus raise monetary policy issues.

A wide variety of e-money devices have been developed or proposed. One strong prospect for widespread future use in less developed areas are mobile phone devices, in which a means of storing value is linked with a communications device.

- This technology is linked to current communications practices and much physical infrastructure is already in place. Adoption could occur quickly.

⁴² The author attended a conference in 1994 at the New York University Law School at which a representative of the Federal Reserve Board said that electronic currency would be a component of M1 when introduced.

⁴³ EMI. "Opinion of the EMI Council on the issuance of electronic money" transmitted to the European Commission. March 2, 1998. EMI Annual Report 1997. pp. 74-75.

- Electronic money systems can be operated by computer software companies or telecommunications companies as extensions of their existing businesses, which could dramatically change monetary conditions and bring in new types of monetary institutions.⁴⁴
- This technology appears to be well suited to facilitate financial transactions in rural and developing areas where transportation is limited and few formal banking institutions exist.⁴⁵ Thus, electronic currency can be one component of development of banking systems that can reach many millions of people without access to formal bank facilities.
- Mobile phone operators with networks in about 100 countries and with about 600 million customers are setting up systems for international transmission of remittances by various means, including mobile phones. These arrangements will require linkages between international payments companies, such as Mastercharge, and local banks and cell phone operators. It is expected that the high costs of international remittances can be dramatically cut and service will be quicker and more convenient.

Other types of e-money systems exist, such as for transfers over the internet or other special e-money devices. Moreover, simple prepaid cards often can be accepted by a wide range of vendors giving them a quasi-monetary role, and they can often be easily reloaded with value, making it hard to draw a sharp line between genuine e-money devices and close competitors. Some definitions of e-money include prepaid cards. Thus, efforts to develop or regulate e-money systems should be viewed as covering a range of different channels and devices that will evolve quickly. This means that rules should be general to cover a range of systems and flexible enough to deal with innovations and new markets.

The wide availability of these devices could bring about major changes in the operation of money and financial markets. First, they can make access to financial markets available for much wider segments of populations, especially in developing countries. Second, they compete with banknotes and coins for use in transactions, which can cause structural changes in the demand for money and in seignorage. Third, new types of financial institutions may evolve which can increase market competition, lower costs, support product innovation, and force changes in regulation and oversight. New instruments and changes in the channels of

⁴⁴ European System of Central Bank rules permit e-money schemes to be operated by nonfinancial institutions (such as internet, communications, or computer firms), which raises regulatory, policy, and statistical issues.

⁴⁵ For example, in lieu of fixed line phone communications in Africa, there are an estimated 225 million mobile phone users who could potentially be provided payments services through mobile phone e-money facilities. This is already reported to be commonly used by small traders and firms in West Africa. Kenya and Tanzania have adopted mobile phone money transfer systems that are used by millions of customers.

transmission might change monetary relationships in the economy and loosen the control of authorities over monetary conditions.

New forms of risk may develop. There will be new forms of operational risk because of the use of sophisticated electronic systems to handle the e-money. Interoperability of systems will be needed to prevent the possibility of failures of transactions between operators of systems. Electronic theft or fraud must be treated as possibilities and security systems developed to deal with them. There could also be a wide range of new issuers or agents for e-money, which will require new rules to register them, supervise them, and guarantee their proper operation.

The ECB also felt that the introduction of the euro could make cross-border transactions easier and less costly and facilitate a shift towards use of electronic money.

E-money systems raise the possibility of privately operated systems, including telecommunications companies, becoming competitors in issuing money with the official monetary system which is based on use of central bank money and oversight by the central bank and other authorities. The central bank and government could lose their ability to control the monetary base and the monetary stock, with potentially major effects on monetary and economic policy.

Finally, electronic money potentially seriously threatens the seignorage income of government if it results in reduced demand for banknotes and coins. In light of the concerns above, in August 1998 the ECB published the "Report on electronic money", that built on the EMI's analysis. It covered reasons for regulation of issuance of electronic money and issuers of electronic money. It also addressed the role of electronic money in payment and settlement systems and prudential supervision. The ECB set out minimum requirements for electronic money systems;

- Issuers of electronic money must be subject to prudential supervision
- Issuance must be subject to sound and transparent legal arrangements
- Technical security must be assured, including the ability to detect counterfeits
- Protection against criminal abuse is needed
- Monetary statistics reporting is required and companies must supply whatever information is needed for monetary policy purposes
- Issuers of electronic money must be legally obliged upon request to redeem electronic money against central bank money at par
- Central banks can impose reserve requirements on all issuers of electronic money
- Electronic money systems should be interoperable, and
- Guarantees, insurance, or loss-sharing schemes are needed to protect the holders of electronic money.

The ECB concluded that the easiest solution was to absorb electronic money schemes into the existing union monetary and institutional framework by limiting issuance of electronic money to credit institutions. The existing mechanisms for control of credit institutions were extended to cover electronic money companies. Also, the ECB is authorized to place reserve requirements on credit institutions. Therefore, electronic money companies were classified as “credit institutions” subject to the same regulatory regime as banks.⁴⁶The ECB argued that all issuers of electronic money should be legally obliged to redeem electronic money at par value. Redeemability is needed from the monetary policy point of view to preserve the unit-of-account function of money, to maintain price stability by constraining issuance of electronic money, and to control the liquidity conditions and short-term interest rates set by the ESCB. This feature, combined with a requirement for interoperability and common insurance arrangements, meant that electronic money could operate as a single market linked with the official monetary market. This avoids the possibility of the market operating with different liquidity or risk conditions from the overall market or between systems. Interoperability widens consumer options, reduces costs to consumers, increases competition to lower costs for customers and encourage innovation, allows switching between services, and improves efficiency.

Such conclusions led to development of an EU regulatory framework for electronic money companies (which were called electronic money institutions – ELMIs) in 2000. (European Commission 2000) The framework;

- Limited ELMIs to issuance of electronic money, provision of related financial and non-financial services, and the issuance and administration of other means of payment, and storage of data on the electronic device on behalf of other undertakings or public institutions, but excluded ELMIs from granting any form of credit.
- Put ELMIs under the scope of the EU money laundering directive.
- Required redeemability with banknotes and coins with charges limited to the cost of the operation.
- Required initial and minimum ongoing capital, set at a low €1 million level.
- Required investments related to electronic money liabilities to be in highly liquid assets with 0% or 20% Basel risk weights. Activity in financial derivatives was limited to hedging of market risks. Individual countries can put limitations on extent of exposure to market risks.

⁴⁶ Communications companies are actively involved in setting up e-money systems. Following the EMU example, regulation will be needed for the e-money activities of these companies. Organizing the e-money activities as a separate subsidiary is useful in avoiding mixing regulated e-money activities with communications activities.

- The capital, liquidity, and market risk limitation requirements are subject to review by authorities at least twice a year.
- The company must be operated in a sound and prudent manner, with internal accounting and controls.
- However, some waivers were permitted for systems that handle only small amounts.

However, the development of forms of electronic money required clarification of the framework by the European Commission in 2009 to revise its Directive. (European Commission 2009). Issuers of electronic money as their primary activity are to be regulated like other monetary financial institutions, but issuance by nonfinancial institutions (such as computer firms, internet companies, communications firms) call for additional regulations. The new types of firms (which are termed for statistical purposes as “hybrid electronic money institutions” or “Hybrid ELMIs”) could include for example post office giro accounts, NCBs not acting as monetary authorities, and other public authorities. The Directive mandates that national authorities regulate the hybrids with various enumerated capital, supervisory, and consumer safeguards and standards. It explicitly states that all electronic money institutions are subject the general standards for payment institutions (in Directive 2007/64/EC)

- The emergence of issuers of electronic money outside the realm of specifically regulated banking institutions raises numerous policy, supervisory, and statistical issues.
- In recognition that electronic money can easily cross borders, the Directive states that rules covering ELMI branches of nonresident firms be analogous to those for domestic ELMIs and should not be more favorable.

Implications for future monetary unions

Future currency unions should consider supporting the introduction of electronic money schemes, especially in unions where large populations have limited or no access to formal financial markets. It could be done either through operation of private schemes under close regulation such as in Europe or as an official function of the union. There are strong reasons for introducing electronic money;

- It is an important innovation in markets that will be widely adopted worldwide. New unions are capable of being competitive with other economies or even establishing leadership in the field.
- Creating an electronic currency could be quicker, less costly, and easier to introduce to the public than a physical currency. For example, if a virtual currency is used prior to issuing physical currency, such as was done with the ECU and for three years with the

euro, initially issuing the currency as electronic money may facilitate its use by the public.

- Electronic money can facilitate cross-border remittances, which are often costly, difficult, and unsecure for large populations of migrant workers. Large segments of populations in unions could directly receive large financial benefits from cross-border electronic money remittances. This could be a major service of the union that would support its acceptance.
- Payments can be made more rapidly, less expensively, and more securely than cash or mail payments.
- Electronic money can effectively expand the market by allowing payments to be made over larger areas.
- Electronic money can be a gateway for provision of basic financial services to large populations who do not have access to them. The system could be linked to current and savings accounts in formal banks that could provide secure and convenient savings methods for the public, and also establish channels for extending credit to e-money customers.
- Electronic money can, if desired, be used to provide documentation of financial transactions needed to support business requirements for populations lacking access to the formal financial system.
- Electronic money can facilitate settlements which can significantly reduce risks.
- Electronic money can be more secure and less prone to theft or loss.
- Systems can be fashioned to handle small transactions and accounts that are often uneconomical for formal banking institutions.

Cautions

However, there are many potential problems with electronic money schemes that should be carefully considered before initiating electronic money schemes in a union. Existing systems need to be studied to draw lessons.

- Growth of electronic money schemes in the EMU has been less rapid than many expected.⁴⁷ The reasons need to be understood and caution may be in order. To allow for experimentation in

⁴⁷ Growth of electronic money in the Euroarea has been slow, and it comprises only a small part of total money. Using a limited definition of e-money, only €2,657 million in euro-denominated e-money was circulating in the euro area at yearend 2011. A heavy majority of this was hardware-based, rather than software based. The collection of electronic money statistics began in February 2006, when € 500 million was outstanding. www.ecb.int/stats/money/aggregates/emon/html. Innopay (2011) has argued that slow growth in Europe is due

(continued)

setting up systems that work best, pilot projects may be appropriate or several systems might be allowed to compete for a period of time. (However, very rapid growth of e-money systems in Africa, such as m-pesa in Kenya, seems to indicate that systems that meet consumer's needs can grow rapidly.

- *Operational risk is very high.* Failure of electronic money systems can cause large losses, freeze transactions, and be economically, socially, and politically disruptive. Backups and redundancy need to be built in. Electricity or communications failures are major threats.
- Initial investment may be large to set up hardware, software, communications infrastructure, and introduce the systems to businesses and the public. There is a danger of investing in very expensive systems that have problems or which become obsolete.
- Electronic systems may be suitable for areas with large populations, a high volume of transactions, and good infrastructure, but might not be feasible in many regions including most rural areas. Different degrees or speed of introduction in different regions of a union could be both economic and political problems.
- Public education will be important. Systems cannot be too complex to be adopted by large segments of the population.
- The technology will evolve. The system will have to be able to deal with innovations and introduction of new methods.
- Smaller or poorer countries may be less capable to independently operate electronic money systems, and therefore systems may need to be operated by corporations acting across borders, by the union itself, or perhaps public-private partnerships.
- Criminal use of electronic money is potentially a major problem.
- Security of users' systems is a major concern. Systems must be made as immune as possible to theft or fraud.
- Public resistance may be high. Although systems might be very useful in particular niches, the general public may resist use of electronic money for a variety of reasons.
- Electronic money will need to be usable on multiple platforms. For example, the same measure of value potentially could be used in mobile phones, computers and across the internet, on prepaid cards (either single purpose or multipurpose).
- Conversion to physical currency needs to be assured. (Unfortunately, per Innopay (2012), regular shortages of cash to redeem m-pesa credits has been an on-going problem.)

to ample availability in Europe of credit cards and other readily available means of payment, and in contrast very rapid growth in Africa reflects the absence of other basic payments and banking alternatives.

- Rules and laws will need to be established covering usage, right of refusal, recovery of value if systems fail, etc.
- Compatibility with international systems needs to be considered.
- Money demand and behavior will be affected. There could be a large loss of seignorage income unless arrangements are made to capture it in the new system.

To conclude, electronic money systems offer some important advantages for new unions, but could also have major problems and expenses. They are an important area of monetary innovation and unions may need to adopt them in some form for their economies and financial systems to remain competitive. Electronic currency has the potential of becoming a central component of the union's monetary system. Planned unions should undertake a study early in their process of how electronic money might be used. The study will also need to consider how diverse preexisting systems and different national systems will fit into the union arrangement. In light of the dangers and expenses a cautious approach may be best, perhaps focusing on a few niches (mobile phone transfers, remittances, etc.) where the need is high, results can be monitored, and experience can be gained. On the other hand, mobile phone technologies have potential to contribute greatly to the changeover to the new union currency and thus might become a central feature of the process of building new monetary unions.

Box: M-Pesa digital money system in Kenya

Several digital money schemes have developed in Africa, where they can occupy niches not being served by formal financial institutions. The M-Pesa system in Kenya has grown exceptionally quickly and has penetrated national financial markets deeply, including in rural areas where large parts of the population were not served by formal financial institutions. Many businesses and households have directly benefitted.

Importantly, M-pesa is not operated by the central bank or by a bank, but by Safaricom, a telecommunications company that originated the scheme largely to promote its mobile phone service. As such it fell outside of the preexisting regulatory authority of banks and thus a new regulatory framework is being developed.

M-pesa involves a widely dispersed system in which customers visit local agents to exchange cash for transferrable mobile phone credits (or conversely exchange credits for cash). Many small, village-level businesses have become agents, which provide access to wide swaths of the population to use the system. M-pesa has become widely used for commerce and remittances. It is commonly used for current depositing and transfers, including supporting large net flows of remittances from urban areas to rural areas. The agents carry out the daily cash netting operations and generate regular cash shipments through intermediaries who

interact with the bank that supports the system. The system has very quickly and strongly changed currency usage patterns and will have large implications on cash management and on the formal financial system.

The system will have a major impact on monetary cash management policies, and also raises important operational and security risks. The important role of M-pesa as a payments institution for millions of customers requires that effective central bank oversight be established and that its practices be subject to regular audits and risk assessments. In sharp contrast to the situation for cash holdings, the operational risk of a breakdown of a mobile phone e-money system affecting commerce for millions of people must be effectively addressed and multiple layers of backup must be in place.

L. Introduction of the New Currency

Banks and professional money handlers must have early access to information about the new currency so that they can modify their systems to deal with the new currency. Therefore, the ECB and national central banks provided information to such entities on the new currency and its security features beginning in 2000 in preparation for the actual introduction of the currency in 2002.

Education and training of cash handlers will be important in new unions. Cashiers, clerks, bank tellers, payroll officers, toll collectors, and the like are the interface between the new currency and the public. They must be fully prepared to handle distribution, collection, and payment on the first day of circulation of the new currency. Programs to train cash handlers must be set up by the central bank, working with banks, retailers, government offices, electronic money issuers, and numerous other entities.

Training materials for cash handlers must be available in all relevant languages. Thus, in Europe, comparable materials were prepared for the official languages of all EU countries, and also in the languages of several countries that might join the union later or were considered likely to use the euro as a cocirculating currency, or would be likely to receive euros from visitors or for other reasons. (Cyprus, Czech Republic, Estonia, Hungary, Poland, etc.).

Cash handlers must be provided with high-quality color materials that show the currency, its key identification features, and the main security items. For the euro banknote, the Trainers Guide provided information on;

- Pictures of the front and back of each note, with the size and identifying color.
- A description of the design theme – for the euro, windows and doors to indicate openness and cooperation, and bridges to symbolize cooperation.

- Identification of the union and currency. These included the flag of the European Union, the initials of the European Central Bank in five variants, the name euro written in Latin and Greek characters, and the signature of the President of the ECB.
- Features for the visually impaired and blind.
- Security features detectable by cash handlers are listed; paper quality, intaglio printing, watermark, security thread, see-through number, holograms⁴⁸, perforations in holograms in the €shape, metallic stripe, and color changing number.

Additional security features available for review by cash handlers, such as microprint 0.2 millimeters high can be seen with a magnifying glass, sharp printing, colored fibers embedded in the paper, changing colors of some elements (under ultraviolet light, the EU flag and president's signature change color to green and on the back the map, bridge, and denomination numbers turn green). For euro coins, similar descriptions of security features were provided, including size, weight, color, composition, and milling around the edge. The one and two euro coins are pill and ring design with contrasting colors, which is difficult to forge. Also, the inner core of these coins has three layers with different metallic composition that give them unique properties in vending machines.

There are also changes in banknotes and coins over time, and special issues that also must be documented for cash handlers and clarified that they are legal tender. In Europe, these include changes for coins in the map of Europe because of expanding membership of the EU; the issuance of coins by the small surrounded territories of Monaco, San Marino, and the Vatican City; and €2 commemorative coins that countries can issue each year.⁴⁹

Notification of the public

The public reception of the new currency will depend greatly on their confidence about whether the currency is genuine. It is necessary to have a public campaign to describe the currency and its security features before its release. This must be done early enough to permit knowledge of the new currency to spread widely. However, very early release of the new design and release of highly detailed images should be avoided to gain a jump on counterfeiters who may wish to introduce forgeries in the early days when the public is still unfamiliar with the new currency.

⁴⁸ In 1998, prior to the start-up of the union, the printing plate for holograms for the euro was stolen. It was replaced with a new version. Because of the very large volume of banknotes to be printed, loss of the hologram to counterfeiters later in the production process could have created major problems in releasing the new euro currency.

⁴⁹ Other special coin issues or collectors' coins may be issued, but the ECB clarified that these do not meet the Euroarea standards and are not for circulation.

Recycling of Currency – the Banknote Recycling Framework

The Eurosystem created a “Banknote Recycling Framework” (BRF) that requires companies handling cash to check that it is in good condition and is not suspect before putting it back in circulation. This section covers the process of collecting, testing, and recycling the currency; the next section covers how to deal with damaged currency and possible forgeries uncovered in this process. In 2002, guidance was given on procedures to detect counterfeits and on minimum sorting standards for currency which regularized the recycling by banks of currency back into circulation.

Practices for recycling currency in Europe vary because of national traditions, but one common practice is for banks to only supply currency received from the central bank, unless cash is recycled after authentication and fitness-checking by machines tested by the Eurosystem. The BRF is designed to create harmonized standards and clear requirements to detect counterfeits, pull damaged currency out of circulation, and avoid competitive distortions in the process.

Elements of the BRF include;

- The framework defined various types of automated cash handling machines. All machines are required to automatically identify and separate suspect banknotes, and create packages of banknotes.
- Rules for recirculation of banknotes were established;
 - Recirculation is permitted only if notes are authenticated and fitness checked. Checking must be by machines successfully tested by the ECB, or by trained staff.
 - Cash handlers must comply with all anti-counterfeiting rules.
 - Recirculation by ATMs is permitted only if tested by automated machines approved the national central bank.
 - Recirculation of banknotes reviewed by trained staff cannot be used in ATMs, but can be put back in circulation over-the-counter.
 - Banknotes not checked for authenticity and fitness cannot be recirculated and must be sent to the central bank.
- Criteria for fitness sorting are established. Separation into batches (authentic, unauthenticated, suspect, fit, unfit, etc.) is required. Batches with mixed attributes must go to the national central bank for further processing.

- It is recommended that national central banks regularly supply €5 and €10 notes because these are subject to most wear.
- National central banks should continually monitor the condition of currency and may provide advice to the ECB on changes to fitness standards to maintain the good condition of the currency.
- Standards are established for crediting accounts when banknotes are suspect or not authenticated. For suspect notes, accounts cannot be credited and the notes must be sent to the national central bank within 20 days along with information about the customer. For unauthenticated notes, information must be kept for 8 weeks.
- Video surveillance of transactions is encouraged.
- Testing standards for money processing and authentication machines were established. Once a machine passes the common test procedures, it can be used anywhere in the Euroarea.
- Cash handlers are responsible to install the latest hardware or software needed to meet current standards or threats.
- Manufacturers are requested to inform NCBs of new procedures that help identify new types of counterfeits. This information will be covered by non-disclosure agreements.

The NCBs will monitor the implementation of the BRF by collecting general information on recycling practices, statistics, information on the machinery, and information on remote processing sites where manual authentication is used. The NCBs can carry out tests of the machinery in use.

Banks and other cash handlers were granted up to two years to implement the changes, and a transitional timetable was set for countries expected to join the Euroarea. However, a number of countries requested extensions of one year; France by two years; and Greece, Ireland, Italy, Portugal, and Spain by three years. This indicates that an average implementation period of about four years can be expected to introduce these ambitious changes. If banks choose not to introduce changes that will permit them to recycle currency, they were expected to make use of the cash handling procedures of their NCB.

Summary of the BRF – The Euroarea established a comprehensive system and very high standards in order to maintain the high quality of euro currency and to suppress counterfeiting. The detection of counterfeits is facilitated by maintaining a high quality stock of currency. Maintaining the common currency requires the application of common standards, especially for operation of money handling machines which have a prominent role.

For future unions, the highly automated currency processing environment that exists in Europe does not exist, or the financial system may be bifurcated with a modern automated sector and a nonautomated sector where institutions are smaller and heavily dependent on hand processing. The programs in future unions will thus probably need to be more oriented toward visual inspection and hand processing, but more sophisticated facilities must be in place throughout the union with reasonable availability to carry out more technical examination of the currency.

Collection of damaged or suspect banknotes and coins

It is the responsibility of cash handlers to take steps to identify possible counterfeits. Prior to the release of the new currency, EC Council Regulation No. 1338/2001 required that all professional money handlers withdraw currency from circulation if they suspect it is not genuine and immediately hand it to national authorities. Entities that fail to do so are subject to sanctions. In 2002, guidance was given on procedures to detect counterfeits and on minimum sorting standards for currency which regularized the recycling by banks of currency back into circulation.

Most currency is examined by currency processing machines; manual inspection is required if machines are not available. The currency may be reentered into circulation only if it passes these tests. Similarly, all currency handled by the national central banks is examined by automated processing machines before being returned into circulation. Reasons that banknotes may be withdrawn include dirt and stains, markings or notations, de-inking due to washing or chemical contact, mutilation (holes, burn marks, tears, etc.), taping or gluing, or suspected counterfeiting.

When banknotes are identified as damaged and unsuitable for entering into recirculation, cash handlers should send them to their national central banks for replacement. Redemption is free of charge, except when the bills are damaged by anti-theft devices.

Suspect banknotes are to be sent to national central banks within 20 days of receipt, along with as much information as can be provided on who provided it.

The ECB publishes information about counterfeits on its website semi-annually, and in annual published reviews, on the number of counterfeit banknotes taken from circulation. As this number is small relative to total circulation, the release of this information instills confidence in the public regarding the soundness of the currency. During the second half of 2011, 310,000 counterfeit bills were detected out of a total of 14.4 billion banknotes. 20 euro and 50 euro banknotes accounted for most of the counterfeits.

Currency outside of the union

The announcement of a new union currency will tend to pull back national currencies that have gone abroad, are hoarded, or are used for black market purposes. In the case of the

deutschmark, there were reports that very large amounts were returned to Germany prior to the issuance of the euro. The mark was held globally, but was considered to be concentrated in East Europe, Turkey, and the Balkans. As much as 100 billion DM was estimated to have been outside the country, of which the Bundesbank estimated that up to 30 billion DM was related to criminal activity. (New York Times; 2001) Deutschmarks that could not be openly deposited and exchanged for euros had to be smuggled back to Germany where they could be used for a legitimate purpose, such as buying real estate, jewelry, or vehicles. The German police made random searches of cars for returning cash and reportedly discovered a sharp increase in inflows. But much may have made it back successfully because of a large inflow of 500-mark and 1000-mark bills returned to the Bundesbank in the year before the changeover to the euro. (New York Times, 2001) Conversely, there was reportedly an outflow of cash from Germany by domestic tax evaders to place the funds in foreign bank accounts where they would be automatically converted into euros when the changeover occurred.

Legal framework for common currency

About three years prior to start up, work must begin on drafting the legal framework for the new currency to guarantee its use as the successor to national currency, its universal acceptance, and use as a measure of value. The framework of cash handling must be covered, as well as anti-counterfeiting provisions. Substantial lead time will be needed to agree on the provisions, standards, and practices for the currency; draft the community-wide regulations or guidelines; allow for national ratification; and implementation by government, businesses, and the public.

M. Retiring Currency

Banknotes wear out through use or become damaged. They must be regularly replaced. Each denomination banknote will have a predictable normal lifespan – with low value notes receiving more wear and thus having shorter lives. Procedures need to be set up to collect old or damaged currency, which can be costly. This is a pure cost to central banks that cannot be recovered. Also, new banknotes are expensive to produce and for each bill removed from circulation a new bill must be printed and introduced.

Retiring the union currency

The retirement of currency is a regular function of central banks that will continue in unions. What is different about union situations is that cross-border movements of banknotes can seriously skew the costs that must be borne by each national central bank. Moreover, there is a special issue of who bears the responsibility and cost of redemption of the union currency circulating outside the issuing country.

Cross-border movement of the union currency will result in NCBs retiring currencies issued in other parts of the union. This incurs costs for the NCB retiring the currency. An equitable

method of distributing the costs is needed.⁵⁰ This needs to be part of the intra-system accounts that deal with the costs of issuing currency, the accounting of income generated from assets acquired to issue the currency, the distribution of seignorage, and the costs of retiring the currency.

Retiring legacy currencies

Under the Big Bang approach, at the time of the changeover to the new currency, there will be a short period of dual currency use after which the national currencies are no longer usable for transactions. It can be expected that the public will quickly exchange most of their holdings for the union currency in order to meet regular cash transactions needs. The transition program of the union must have specific arrangements to collect and retire almost all of the national currencies within a short period.

Under gradual approaches, allowing either parallel use of the old and new currencies, or replacement whenever the legacy currencies are deposited in formal institutions or are retired because of condition, there may be a surge of replacements at first, but there is likely to be a long period in which the old national currencies are gradually taken out of circulation. The portion of the national currency retired may differ between countries.⁵¹

In either case, the public may hold small amounts of the pre-union national currencies for extended periods. Arrangements must be made to retire the national currencies for years. During the first year, it is recommended that all banks are required to accept the national currency in exchange for the union currency. Thereafter, only a small number of redemption points are needed, perhaps at offices of the NCBs. It is important that the arrangements for redemption of legacy currencies be announced before the changeover, including the length of time in which currency can be exchanged and with clear descriptions of how it will be handled in each country.

It is also recommended that arrangements be made for banks to accept other members' currencies. Because of the common legal and accounting elements of the union countries, arrangements can be made for member central banks or the union central bank to collect notes for other member countries, and potentially carry out the destruction of the currency. There could be several options;

⁵⁰ This is a major problem. In Europe, a regular pattern is observed of euros issued in Northern Europe migrating to Southern Europe for vacations, resulting in countries such as Spain or Malta incurring high expenses to retire damaged euros. Serious problems can also occur where laborers work in one country, but regularly migrate (perhaps at the end of a crop year) with cash back to their home countries.

⁵¹ This complicates accounting because countries with a larger stock of national currencies outstanding will continue to earn seignorage on the currency. Without a mechanism to induce changeover to the union currency, individual countries will have an incentive to delay retiring the national currency.

- Each NCB agrees to collect the currency of other member countries. Each could either then ship the currency back to the home country for reimbursement, or certify that the withdrawn currency is destroyed and receive payment based on verified certification.
 - Each NCB could collect the currency of other member countries and transfer it to the union central bank, which would make settlements between the recipient and issuing central banks, which could be on a gross basis or on a multilateral net basis.
 - Because there will be less familiarity with a currency outside the home country, arrangements for retirement in other union countries might be made contingent on verification by the home country that the currency received is genuine.
-

N. Timeline

Currency		
Preparatory period	<ol style="list-style-type: none"> 1. Compile data by country on currency demand, denomination, seasonality, purpose 2. Report on national currency management practices 	
Early actions (four to five years prior)	<ol style="list-style-type: none"> 3. Set up Currency and Printing Committee 4. Initial contact with printers and mints 5. Take information gathering visits to unions, major countries, and vendors 6. Investigate use of plastic banknotes 7. Investigate use of electronic currency 8. Decision on common, own, or vendor production 	This schedule is for a small or regional union. Large, or continent-wide unions should move all steps at least one year earlier.
Three years prior	<ol style="list-style-type: none"> 9. Consultations on user needs, including special needs 10. Establish currency themes and denominations 11. Set coin-banknote boundary and denomination ladder 12. Select security features 13. Decisions on currency design and features 14. Public review or survey on currency and designs 15. Consultations with industry on ATMs, money sorting and authentication machines, and vending machines 16. Draft standards for money sorting machines, ATMs, and vending machines 17. Final decisions on design 18. Decisions on electronic currency 19. Draft legal framework for common currency 20. Begin work on anti-counterfeiting regime and detection centers 21. Begin discussions with Interpol on anti-counterfeiting enforcement 22. Union and all member countries subscribe to Geneva anti-counterfeiting convention. 23. Begin development of training materials on new currency and security features 24. Survey of country anti-counterfeiting practices and laws 	If electronic, handheld, or mobile phone currency is adopted, a separate major program will be required.
24 months prior	<ol style="list-style-type: none"> 25. National legal implementation 26. Printing masters prepared (6 months) 27. Arrange for purchase of materials 28. Report on usage outside of planned union 29. Preparation of materials for cash handlers 	

18 Months Prior	<ul style="list-style-type: none"> 30. Begin training of cash handlers 31. Test run under operational conditions 32. Evaluation of test and corrections 33. Decision on initial volume 34. Begin production of banknotes and coins 35. Set up anti-counterfeit network, testing labs, and legal framework for national adoption 36. Certification of machines through live runs 	<p>For large unions, production of banknotes and coins should begin two full years prior to startup, or earlier.</p> <p>For introduction of the currency to the public, see Chapter 12 on the cash changeover and transition to the new currency.</p>
Final 12 months	<ul style="list-style-type: none"> 37. Full production of banknotes and coins underway 38. Shipments begin to central banks and distribution points 	
Final 6 months	<ul style="list-style-type: none"> 39. Final decision on membership 40. Final decision on intra-union conversion rates for national currencies into union currency 41. By 6-month point, central banks must have working stock on hand 	
Run-up to union	<ul style="list-style-type: none"> 42. Distribution to banks, and cash handlers, and government offices 43. Distribution to external users 44. Distribution to central banks or distribution centers outside of union 45. Loading of ATMs 46. 20% reserve in the field by startup date 	
Day before union start-up day (U – 1)	<ul style="list-style-type: none"> 47. Calculate final external conversion rates for new currency 	
Union start-up day (U)	<ul style="list-style-type: none"> 48. New currency becomes legal currency of union 49. Monitor experiences 	
Early union period	<ul style="list-style-type: none"> 50. Evaluate performance of machines 51. Priority oversight of possible counterfeits 52. Measure uptake of currency, by country 53. Measure retirement of national currencies 54. Initiate currency handling procedures 55. Pull old currency out of circulation 56. Prepare report on changeover experience 	
Union steady state	<ul style="list-style-type: none"> 57. Set annual production levels 58. Examine turnover and condition of banknotes 59. Regular report on authenticity 	

O. Appendix I - Conversion Rates from National Currency to the Union Currency

One of the most important decisions for new unions is setting the rates at which to convert from national currencies into the new union currency. This appendix describes methods to calculate the conversion rates. The decision on setting conversion rates is important for the individual countries involved (economically and politically) and for the functioning of the new union. This should be a major research and analysis effort for each union, and a clear decision-making process should be employed so that union members and international markets have confidence that the rates were well-chosen and based on sound economic evidence. Given this, new unions may wish to test multiple methods and compare results.

Euro area Method

The euro area system (described in Chapter 3) was based on decades' long experimentation with the European Currency Unit (ECU) that allowed market forces (operating with certain bounds and with occasional resettings of individual rates) to drive the evolution of exchange rates. The long development of the system allowed time for the relative price configuration of the European exchange rates to be integrated into the domestic price structures of the economies so that intraregional trade could evolve based on relative national prices. Ultimately, the configuration of exchange rates built into the ECU established the conversion rates for the euro because the ECU was converted into the euro one-to-one. The EMU method is sound in concept, but *a priori* it is unclear how much guidance it can provide to other regions that will not have a long gestation period for their unions and may not have the same degree of economic integration that existed in Europe.

Dollar Peg of the Gulf Cooperation Council (GCC)

As preparation for their currency union, the countries of the GCC pegged their currencies to the U.S. dollar, but at different rates for each country. This established the *nominal* relationship of each currency vis-à-vis the dollar and with each other currency. This arrangement has been very effective in reducing conversion costs between the Gulf currencies and provided a method to set the conversion values for the new union currency. A tentative decision to continue the current dollar peg at the start of the GCC currency union means that the nominal conversion rates have already been set.

However, using the rates for the *nominal* peg might not be optimal if the *real* exchange rate moves over time. For example, if during the time since the peg was set a Gulf country experienced rapid domestic price inflation relative to the other GCC countries, it experienced real exchange rate appreciation against the others that makes the economy less competitive. This change in relative prices occurred in Qatar and the UAE during about 2006 – 2008 that markedly changed the real exchange rate between the Gulf currencies. The method described below addressed the issue of the changes in the real exchange rate relationships between the currencies as a result of different rates of inflation in the countries.

Krueger/Kamar/Carlotti (KKC) Methodology

A method developed by Krueger, Kamar, and Carlotti⁵² can be used to estimate conversion rates in new unions that do not have a market-based arrangements used in the euro area, the European Exchange Rate Mechanism (ERM) and ERM II. The method sets the conversion rates based on estimates of each country's real equilibrium exchange rate (REER) and its degree of misalignment from a common reference value. KKC provide a detailed presentation of the method suitable for rigorous testing.

The notion of a country's equilibrium exchange rate as guidance for setting the conversion rate into the euro was introduced in the Exchange Rate Mechanism II (ERM II) for new entrants to the Euroarea. ERM II requires countries seeking to join the EMU to hold their currencies for at least two years within specified bands around a central parity vis-à-vis the euro. It also requires that the central rate chosen should reflect the best possible assessment of the equilibrium exchange rate at the time of entry into the mechanism. The ECB says that the assessment should be based on a broad range of economic indicators and developments. (ECB, 2003)

Identifying the equilibrium exchange rate at the conversion date is therefore essential. If an exchange rate is misaligned (overvalued or undervalued) at the time of the conversion into the union currency, it will be frozen at that misalignment leading to economic distortions across the union members. An undervalued conversion rate provides greater competitiveness for the country in comparison with its partners in the currency union, and will require a higher than average inflation rate throughout the union to reduce the misalignment. An overvalued entry could involve significant costs in terms of unemployment and bankruptcies (Wren-Lewis, 2003). Therefore, accurate assessment of the misalignment for all potential members of the union is crucial.

The KKC method provides a comprehensive approach to determine the conversion rate, taking into account the notion of exchange rate equilibrium. It focuses on *forecasts* of macroeconomic conditions and equilibrium exchange rates and thus has an advantage of providing policy makers seeking currency union with a framework to help identify the required exchange rate adjustments in the future when the union is expected to be formed.

The methodology has three steps:

- The first step identifies the year in which the economy was closest to its internal and external equilibrium. Several methods can be used;

⁵² Krueger, R., B. Kamar, and J-E Carlotti. *Establishing Conversion Values for New Currency Unions: Method and Application to the planned Gulf Cooperation Council Currency*. IMF Working Paper 09/184. August 2009.

- a. Use economic judgment to select a period in which there is apparent domestic and external equilibrium, based on indicators such as near-full employment, constrained price pressures, exchange rate stability, and a sustainable current-account balance.
- b. Use the IMF standard methodology to estimate the equilibrium exchange rate conditions. Three methods are used by the IMF, described in the Box *IMF CGER Exchange Rate Assessment Methodologies*, below.
- c. Use the real exchange rate equilibrium approach that links the exchange rate to its long-term fundamentals. The lowest deviation from equilibrium (the lowest misalignment) in the recent years is an indication of the equilibrium year.⁵³
 - The second step estimates the real exchange rate equilibrium and misalignment of *each* currency vis-à-vis the prospective anchor currency for the union, or vis-à-vis the real effective exchange rate (REER) if the anchor is a basket of currencies or if the objective is for the new currency to float freely.⁵⁴ Forecasted values of the real exchange rate and its fundamentals are used to allow for forward-looking perspectives.
 - The final step consists of normalizing the equilibrium exchange rate from Step two above to have a value of zero in the year of equilibrium identified in Step one. The forecasted real exchange rate misalignment calculated in step two will serve as a measure of the necessary nominal exchange rate (NER) adjustment for the conversion rate.

These methods can be used to determine if the existing exchange rate configuration of the pre-union currencies is robust or should be changed. Small measured misalignments (such as less than 5 percent or 10 percent) might be considered “close enough” and left unchanged. Larger misalignments should be corrected.

Because the conversion to the new union currency is a prospective event that will occur in the future, the methodology uses forecasted data for all the variables and proxies in the models. Data for each country from the IMF’s World Economic Outlook (WEO) forecasts are used because they are available for many countries for the coming five years in a harmonized fashion. However, other forecasts can be used for comparison of results.

For example, a forecast misalignment of each exchange rate is based on the information identified in points one and two. For each prospective union country, the equilibrium

⁵³ The KKC study uses this method in order to obtain nonsubjective, country-specific measures of exchange rate alignments.

⁵⁴ The countries seeking to create a GCC union have linked their currencies to the U.S. dollar – misalignment in the real exchange rates can be measured vis-à-vis that common measure. Other unions may also have fixed pegs, such as to the dollar or euro. However, other unions that may wish to peg their currencies to a fluctuating currency basket or allow the union currency to float will not have a fixed nominal peg and instead can adjust to the REER using the method here.

bilateral real exchange rate is set to equal zero at the equilibrium year identified in step 1. Then the misalignment estimated in step 2 is used to get the required percentage of adjustment for each year following the initial established rate – which is forward looking because of the use of forecast data. For example, if the REER was at equilibrium in year 2006, and the misalignment in year 2010 is estimated to be +27% (i.e., overvalued by 27%), 23% in 2011, and 17% in 2012, the exchange rate needs to be devalued by 27% if conversion into the currency union takes place in 2010, by 23% if the currency union takes place in 2011, and by 17% if the common currency is established in 2012.

One reason for using this approach is that each prospective union will face challenges to its credibility and the new union currency may be subject to speculative attacks. Information from this method can impart a view to the public that exchange rates are based on fundamentals, which may contribute to greater stability for the currencies.⁵⁵ The rigor needed to apply the method requires that authorities carefully organize their research and analytic program to compile the range of relevant data from all the prospective union members and carefully analyze the data and produce defensible results. By doing so, the researchers and union authorities will be very familiar with conditions in each country and the conditions that favor or hinder the use of any specific conversion rate. This expertise will contribute to public confidence that the proper exchange rate has been used. Each prospective union should undertake such investigations, ideally starting well before the official beginning date of the currency union.⁵⁶

Moreover, the information generated will provide key insights on the convergence process, especially real convergence, that can help evaluate the process of union building. One possibility is to apply different scenarios to the underlying parameters to reflect possible policy or exchange rate regime options.

Text Box: IMF CGER Exchange Rate Assessment Methodologies

⁵⁵ Also, new unions will face the issue of possible manipulation of bilateral conversion rates just prior to setting up the union. The application of the method in this paper can provide independent information that may be relevant to help avoid possible manipulation.

⁵⁶ In all regions, data issues will present challenges to all methods to calculate conversion rates. Historical time series going back well before the planned start-up date for the union will be needed. For this reason, programs to compile the relevant statistics under common standards should begin in all potential member countries early in the process of developing the union. A centralized database is required to make use of the data to estimate the conversion factors.

The IMF has a standard method for assessing exchange rate conditions called the Consultative Group on Exchange Rate Issues (CGER) approach. The CGER uses a multi-country panel to estimate equilibrium trade conditions. The use of a panel permits application of the results to a wide range of countries and therefore the method is easy to apply, but it lacks precision that can result from focusing on variables affecting individual countries. Assessments of exchange rate misalignments based on CGER will always need to be informed by country specific factors that are difficult to incorporate into studies based on large cross-country datasets.

Surveillance over the exchange rate policies of its member countries is a central responsibility of the IMF. In late 1994, the IMF staff took a step toward making its surveillance more effective by initiating more extensive and systematic assessments of the current account positions and exchange rates of the major industrial countries, incorporating both the perspectives of the IMF's area departments and calculations derived from a multilateral framework implemented by the IMF Research Department. In 1995, an interdepartmental working group, the Coordinating Group on Exchange Rate Issues (CGER), was established to strengthen and extend this work, and to provide a greater degree of discipline and consistency in the staff's judgments about exchange rates. CGER's general approach for assessing the current accounts and exchange rates of the major industrial countries was reviewed by the IMF's Executive Board in October 1997, and a description of the methodology was subsequently made public.

Abiad et al (2009) describes three complementary approaches used in the CGER: the macroeconomic balance approach, a reduced form equilibrium real exchange rate approach, and an external sustainability approach.

The **macroeconomic balance (MB) approach** calculates the difference between the current-account balance projected over the medium term at prevailing exchange rates, and an estimated equilibrium current-account balance or "CA norm." The latter is a function of medium-term determinants of the savings-investment balance, such as demographic factors (population growth and old-age dependency), the fiscal balance, and level and growth rate of output per capita. The exchange rate adjustment that would eliminate this difference over the medium term—a horizon over which domestic and partner-country output gaps are closed and the lagged effects of past exchange rate changes are fully realized—is obtained using country-specific elasticities of the current account with respect to the real exchange rate.

The reduced-form **equilibrium real exchange rate (ERER) approach** estimates an equilibrium statistical relationship between the real exchange rate for each country and macroeconomic fundamentals, such as the net foreign asset (NFA) position of the country, relative productivity differentials between the tradable and nontradable sectors, and the terms of trade. The exchange rate misalignment is then calculated as the difference between the estimated equilibrium real exchange rate, based on medium-term projections of the fundamentals, and its current value.

The **external sustainability (ES) approach** calculates the difference between the current- account balance projected over the medium term at prevailing exchange rates, and the balance that would stabilize the NFA position of the country at some benchmark level. Using the same elasticities as in the MB approach, this difference is translated into the real exchange rate adjustment that – over the medium term – will bring the current-account balance in line with its NFA-stabilizing level.

The three misalignment estimates are then combined to give an overall assessment, using simple criteria. If the average of the three misalignments is within five percent of zero, or if each of the three misalignments are less than 10 percent in absolute value, then the currency is assessed to be broadly in line with fundamentals. Otherwise, the approximate midpoint of the three estimates (when all three estimates are within 10 percentage points of each other) or a range encompassing all three estimates (when the estimates are at least 10 percentage points apart) is used as the assessment.

Cross-Country Price Comparisons

Although unlikely to be the primary method of setting conversion rates, information on relative prices of traded goods can provide important supplemental information on the price structure in the new union conversion rates. The use of price information is based on the concept of purchasing power parity (PPP) which says that (with allowance for differences in shipping costs) the price of identical goods traded between countries converted by the exchange rate should be equal. A corollary is that if they are not equal, arbitrage will take place to shift purchases to where the goods are less expensive. This shift in demand for goods between countries can lead to changes the exchange rates until the point is reached where parity is restored. In a classical economic environment, movements in exchange rates that cause deviations in PPP will be short-lived.

This basic concept has been thoroughly empirically reviewed, but most important for this purpose is the International Comparison Project (See the original study (ICP; 1975), and the numerous follow-up studies). The ICP is a major international statistical initiative needed to produce price measures for national income measurement and to measure poverty and wealth. It uses the concept of PPPs to convert national expenditure data into a common currency. *The body of research for the ICP has shown that movements of exchange rates can cause significant and persistent deviations in exchange rates from those that result in PPP.*

Another very important conclusion of the ICP is that converting purchasing power in different countries by exchange rates systematically understates the purchasing power of the currencies of low-income countries. This makes per capita incomes of low-income countries look lower than the reality. (The reality may still not be good and the poverty being described is still very real, but at least it is being better measured. For example, a more accurate higher estimate of the starting point will tend to show that improvements in ending poverty are less rapid than shown with the less accurate data.) For new unions, a wide dispersion of incomes among prospective members could indicate misalignments away from PPP, which is

ultimately one of the goals of creating an integrated economic area within the union. The challenges of finding the best conversions rates will be greater under these circumstances.

These conclusions are very important for new currency unions. *It cannot be assumed that PPP conditions will exist between countries joining a union.* Whether PPP exists can be empirically determined using the ICP methodology, and mechanisms can be sought to encourage greater integration of the price structure in the planned union, through market mechanisms such as use of the ECU in Europe or other methods such as the KKC method above.

Fortunately, the ICP program is being widely applied and good information on prices of comparable goods is available for many countries, including in Africa. As these data will continue to be needed for future unions, continuing support for the ICP is needed. Planned unions may also wish to consider some customization of the ICP methodology to better obtain information specific to their future union.

P. Appendix II - ERM bilateral central rates

This appendix presents two tables used in estimating the conversion values of national currencies into the euro. The uses of these tables are described in section D, above.

Table 1 presents the matrix of bilateral central exchange rates used to set the central rates for the ECU that was used to set the final irrevocable conversion rates for the euro.

Table 1 - ERM bilateral central rates used to set the irrevocable conversion rates for the euro

	<u>DEM100 =</u>	<u>BEF100 =</u>	<u>ESP100 =</u>	<u>FRF100 =</u>	<u>IEP1 =</u>	<u>ITL1000 =</u>	<u>NLG100 =</u>	<u>ATS100 =</u>	<u>PTE100 =</u>	<u>FIM100 =</u>
GERMANY:	1.00000									
BEL/LUX ⁵⁷	2062.55									
SPAIN:	8507.22	412.462								
FRANCE:	335.386	16.2608	3.94237							
IRELAND:	40.2676	1.95232	.473335	12.0063						
ITALY:	99000.2	4799.90	1163.72	29518.3	2458.56					
NETHERLANDS:	112.674	5.46285	1.32445	33.5953	2.79812	1.13812				
AUSTRIA:	703.552	34.1108	8.27006	209.774	17.4719	7.10657	624.415			
PORTUGAL:	10250.5	496.984	120.492	3056.34	254.560	103.541	9097.53	1456.97		
FINLAND:	304.001	14.7391	3.57345	90.6420	7.54951	3.07071	269.806	43.2094	2.96571	

Table 2 presents the calculations used to set the irrevocable conversion rates for national currencies into the euro. The data in Table 2 are sample data for yearend 1997 (the year before the actual conversion) as published May 2, 1998 in the *Joint Communiqué of Finance Ministers and Central Bank Governors of the Member States adopting the euro* to show the calculation that would be used to set the actual rate for the euro. The actual irrevocable conversion rates based on exchange rates at the end of 1998 are shown in Table 3, immediately below Table 2.

Table 2 – Calculation of exchange rates of the official ECU against the EU currencies in the euro area – Sample data for December 31, 1997.

⁵⁷ Belgium and Luxembourg used a single currency.

	National currency units in ECU basket (weight _{NC})	US\$ exchange rate on Dec. 31, 1997 (NC/\$)	Dollar equiv. of national currency amount (weight _{\$})	ECU exchange rates
	(a)	(b)	(c) = (a) / (b)	(d) = (USD/ECU) × (b)
DEM	.6242	1.7998	0.3487541	1.97632
BEF	3.301	36.92	0.0894095	40.7675
LUF	.130	36.92	0.0035211	40.7675
NLG	.2198	2.0172	0.1089629	2.22742
DKK	.1976	6.8175	0.0289842	7.52797
GRD	1.440	282.59	0.0050957	312.039
ITL	151.8	1758.75	0.0863113	1942.03
ESP	6.885	151.59	0.0454186	167.388
PTE	1.393	183.06	0.0076095	202.137
FRF	1.332	5.9881	0.2224412	6.61214
GBP	.08784	1.6561	0.1454718 *	.666755
IEP	.008552	1.4304	0.0122328 *	.771961
<i>ECU basket = Sum of dollar weights above</i>			<i>USD/ECU = 1.1042128*</i>	
<i>FIM</i>		5.4222	1.1042128	5.98726
<i>ATS</i>		12.59	1.1042128	13.9020

Table 3 – Irrevocable conversion rates (Actual rates derived from December 31, 1998 exchange rates, following the methodology used in Table 2, above)

Currency	Six-digit conversion rate
Austrian schilling	13.7603
Belgian franc	40.3399
Dutch guilder	2.20371
Finnish markka	5.94573
French franc	6.55957
German mark	1.95583
Irish pound	.787564
Italian lira	1936.27
Luxembourg franc	40.3399
Portuguese escudo	200.482
Spanish peseta	166.386

Q. Appendix III – Impacts on the banknote printing and minting industries

The international banknote printing and minting industries could be dramatically affected by new monetary unions in Africa and the Gulf. Factors include greater uncertainties than in Europe, consolidation of the current highly fragmented market, and restructuring contracting processes.

Uncertainties

Future unions face greater uncertainties regarding banknote and coin production than was experienced in Europe. The uncertainties could affect costs and scheduling.

- Union-wide usage patterns have not yet been fully investigated. As has been emphasized in this paper, Europe can provide guidance on the types of usage factors to consider, but different conditions in each future union could result in different answers – printers and mints will need more specific guidance before serious currency design work can begin.
- In Europe, the likely start-up dates for the euro were fixed by treaty, but start-up dates in the future unions have not been firmly set, and one or more of the possible unions might not materialize. Printers and mints will be hesitant to undertake work “on spec” years before uncertain union start-up dates.
- Ultimate membership of the future unions is not settled.
- The conversion rates from national currencies into the union currency and the sizes of the nominal units have not yet been set. Until the conversion rates, nominal unit size, and coin-banknote gaps are set, the volume of production runs cannot be set. In contrast in Europe long-term experience with the ECU provided guidance. The Nigerian naira, Saudi riyal, and South African rand might serve as lead currencies to set these parameters in their respective unions, but no similar lead currency is available in East Africa.
- Unlike Europe, banknote and coin production will interact intimately with e-money conditions and potentially could result in less demand for physical cash in total or for specific denominations. Rapid evolution in the e-money industry complicates the picture.

Consolidation

Printing and minting markets for new unions differ greatly from those in Europe when the euro was created. Most potential Euroarea countries had existing public operations adequate for domestic demand that were converted to euro production under official surveillance. National officials had long experience and skills to undertake the transition in a timely, effective manner. In contrast, most African and Gulf countries rely on negotiated contracts

with international printers and mints (Crane, de la Rue, Giesecke & Devrient, etc.), on whom the countries are heavily dependent for printing capacity and expertise. As many as two dozen currencies could disappear to be replaced by a handful of larger currencies.

Renegotiation of printing and minting contracts

Contracts with existing currency producers will be renegotiated. Countries in a new union will begin with a diverse range of contracts for banknotes and coins with different conditions and costs, which might involve multiple printers or mints. Ultimately, these fragmented arrangements will be replaced with a single contract, a process that might not run smoothly and which could upset vested interests.

A power shift will be involved as new negotiating teams representing multiple countries acting under regional oversight come to the table. Individual small-country negotiators potentially subject to undue suasion by printers and mints (as suggested by recent press reports that some staff of the Austrian national printing press had bribed national authorities to get contracts) will have diminished roles. Importantly, negotiations must be undertaken with regional, multicountry oversight and audit to assure each of the participating countries. On the other side of the table, the currency producers will be negotiating for bigger contracts to replace sometimes very small country production runs. These more lucrative prizes might attract greater attention by official national printers and mints, who might enter the bidding for contracts for the first time.

As printing and minting runs become larger in new unions, it becomes more feasible for new unions to develop their own capacity. Logically, widely used lower value banknotes and coins with less sophisticated security features should be produced first, with an intention to increasingly produce higher value notes and coins as expertise is gained.

Efficiencies of scale

The shift to contracts representing many countries could result in important efficiencies of scale. The costs to market and design perhaps two-dozen currencies will be eliminated, and production runs will be larger – potentially much larger.

Congestion

Finally, complicating the picture is that four unions might approach printing presses and mints simultaneously. If capacity is limited, which is possible for large new currency runs, currency production could be a definitive impediment to launching a union.

R. Appendix IV – E-money and the changeover to union currencies

By the time new unions in Africa and the Gulf start up, it can be assumed that e-money systems will exist within each union and thus physical cash and e-money policies for the union must be jointly set. Different variants of e-money systems could have different implications for demand for physical currency and for changeover strategies.

- Union planners will need to know the types of systems that will exist within the union prior to settling on cash policies. A policy of simultaneous introduction of e-money and new union physical currency might prove unsatisfactory because the total public demand for the e-money and the channels for its use will be unknown.
- The regulatory scheme for e-money could matter. Will privately-operated systems continue and be allowed market flexibility, or will they be tightly controlled and perhaps even run by the union? Less regulated systems might better respond to technical or market innovations, but more control could allow better integration of e-money and cash strategies.

E-money systems can directly contribute to the cash changeover

- E-money systems can instantaneously convert between national currency and union currency values. National currency values entered into the system can automatically be displayed in the union currency (or also in other national currencies).
- Record keeping accompanying e-money systems can be readily redenominated into the new currency.
- The existing e-money systems can provide information about the cash changeover throughout the country using mobile phone facilities.
- E-money systems can internally operate as the union currency during any virtual currency phase for the new union currency.

E-money agents spread across the country can become channels to receive old national currencies and distribute the new union currency. For example, in the M-pesa system, the system of retail agents spread throughout the country can serve to collect old currencies and distribute the new union currency.

Finally, developers of currency policies in future unions must be aware that they must create a currency that is useful and which will be readily accepted by the public and businesses. Packaging the new union currency within a useful e-money system could be important in achieving a widespread “buy-in” by the public and businesses.

Bibliography

De Grauwe, P. (1997) The Economics of Monetary Integration. Oxford University Press, Oxford.

European Antifraud Office (2012) “Euro Coin Counterfeiting in 2011” Press Release January 27, 2012.

European Central Bank (2003) Decision of the European Central Bank of 20 March 2003 on the denominations, specifications, reproduction, exchange and withdrawal of euro banknotes. (ECB/2003/4).

_____ (2011) “Biannual information on euro banknote counterfeiting” ECB Press Release 17 January 2011.

European Monetary Institute (EMI) (1998) Annual Report: 1997. April, 1998.

European Commission (EC) (2000) Directive 2000/46/EC of the European Parliament and of the Council "On the Taking up, Pursuit of and Prudential Supervision of the Business of Electronic Money Institutions".

Financial Times (2010) “Call for new global currencies agreement” October 5, 2010.

Innopay (2011) Mobile Payments 2012. (Innopay B.V., Schiphol, Netherlands).

Krueger, R. and Enoch, C. (2010) “Currency unions: key variables, definitions, measurement, and statistical improvement” in IFC (2010) Pages 139-158.

Krueger, R., and Ha, J. (1995) “Measurement of the Cocirculation of Currencies.” IMF Working Paper 95/34.

Krueger, R., B. Kamar, and J-E. Carlotti.(2009) Establishing conversion values for new currency unions: method and application to the planned Gulf Cooperation Council (GCC) currency union. IMF Working Paper 09/184.

New York Times (2001) “Euro’s Entry is Forcing Europe’s Hidden Hoards to Surface” September 6, 2001.