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Banknote Migration in the CENTROPE Region

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1. Introduction

The objectives of central banks within the framework of the European System of Central Banks (ESCB) are well defined and aligned to the assignment of the European Central Bank (ECB). Every central bank has to adjust its activities due to its specific environment which is determined and influenced by the size and vitality of the economy as well as by the competitive position and structure of the financial market. Of course, structural shifts have an impact on the decision making processes in central banks.

The Oesterreichische Nationalbank (OeNB) has been facing four major shifts of its political and economic environment within the last decade. In 1995 Austria joined the European Union, in 1999 Austria was a founding member state of the European Monetary Union, in 2002 the euro cash was introduced and in 2004 the enlargement of the European Union by ten countries (four of them having a common border with Austria) took place. All of these historical events represented an important challenge for the OeNB, and in all four cases the OeNB adjusted to the new framework by:

- focusing on the economic analysis of Central and Eastern European countries,
- successfully introducing the euro cash,
- setting a new focus on the analysis of Southeastern European countries,
- providing technical assistance in euro changeover matters especially to neighboring countries (for example: twinning projects with Hungary and Slovakia) and
- providing technical assistance in all areas to Central, Eastern and Southeastern European countries as well as CIS countries.

With the enlargement of the European Union the neighboring countries of Austria moved closer.

From a regional point of view there is another important issue in this respect. Nowhere in Europe there are two capital cities so close to each other like Vienna and Bratislava (55 km bee-line) forming a transnational economic region. The enlargement opened the floor for close cooperation between Austria and Slovakia and especially between the two cities Vienna and Bratislava.

The potentials for cooperation are enormous. In order to analyze the possible common issues, possibilities and challenges the idea of "CENTROPE – Central European Region" was born. The initiative was created by the Federation of Austrian Industry in 1997. "CENTROPE" covers more than the Vienna and Bratislava region; it includes north-western parts of Hungary and southern parts of the Czech Republic as well. The region has a population of about 7 million representing thus an important European metropolitan area.

2. Role of the Euro Outside the Euro Area

Foreign cash or foreign currency-denominated bank deposits are important financial assets for residents of many countries, especially with developing or emerging markets. After the introduction of the euro cash, holdings of euro banknotes and euro-denominated bank deposits have become increasingly important. The rise in the euro exchange rate since 2002 has enhanced the image of the currency outside the euro area. The euro is indeed an international currency today.

Foreign holders of euro banknotes benefit from their holdings as they acquire an asset that is liquid, secure and stable in value. These characteristics are often unavailable in their own country's currency, especially during and after periods of turmoil. In some non-euro area countries, the euro has even gained the position of a common medium of exchange.

The ESCB benefits from currency holdings outside the euro area by the so-called seigniorage. Seigniorage benefits are realized from the interest earned on the asset counterpart to the ECB liability for the currency in circulation. The ECB issues non-interest bearing obligations (i.e. banknotes and coins) and then uses the proceeds to acquire interest bearing assets. As euro currency in circulation has been increasing in response to the growing trust into the euro, interest earnings have also been increasing.

However, there are costs of external euro circulation. These costs originate mainly from expenses for the physical handling of cash (issue, sorting process, repatriation, re-issuing, destroying, and authentication procedures). It is a challenge and a responsibility of the ECB and the National Central Banks (NCBs) of the ESCB to ensure the integrity of the euro. It is an inviting target for counterfeiters, as it is a globally used currency.

According to a survey conducted by the European Commission aiming to build up a better picture of the role of the euro as a private means of payment and exchange, the international perception of the euro has been strengthening continuously in all regions of the world over 2003 (European Commission, 2004). The survey analyses three main aspects of the euro: the possibility of exchanging euro cash; the use of euro cash for payments; and public attitudes towards the euro. The results of the survey revealed that in general euro cash can be exchanged more easily. There are no major difficulties in selling euro cash for local currency.

Problems were encountered only outside of tourist areas and major cities particularly in Central American countries. It is, however, more challenging to obtain euros. Again in the Americas, but also in certain parts of Africa and Asia difficulties emerged. Of course, the closer you come to the euro area, the easier it is to exchange. Limits on holdings and on the exchange of foreign currencies were mainly found in Africa and Asia, where restrictions on the import of foreign currency and on the amounts held by individuals were imposed.

The possibility to pay with euro cash remains largely restricted to tourist areas. The display of prices in euro is even less widespread and mostly restricted to European non-euro area countries. However, it is common use in some countries to display prices in euro for high value items.

The public awareness of the euro improved significantly in all regions. Many respondents of the survey attributed the improvements of public awareness to the euro exchange rate appreciation against the U.S. dollar. The familiarity of the general public with the euro is still very low in the Americas or in Asia, though. Due to economic links to the EU the business sectors are in general much more familiar with the euro than the public.

In the euro area neighboring countries the euro is the most important foreign currency. According to the quarterly survey conducted by the Oesterreichische Nationalbank in Croatia, Hungary, the Czech Republic, Slovenia and Slovakia the estimated amount of euro that circulated in these countries increased constantly since 2002. However, it has not reached the total amount of the constituent currencies prior to the cash changeover yet as there has been a substantial decline by about one third in the joint demand for Deutsche mark and Austrian schilling before the introduction of euro cash. The survey revealed that an average of about 71% of the respondents exchanged their Deutsche mark holdings for euro, 21% for local currencies, 4% for U.S. dollars, 1% for Swiss francs, and 2% for other currencies. The projections for the demand for U.S. dollars show a downward trend over the period from 2000 to 2004, with U.S. dollar demand in late 2004 being about half of the demand in 2000.

Most of the respondents of the survey consider the euro as a stable currency. Even among holders of U.S. dollars the euro is seen as more stable than the U.S. dollar (Stix, 2005).

The confidence in the local currencies has increased in these countries over the past years due to stability-oriented economic policies. This would imply that euro cash holdings might decrease, but as economic links to the euro area are strengthening continuously and as all of these countries follow their path to the adoption of the euro[1], the future role of the euro is expected to increase further.

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[1] According to the national euro changeover plans Slovenia intends to introduce the euro as a legal tender in January 2007, Slovakia in 2009, the Czech Republic and Hungary in 2010 (possibly in 2009). Croatia is not a member of the European Union, thus, there is no

3. Banknote Migration

3.1 Determining Factors

The amount of banknotes in circulation is determined by the size of the population, the economic performance (Gross domestic product – GDP and Gross regional product – GRP), the level of income, the branch network of the commercial banks and the preferences for specific means of payment (cash and non-cash) in a country.

In order to highlight the CENTROPE regions, it seems necessary to show them in their context and to explain their position within their territories.

Table 1: General Data CENTROPE Region (Absolute Values)

Country	Region	Area (km²)	Population (2003)	GDP/GRP (mio. EUR)	GDP/capita EUR
Czech Rep.	Jihočeský	10,057	625,541	4,135	13,052
	Jihomoravský	7,066	1,122,570	7,811	13,722
	Czech Rep.	**78,867**	**10,211,455**	**75,824**	**14,660**
Hungary	Győr-Moson-Sopron	4,208	440,000	3,502	14,584
	Vas	3,336	267,000	1,794	12,240
	Hungary	**93,029**	**10,142,400**	**68,891**	**12,402**
Austria	Burgenland	3,965	277,400	4,959	17,900
	Lower Austria	19,178	1,554,000	33,422	21,600
	Vienna	415	1,553,700	57,141	36,800
	Austria	**83,871**	**8,117,800**	**212,511**	**26,500**
Slovakia	Bratislavský	2,052	599,787	6,694	26,109
	Trnavský	4,147	552,014	2,597	11,183
	Slovakia	**49,034**	**5,380,053**	**25,730**	**11,328**

Source: National statistical offices.

The regions that are part of CENTROPE contribute an important share of GDP of their respective countries. As Bratislava and Vienna – the capital cities of Slovakia and Austria – belong to CENTROPE, it is evident, that the share of CENTROPE is significantly high in those two countries. In Austria about 45% of GDP derive from Vienna, Lower Austria and Burgenland with about 27% deriving only from

national euro changeover plan yet. However, the survey revealed that 90% of the Croatian respondents reckon on the euro introduction, the majority of them expecting it beyond the turn of the decade.

Vienna. In Slovakia the picture is similar, as the economically most powerful regions, Bratislavský and Trnavský, belong to CENTROPE contributing about 36% to the Slovak GDP. The CENTROPE regions of the Czech Republic, Jihočeský and Jihomoravský, account for about 16% of the Czech GDP. The Hungarian CENTROPE regions, Győr-Moson-Sopron and Vas, contribute about 8% to the Hungarian GDP.

In addition to the size of the population and the economic performance, the wages and the productivity play an important role in the demand for banknotes. The CENTROPE region has substantial disparities in wage and productivity levels. The average wages in Austria are 6 to 7 times higher than in the neighboring EU countries. However, the CENTROPE regions do not belong to the "low-wage regions" in their respective country except for some border regions in Austria and the Czech Republic.

The general factors are determining the circulation of banknotes in a specific country. However, the number of banknotes in circulation is also determined by the number of issued denominations, their value as well as by the value of the denominations put into circulation via automated teller machines (ATMs).

Analysis of data from the Currency Information System (CIS) and sample studies of some euro area NCBs revealed that if one country issues a specific denomination via ATMs and its neighboring country does not issue it via ATMs, the denomination in question does, however, appear in the sample of the not-issuing country. Austria, for example, has rarely issued the 50 euro banknote via its ATMs for some time[2]. Germany and Italy, its neighboring euro area countries, do issue this denomination. However, the 50 euro banknote has a relatively high share in the denomination split of the returned banknotes in Austria.

In addition, the sample studies made it clear that higher denominations migrated more than lower denominations. That would explain that the 50 euro banknote is more common in Austria than the 20 euro banknote even though both denominations are rarely issued via ATMs.

Another important aspect in analyzing banknote migration is the circulation itself. It defines the potentials for migration by limiting the amount of money. Focusing on the banknote migration in CENTROPE, it is necessary to find a tool for evaluating the regional cash in circulation.

In line with the Quantity Theory of Money there is a linear relation between the GDP and the cash in circulation. By using the available data on the Gross regional product (GRP), it is possible to calculate the hypothetic regional cash in circulation.

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[2] Recently, Austrian ATMs are filled with 50 euro banknotes as well. Before only ATMs with four cassettes located in self service areas were filled with this denomination.

Table 2: Banknote Circulation[3]

	2000		2001		2002		2003		2004	
	Mio. Pieces	Mio. EUR	Mio. Pieces	Mio. EUR	Mio. Pieces	Mio. EUR	Mio. Pieces	Mio. EUR	Mio. Pieces	Mio. EUR
CZ	n.a.	5,621	n.a.	6,495	257	6,820	270	7,468	282	8,643
HU	n.a.	3,550	216	4,510	226	4,766	245	5,452	241	5,756
AT[4]	461	14,033	369	10,319	-	-	-	-	-	-
SK	118	1,699	129	2,094	132	2,223	138	2,446	146	2,775

Source: Česká národní banka, Magyar Nemzeti Bank, OeNB, Národna banka Slovenska.

Chart 1: Gross Domestic Product in Relation to Cash in Circulation (Linear Relation)[5]
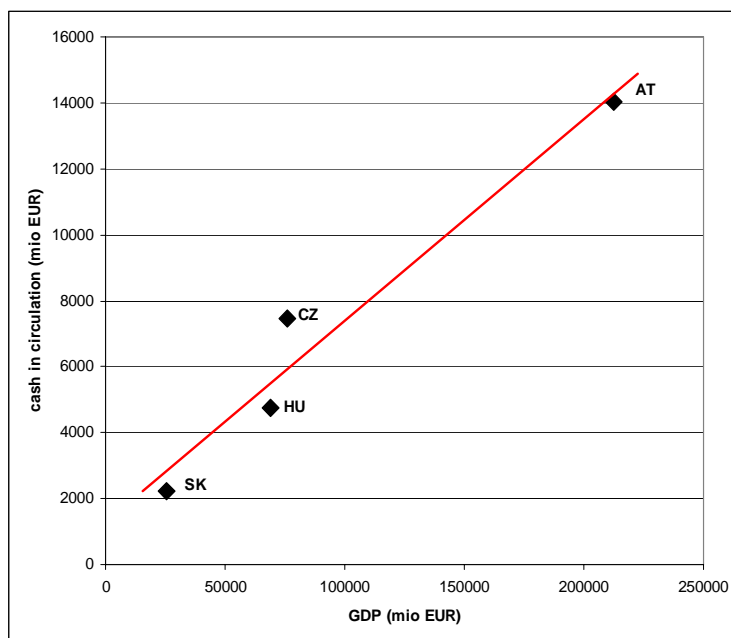
Source: Author's calculations.

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[3] The euro values are calculated on the basis of the respective exchange rates at the end of the period.

[4] Since the introduction of the euro (2002) a logistical circulation of cash is available only.

[5] Czech Republic: GDP and cash in circulation: 2003. Slovakia and Hungary: GDP and cash in circulation: 2002. Austria: GDP: 2001, cash in circulation: 2000, as in 2001 Austria was already preparing the cash changeover, the cash in circulation (in Austrian schillings) decreased substantially at the end of 2001. This would have distorted the result.

Table 3: Hypothetic Regional Cash in Circulation

		GDP (GRP) (mio. EUR)	Hypothetical regional cash in circulation (mio. EUR)
Czech Republic (2003)	Jihočeský	4,135	407
	Jihomoravský	7,811	769
Hungary (2002)	Győr-Moson-Sopron	3,502	242
	Vas	1,794	124
Austria (2001)	Burgenland	4,959	327
	Lower Austria	33,422	2,207
	Vienna	57,141	3,773
Slovakia (2002)	Bratislavský	6,694	578
	Trnavský	2,597	224
CENTROPE		**122,055**	**8,651**

Source: Author's calculations.

Chart 2: Size of GDP (Cash in Circulation) in Relation to the Share of CENTROPE
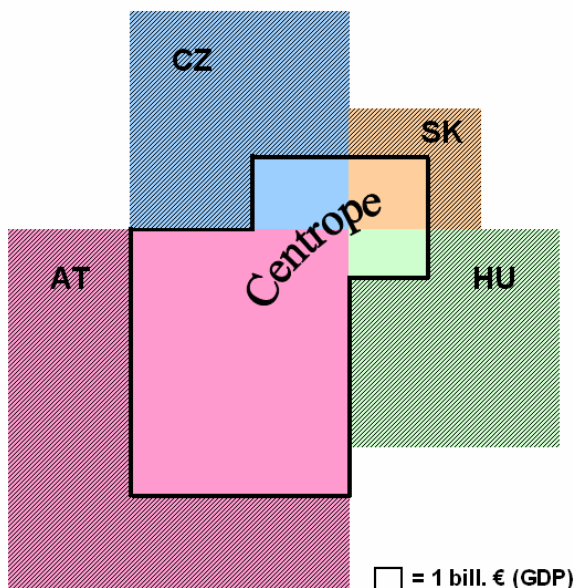
Source: Author's calculations.

Almost one third of the total GDP of all four countries (Czech Republic, Hungary, Austria and Slovakia) is produced in CENTROPE. Accordingly about one third of the total amount of cash in those countries is circulating in CENTROPE.

Another important aspect is the fact of euro cash holdings. They play an essential role in the determination of banknote migration. In general, people use currency holdings for their daily transactions, for hoarding purposes, for precautionary reasons and for speculative operations. As a matter of fact, cash is an anonymous medium of circulation. Thus, it is used for illegal purposes (shadow economy) as well. These reasons apply to home and foreign currency holdings (Fischer et al., 2004).

In addition, several factors have an impact on foreign currency holdings. The decision of an individual agent to hold foreign currencies depends on:

- the economic and political situation in the home country as well as in the foreign country (or group of countries),
- seasonal variations (summer holidays, bonus payments or expenditures for Christmas),
- transaction costs for the exchange of home to foreign currency,
- financial innovations (electronic money, payments via internet),
- socio-economic factors (age, sex, education, urbanization, unemployment etc.),
- exchange rate developments (between the home and the respective foreign currency as well as among foreign currencies) and
- interest rates.

Restrictions to currency holdings and currency transfers may also affect the decision. However, the Czech Republic, Hungary and Slovakia are already members of the European Union, they are directly linked to the euro area and have, thus, no such restrictions.

Chart 3: Euro Cash Holdings in Percent of Total Circulation
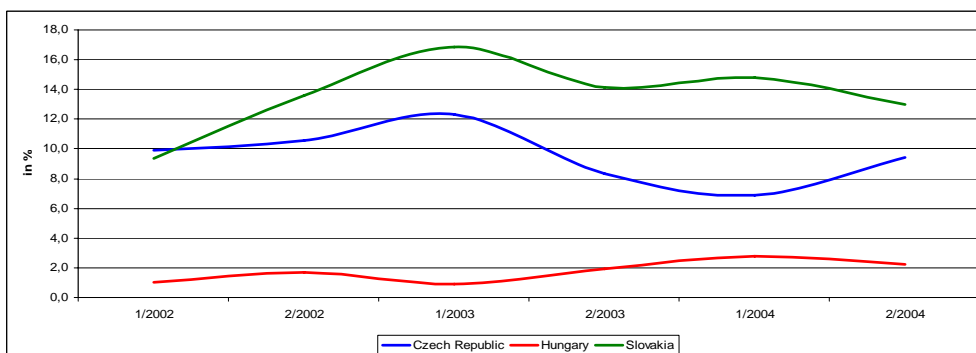
Source: Stix (2005).

Cash is traveling. Tourists want to be supplied with banknotes in order to be able to spend them abroad, they withdraw them at ATMs in the destination country and they bring back their surplus (banknotes and coins they did not spend during their stay) to their own country.

The number of Czech, Hungarian and Slovak tourists in Austria and Austrian tourists in the Czech Republic, in Hungary and in Slovakia should provide an indication of the amount of money spent on either side (euro area and non-euro area country).

In addition to the amount of cash in circulation, the currency holdings and the tourist movements, the contribution of labor force migration has to be considered. Austria has a long common border to the Czech Republic, Hungary and Slovakia. Due to the higher income levels, Austria is attractive to workers and employees from the new Member States. In the framework of the EU enlargement in 2004, a couple of studies and analyses have been made in order to describe possible (daily) labor force migration scenarios. A compilation of studies made by the Austrian Ministry of Economics and Labor indicates that in 1999 there were about 5,000 people migrating daily from the Czech Republic, Slovakia or Hungary to Austria. Estimations revealed a potential daily migration of about 76,000 people until 2012[6].

In order to be able to measure currency flows abroad, the United States Treasury Department proposed different methods (United States Treasury Department, 2003). A common approach is the so-called biometric method. It is often used by biologists trying to estimate the size of a large animal population, when only a small part can be seen at any one time. Pieces of currency (banknotes and coins) are comparable to a large population. By capturing a sample, marking them, releasing them, and capturing another sample later, the unknown general population can be estimated. The basic idea is that the share of marked items in the general population equals the share of marked items in the recaptured sample.

The U.S. authorities adapted this approach in order to estimate the U.S. currency circulation abroad. They combined two kinds of information. On one hand they use the data from Federal Reserve Cash Offices on currency shipments to and from local banks. On the other hand they knew that most of the USD 100 shipments handled by the Federal Reserve Bank of New York are to and from foreign banks. Thus, New York's shipments are earmarked. The ratio of the shipments to and from foreign banks and the total shipments corresponds to the ratio of the internal circulation within the United States and the circulation abroad.

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[6] Including Slovenia. Source: Ministry of Economics and Labor of the Republic of Austria, 2002.

3.2 Cash Circle Flow Model (As-Is Analysis)

The basic assumption in the cash circle flow model is that the net banknote migration can be calculated as the sum of the balances between banknote exports and banknote imports of a particular country i (1).

$$(1) \qquad B_{net} = \sum_{i=1}^{n} (bnX_i - bnI_i)$$

B_{net} *net banknote migration*
bnX_i *banknote exports to country i*
bnI_i *banknote imports from country i*

In order to be able to elaborate regional disparities, it is necessary to define a region j, which is a part of country i. The sum of the banknote exports into all regions j of the destination country i results in the banknote exports to country i (2), and the sum of the banknote imports from all regions j of the source country i results in the banknote imports of country i (3).

$$bnX_i = \sum_{j=1}^{n} bnX_{i,j}$$

(2)

$$(3) \qquad bnI_i = \sum_{j=1}^{n} bnI_{i,j}$$

On the basis of these two equations it is possible to express the importance of a particular region in the country (4):

$$(4) \qquad \frac{bnX_{i,j}}{bnX_i} = \alpha_{i,j} \quad \text{or} \quad \frac{bnI_{i,j}}{bnI_i} = \beta_{i,j}$$

$\alpha_{i,j}$ *weight of region j in country i regarding banknote exports*
$\beta_{i,j}$ *weight of region j in country i regarding banknote imports*

The banknote exports and banknote imports of a region are determined by different influencing factors. This model is based on the assumption, that the banknote exports are a function depending on tourist traffic into country i, euro cash holdings in country i and on commercial holdings of banks, exchange offices and other enterprises in country i (5). The banknote exports increase only, if the holdings increase from one period to the other.

$$(5) \quad bnX_{i,j} = f(T^{-}_{i,j}, R_{i,j}, G_{i,j})$$

Assumptions:

$$(6) \quad T^{-}_{i,j} > 0$$

$$(7) \quad (R^{t}_{i,j} - R^{t-1}_{i,j}) > 0$$

$$(8) \quad (G^{t}_{i,j} - G^{t-1}_{i,j}) > 0$$

The banknote imports are a function depending on the tourist traffic from country i, euro cash holdings in country i and on commercial holdings of banks, exchange offices and other enterprises in country i (9). The banknote imports increase only, if the holdings decrease from one period to the other.

$$(9) \quad bnI_{i,j} = f(T^{+}_{i,j}, R_{i,j}, G_{i,j})$$

Assumptions:

$$(10) \quad T^{+}_{i,j} > 0$$

$$(11) \quad (R^{t}_{i,j} - R^{t-1}_{i,j}) < 0$$

$$(12) \quad (G^{t}_{i,j} - G^{t-1}_{i,j}) < 0$$

$T^{-}_{i,j}$	*tourist traffic into region j of country i (from Austria)*
$T^{+}_{i,j}$	*tourist traffic from region j of country i (to Austria)*
$R_{i,j}$	*euro cash holdings in region j of country i*
$G_{i,j}$	*commercial euro holdings in region j of country i*
$R^{t}_{i,j}$	*euro cash holdings in region j of country i at time period t*
$R^{t-1}_{i,j}$	*euro cash holdings in region j of country i at time period t-1 (previous period)*

$G_{i,j}^{t}$ *commercial euro holdings in region j of country i at time period t*

$G_{i,j}^{t-1}$ *commercial euro holdings in region j of country i at time period t-1 (previous period)*

All these influencing factors are determined by
- the size of the population
- the level of income
- the economic performance and
- the preferences of the population for the different means of payment of the particular region.

3.3 Cash Circle Flow Model (Forecast)

With the introduction of euro cash as legal tender in country i, changes in the holdings become irrelevant to banknote migration, as the national central bank of country i will be responsible for the issue of banknotes. Therefore the following equation applies (13):

(13)
$$R_i, G_i = 0$$

Consequently, the tourist traffic remains as determining factor for banknote migration:

(14)
$$bnX_{i,j} = f(T_{i,j}^{-})$$

(15)
$$bnI_{i,j} = f(T_{i,j}^{+})$$

3.4 Statistical Evidence

Commercial banks that are allowed to deal with foreign currency are obliged to report their foreign currency transactions to the OeNB.

Based on these reports it is possible to demonstrate the flows of cash between Austria and its neighboring countries, the Czech Republic, Hungary and Slovakia. In all three cases the net flows to Austria are positive. Therefore, more euro cash is returning to Austria than it is leaving the country.

The total inflows from the three neighboring countries in question amount to about 8% of the Austrian cash in circulation in 2000. Whereas, the total outflows amount to less than 3%.

Table 4: Aggregated Flows from and to Austria

In mio. EUR	2002	2003	2004	2005[7]
Total outflows from AT to CZ, HU and SK	376.43	143.27	159.01	127.90
in % of Austrian cash in circulation (2000)	*2.68*	*1.02*	*1.13*	*0.91*
Total inflows from CZ, HU and SK to AT	1,062.12	1,196.79	1,040.00	495.38
in % of Austrian cash in circulation (2000)	*7.57*	*8.53*	*7.41*	*3.53*
Net flow AT-(CZ+HU+SK)	**685.69**	**1,053.52**	**880.99**	**367.48**

Source: OeNB.

According to the net flows of euro cash, it is obvious that Austria has an important inflow of cash from its neighboring countries. This result is supported by an ECB report on the issuance of euro banknotes. The report shows that since 2003 the OeNB has been issuing fewer banknotes than it received. While the Deutsche Bundesbank (DBB) provides the vast majority of the banknotes to non-euro area countries, the OeNB has been the most prominent receiver of returning banknotes. Consequently, the OeNB is facing a substantial increase in its banknote sorting and re-distribution activities.

The transaction in Czech crown, Hungarian forint and Slovak crowns are substantially lower than the euro cash flows between Austria and those countries. Most of these transactions are a result of payments into and from an account in Austria. Smaller parts but still essential are interbank dealings and the exchange of money by tourists.

Based on the available statistical data, it is possible to calculate the total amount of cash transactions. In 2004, about 1.7 billion euro in cash were transferred between Austria and its neighboring countries, the Czech Republic, Hungary and Slovakia.

By applying the Quantity Theory of Money and assuming that the size of the Gross Regional Product (GRP) corresponds to the number of cash transaction between the countries involved, the CENTROPE region transferred about 533 million euro in cash in between the borders of the region. Thus, almost one third of the total migrating cash is circulating in CENTROPE.

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[7] Until 30 June 2005.

Table 5: Total Cash Flows between Austria and Its Neighbouring Countries

Transaction with	Currency	2004		
		Inflows	Outflows	Total
		In mio. EUR		
Czech Republic	Crown	96.97	97.38	194.35
	Euro	469.96	53.08	523.04
Hungary	Forint	97.42	97.03	194.45
	Euro	424.39	88.74	513.13
Slovakia	Crown	41.74	42.92	84.66
	Euro	145.65	17.19	162.84
Total		**1,276.13**	**396.34**	**1,672.47**
CENTROPE (estimated)		407.00	126.00	533.00

Source: OeNB, author's calculations.

4. Euro Area Enlargement – Consequences for the OeNB

4.1 Frontloading in the New Euro Area Countries

The enlargement of the European Union was accomplished in May 2004. All new Member States have expressed their wish to join the euro area. Estonia, Lithuania and Slovenia will most probably be the first new Member States that will introduce the euro. Their preparations have reached an advanced level. Provided they fulfill the Maastricht criteria, the euro will become the legal tender of these countries on 1 January 2007.

The other new member states will follow in the subsequent years. The Czech Republic and Slovakia have already approved their national changeover plans. According to these plans Slovakia is preparing for the introduction of the euro in 2009 and the Czech Republic in 2010. Both dates are preliminary. They depend on the economic situation and the public opinion. In Hungary preparatory work is ongoing. Although, the national changeover plan has not been approved by the government yet, the Hungarian coordinating institutions in charge of the preparations for the euro changeover have set the 1 January 2010 as the national target date for euro adoption.

The frontloading process (the distribution of banknotes and coins in a specific country before the euro introduction) was one of the major challenges for the current euro area countries. Each of them managed it in a different way depending on economic and cultural factors. The economic structure, the public opinion and the payment habits (the use of credit and debit cards) influenced the decision on how many banknotes and coins should be frontloaded. The ratio of frontloaded cash to cash in circulation reveals the differences. While in Austria the frontloaded

cash reached about 75% of total cash in circulation, the frontloaded amount in Spain remained at about 18% (Gruber and Ritzberger, 2005).

The situation for the new Member States is significantly different. The euro is already legal tender in the euro area. Thus, it is a foreign currency to the new Member States prior to the cash changeover. According to a study on euro cash holdings in Austria's neighbouring new Member States and in Croatia there are already substantial holdings of euro cash (Stix, 2005). Therefore, the amount of cash to be frontloaded will probably be lower than in the case of no additional cash holdings. The total amount of euro cash needed for circulation will reach the value of about 9 billion euro in the Czech Republic, about 6 billion euro in Hungary and about 3 billion euro in Slovakia, based on the current amount of their local currency in circulation.

Assuming that there will not be a significant change in the behavior of cash use, people in the three countries will most probably prefer low denominated euro banknotes. Therefore, the amount of money per capita in terms of pieces of banknotes will be higher than it is in Belgium or Finland, where higher denominated banknotes are preferred.

4.2 Consequences for the OeNB

Cash (banknotes and coins) must be distributed in order to supply the users of cash (consumers, enterprises, banks). The demand for cash is analyzed, regulated and met by the NCBs. In the Eurosystem the NCBs are cooperating in order to ensure the distribution of euro cash and the efficient management of surpluses or shortages among the NCBs. The ECB is continuously monitoring and coordinating the storage and the transport of euro banknotes and coins. At the moment, alternative storage and transport options are being discussed.

The current situation is characterized by a complete interconnection of each NCB. Newly printed banknotes and surplus stocks are (re-)distributed between NCBs according to the monthly delivery schedule. All twelve NCBs are interlinked among themselves. The development and maintenance of the delivery schedule is however an administratively complex process and does not always result in the most efficient organization of the transports. As new Member States will most likely join the euro area soon, the administration will become even more complex. In addition, the so-called Single Euro Tender Procedure (SETP), regulating the procedures for the production (printing) of new banknotes, will have an impact on the planning process in the long run.

With the increase of receiving and supplying NCBs, more scheduled transports and ad-hoc bulk transfers will be needed, leading to an increasingly difficult efficient management of those transports. Given the fact that seven out of the ten new Member States have less than six million inhabitants, there will also be an increasing need for transports with smaller banknote volumes.

The impact of SETP will also be considerable. Currently, the distribution plan takes into account the requirements of the NCBs, so that an NCB in need of a large quantity of a certain denomination produces this denomination itself in order to avoid cross border transports. In the SETP framework printing works will be awarded with production orders independently of where the banknotes are needed.

Against this background the ECB evaluated an alternative to the current concept. The proposed concept is based on a hub-and spoke system, where excess stocks would be delivered to an assigned hub and then transported to the NCBs that require banknotes. The current common procedure of delivering newly printed banknotes directly from the printing works to the requesting NCB would be maintained.

Chart 4: Hub-and-Spoke System
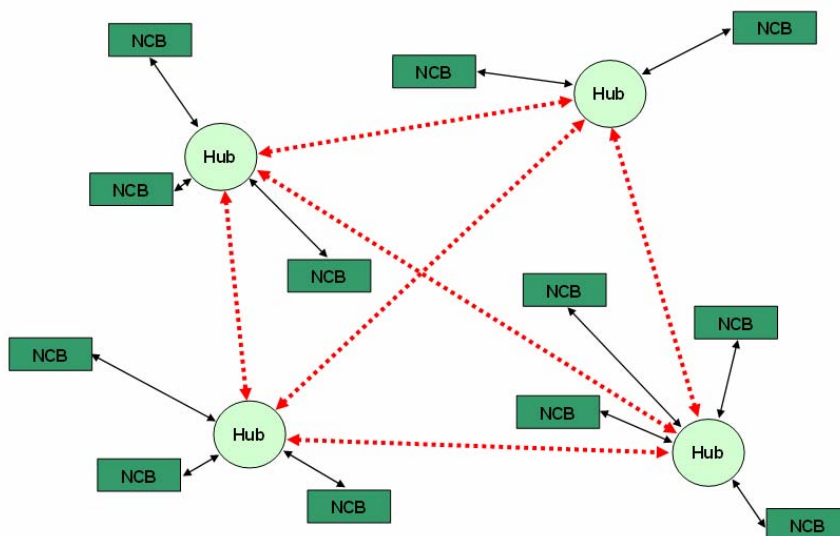
Source: Author's calculations.

The assigned hub would supply its NCBs with the banknotes needed. The transport coordination could be performed by the hubs without any involvement of the ECB. The advantage of low transport times of the current system by using direct links among the NCBs would be replaced by a decrease of costs due to the bundling of flows, concentration of equipment and sorting at specific location. In addition, it would allow transports by truck for shorter distances.

On one hand a hub-and-spoke solution would enhance a more efficient transportation by maximizing the number of combined shipments. It would lower the overall logistical costs through efficiency gains. It would balance unequal flows

more easily and it would reduce the complexity in the planning of the transports considerably. On the other hand the implementation of hubs would need additional investments of interested parties in order to meet the necessary requirements. Compared to the current situation, the number of transports would definitely increase in any case. By sticking to the current system the number of transports will increase with the accession of new Member States and with the launch of the SETP. The question is, if the system still stays manageable given the current complexity.

In order to reach a high degree of efficiency, it is important to elaborate the decision on the location of the hubs thoroughly. Following the discussion in the ECB, it seems most reasonable to place the respective hubs strategically. Four hubs (or perhaps five after the accession of new Member States) would probably be sufficient. Special attention should be paid to the existing infrastructure (especially airports). High security standards and good connections to the other airports in Europe are a precondition for a successful implementation of a hub.

The OeNB is well integrated in the ESCB. Cross-border transports have already been made to all participating euro area member states. In addition, the OeNB is already cooperating with the central banks of the new Member States. Especially the euro cash changeover is of great interest for them. The experiences in euro cash matters, the already existing cooperation network with Central and Eastern European countries and the strategic favorable geographical location contribute to the fact that Vienna could be a perfect location for a hub. Administered by the OeNB a hub in Vienna would meet several conditions stated above and it would offer some important advantages:

- Favorable geographical location: Vienna is close to four new Member States that will introduce the euro. Slovenia will be first. It will most probably join the euro area already in 2007. Slovakia will possibly follow in 2008 or 2009. The timetables in the Czech Republic and in Hungary are still in abeyance, but they might become members of the euro area in 2010 depending on the political willingness and the economic preparedness (Maastricht criteria).

- Well prepared airport: The airport of Vienna meets the security conditions for cash transfers as the OeNB already uses it for current cross-border transports. The airport is well interconnected with a lot of other European airports especially with those of the new Member States in Central and Eastern Europe. Furthermore, there already exists a close cooperation with the Bratislava airport.

- OeNB experience: The introduction of the euro, the reorganization of the cash services, the cooperation in the ESCB and the experiences with the current cross-border transport procedures have made the OeNB an attractive and experienced partner for many central banks in Central, Eastern and Southeastern Europe.

- The OeNB is well prepared to run a hub in Vienna. It disposes of state-of-the-art vaults and it has adequate transport capacities in order to be able to meet future requirements.
- CENTROPE: Vienna constitutes the core of CENTROPE together with Bratislava. CENTROPE is definitely an important European market with about 7 million inhabitants (almost 34 million people including the respective home country), a GDP of about 122 billion euro and a hypothetical need for cash of about 8 billion euro. The total cash in circulation in euro terms in the Czech Republic, Hungary, Austria and Slovakia and including Slovenia would amount to about 30 billion euro. The region consists of metropolitan areas (Vienna, Bratislava), major towns (Brno and České Budějovice in the Czech Republic; Győr, Sopron and Szombathely in Hungary; St. Pölten in Austria and Trnava in Slovakia) and emerging areas with high growth rates. In addition, the unique situation of the proximity of two capital cities offers the opportunity of a close co-operation especially between the central banks of Austria and Slovakia.
- Returned and sorted banknotes: The OeNB had a negative net-issuance development since 2003, meaning that it issued fewer banknotes than it received. It has even been the most prominent receiver of banknotes returning from customers in non-euro area countries. Compared to its capital key, the OeNB has, thus, a much higher share in returned and sorted banknotes than its capital key might indicate.
- Euroization: The high degree of euroization in South-eastern Europe underlines the need for logistical and strategic stocks in geographical proximity.
- Furthermore, Kosovo and Montenegro having introduced the euro unilaterally can benefit from it due to their relative geographical proximity.
- Commercial banks: Austrian commercial banks play an essential role as investors in Central, Eastern and South-eastern Europe. They manage the whole region from their headquarters in Vienna. It is advisable to maintain close links to the commercial banks. The installation of a hub in Vienna would emphasize the role of the financial market place.

The disadvantages of installing a hub in Vienna would consist in:

- Infrastructural links: Apart from the airport, which already meets the conditions, the railway and motorway infrastructure lag behind the development of the traffic in the region. The infrastructural links between Austria on one hand and its neighboring countries in the north and west must be improved in due time.
- Investment costs: The creation of a hub would need investments in the storage facilities in order to get the capacities needed. The investment costs for a hub in Vienna depend on the needed capacities. As a matter of fact, the vaults of the OeNB are already capacious. A hub in Vienna could probably be a cheap solution, being, thus, even an advantage.

5. Conclusion

It is a unique situation in Europe that two capital cities are this closely situated, forming the core of the so-called CENTROPE region. CENTROPE is characterized by a well-performing economy and great potentials of growth and cooperation. However, it is still a heterogeneous region with substantial disparities in wage and productivity levels, and a suboptimal infrastructural network.

The CENTROPE project is an initiative of the Federation of Austrian Industry aiming at developing a multilateral, binding and lasting cooperation strategy for the region.

As a matter of fact the central banks of the Czech Republic, Hungary, Austria and Slovakia are directly involved. Therefore, it is important to analyze the potential challenges and chances from a central bank's point of view. One essential question arises from the fact that banknotes are migrating across borders. The so-called banknote migration is determined by the cash in circulation, the currency holdings, tourism and the labor force migration, which are influenced by the size of the population, the economic performance, the level of income, the preferences for specific means of payment, the branch network of the commercial banks and the role of the currency beyond the national borders.

According to the analysis made in this study, about one third of the migration between the Czech Republic, Hungary, Austria and Slovakia takes place within the CENTROPE region. About four fifths of the total cash flows between Austria and its neighboring countries are inflows to Austria.

The significance of the region, the strategic position of the Bratislava-Vienna axis in the European framework and the characteristics of the banknote migration lead to a specific challenge for the Oesterreichische Nationalbank related to euro cash logistics.

In the euro area it is necessary to supply cash efficiently and to meet the requirements of the stakeholders (especially national central banks, cash transport organisations and commercial banks). The OeNB has identified the changing environment. Preparations have already been made in order to meet the conditions of an efficient cash distribution and to cope with the future challenges of the euro area enlargement. A hub for banknotes and coins in Vienna would be a beneficial approach for an efficient management of euro cash. The costs of cash have most recently attracted more and more attention. The supply and the demand for banknotes and coins should be managed smoothly and should be cheap. The enlargement of the euro area is inexorably approaching. It is a chance for the OeNB to contribute a profitable solution for the wider European context.

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