

6. ANALYZING THE SUITABILITY OF THE CURRENCY BOARD ARRANGEMENT FOR ESTONIA'S ACCESSION TO THE EMU

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Introduction

Since 1992, when the Estonian kroon was introduced as part of the monetary reform, the main objective of the country's monetary policy has been to ensure price stability and sustainable economic growth. The Currency Board Arrangement (CBA) has been the basis for the emergence of a reliable macroeconomic environment; it has assisted in the creation of market economy relationships and the reorientation to developed foreign markets, having thereby supported the achievement of monetary policy objectives.

After becoming a member of the European Union (EU) in May 2004 Estonia has undertaken to become a full member of the EMU, which means that independent monetary policy will be abandoned and Estonia will be part of the common monetary policy system coordinated by the European Central Bank (ECB). Thus joining the EU can be considered as the first phase of joining the EMU. It is noticeable that new member countries of EU lack the option of rejecting the EMU membership according to the "opt-out" clause while Great Britain, Sweden and Denmark, who joined the EU earlier, had the right not to join the common currency system.

¹ The views presented herein are entirely those of the author and not of the institution he is affiliated to.

In the second stage, i.e. the period between becoming a member of the EU and a full member of the EMU, the legislation coordinating fiscal, economic and monetary policies must be harmonized with the EU legislation. Estonia, as a candidate country of the EMU, must participate in the second stage of the exchange rate mechanism (ERM2), during which it is necessary to prove the presence of a stable economic environment and a readiness to integrate into the common currency zone. The criteria for estimating the economic stability of an accession country were laid down by the Maastricht Treaty. The general content of the Maastricht criteria involves the requirement of a stable price level, a stable exchange rate, and a balanced government budget. As the most essential requirements could be considered, firstly, that annual inflation must not exceed the average level of three European Union member countries with the lowest inflation by more than 1.5 percentage points, and secondly, that the exchange rate of the national currency against the euro has to be kept stable in the period prior to joining the EMU.

The capability of fulfilling the above-mentioned conditions during the ERM2 largely depends on the exchange rate regime used and the existing monetary policy framework. Before joining the monetary union, the new members of EU can use various alternative regimes except a crawling peg/band, a fixed peg to currencies other than the euro, and unilateral euroization, which are proclaimed inappropriate by the European Commission. There is no uniform solution suitable for everyone and the choice of the best exchange rate regime depends on the economic conditions of the country and its economic policy objectives. Also each country has different optimal timing for adopting the euro depending on the same factors. The third stage of monetary policy convergence involves obtaining the status of full member of the EMU.

Convergence of Estonian monetary policy is taking place within a facilitating regional environment — in parallel with Estonia's integration into the EMU — the harmonization of the monetary policies is being carried out in the Baltic Sea region as a whole. In

a short term, besides Estonia also Latvia, Lithuania and Poland are joining the EMU in addition to the Baltic Sea region countries currently belonging to the EMU (Finland, Germany).

Out of the old EU member countries in the Baltic Sea region only Sweden and Denmark do not belong to the EMU.² After Estonia, Latvia, Lithuania and Poland have all joined the monetary union, it will be possible to speak about the homogeneous monetary policy environment in the Baltic Sea area. The single currency and identical monetary policy will decrease currency risks and tighten economic relations between the countries in the region.

Estonia deserves special attention in the given context because the currency board arrangement has substantially tightened links between the euro zone and the monetary policy environment here. The fixed exchange rate against the euro and the lack of active monetary policy has made the present monetary policy framework similar to the one we might have as an EMU member. Still it is possible for Estonia, as with other EMU candidate countries, to choose between several systems for passing through ERM2. As the European Commission has given an estimate that the currency board arrangement does not contradict *acquis communautaire* principles, it has been decided to continue using it.

Accordingly, the objective of the present work is to econometrically evaluate the suitability of the CBA for Estonia while going through ERM2. The main research hypothesis for testing its validity via modelling is formulated as follows:

The currency board arrangement enables fulfilment of the Maastricht criteria at least as successfully as alternative regimes.

² It cannot be ruled out that public opinion in Sweden and Denmark will change and in the future they will decide to vote in a referendum to become full members of the EMU.

In order to test the suitability of the currency board arrangement, alternative currency rate regimes are formulated in the macro-econometric model and their operation is analyzed by shock simulation exercises. Comparison of the simulation results forms the basis for confirming or rejecting the research hypothesis.

The structure of the present chapter is as follows: the first section gives a brief introduction to the conditions for becoming a full member of the EMU and the economic policy background of the established requirements. In the second section, a survey of the key elements of the currency board arrangement is presented and it is analyzed relative to the impact of the currency board on Estonia's economic development so far. In the third section, the macro-model used in the analysis is described, and the components of the model, which enabled carrying out a switch from one exchange rate regime to another, are viewed more thoroughly. In the fourth section, the results of the shock simulations are compared and the adaptation dynamics in case of alternative rate regimes and monetary rules are observed, followed by the conclusions in the final section.

6.1. Requirements of monetary and exchange rate policy for new EU members before becoming a full member of the EMU

After joining the European Union, the former accession countries will also become members of the European Monetary Union with limited rights. As new members of the EU lack the possibility to reject the future status of a full member of the EMU, becoming a member of the EU includes the obligation to fulfil the conditions aimed at preparing the country for further integration with the monetary union. In this respect, the main obligation of new EU members is to devise an annual compatibility programme with the main focus on fulfilment of the Maastricht criteria, showing

improvements achieved in approaching the desired target values. The minimum time interval between becoming a member of the EU and the EMU is two years, but the length of the actual so-called interim period depends on the ability of each country to ensure a stable macroeconomic environment. According to the provisions of the Maastricht Treaty:

- inflation must not exceed the average inflation level of three EU member countries with the lowest inflation rate by more than 1.5 percentage points,³
- the budget deficit in the public sector must not exceed 3% of the GDP,⁴
- public debt must be lower than 60% of the GDP,⁵
- the long-term interest rate must not be more than two percentage points higher than the average interest rate of three EMU member countries with the lowest inflation rate,

³ From the standpoint of the Central and Eastern European countries (CEE), the established maximum rate of inflation is controversial because the convergence of the real income level between the CEE countries and the EU15 causes a substantially faster growth in prices (the so-called controversy between real and nominal convergence). Also the Balassa-Samuelson effect is believed to force prices to grow faster in CEE's than in EU15 countries until the productivity level of Western Europe is reached. From the perspective of the CEE countries, Szapáry (2000) has expressed criticism about the potential for fulfilling the Maastricht criteria.

⁴ The Stability and Growth Pact signed in Amsterdam in June 1997 established the fines for countries exceeding the 3% limit. The size of the fine consists of the fixed portion, which is 0.2% of annual GDP and the changing portion, depending on what the rate limit has been exceeded. The maximum fine is 0.5% of GDP. Payment of the fine is not claimed if the European Commission finds that exceeding the maximum rate is of temporary character or the excessive deficit is a result of an extensive recession — over 2% decrease in GDP (or depending on the circumstances 0.75–2%).

⁵ While also the majority of the present European Union members are not able to meet the intended requirement, some concessions have been made in this respect — the tolerance of the debt in the public sector of the country is judged relatively acceptable if it is decreasing rapidly enough.

- the exchange rate may fluctuate within the interval given by the European Currency System and must not be devalued for two years.⁶

The Maastricht criteria form a summary of the economic policy across the member countries of the European Union that helps indicate the readiness of a country to join the common currency system. Readiness of the country should guarantee that integration would not endanger stable operation of the system. The meaning of the five requirements given above lies in the fact that once an EU member country has joined the euro system, it has to completely abandon its independent monetary policy as an economic policy tool. This means that the option of funding the government budget deficit from the resources of the central bank will disappear, as well as the capacity of the central bank to influence the money market through interest rates regulation. At the same time, it will become impossible to increase the amount of money in circulation in order to decrease interest rates and thereby depreciate the exchange rates.

By meeting the requirements of budgetary balance and exchange rate stability, the countries prove that the public sector's debt burden will not increase because of a permanent budgetary deficit or that the country does not count on a devaluation of the currency.

The exchange rate policy of an EMU member country with limited rights must be guided by the common interests of the EU. After joining the EU, the country's central exchange rate against the euro is fixed by a multilateral agreement between the member countries in the euro zone, the European Central Bank and the accession country. Subsequently, the country shall participate in the currency exchange mechanism ERM2. In ERM2, the country must be capable of maintaining exchange rate stability with a maximum

⁶ This condition forms the basis for the requirement of a transition period of a minimum of two years between joining the EU and receiving a full membership in EMU.

acceptable divergence threshold of 15% on the fixed value of the central exchange rate against the euro.⁷

The EU lacks a uniform standpoint about which exchange rate regime the EMU candidate should use during ERM2. The choice of the exchange rate regime mainly depends on the current situation in the economy of the country and the economic policy objectives it wants to achieve by means of the exchange rate policy. Still the vision is uniform in that a crawling peg, unilateral introduction of the euro and a peg fixed to a currency other than the euro contradicts the principles of *acquis communautaire*. It is possible for a country participating in ERM2 to choose the most suitable of the remaining acceptable rate regimes, which enables ensuring economic development of the country in the desired direction, including fulfilment of the Maastricht criteria.

If the country demonstrates the reliability of its monetary and exchange rate policy during ERM2 and fulfils the criteria for becoming a full EMU member, it can submit an application to the European Council to obtain the status of a full member in the euro zone. In case of a positive decision, the country is then invited into the EMU as a fully qualified member. Being a full EMU member enables the country to perform the common currency policy through the European Central Banks System.

6.2. The currency board arrangement in Estonia

The selection of the exchange rate regime is determined by several different national factors. The most crucial among them could be the size of the economy, its vulnerability to shocks, the mobility of capital, diversity of production, dollarization, the expected magnitude of exchange rate risk and the extent of its influence (Saarniit, 2001). The objective of introducing a currency board arrangement is

⁷ It is also possible to set a smaller band.

to create a reliable economic policy environment and ensure low inflation (without active control of inflation). Creating a reliable environment is based on simultaneously satisfying three conditions, namely: a) holding foreign currency reserves to the extent of the base money, b) a strong and reliable financial system, and c) a conservative fiscal policy (Gulde *et al.*, 1999). Holding foreign currency reserves to the amount of the base money is the most important factor for creating reliability for the currency board and the currency itself. If foreign reserves cover at least the lowest level of money supply aggregate (M0), this provides confirmation for the financial sector and the public that the national currency is guaranteed by an equivalent amount of foreign currency (anchor currency), and if required, it is possible to exchange the national currency for foreign currency in an equal amount by value (Enoch *et al.*, 1998).

The currency board arrangement introduced in Estonia in June 1992 has been operating successfully up to now. The system was launched with the aim of applying an exchange rate based stabilization policy. To date the gradual harmonization of the economy with that of the European Union has been the central idea of this monetary policy (Kraft, 1999). Therefore, the role of the Currency Board has changed — it is increasingly essential to support Estonia's transition to the euro zone, instead of simply being a tool for stabilizing the economic environment.

The law on guaranteeing the Estonian kroon establishes the foundations for the functioning of the Currency Board in Estonia. According to law, the functioning of the system is guaranteed using the following elements:

- the base money is backed by foreign currency reserves and gold,
- the rate of the Estonian kroon is pegged to the euro (previously against the German mark),⁸

⁸ Since 1999 the exchange rate of the kroon has been 1 EUR = 15.64664 EEK, before that 1 DEM = 8 EEK.

- the Estonian kroon is freely convertible at the official rate,
- devaluation of the Estonian kroon is prohibited,
- the Bank of Estonia issues kroons only according to changes in foreign reserves.

According to the abovementioned elements, quite an orthodox form of CBA is applied in Estonia in order to ensure the main objective of monetary policy — the stability of the exchange rate. As the real exchange rate of the kroon is pegged to the euro, the stability of the exchange rate depends on the stability of prices and consequently the actual objective of the monetary policy is to ensure price stability. In a small country with an open economy there is a strong relationship between price and exchange rate stability. A fixed rate acts as a so-called nominal anchor to domestic prices and interest rates (Eichengreen *et al.*, 1999). The existence of this kind of an anchor has been particularly necessary in such a changeable environment with unexpected developments as has been seen in Estonia since independence was regained.

The currency board arrangement has been an efficient means for stabilizing prices in such a small and open economy as Estonia. Because of the high proportion of exports and imports in the GDP, export and import prices are the main factors for determining price stability. The base money, which is fully backed by foreign reserves, and the fixed exchange rate have enabled reliable foreign economic relations and stabilized price level dynamics. Considering the smallness and openness of the Estonian economy, maintenance of a floating rate and active control of monetary policy would have been a relatively complicated task.

Application of the currency board arrangement and developments in the economic policy environment have so far essentially influenced Estonia's ability to fulfil the Maastricht criteria. One of the positive effects brought about by the CBA is strong and balanced fiscal discipline. Under the currency board arrangement, the central bank cannot be the lender of the last resort (LOLR) to finance the public sector with loans. This has made the public

sector keep its budget relatively well balanced, as implementation of an expansive fiscal policy in these conditions would mean accumulation of (foreign) debts. Up to now, the deficit has exceeded the maximum rate fixed for the EMU countries only in 1999, when a decrease in the tax base proceeding from the negative economic growth caused a decrease in budget revenues; at the same time, counter-cyclical fiscal policy increased budget expenditures. The negative real growth of the gross output created a deficit of about 4.5% of the GDP.

The small amount of foreign debt in the public sector also provides evidence of strict fiscal discipline, which makes the Maastricht criteria concerning the public sector debt unimportant for Estonia. So far, public sector debt has stayed within the interval 4.7–8.6% of the GDP.⁹ As the maximum acceptable amount is up to 60% of the GDP, this requirement is of secondary importance for Estonia and does not deserve special attention.

Considering further integration into the European Union, the main institutional objective of Estonian fiscal policy is harmonizing the implementation of fiscal policy and its means with the legislation of the European Union. Immediately after integration into the European Union, the implementation of the fiscal policy must be in conformity with the Stability and Growth Pact, whose objectives establish in figures the requirement for budgetary balance or surplus throughout the business cycle (The Monetary ... 2001). Taking into account that in earlier years the government budget has been close to balance (even a surplus has been experienced), meeting the corresponding requirements should not be very complicated.¹⁰ In the future, however, one of the factors impeding

⁹ Due to unavailability of data, the public sector's debt does not reflect the direct loans to local governments from legal persons and financial institutions in foreign countries and the state guarantees for foreign loans ratified by the *Riigikogu* (Estonian parliament).

¹⁰ Also the low cyclical sensitivity of the budget balance helps keep the budget deficit lower than 3% of the GDP (see for example, Kattai 2003).

the achievement of balance may be the lack of privatization profits, which has helped to avoid a deficit in some earlier cases.

Exchange rate fluctuations against the euro are ruled out by pegging the kroon to the euro. The law also eliminates the danger of devaluation. The only problematic point is whether the fixed exchange rate between the kroon and euro is in equilibrium and suitable for a central exchange rate. Recent surveys have confirmed the opinion that the real effective exchange rate of the Estonian kroon was close to an equilibrium rate or a little undervalued during the early years of the kroon (Hinnosaar *et al.*, Filipozzi 2000).¹¹

Fulfilment of the interest rate criterion is not the primary problematic field either. Local money markets are deeply integrated with the money markets of the euro zone, the most important elements of which are the banking sector, belonging mainly to foreign owners, and the right of the commercial banks to buy and sell kroons for foreign currency in the “forex window” of the central bank. As the commercial banks have access to foreign monetary markets at a lower interest rate (compared to the local inter-bank interest rate), the interest rates for local retail loans are more influenced by the interest rates of the euro zone than by the conditions at the domestic monetary market.

The gap between Estonian inter-bank money market interest rates and interest rates in the euro zone money market has decreased substantially during Estonia’s period of independence (being less than 0.5 percentage points in 2002),¹² showing a low country risk and offering the banking sector a practically equal alternative

¹¹ The real effective exchange rate of the kroon has acted like that of a currency in a transition economy. Since the underestimated starting point, the kroon gained strength quite quickly at first, later this trend slowed down, staying near the equilibrium value. Developments in the price level of foreign countries have caused some deviation of the real rate from the equilibrium value (for example, the impact of the Russian crisis in 1998) — see, for instance, Filipozzi (2000).

¹² Estimated as the gap between TALIBOR and EURIBOR.

beside foreign financial sources. Despite the fact that the main source of loan funds for commercial banks is still financiers from outside Estonia, a positive aspect of this phenomenon is the potential to avoid exceeding the interest rate criterion, even with quite heavy shocks impacting on the economy, as a result of which the rise in the level of national risk pushes up risk premiums in the interest rates of domestic monetary markets. Thanks to the close connection between the banking sector and the external monetary markets, the impact of the shocks is not transmitted to the domestic retail loan market and does not endanger the long-term interest rate.¹³

Low inflation is the last requirement needing fulfilment during ERM2. Many articles have highlighted a rapid slowing down of inflation in Estonia. The current exchange rate regime is the factor most frequently brought out as the decisive factor (for example, Gulde *et al.* 1999; Hanke 2000).¹⁴ The fact that hyperinflationary price dynamics was stabilized in seven years to such an extent that the annual growth in price levels was less than 10% proves the success in slowing down inflation. Although the interval between the required inflation level and the actual value has not been too big, the inflation criterion must be considered as the most important of all the Maastricht criteria. In other words, the inflation criterion is the most difficult one among the Maastricht criteria to be fulfilled.

Since the second half of 2002, the difference between inflation in Estonia and the euro zone has been even smaller than the 1.5

¹³ This effect was observed during the Russian crisis when the interest rate of the Estonian money market rose considerably (the gap between TALIBOR and EURIBOR rose from 3 to 14 percentage points), but it did not bring about a rise in the interest rates of retail loans because commercial banks brought in cheaper loan funds from foreign markets (Kaasik, *et al.*).

¹⁴ Quite the opposite has also been shown — in a country with a currency board arrangement, the Balassa-Samuelson effect may cause higher inflation than in other cases (Freytag, 2002).

percentage points fixed by the Maastricht Treaty, but this phenomenon is of a short-term character and is caused by the cooling off of the world economy. It can be reckoned that in the mid-long perspective, the convergence of Estonian income levels will exert quite strong inflationary pressure on local prices. According to this, the main emphasis in evaluating the suitability of the exchange rate regime is on fulfilment of the inflation criteria.

Analyzing the participation of Estonia in ERM2 and its later integration into the EMU it is interesting to present the accompanying changes in the present monetary policy framework. As shown in the previous section, membership in the EMU eliminates the possibility of implementing independent monetary policy. The subsequent inability of the central bank to finance the budgetary deficit in the public sector will not bring about changes in Estonia, because the currency board forbids the central bank to be the lender of last resort. Another essential aspect in delegating monetary policy to the European Central Bank is the fact that the national central bank has no more authority to increase the amount of money in circulation and thereby decrease interest rates. In this respect, joining the EMU will not bring about changes for Estonia because while the CBA is in force, the money supply forms endogenously according to demand in the money market and the interest rate forms according to the balance in the monetary market — the central bank cannot actively control the money supply process. Under these circumstances, the monetary policy framework established by the CBA is relatively similar to the monetary policy environment in the EMU, thereby facilitating integration.

6.3. Set-up of the model

The task of finding a suitable exchange rate regime in order to participate in ERM2 may be divided into two subtasks. On the one hand, the choice of the regime is essential from the standpoint of

the potential for establishing a suitable central exchange rate and keeping it stable — setting up the problem depends on whether the exchange rate between the kroon and euro is balanced (equilibrium exchange rate). There are several studies on this specific matter in addition to the articles presented in the previous section and in the present chapter the abovementioned aspect is not analyzed. Instead, our research is directed towards the other part of the problem only — how the chosen exchange rate regime influences the potential for fulfilling the Maastricht Treaty, or does the currency board support the process of joining the single currency area? There exists an opinion that, considering the extent of Estonia's integration into the EU, the euro should be introduced as soon as possible (Eesti Panga ... 2003) and swift fulfilment of the Maastricht conditions would be one of the prerequisites for this.

As indicated before, the suitability of the Estonian exchange rate regime is essential mainly for the purpose of fulfilling the Maastricht inflation criterion (*ceteris paribus*, because establishing any other regime would change the existing monetary policy framework and thereby also the conditions for approaching the Maastricht criteria). Surveying the potential for fulfilling the remaining criteria is of less importance. In the present section, one of the many possible approaches is presented for how to analyze (by means of an econometric model) the impact of the exchange rate regime on the potential for fulfilling the Maastricht inflation criterion during the second stage of the exchange rate mechanism.

An EMU candidate country must choose the most suitable regime for ERM2 from among the regimes accepted by the European Commission. Consequently, further modelling aims to show which regimes would give better results in controlling inflation under Estonian conditions (looking for an answer to the question of whether the CBA is at least as good as others in this respect, including regimes with direct control of inflation). Therefore, analysis in this field is reduced, to a large extent, to defining alternative regimes in the model. The behaviour of the economy

and the CPI reaction to different shocks impacting on the economy are compared in alternative regimes in order to evaluate their relative superiority (results of shock simulations). In the analysis, the Bank of Estonia's macromodel of the economy MMOM is used, which has been described in more detail by U. Sepp and M. Randveer (Sepp *et al.*, 2002).

MMOM is a small-scale quarterly macroeconomic model consisting of 23 separately estimated behavioural equations and almost an equal number of equivalences and definitions. In most cases, an error correction mechanism is used to estimate behavioural equations (estimation period Q1 1996 – Q4 2000). Since it characterizes the second-generation macromodels, MMOM has Keynesian short-term and neo-classical long-term properties. When compiling the model, the main elements characteristic of the Estonian economy have been considered.

Firstly, the smallness and openness of the Estonian economy are taken into account, implying that local economic development is closely connected to the transition of external influences and the development of the world economy. The main connecting link between global and Estonian economic development is foreign trade. Being very small and open, the Estonian economy acts as a price taker in global markets and consequently, import prices determine domestic prices.

The second feature characteristic of the model is the formation of the economic processes on the basis of market forces. Also free movement of capital, goods and services is considered here.

The third aspect considered when constructing the model, is the real and nominal convergence occurring in the economy.

6.3.1. Suitable regimes for participating in the second stage of the exchange rate mechanism

The number of different exchange rate regimes is quite large. Every regime comprises different opportunities for implementing monetary and economic policies. Eight regimes are distinguished between in the IMF classification (see Table 1).

Table 1. IMF classification of exchange rate regimes

Regime	Description
Dollarization, euroization	Lacks a separate legal institution
Currency board arrangement	The money base is fully backed by an equal amount of foreign exchange reserves
Conventional fixed peg	Peg to some foreign currency or currency basket with a maximum deviation (bands) of +/- 1%
Horizontal band	Peg with bands larger than +/- 1%
Crawling peg	Fixed rate which is revised, if necessary, according to changes in selected indicators
Crawling band	Crawling peg combined with bands larger than +/- 1%
Managed float	Floating exchange rate with active intervention
Independent float	A rate determined by market forces; monetary policy is independent of exchange rate policy

Source: Exchange Rate Arrangements (1999).

The first three, dollarization/euroization, currency board, and conventional fixed rate are all quite similar. Countries using these regimes lack the opportunity to implement an active monetary policy. The main difference between the currency board and the other two regimes is the complete reliability of the currency, based on fully backed base money. As unilateral dollarization/euroization, crawling peg/band, and horizontal band are unsuitable for participation in ERM2; in the following analysis, they will be

excluded as possible alternatives to the CBA. However, independent float and managed float can be used as can the conventional fixed exchange rate.¹⁵

6.3.2. Exchange rate equation

In general, the functioning of exchange rate regimes is influenced by two factors: whether a fixed or floating rate is applied in the economy, and which monetary policy is implemented in parallel. That is, according to which principles the current exchange rate is influenced by interventions and whether it is influenced at all. Modelling the exchange rate channel occurs on the basis of these factors.

Firstly, the exchange rate equation for the Estonian kroon is defined both for the fixed rate and the floating rate. The direct exchange rate of the Estonian kroon is derived from the arbitrage condition and is expressed as follows:

$$(1) \quad e_t = \frac{e^T E_t \left(\frac{e_{t+1}}{e^T} \right)}{i_t^M},$$

$$(1') \quad i_t^M = \frac{(i_t + 1)}{(i_t^{LR} + 1)},$$

$$(1'') \quad i_t^{LR} = \chi(i_t^f, R_t).$$

The current exchange rate in the market (e_t) is formed according to the expected exchange rate in the period $t+1$ ($e^T E_t \left(\frac{e_{t+1}}{e^T} \right)$) and the deviation of the average short-term interest rate (i_t) against its

¹⁵ For potential exchange rate regimes before integration into the EMU see also Freytag, 2002.

long-term trend (i_t^{LR}) (see equation 1'). The latter is in turn a function of the foreign interest rate (i_t^f), for which the EURIBOR is chosen and risk premium (R_t) (see equation 1''). The expected exchange rate in the period t against the period $t+1$ depends on the targeted exchange rate e^T and $E_t\left(\frac{e_{t+1}}{e^T}\right)$, which shows how extensive the deviation of the expected exchange rate is against the targeted value. The model sets a prerequisite that the long-term value of the nominal interest rate is consistent with the targeted exchange rate. Consequently, if the expected deviation is zero ($E_t\left(\frac{e_{t+1}}{e^T}\right) = 1$) and the interest rate for short-term loans is at the level of the long-term trends ($i_t^{LR} = i_t$), the current exchange rate in the market equals the targeted rate ($e = e^T$). If the expected deviation is not equal to zero ($E_t\left(\frac{e_{t+1}}{e^T}\right) \neq 1$), but $E_t\left(\frac{e_{t+1}}{e^T}\right) = i_t^M$ is still valid, the uncovered interest rate parity keeps the actual exchange rate unchanged. In a situation where $E_t\left(\frac{e_{t+1}}{e^T}\right) \neq i_t^M$, the real exchange rate must either increase or decrease to maintain parity according to the formula (1'''):

$$(1''') \quad E_t\left(\frac{e_{t+1}}{e^T}\right) > i_t^M \quad \Rightarrow \quad e_t \uparrow,$$

$$E_t\left(\frac{e_{t+1}}{e^T}\right) < i_t^M \quad \Rightarrow \quad e_t \downarrow.$$

The expected exchange rate deviation for the period $t+1$ is modelled as a combination of rational and adaptive expectations (with equal weights):

$$(2) \quad E_t \left(\frac{e_{t+1}}{e^T} \right) = \left[E_t^R \left(\frac{e_{t+1}}{e^T} \right) E_t^A \left(\frac{e_{t+1}}{e^T} \right) \right]^{0.5}$$

In instances of adaptive expectation ($E_t^A \left(\frac{e_{t+1}}{e^T} \right)$), it is presumed that the value of the exchange rate deviation for the period $t+1$ is equal to the actual deviation two periods before: $E_t^A \left(\frac{e_{t+1}}{e^T} \right) = \frac{e_{t-1}}{e^T}$.

Rational expectations ($E_t^R \left(\frac{e_{t+1}}{e^T} \right)$) are expressed by the deviation of the expected forward points ($E_t(FW_{t+1})$), defined as a gap between spot and forward exchange rate, against its mean (\overline{FW}). Forward points are mainly influenced by foreign trade conditions and trade channel. Accordingly, the expectations of forward points and thereby also the rational expectations of exchange rate deviation are dependent on changes in effective foreign demand in the period t ($E_t(F_t^{X-D})$) and expected changes in the period $t+1$ ($E_t(F_{t+1}^{X-D})$). The weighted average GDP of Estonia's main trade partners is used to measure effective foreign demand (weighting is based on the proportion of the country in Estonian exports). The lagged forward points ($E_{t-1}(FW_t)$) are used to describe the inertia of the rational expectations of the exchange rate deviation:

$$(3) \quad E_t^R \left(\frac{e_{t+1}}{e^T} \right) = \frac{E_t(FW_{t+1})}{\overline{FW}},$$

$$(3') \quad E_t(FW_{t+1}) = \beta_0 + \beta_1 \left[\sum_{j=0,1} \beta_{2+j} E_t(F_{t+j}^{X-D}) + \beta_4 E_{t-1}(FW_t) \right] \\ + (1 - \beta_1) \left[\sum_{j=0,1} \beta_{5+j} E_t(F_{t+j}^{X-D}) + \beta_7 E_{t-1}(FW_t) \right],$$

$$\beta_2, \beta_3, \beta_5, \beta_6 < 0,$$

where $\beta_0 > 0$,

$$\beta_4, \beta_7 = [0,1],$$

$$\beta_1 = \begin{cases} 1 & \text{if } E_t(F_{t+j}^{X-D}) < SD^{F^{X-D}} \\ 0 & \text{if } E_t(F_{t+j}^{X-D}) \geq SD^{F^{X-D}} \end{cases}.$$

The function of parameter β_1 is to reflect the switchover in expectations (the danger of devaluation) if there are drastic changes in foreign demand. According to previous observations, unanticipated changes occur when the decrease in effective demand is larger than the standard deviation of this indicator ($SD^{F^{X-D}}$).

It is necessary to add that exchange rate expectations only apply for a floating rate, whereas for a fixed rate (including a currency board), $e_t = e^T$ is valid and parity can only be ensured by the reaction of the interest rate to economic indicators.

6.3.3. Monetary rules

The task of the monetary rule is to reflect the decisions of financial institutions in implementing monetary policy — monetary policy steps devoted to decreasing inflation, stabilizing economic growth, etc. The potential and specific requirements for carrying these out are dependent on the chosen exchange rate regime. Therefore it is described here how the policy rule operates.

In the model, monetary policy interventions only take place in the case of interest rate regulations; other alternative instruments (regulating exchange rates, administrative prices, etc.) are not involved. The foundation for the definition of monetary rule is the traditional Taylor rule (Razzak 2001):

$$(4) \quad i_t^* = r^T + \pi_t + \lambda_\pi (\pi_t - \bar{\pi}) + \lambda_{\tilde{y}} (\tilde{y}_t),$$

where i_t^* is the nominal short-term interest rate regulated by the central bank, r^T is the equilibrium (or targeted) real interest rate, π_t is actual inflation, $\pi_t - \bar{\pi}$ is the difference between the actual and targeted inflation rates and \tilde{y}_t is the GDP gap expressed as a difference between the real GDP and its potential level measured in per cent. The coefficients $\lambda_{\tilde{y}}$ and λ_π are reaction parameters, the magnitude of which determines how active the implementation of monetary policy is (the larger the value of the parameter, the more extensively the central bank changes interest rates in case of deviation from the target values).

The objective of the monetary policy of the central bank does not always have to be to ensure price stability and/or economic growth. Additionally, its target may also be, for instance, the stability of the exchange rate. Modifying formula (4) by changing the targeted economic indicators, it is possible to define different monetary policy objectives, which are achieved by altering interest rates. For that purpose, Taylor rule is presented in a more general form:

$$(4') \quad i_t^* = \Theta_t + \Phi_t,$$

$$(4'') \quad \Theta_t = r^T + \pi_t,$$

$$(4''') \quad \Phi_t = \sum_{j=1}^n \lambda_j (\theta_t^j - \bar{\theta}^j),$$

where λ_j is the reaction parameter of the targeted indicator j , θ_t^j represents the actual value of the targeted indicator j , and $\bar{\theta}^j$, the target value. Three different monetary rules are used in the present paper: economic growth stability, price level stability and exchange rate stability targeting rules. They are explained in a more detailed way in section 6.3.5.

6.3.4. Interest rate channel

The effects of monetary policy are transferred to the real economy through the interest channel. The most important part of it in the model is the average interest rate for short-term loans. The interest rate is modelled using an error correction mechanism:

$$(5) \quad \Delta(i_t) = \alpha_1 ECM_t + \alpha_2 \Delta \log(rm2_t) + \alpha_3 \Delta(i_t^f) + \alpha_4 \alpha_5 \Delta[E_{t-2}(FW_{t-1})] + \Phi_t,$$

$$\text{where} \quad ECM_t = i_{t-1} - [i_{t-1}^f + (\psi(t))_{t-1}],$$

$$\Phi_t = \sum_{j=1}^n \lambda_j (\theta_t^j - \bar{\theta}^j),$$

$$\alpha_1 < 0; \alpha_2, \alpha_3, \alpha_5 > 0,$$

$$\frac{\partial \psi(t)}{\partial t} < 0, \quad \frac{\partial^2 \psi(t)}{\partial t^2} > 0,$$

$$\alpha_4 = \begin{cases} 1 & \text{if } \Delta(E_{t-2}(FW_{t-1})) \geq 2SD^{FW} \\ 0 & \text{if } \Delta(E_{t-2}(FW_{t-1})) < 2SD^{FW} \end{cases}.$$

The long-term (equilibrium) value of the interest rate ($[i_{t-1}^f + (\psi(t))_{t-1}]$) consists of foreign interest rate (i_t^f),¹⁶ for which the 3-month EURIBOR is chosen, and a risk premium, which characterizes the country's risk. The risk premium is reflected by a simple time function ($(\psi(t))_t$), where the value decreases with a slowing effect and approaches zero. When considering future periods, it is not necessary to find a more complicated function for describing the formation of a risk premium because in the case of Estonia, the country's risk has almost disappeared and its behaviour is reminiscent of a random walk.

The short-term part of the equation describes the formation of the interest rate subject to the uncovered interest rate parity. As noted for the long-term part, also the short-term part of the interest rate relies on the three-month EURIBOR. The change in forward points, which characterizes the danger of devaluation, is added to the equation to describe the impact of speculative attacks. The expectation of devaluation in period t for period $t+j$ ($\Delta E_t(FW_{t+1})$) usually has no impact on interest rates ($\alpha_4 = 0$). An effect is revealed only when the change in forward points exceeds the standard deviation of forward points at least twice (in that case $\alpha_4 = 1$).

In addition, the short-term change in the short-term loan interest rate depends on change in money supply ($rm2_t$) and the monetary rule guiding the interest rate (Φ_t) derived from formula (4'''). The addition of the money supply into the interest rate equation is based on the LM curve ideology, according to which growth in money supply pushes down the interest rate and vice versa.

¹⁶ Due to the vicinity of the European money markets.

In the current chapter, it is essential to accurately reflect the operation of different exchange rate regimes in the model. Therefore, in connection with this, the question of the technical difference between a currency board and a fixed rate without interventions should be answered. In both cases, the rate is pegged to a specific currency and application of the monetary rule described above is not possible. In this particular case, the problem is solved by modelling the CBA as a fully reliable fixed exchange rate, so that the nominal exchange rate is stable — there is no danger of devaluation and the model lacks those elements reflecting that particular possibility.

6.3.5. Monetary regimes

The monetary regime refers to the combination of the exchange rate regime and the specific monetary rule. The fixed rate (with its special case being a currency board) and the floating rate are observed here as possible exchange rate regimes. In both cases, there are different opportunities for implementing monetary policy. Here, three possible targets of the monetary policy of the central bank are distinguished between: price level stability, exchange rate stability, and economic growth stability. In addition to these, the so-called monetary regime without a target is surveyed, where the monetary policy institutions do not intervene in the operation of the money market and the interest rate is formed freely according to market conditions ($\Phi_t = 0$).

The currency board does not permit attainment of monetary policy targets through intervention. The exchange rate is fixed and the economy adjusts only according to market forces. Other monetary regimes with a fixed exchange rate used in the comparison target price level or economic growth stability. Conventional fixed peg (i.e. fixed rate combined with the monetary rule without a target) is ignored because the latter differs from the CBA only in that it involves the component in the interest and exchange rate equations

that describes the danger of devaluation. This means that only extremely large shocks make the simulation results differ for these two regimes, whereas mostly they are identical. In case of a floating exchange rate, all four alternative targets are surveyed (see Table 2).

Table 2. Monetary regimes used in the model

Exchange rate regime			Target of the monetary rule
currency board	fixed rate	floating rate	
	+	+	price stability
		+	exchange rate stability
	+	+	economic growth stability
+		+	without a target

Depending on whether the model tests an economy with a fixed or floating exchange rate, the relative importance of monetary policy transmission channels differ.

Under the conditions of a fixed exchange rate the adaptation mechanism in the model consists of the interest rate and credit channels, that is, the adaptation of the economy to changes is ensured through the reaction of the interest rate and loan capacity to market forces. The exchange rate channel is added to them in case of a floating rate.

6.3.5.1. Targeting price level stability

In the model, the inflation of consumer prices (π) is divided into the inflation in the tradable (π^{TR}) and non-tradable sector (π^{NT}) (equation 6). The latter depends only on administrative decisions (A) (equation 6'). The inflation in the tradable sector depends on foreign price signals transmitted to the domestic market through

import prices (π^M) and the Estonian producer price index (π^P) (equation 6''). The impact of the producer price index on inflation in the tradable sector comes from the supply side impulses prevailing in the market with imperfect competition. The corresponding index is modelled as a hybrid Phillips curve, dependent on the GDP gap (Y/Y^*) and import price index (equation 6'''). The dynamics of the import price index is dependent on the relative income level compared with the European Union (Y/Y^f) and trading conditions characterized by the nominal effective exchange rate (NEER) (equation 6'''').

$$(6) \quad \pi = \eta(\pi^{TR}, \pi^{NT})$$

$$(6') \quad \pi^{NT} = \eta(A)$$

$$(6'') \quad \pi^{TR} = \eta(\pi^M, \pi^P)$$

$$(6''') \quad \pi^P = \eta\left(\pi^M, \frac{Y}{Y^*}\right)$$

$$(6'''') \quad \pi^M = \eta\left(\frac{Y}{Y^f}, NEER\right)$$

As foreign prices are exogenously determined for a small economy (a small economy cannot influence world market prices), then under the conditions of a fixed rate, inflation can be stabilized mostly by intervention in economic activity, thereby influencing the producer (via influencing the GDP gap) and import prices (as a result of changes in the relative income level). In the present case, monetary policy interventions are used to influence economic activity by means of changing the interest rate; the possibility of administrative price regulation is neglected.

In addition to the abovementioned, under a float, the changes in exchange rates also stabilize import price dynamics resulting from changes in foreign prices.

Ensuring price stability works by way of targeting low growth in consumer prices. The corresponding monetary rule (Φ_t) is derived from formula (4'''):

$$(7) \quad \Phi_t = \lambda_\pi (\pi_t - \pi_t^T)$$

Through the growth in inflation (π_t) above the targeted level (π_t^T), the monetary rule obtains a positive value ($\Phi_t > 0$) and the short-term interest rate rises (see equation 5). The rise in the interest rate decreases investments, as a result of which growth of the real capital stock slows down and the slowdown of gross output growth responds to it on the supply side of the model. At the same time, an increase in interest rates brings about a decrease in the credit given by the finance sector, which restricts the growth of consumption and slows down gross output growth on the demand side of the model.

Slowdown of the real GDP growth decreases the relative income level, consequently lowering import prices. This leads to a slowdown of the growth in producer and consumer prices. If interest rates go down, the opposite occurs. The greater the reaction parameter (λ_π), the greater the stabilizing effect.

In an economic environment with a floating exchange rate, a rise in interest rates brings about a slowdown in import prices growth via the nominal effective exchange rate appreciation and vice versa, consequently providing the option of decreasing the deviation of the CPI base index against long-term growth. Appreciation of the exchange rate also leads to a decrease in exports, which prevents growth in gross output and prices.

6.3.5.2. Targeting exchange rate stability

The monetary rule for targeting the stability of the exchange rate is also derived from formula (4'''). Changes in interest rates must smooth the dynamics of the exchange rate in such a way that the difference between the actual (e_t) and the targeted rate (e^T) approaches zero:

$$(8) \quad \Phi_t = \lambda_e (e_t - e^T).$$

In ensuring the stability of the exchange rate, the same processes start as were depicted in the treatment of controlling the price level. Stabilization of the target figure takes place through the interest, credit and exchange rate channels. However, there is a difference: the monetary rule is not dependent on the CPI but on the deviation of the currency exchange rate against its long-term value. Interest rates will increase (decrease) if the equilibrium exchange rate is higher (lower) than the targeted figure, smoothing the variation of the exchange rate and allowing it to approach a long-term equilibrium level.

6.3.5.3. Targeting stable economic growth

The third alternative monetary rule is targeting stable economic growth (i.e. a decrease in the GDP gap). This rule is a function of the targeted (\tilde{y}_t^T) and actual value (\tilde{y}_t) of the GDP gap:

$$(9) \quad \Phi_t = \lambda_{\tilde{y}} (\tilde{y}_t - \tilde{y}_t^T).$$

In general the value for the desired GDP gap is taken as zero, or in ideal conditions the real GDP would equal its potential level. If the real GDP is lower than its potential, the monetary rule will substantially stimulate the economy by means of decreasing interest rates. As a result, gross investment will rise, the amount of capital will increase and growth in real GDP will speed up. Also, on the demand side of the model, an increase in consumption

corresponds to that, assisting in the attainment of a long-term steady growth trajectory.

6.4. Price level dynamics in the case of alternative monetary regimes

There has been a lot of criticism about how to interpret the simulation results within the context of different monetary policies. The main counter argument is that the estimated relationships between the economic indicators are not valid when the political framework of the country changes, because different policies (also different exchange rate regimes) change the structure of the economy and the rational expectations of economic agents are incomparable (Lucas' criticism) (Van Bergejik *et al.* 2001). To make the model reflect the rational expectations of the economic agents in differing political conditions, Lucas reckons that the model must apply alternative policy rules (Rudenbusch, 2002). The model proposed in the current chapter takes this into account.

The time series used for estimating MMOM equations all comprise, to a lesser or greater extent, information about the current exchange rate regime and monetary policy framework. If another regime had been established in 1992, it is likely that the dynamics of time series would have been somewhat different as would have been the values of the parameter estimates. It can be said that the reliability of the results obtained in the present work depends on the ability of the applied monetary rules to describe the regime and the structural changes in the economy as well as the behaviour of the economic agents when the economic policy is changing.

Next we will analyze the potential to meet the required low inflation level according to the applied regime. For that purpose, we will supplement a macromodel by the seven monetary regimes defined earlier. The period for modelling is the first quarter of 1996 until the fourth quarter of 2010. Up to the fourth quarter of 2000,

the time series are made up of historical data, whereas predictive values are used for the following period.

The most essential exogenous variables having an impact on the behaviour of the model during the predictive period include the US dollar, the Swedish crown and the Russian rouble exchange rates (future values are taken to equal the latest actual observation) and the European Union's GDP (presumed 2.9 per cent annual growth). The consistency of the indicators used in the model is guaranteed by entering the adjustments in the prognosis period, by which the accurate behaviour of the endogenous variables in relation to each other is achieved.

When testing the model without adding the shocks, we notice that the currency board and fixed rates generate lower inflation than the regimes with floating rates. A floating rate with the economic growth stability targeting monetary rule is the exception which achieves the lowest inflation (see Table 3). Its "cost" is an extensive slowdown of economic growth.

Table 3. Average annual growth in the CPI base index (Q1 1996 – Q4 2010 in case of different monetary regimes)

currency board	fixed rate	floating rate	Target of the monetary rule
	6.038	6.563	price level stability
		6.300	exchange rate stability
	6.027	5.690	economic growth stability
6.027		6.678	without a target

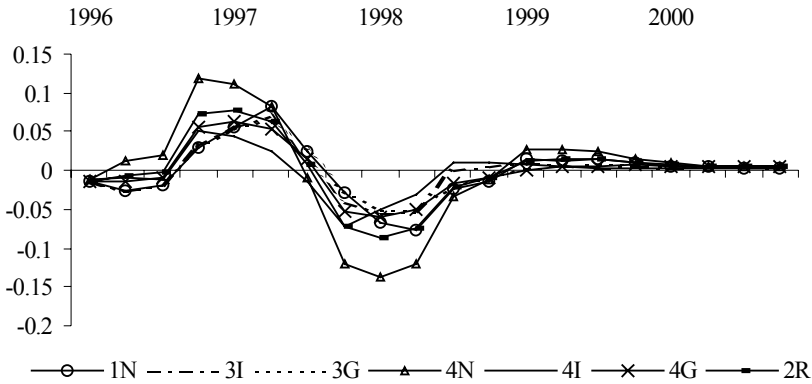
Although the data presented in Table 3 clearly show that CPI inflation under a currency board is among the lowest, the results of the simulations fail to provide an answer to the question of whether the currency board is as good as other regimes in controlling inflation. This can be explained by the dependence of the modelling results on the arbitrary choice of the reaction parameters of the

monetary regime. By changing the values of the reaction parameters, it is possible to influence the annual growth of the CPI (currency board excluded) and thereby realign the regimes according to their success in achieving lower inflation.

In order to acquire a more accurate comparison base, the CPI behaviour is analyzed by shock simulations. The simulation exercise will show how extensively CPI deviates from its baseline and how quickly the effect of the shock is absorbed. Baseline is defined as a solution without a shock under the corresponding monetary regime. Accordingly, the differences in the CPI base solutions, arising from the arbitrary choice of the reaction parameter, will become practically unimportant and the monetary regimes are more comparable. Three temporary demand-side shocks (with a duration of 1 quarter: Q1 1996) are tested — the growth in the GDP of the European Union (1% growth), the growth in the GDP of Estonia (1% growth) and the growth in the Estonian relative income level (growth by 1 percentage point). The last simulation mimics pure inflationary pressure on the domestic price level caused by income convergence. Shock is added directly to the relative income variable that enters import price equation letting only the inflation block to operate fully.

The duration of the short-term EU demand shock effects is three to four years (see Figure 1). The deviation of the CPI is most extensive in the case of a floating rate combined with the monetary rule without targets (4N in Figure 1). Such a large CPI deviation is directly caused by the fact that under a floating rate without monetary targets any balancing interventions have been switched off, therefore the shock brings about a much more extensive change in the nominal and real exchange rate. As the exchange rate channel works mainly by influencing net exports and considering the openness of the Estonian economy, the fluctuations in the exchange rate would have a large impact on the Estonian economy, which is consequently expressed in a substantially higher deviation

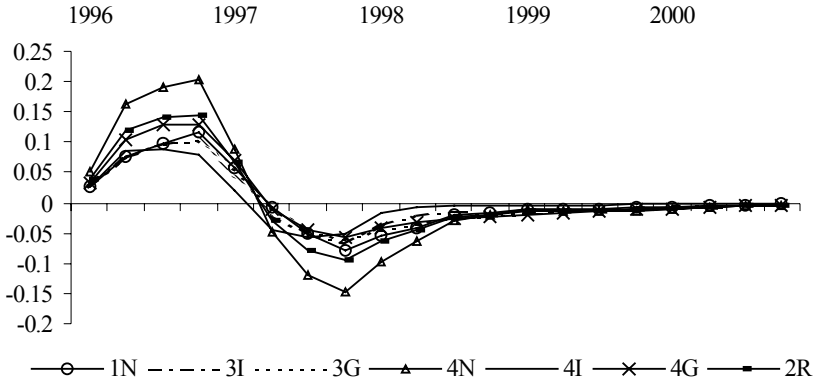
in the price index. The rest of the monetary regimes produce a similar result, in the sense of the impact of the described shock.



1N – currency board; **3I** – fixed rate, price level stability targeting monetary rule; **3G** – fixed rate, economic growth stability targeting monetary rule; **4N** – floating rate, monetary rule without targets; **4I** – floating rate, price level stability targeting monetary rule; **4G** – floating rate, economic growth stability targeting monetary rule; **2R** – floating rate, exchange rate stability targeting monetary rule.

Figure 1. Deviation of CPI annual growth against the base solution in the case of 1% growth in the average real GDP of the European Union (difference in percentage points); shock period — 1st quarter of 1996.

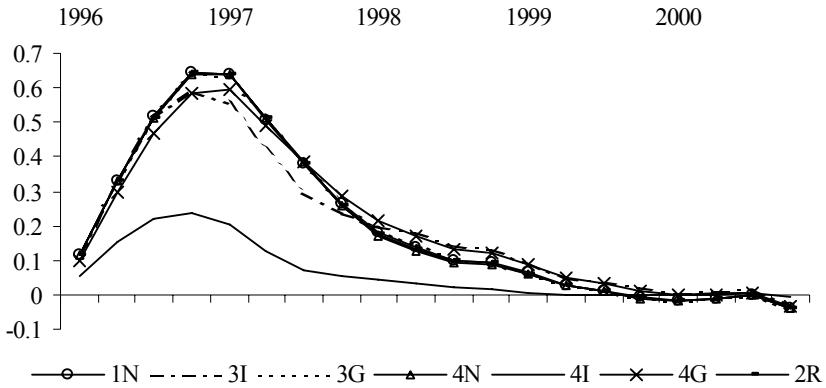
The change in the CPI accompanying real growth in the Estonian GDP is similar to changes in case of 1% GDP growth in the European Union (Figure 2). The shock is absorbed in about three years. The floating rate combined with a monetary rule with no targets again shows much higher sensitivity than other regimes. The justification for this is analogous to the occurrence of the EU average GDP shock.



1N – currency board; **3I** – fixed rate, price level stability targeting monetary rule; **3G** – fixed rate, economic growth stability targeting monetary rule; **4N** – floating rate, monetary rule without targets; **4I** – floating rate, price level stability targeting monetary rule; **4G** – floating rate, economic growth stability targeting monetary rule; **2R** – floating rate, exchange rate stability targeting monetary rule.

Figure 2. Deviation of the annual growth of CPI against the base solution in the case of 1% growth of Estonia’s real GDP (difference in percentage points); shock period — 1st quarter of 1996.

The short-term shock added to the Estonian relative income level causes a deviation of the CPI against its base solution over four years (Figure 3). The deviations are similar for all regimes except for the floating rate targeting stable inflation when the reaction following the shock is significantly lower (4I in Figure 3).



1N – currency board; **3I** – fixed rate, price level stability targeting monetary rule; **3G** – fixed rate, economic growth stability targeting monetary rule; **4N** – floating rate, monetary rule without targets; **4I** – floating rate, price level stability targeting monetary rule; **4G** – floating rate, economic growth stability targeting monetary rule; **2R** – floating rate, exchange rate stability targeting monetary rule.

Figure 3. Deviation of the annual growth of the CPI against the base solution in the case of 1% growth in the relative income level (difference in percentage points); shock period — 1st quarter of 1996.

In conclusion, it can be said on the basis of three shock simulations that in general the currency board arrangement is not worse in maintaining stable inflation than the alternative monetary regimes; although there have been contradictory opinions expressed in the literature. According to Avramov (1999), and Kwan and Lui (1999), the practice in Argentina and Hong-Kong shows that an economy with a currency board is especially vulnerable to demand-side shocks, resulting in a high volatility of interest rates and indicators in real terms. In the macromodel used in the present study, the maintenance of price stability is dependent on the stable growth of economic indicators in real terms. When compared with other regimes, in the case of CBA a significantly more extensive

deviation of CPI was not noticed (in Table 4 it is shown that the shock responses in CPI are not systematically larger under currency board regime than under other regimes, measured as root mean squares of CPI deviation from the base simulation). Consequently, it can be said that the observations described by Avramov and Kwan-Lui are not valid for the Estonian conditions.

Table 4. Root mean squares of CPI deviation from it's baseline (Period 1st quarter of 1996 – 4th quarter of 2000)

<i>Regime</i>		<i>Shock</i>		
Exchange rate	Target of the monetary rule	EU GDP growth	Estonian GDP growth	Relative income level
Currency board	No target	0.035	0.049	0.296
Fixed	Price level stability	0.030	0.044	0.273
Fixed	Economic growth stability	0.029	0.045	0.296
Floating	No target	0.065	0.092	0.296
Floating	Price level stability	0.027	0.040	0.100
Floating	Economic growth stability	0.032	0.055	0.283
Floating	Exchange rate stability	0.042	0.066	0.296

It is quite likely that at least in the mid-term forward period Estonian inflation will exceed the level determined by the Maastricht Treaty. Yet Estonia may be able to fulfil the required criteria in case of certain concurring conditions during the period when inflation is under evaluation. This may happen if the scenario of 2002 and 2003, when the cooling off of the world economy led Estonian inflation to an extreme low, is repeated. In the present study the small influence of shocks on price levels is considered to be an essential finding, which in principle proves the ability of the currency board to ensure stable prices and a stable economic

environment, securing admission to the EMU. In addition to this, the positive effects of using a currency board on fulfilling the other Maastricht criteria must also be considered.

Estonia's admission to the European Monetary Union will mean support for a potentially swift harmonization of monetary policies in the Baltic Sea region. In this way Estonia can contribute to a facilitated exchange of goods and increased mobility of capital inside the region.

Conclusions

Success in the second stage of the exchange rate mechanism (ERM2) and the ability to fulfil the stability requirements of the Maastricht Treaty largely depend on the exchange rate regime chosen by the country and subsequently on what monetary policy instruments are available. In the current chapter we found that meeting the criterion of low inflation was most difficult for Estonia.

The chapter presented shock simulations (based on a macroeconomic model) as a method for evaluating the relative superiority of different exchange rate regimes approved by the European Commission for entering ERM2 in the context of inflation persistence in Estonia. A model-block consisting of alternative monetary regimes, i.e. combinations of a certain exchange rate regime and monetary policy function (monetary rule), was added to the macromodel for that purpose. The essential parts of a monetary regime being the exchange rate channel, the interest rate channel, and the right of financial institutions to influence the economy in the desired direction via intervention, it seemed necessary to define the corresponding elements.

Three exchange rate regimes were distinguished between and combined with four monetary rules, each representing a different goal — price level stability, economic growth stability, exchange

rate stability and lastly, a special case, monetary policy with no target. As adaptation mechanisms differ across the monetary regimes, also prices react differently to the shocks occurring in the economy.

It appeared that inflation was the lowest under the currency board regime when running base simulations. But it did not reflect inflation reactions to shocks, i.e. change in price dynamics when there is a change in the economic environment. This is why no conclusions can be drawn on the basis of those simulations. Price level adaptation was analyzed in the case of a sudden increase in the European Union's GDP growth, the Estonian GDP growth and the relative income level of Estonia (compared to the EU average).

As a result of mimicking the shocks, it was not possible to reject the research hypothesis. It appeared that in general the currency board arrangement gives at least as good results as other regimes in maintaining price stability, contrary to some other studies that reached somewhat different conclusions. The currency board arrangement introduced in Estonia after regaining independence seems to be sufficiently reliable in guaranteeing stable price levels during ERM2, accordance with the Maastricht criteria, and swift admission to the EMU. At the same time, swift integration with the single currency zone would accelerate the monetary policy convergence in the Baltic Sea region, thus facilitating closer transregional economic connections.

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