Eesti Pank
Bank of Estonia

Report on the Adoption of the Euro

January 2008

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SUMMARY

Eesti Pank wishes to share with the public the information at its disposal about Estonia's readiness to change over to the single currency of the European Union – the euro – and to also introduce its points of view. For this purpose, we started to publish a regular report on the adoption of the euro in 2007. This report is an interim summary supplementing the full version completed in May 2007, which besides describing the current situation also discusses some additional economic policy issues related to the adoption of the euro.

The introduction of the euro at the first opportunity has been and will remain the priority of Estonia's economic policy in the coming years. The changeover to the euro must be viewed as a natural development for Estonia, because the foundations of Estonia's economic policy are very similar to that of the euro area. Estonia is an EU Member State with a small open economy and a conservative fiscal policy. The principles of the currency board arrangement and the exchange rate of the Estonian kroon pegged to the euro, which will remain so until the adoption of the euro, form the basis of our monetary system. Estonia has moved towards deeper integration with the euro area during its entire period of independence. By joining the European Union it has also committed to adopting the euro.

In 2006, the technical preparations carried out by Eesti Pank, in cooperation with government authorities and the private sector, for adopting the euro reached the stage where all the activities not directly related to the adoption date were completed. The assessment of the European Commission concerning the respective preparations in Estonia was also very positive.

For an open economy like Estonia, which is rapidly catching up to the standard of living in the euro area, a slightly higher inflation rate compared to the euro area is natural and does not pose a threat to price stability. However, the low inflation rate prescribed by the current interpretation of the requirements for the adoption of the euro will not be an easy target for Estonia. According to Eesti Pank's economic forecast of spring 2007, it must be admitted that the introduction of the euro is also unlikely in 2009 and therefore will be postponed to at least 2011. Furthermore, in order to join the euro area Estonia will have to carry on meeting the criteria concerning public finances, exchange rate stability and low interest rates.

The three articles appended to this report discuss some of the economic policy issues related to the adoption of the euro in greater detail.

The first article, "The Maastricht Inflation Criterion and the Expansion of the European Union", gives an overview of research co-authored by John Lewis and Karsten Staehr. The results of the research reveal that the accession of new Member States to the European Union may decrease the reference value of the inflation criterion if the inflation level of the joining countries is lower than the EU average, thus making the achievement of the inflation criterion more difficult.

The second article, "Meeting the Exchange Rate Criterion during a Period of Nominal Convergence", sums up John Lewis's research, which analyses how convergence affects the possibilities of simultaneously fulfilling the exchange rate and inflation criteria.

The third article, "Income Convergence and Real Interest Rates and Their False Implications for Exchange Rate Policies", by Märten Ross, Deputy Governor of Eesti Pank, analyses the connections between the real exchange rate and income convergence in the conditions of a fixed and floating exchange rate. Ross shows that if financial markets operate effectively and capital moves freely, then in the case of nominal convergence the level of real interest rates does not depend on the exchange rate system. The article is supplemented by an analysis by Rasmus Kattai on whether real interest rates depend on the exchange rate regime in use or not.

1. ESTONIA'S READINESS TO ADOPT THE EURO

The introduction of the single currency of the European Union – the euro – is an obligation of all the Member States of the European Union.[1] At present, 15 Member States of the European Union belong to the euro area.[2] Cyprus and Malta became members of the euro area on January 1, 2008. The other EU countries are regularly assessed by the European Commission and the European Central Bank to determine whether they meet the requirements for the introduction of the euro – the Maastricht criteria. The Government of the Republic of Estonia and Eesti Pank have set the goal of adopting the euro at the first opportunity when Estonia has fulfilled all the required criteria. The assessment at the end of 2006 showed that Estonia had sound public finances, a stable exchange rate and low interest rates but failed to fulfil the inflation criterion. The next evaluation of convergence reports takes place in spring 2008. The relatively high inflation rate will not allow Estonia to fulfil the requirements for the introduction of the euro before 2011.

1.1. Conformity of non-euro area EU Member States to the Maastricht criteria

The adoption of the single currency and the single monetary policy of the European Union require meeting certain economic and legal requirements. The specific prerequisites known as the Maastricht criteria are included in Article 121 of the Treaty on European Union and Protocol No 21 annexed to the Treaty. The objective of the Maastricht criteria is to ensure the smooth functioning of the European Monetary Union and a stable price level by means of a single monetary policy. These criteria require price stability and low interest rates, a stable exchange rate, and sound public finances. In addition, an appropriate legal framework is essential to designing and implementing the single monetary policy. The degree of fulfilment of the Maastricht criteria is assessed by the European Commission and the European Central Bank, who compile regular Convergence Reports.[3] The following is an overview of Estonia's steps towards achieving the criteria.

1.2. Price stability

According to the Treaty on European Union, a Member State's inflation rate must not exceed the average of the three best-performing Member States in terms of price stability by more than 1.5 percentage points.

In general, price stability refers to an inflation rate that does not affect people's decisions concerning production, consumption, investment and saving. The European Central Bank interprets the price stability of the euro area as an inflation rate close to but below 2% in the medium term. In rapidly developing economies a balanced inflation rate (i.e., not endangering price stability) can also be slightly higher in the medium term.

Compared to the reference value of the Maastricht criterion (2.5–3.0% in different years), Estonian inflation has been higher in almost all the years compared. The relatively high inflation rate stems from the present developmental stage of our economy, which is characterized by a low level of prices compared to other EU countries, fast economic growth and structural changes related to the development. The convergence of the Estonian income and price

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[1] Denmark and the United Kingdom are exceptional in this case, as at the time of agreement on the principles of the monetary union (at the beginning of the 1990s) they were allowed to choose whether or not and when to adopt the euro. Future joiners (incl. Finland and Sweden) were not given this option.

[2] The Member States of the European Union are divided into two groups based on their participation in the Economic and Monetary Union: full-fledged members of the Economic and Monetary Union (Member States that belong to the Eurosystem) and countries with a derogation (Member States that do not belong to the Eurosystem).

[3] Convergence Reports are available on the Internet at the following web sites:

The European Commission: http://ec.europa.eu/economy_finance/publications/convergencereports_en.htm
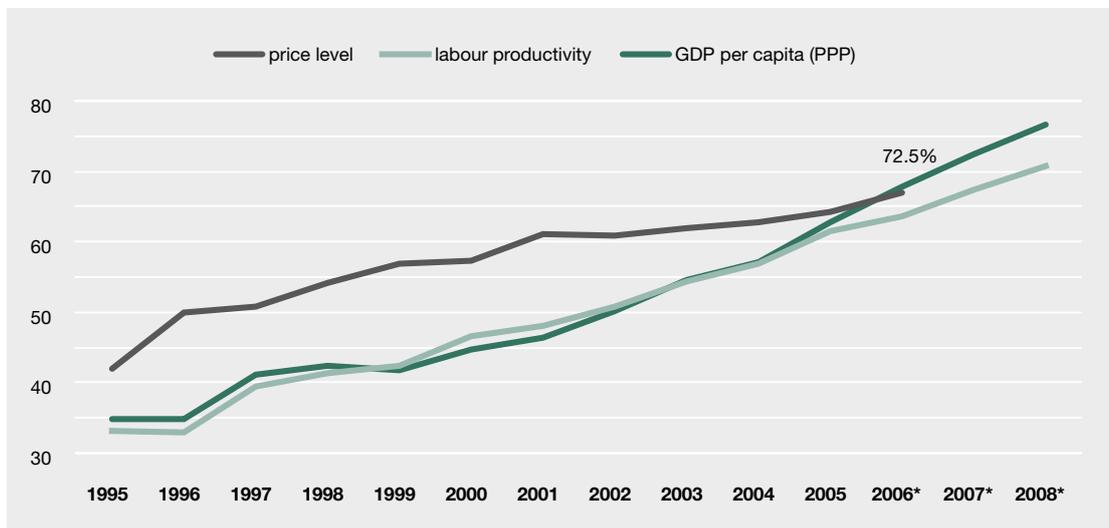
The European Central Bank: http://www.ecb.int/pub/convergence/html/index.en.html

Figure 1. Estonia's income convergence with the EU (% of EU-27 level)

Source: Updated Convergence Programme 2007

levels towards the average of the European Union is accelerating the increase in prices in Estonia, since in order to diminish the differences, incomes and prices – as well as productivity – must rise in Estonia on average somewhat faster than in the European Union (see Figure 1).

The non-fulfilment of the Maastricht criteria does not mean that Estonia has substantial problems with ensuring price stability. For stable economic growth it is essential that prices rise in line with the growth in productivity. In this sense price stability is not at risk in Estonia in the coming years despite the temporary acceleration of inflation, but compliance with the inflation criterion still remains unlikely (see Figure 2).
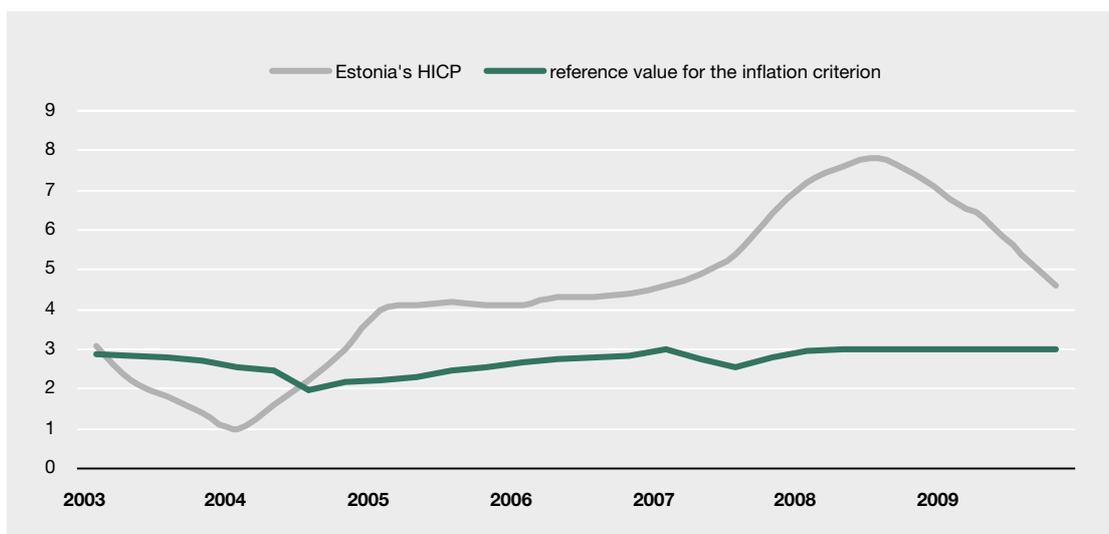

Figure 2. Meeting the inflation criterion (%)

Sources: Eesti Pank forecast (autumn 2007), Eurostat, European Commission forecast (autumn 2007)

Estonia will not fulfil the inflation criterion in the coming years

According to the autumn 2007 forecast of Eesti Pank, it is unlikely that Estonia will be able to meet the Maastricht inflation criterion in 2009 (provided that the interpretation of the criterion remains unchanged). Strong economic growth during recent years together with external price pressures have boosted Estonia's inflation and despite the deceleration in economic growth, price pressures have not yet decreased in Estonia. At the end of 2007, the appreciation of foodstuffs and fuel picked up on global markets, also affecting the growth in prices in Estonia. The price rise of foreign commodities, primarily foodstuffs, has been greater than expected and inflation has thus slightly exceeded the forecast. It must be kept in mind that these are single price rises and their influence will start waning in the middle of 2008. In addition, wage growth is expected to start decelerating next year and thus domestic price pressures will also abate. According to the autumn forecast of Eesti Pank, **average consumer price growth will remain at approximately 7% in 2008**. The forecast indicates that the inflationary pressures will also continue decreasing in 2009 if the average inflation rate of the year is 4.6%.

Inflation will achieve its peak in 2008, when price growth will be influenced by tax policy measures scheduled for January and July. On the other hand, the Government's decision to bring all the mandatory rises in excise duties into effect in 2008 improves the probability of fulfilling the inflation criterion in the next few years when the influence of the tax changes is no longer reflected in the inflation rate. According to the forecast of the Ministry of Finance, as a result of bringing the increases in excise duties forward, in 2010–2011 the influence of price rises on inflation resulting from Government actions will decrease by 0.5% and 0.2%, respectively. However, the forecast indicates that Estonia will still not be able to fulfil the Maastricht inflation criterion in 2009. According to the autumn forecast of the European Commission, in the following years the reference value will remain around 3%. After 2009 Estonia's inflation is expected to decrease to a level compatible with balanced economic growth (3–4%).

1.3. Long-term interest rate

The long-term interest rate of a Member State must not exceed the average interest rate of the three best-performing Member States in terms of price stability by more than 2 percentage points.

The long-term interest rate shows the expectations of market participants and the integration level of the financial market. Low interest rates (which comprise expectations of low inflation as well as low risk premiums) reflect market participants' understanding that the development of the economy will remain stable in the future. According to the criterion, the interest rate on the long-term (ten-year) government bonds denominated in the national currency of the candidate country may not exceed the average long-term interest rate of the three Member States with the lowest inflation level plus 2%.

The long-term interest rate has been relatively low in Estonia but the indicator is not directly comparable with the indicators of other Member States because instead of long-term government bonds denominated in kroons it is calculated on the basis of long-term kroon loans issued to the private sector. The long-term interest rate indicator for Estonia was developed in 2004 in cooperation between Eesti Pank, the European Commission and the European Central Bank, and it is based on the interest rates of kroon loans with maturities of up to five years.

According to the Convergence Report of the European Commission, Estonia will fulfil the interest rate criterion (see Figure 3). So far, the European Central Bank has not used this interest indicator in its Convergence Reports, basing its assessment instead on a general analysis of the financial environment.
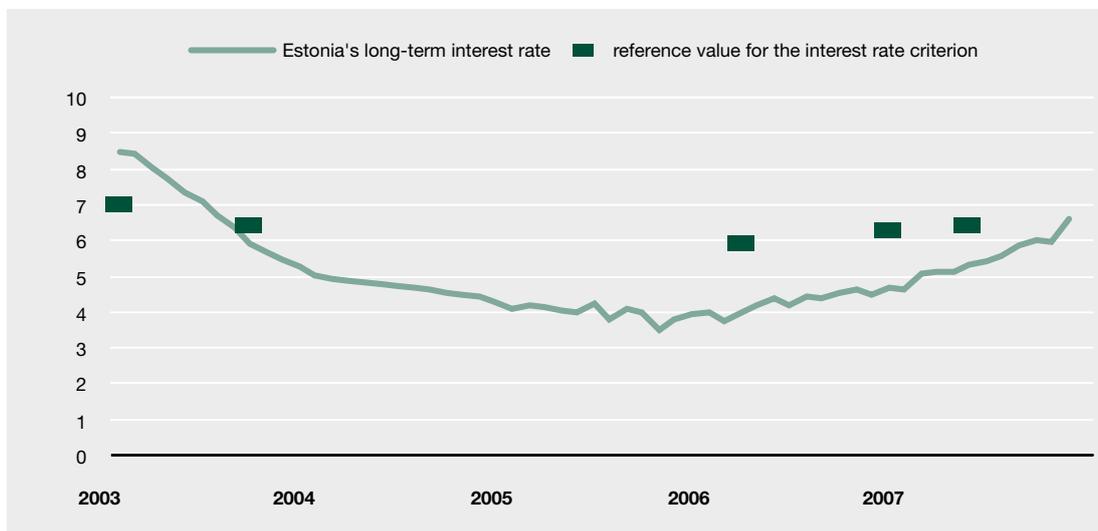
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Figure 3. Estonia's long-term interest rate and reference value for the interest rate criterion (%)

Sources: Eesti Pank, European Commission Convergence Reports

1.4. Stable exchange rate

The country must, for at least two years, participate in the currency exchange rate mechanism ERM II and keep the exchange rate of its currency stable against the euro (in particular without devaluation on its own initiative).

The smooth operation of the currency board since 1992 reflects the competitiveness and stability of our economy. Therefore, Estonia was one of the first Member States to join the exchange rate mechanism ERM II soon after accession to the European Union in 2004.
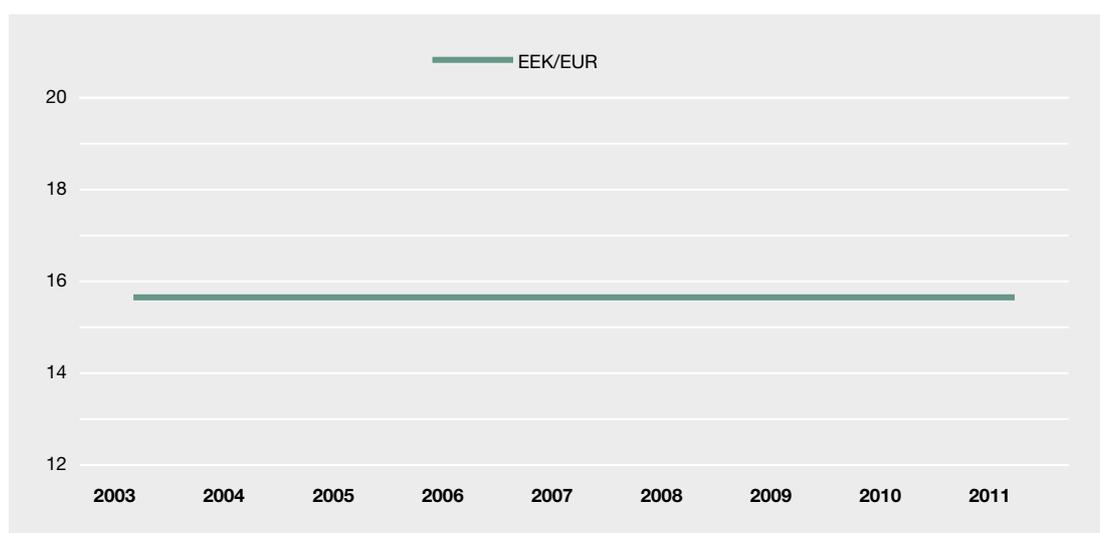

Figure 4. Exchange rate of the Estonian kroon and the euro

Source: Eesti Pank

Both the European Commission and the European Central Bank have noted that the exchange rate of the Estonian kroon has not experienced any problems within the framework of the ERM II. In addition, Estonia has fulfilled its (unilateral) commitment to maintain the rate of the kroon against the euro within the zero per cent fluctuation band (see Figure 4).

1.5. Public finances

The general government deficit must be lower than 3% of GDP. Government debt must be less than 60% of GDP or approaching the required level at a satisfactory speed.

Owing to a relatively conservative fiscal policy, the state budget has been in balance or surplus during the years of rapid economic expansion (see Figure 5). Government debt (as a ratio to GDP) has been steadily decreasing as a result of repayments and strong economic growth, being the smallest among the states assessed (see Figure 6). It must be ad-

mitted that Estonia has been successful in fulfilling the criteria for public finances.

However, although Estonia is by far complying with the public finance criteria, it is of the utmost importance to continue following the present fiscal policy principles in the future too in order to maintain a stable economy and sustainable public finances.

1.6. Legal requirements for the adoption of the euro

First and foremost, an assessment is given of the compliance of the objectives of the central bank with those of the European Central Bank and of the independence of the central bank.

In 2006, the Eesti Pank Act was amended so as to remain in compliance with the Treaty on European Union and the Statute of the European System of Central Banks (ESCB). When the time for the changeover to the euro becomes more certain, the Act on the Introduction of the Euro needs to be adopted. In addition to the legislation mentioned
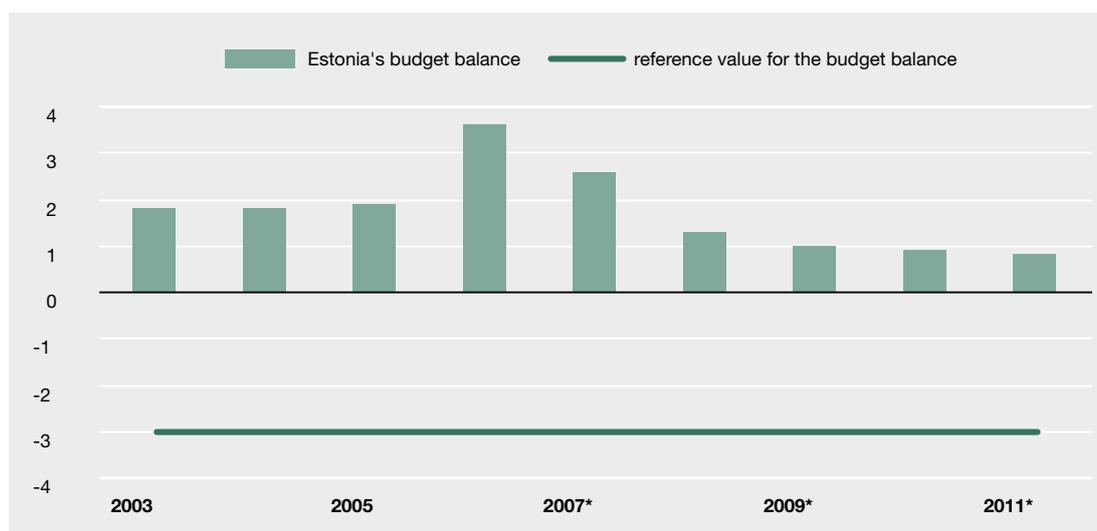

Figure 5. Estonia's budget balance and reference value for the budget balance criterion (% of GDP)

Sources: Ministry of Finance forecast (autumn 2007), European Commission forecast (autumn 2007)

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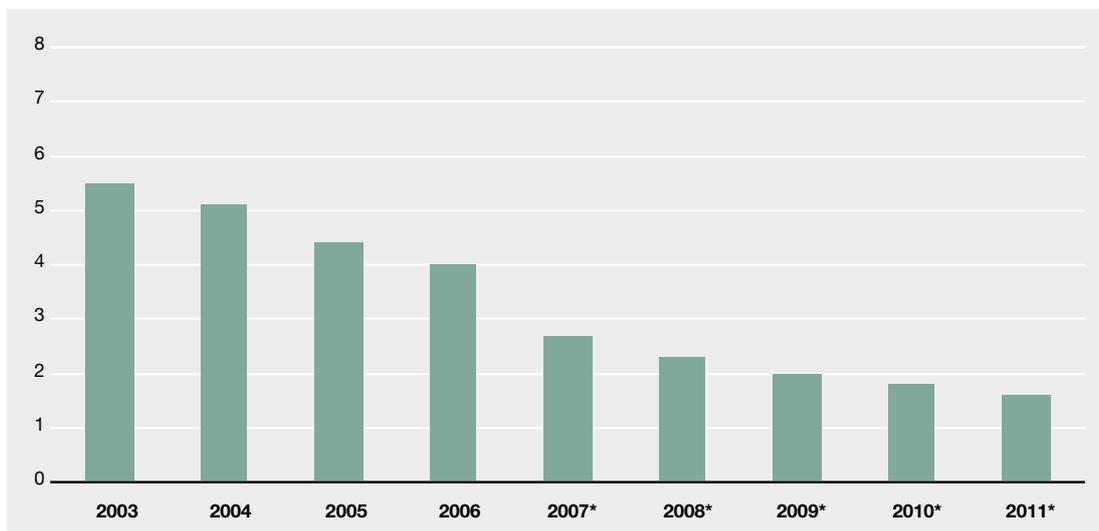Adoption of the
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Figure 6. Estonia's general government debt (% of GDP)

Source: Ministry of Finance forecast (autumn 2007)

above, it is necessary to change the Currency Law of the Republic of Estonia and the Law on the Security of the Estonian Kroon. These acts will be repealed with the Act on the Introduction of the Euro. The Act on the Introduction to the Euro has been approved by the relevant ministries but due to the postponement of the date for the changeover it was decided to temporarily suspend the proceedings on the draft act.

1.7. Timing of the adoption of the euro

Estonia's liberal and open economic policy has laid a good foundation for strong economic growth and also for the fulfilment of the Maastricht criteria. The openness of the Estonian economy and the fixed exchange rate of the kroon force our enterprises to be competitive under very similar economic and political conditions as the present Member States of the euro area. This, in turn, supports the stability of the Estonian kroon's exchange rate and compliance with the respective criterion without any problems. At the same time, the Estonian Government has pursued the balanced budget principle; therefore, Estonia meets the public finance criterion. The low long-term interest rate indicates that financial

markets are internationally integrated and investors believe in the sustainability of the competitiveness of Estonia's economy and economic policy. If our economic policy makers and enterprises justify that belief, Estonia will not have any fundamental problems with fulfilling these criteria in the future either.

At the same time, the inflation criterion with its present interpretation remains a problem for a fast developing economy which is converging towards the average level of the wealthier countries of the euro area. On the one hand, economic openness enhances the growth opportunities of the Estonian economy; on the other hand, the monetary and fiscal policy decreases the possibilities of influencing inflation in the short term. For an open economy such as Estonia, a fixed exchange rate based on a currency board arrangement is optimal for anchoring inflationary expectations and ensuring price stability.

In directing domestic demand in the short term, besides the fixed exchange rate, the Government's conservative fiscal policy also plays a crucial role.

A conservative economic policy (particularly fiscal policy) is essential to ensure the stability of Estonian economic development and the fulfilment of the Maastricht criteria.

According to the spring 2007 forecast of Eesti Pank, it is unlikely that Estonia will be able to fulfil the Maastricht inflation criterion in 2008–2009 (provided that the interpretation of the criterion remains the same). The forecast expects the acceleration of the average annual inflation rate to reach its peak in the first half of 2008. Although thereafter the inflation rate will start decelerating, it will still exceed 4% at the end of 2009, whereas the reference value calculated on the basis of the autumn 2007 forecast of the European Commission will most probably be 3%.

In conclusion, it must be admitted that the **introduction of the euro will be delayed past 2011**. Therefore, Eesti Pank and the Government have not set a new target date for the changeover to the euro. The **exact date** for changing over to the euro will be announced at least **12 months before the adoption of the single currency** so that the state and the private sector can complete their preparations. Despite the postponement of the adoption date, Estonia's accession to the euro area remains an essential economic policy objective.

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2. INTER-AGENCY COOPERATION ON THE ADOPTION OF THE EURO

Upon joining the European Union and the Exchange Rate Mechanism II (ERM II), the Estonian authorities set the goal of being technically ready for the adoption of the euro by mid-2006 and to introduce the euro on January 1, 2007. The assessment of the European Commission published in November 2006 on the technical readiness of the non-euro area EU Member States was very positive for Estonia. Estonia had completed all the preparations not directly dependent on the date for the changeover to the euro.

The following gives an overview of the coordinated preparations of Estonian authorities to introduce the euro and the measures taken by Eesti Pank.

2.1. National preparations for the introduction of the euro in Estonia

Arrangements at the national level

To ensure a smooth changeover to the euro and coordinate necessary activities the Government decided at its cabinet meeting on December 9, 2004, to form the National Changeover Committee chaired by the Secretary General of the Ministry of Finance. The Committee also includes a Deputy Governor of Eesti Pank, the Secretary General of the Ministry of Justice, the Secretary General of the Ministry of Economic Affairs and Communications, the Secretary General of the Ministry of Internal Affairs, the Director for European Union Affairs at the State Chancellery, and an adviser from the Ministry of Finance. In addition to public sector experts, the private sector was also involved through the working groups of the Committee.

In order to prepare for the changeover to the euro, Estonia's National Changeover Plan was compiled under the instruction of the National Changeover Committee, which includes guidelines for govern-

ment authorities and information for the general public. The latest guideline of the euro plan, version 6, was approved on November 29, 2007, and is available on the web sites of the Ministry of Finance, Eesti Pank[4] and on the euro web at www.euro.eesti.ee.

The preparations of Eesti Pank

The central bank already started preparations for ensuring a smooth changeover to the euro in autumn 2003. Since joining the European Union in May 2004, Eesti Pank has been a member of the European System of Central Banks (ESCB). Preparations for joining the ERM II in June 2004 were equally important. For that purpose, Eesti Pank engaged in regular cooperation with the European Commission, the European Central Bank and other EU Member States.

In 2004, Eesti Pank started to draft the framework for changing over to the euro, taking into account the experience of other states and the specifics of Estonia. The principles elaborated on by the bank formed the basis for the official plan for the changeover to the euro in the spring-summer of 2005. All major matters concerning the currency exchange were agreed upon with market participants by autumn 2006.

The objective of Eesti Pank was to be ready by the middle of 2006 in terms of the organisation's everyday operations and for the introduction of the euro area's single monetary policy. The central bank has completed all preparations not directly dependent on the date for the adoption of the euro. The activities which can be commenced only after the European Commission has made its final decision on the accession to the euro area, such as minting Estonian euro coins, have been suspended.

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APPENDICES

1. The Maastricht Inflation Criterion and the Expansion of the European Union

The inflation criterion stipulated by the Treaty of Maastricht establishes that in order to join the Economic and Monetary Union the inflation of the harmonised index of consumer prices (HICP) of a country must remain lower than or equal to the reference value, which is determined based on the average HICP index of the three best-performing EU Member States in terms of price stability plus 1.5%. In the latest convergence reports, the best-performing reference group included three EU countries with the lowest positive inflation. Thus, countries with a negative inflation rate are excluded from the reference group but this standard might not necessarily be applied in future assessments.

Several factors have boosted Estonia's inflation, making the fulfilment of the inflation criterion pursuant to the Treaty of Maastricht more difficult. At the same time, the expansion of the European Union from 15 to 27 Member States has decreased the expected reference value of the inflation rate, which in turn has made meeting the criterion less feasible. The addition of new Member States to the European Union can never increase the average inflation rate of the three best-performing Member States but may decrease it if the inflation rate of at least one of the new Member States is sufficiently low.

In their recent research, John Lewis and Karsten Staehr used numbers to determine the influence that the expansion of the European Union from 15 to 27 Member States exerts on the inflation reference value.[5] The research assesses the impact of the European Union's expansion on the inflation reference value by applying two different methods.

The first method is counterfactual analysis, which uses the inflation indicators of the current 27 Member States of the European Union from January 1999 until June 2007. Figure 1 presents the inflation reference values of the European Union's 15 and
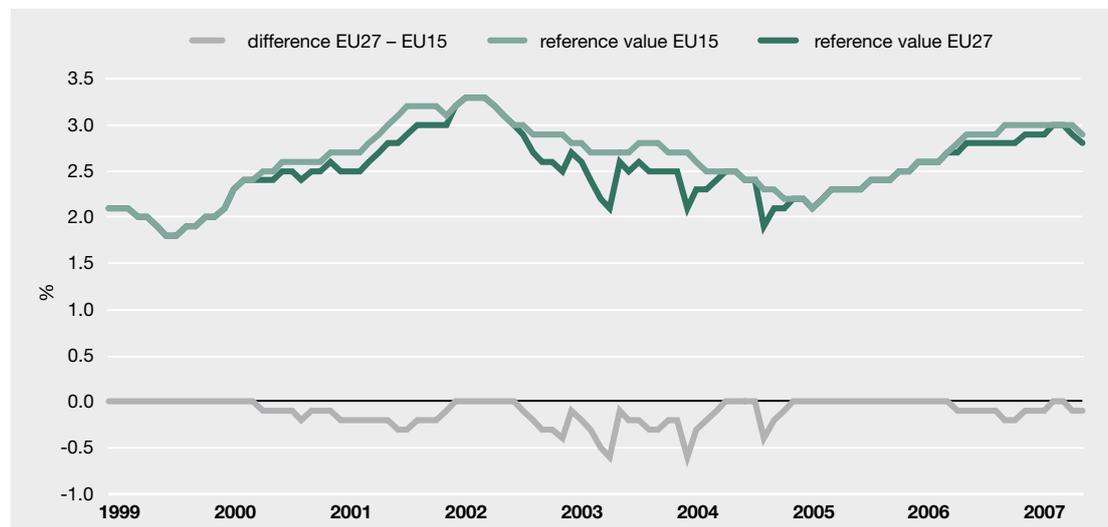

Figure 1. Inflation reference value with EU27 and EU15 countries (% a year)

Source: Lewis & Staehr (2007), adjusted

[1] J. Lewis, K. Staehr (2007). The Maastricht Inflation Criterion: What is the Effect of Expansion of the European Union? DNB Working Papers, No. 151, De Nederlandsche Bank, http://www.dnb.nl/dnb/home/file/Working%20Paper%20No%20151-2007_tcm47-164976.pdf.

27 Member States, respectively, and the difference between these reference values (countries with negative inflation rates have been excluded from the reference group).

Based on Figure 1, it is possible to conclude that had there been 27 and not 15 European Union Member States from the beginning, the inflation reference value would have been significantly lower for extended periods since 1999 (up to 0.6%). With 27 countries, the average reference value is 0.11% lower than is the case of 15 EU Member States. The figure also shows that the reference value of inflation fluctuates significantly from month to month as countries with inflation rates around zero move in and out of the reference group.

The second method is based on the Monte Carlo simulation, which is used to ascertain the distribution of the reference value for given sets of EU Member States. The distribution and parameters can be deduced from previous inflation data or they are based on expert assessments. The prerequisite for the baseline scenario is that the inflation rates of all countries follow a normal distribution with average

and standard deviations and correlations, such as in the sample from January 1999 until June 2007. Figure 2 presents the distribution of the inflation reference value in the baseline scenario with 15 and 27 EU Member States, respectively, provided that the countries with below-zero inflation are excluded from the reference group.

The simulations reveal that the distribution of the reference value shifts to the left after the increase of EU Member States from 15 to 27. The expected reference value decreases by 0.15% and there is a 25-percent probability that the drop is 0.3% or even greater. The numerous simulations using a broad range of distributions and parameter specifications show that these results are rather robust.

Including countries with negative inflation in the calculation of the reference value influences the results considerably. For instance, the simulations show that if countries with negative inflation are included, the average reference value of the European Union with 27 Member States is probably 0.5% lower than in the case of 15 Member States.
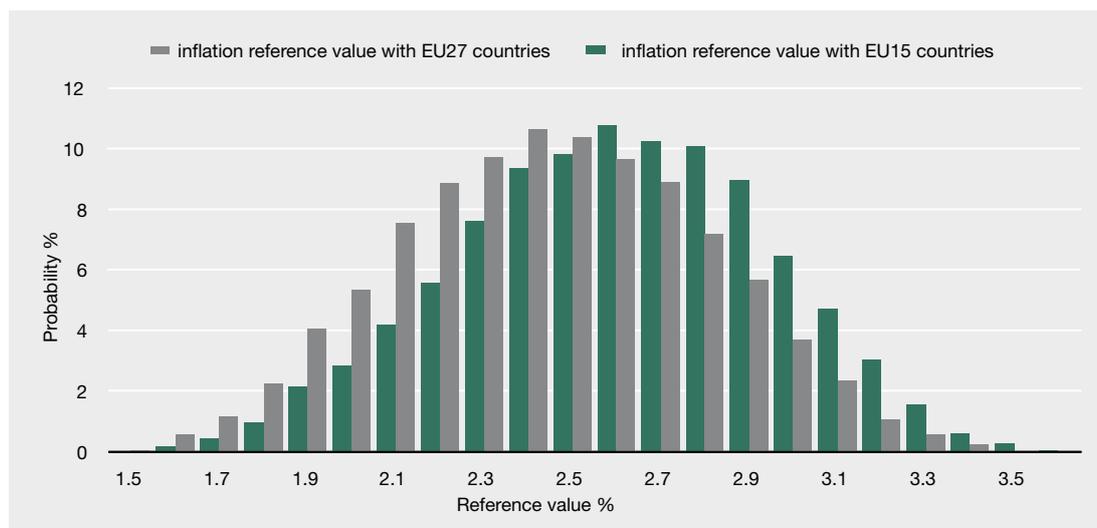

Figure 2. Probable distribution of inflation reference value with EU27 and EU15 countries (% a year)

Source: Lewis & Staehr (2007), adjusted

2. Meeting the Exchange Rate Criterion during a Period of Nominal Convergence

Among other criteria, the Central and Eastern European countries (CEECs) that are seeking to adopt the euro also have to meet the criteria for price and exchange rate stability. Meanwhile, the economies of these countries are experiencing a period of nominal convergence, as their price levels against the euro area are climbing. This process, which is sometimes referred to as the *appreciation of the real exchange rate*, may take place via an inflation differential with the euro area or the appreciation of the nominal exchange rate (or both).

This article analyses whether the impact of convergence may become a problem for the simultaneous fulfilment of the exchange rate and inflation criteria. In countries where their monetary policy has set a fixed exchange rate (pegged exchange rate or currency board), the exchange rate criterion can be achieved but the authorities essentially have to wait and hope for an inflation rate low enough to meet the inflation criterion. On the other hand, countries targeting inflation may use monetary policy in order to guarantee the achievement of the inflation criterion, but can thereafter only hope that the exchange rate will remain sufficiently stable to satisfy the exchange rate criterion.

Whether the nominal convergence process hinders the simultaneous achievement of these two criteria depends on the scope of the convergence effect. Thus, the first step in conducting the analysis is to assess the likely scope of the convergence effect. This article discusses and specifies Kattai's (2006) nominal convergence model, which uses the past behaviour of the relative price level as well as the presumable timing and end of the convergence in order to forecast further developments in the relative price level. According to this approach, the presumable appreciation of the exchange rate depending on the specific country and scenario used is generally 4–6% a year.

If the country has a fixed exchange rate, the main difficulty lies in achieving the inflation criterion. The reference value (which, pursuant to the Treaty of Maastricht, is 1.5% plus the average inflation rate of the three European Union Member States with the lowest (positive) inflation rate) is an average of 0.6% higher than the euro area's inflation. While the euro area's inflation rate is 2%, the presumable reference value is 2.6%. In all countries and according to every scenario the inflationary trend affected by convergence is 5–7% per year, which indicates that the fulfilment of these criteria will be complicated. Although the abovementioned scenarios point to a decrease in the inflationary trend, it will probably exceed the reference value for approximately 15 years.

The key issue for countries targeting inflation is whether the nominal exchange rate appreciates enough to breach the upper limit of the exchange rate mechanism. All convergence scenarios indicate a two-year exchange rate rise below 15 percent (usually 7–10%). In other words, the convergence effect alone cannot cause the appreciation of the exchange rate to exceed the limit. Thus, it is easier for countries that target inflation than for countries that have fixed their exchange rates to adapt to the nominal exchange rate appreciation within the criteria of the Maastricht Treaty. If trend appreciation is deemed in compliance with the exchange rate criterion, countries targeting inflation will find the criteria easier to fulfil than countries with fixed exchange rates.

The second part of the article employs data on 16 countries that have pegged their currencies to the euro or are members of the euro area in order to examine the influence of the relative price level on achieving inflation rates below the reference value based on experience. The most important result is the following: low price levels are linked to a remarkably smaller probability that the inflation rate will remain below the reference value within one month. The analysis was also repeated to check

the accordance to the reference value during 3, 6 and 12 consecutive months. It turned out that increasing the number of months for checking compliance with the reference value diminishes its likelihood on every given price level and increases sensitivity to price levels. Another intriguing result is that even a country that has the same price level as the euro area has a less than 50% probability of remaining in compliance with the reference value for 12 consecutive months. This indicates that without an independent monetary policy it is complicated to remain within the boundaries of the reference value even if there is no difference in the price level.

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3. Income convergence and real interest rates and their false implications for exchange rate policies

In 2004 ten new member states joined the European Union and were followed by another two countries in 2006. This step had remarkable effects not only politically but also economically. It accelerated financial and labour market integration and hastened growth in many new member states. One side-effect of this was that the new-phase-in-old discussion over optimal exchange rate policies during the income catch-up process also resurfaced.

The reason for this resurgence was that deeper integration was accompanied either by higher current account imbalances and a relatively high inflation rate in fixing countries or by relatively strong nominal exchange rate appreciation together with a strong increase in price levels vis-à-vis the Eurozone in floating countries. Maybe not surprisingly, the dispute was not even centred around the exchange rates themselves or on optimal currency areas in general, but on the issue of the developments of real interest rates under different currency regimes.

However, as the following analysis explains, the issue of real interest rates is either over-stated or is not possibly at the centre of the problems at all. Firstly, under increased capital market integration the currency arrangement should not have much impact on real interest rate developments anyway. Secondly, there are considerable doubts about how relevant the usual CPI-based calculation method is for real interest rates under the price level convergence process.

Rather, it is up to the credibility of the monetary framework to lock in the medium-term expectations that matter and for that purpose one exchange rate configuration or another do not a priori matter.

Overall frame: Why do we have currency unions?

The idea of currency unions is the same as the idea of the invention of money itself. Its aim is to facilitate trade, provide a basis to capital accumulation and give clarity to efficient accounting. Through this, currency areas are expected to support long term economic efficiency and provide a basis for faster growth in incomes.

Although it is obvious that many adjustment mechanisms function better within nation states, there is no fundamental difference between currency unions and nation states with the same currency. Therefore, the reasons why a single currency is economically sensible both between Upper-Bavaria and Schleswig-Holstein, and Italy and France are basically the same.

If things were that easy, different currencies would not exist. The main argument against a single global currency is that the macroeconomic costs incurred by different shocks to different economic areas would be easier to absorb if there were separate currencies with different interest rate policies. The basic thinking goes that while countries or regions could be in different phases of the economic cycle there are different needs for the cost of capital to preserve the stability of the economy. In principle again, this question could arise as well between the cities of Hamburg and Dresden as well as between Ireland and Belgium.

Fundamentally, there is also no difference in this argumentation between currency unions and credible fixed exchange rates. Surely, many political aspects are different in scale. For example, the likelihood of pulling out of a currency union is definitely smaller than abandoning currency pegs. However, these arguments do not change the basic transmission mechanisms. Rather, they just influence the estimations of the concrete values of risk parameters in this formula.

Of course, one could argue that if a country or a region is within a currency union, it already influences the decision-making of the union and, therefore, the interest rate can not be "that wrong." However, once we limit our reasoning to small open economies that are sufficiently small to be price takers not just globally but even within the Eurozone, then this argument is also not practically feasible. For example, one could ask how much even Spanish (not to mention smaller countries) economic figures

were able to bias Eurozone interest rates to more "proper levels" specifically for its needs during the boom in this century. The honest answer is "none at all" or at least "very little".

But where does the line go? When are the advantages of having simplicity in foreign trade and clarity in tradable prices greater than the cost of having the "wrong" interest rate? This is a tricky issue.
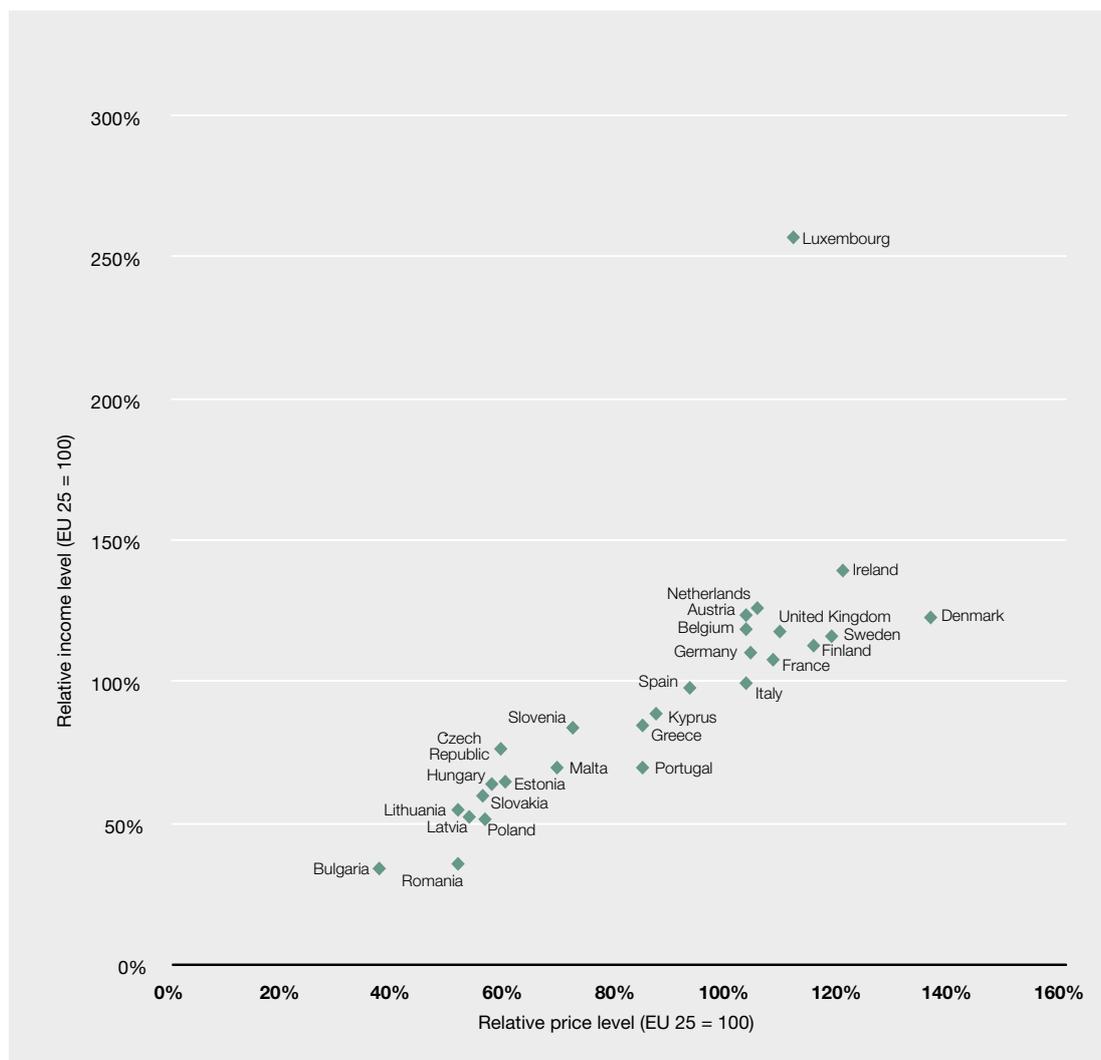

Figure 1. Relative income and price levels in Europe in 2006

Currency choices and price level convergence

Until the abovementioned discussion is limited to the case of simple cyclical frictions between different economic areas things will still be quite simple. However, things are considerably more complicated in the situation where we bring in the concept of income- and price-level convergence. It is well documented that there is a strong, almost 1 to 1, correlation of income- and price-levels in the long-run, but this is particularly so within better integrated economic regions like Europe (see Figure 1).

The reason for that is simple: while the prices of those resources that are tradable over the regions equalize to one level under any circumstances, the prices of non-tradable resources (including a considerable part of labour) depend in turn on the productivity level of industries and service-providers of the tradable goods. To put it differently: non-tradable prices depend on the wage level of the tradable sector. The latter, in turn, depends on the ability of these enterprises to be competitive in the world markets.

Consequently, if the relative productivity of a country or economic region happens to change vis-à-vis the rest of the world, its price level changes, thus delivering either higher or lower inflation than in its peers (or similar amount of exchange rate appreciation or depreciation)[1].

Therefore, in the case of such positive relative productivity shocks in tradables in one country or region, there is a relatively risk-free bet that inflation will be higher for a long time on average if these countries or regions happen to be either in a fixed exchange rate regime or within a currency union. Naturally, under a floating exchange rate regime this leads to a similarly risk-free bet on the nominal appreciation of the currency if inflation remains constant with regards to the reference country.

This leads to the seemingly logical conclusion that under fixed exchange rate regimes or in currency unions a positive relative productivity shock will deliver persistently lower average real interest rates in the catching up regions as the nominal interest rates converge due to interest rate arbitrage. Therefore, assuming that the real interest rate level were to equilibrate GDP growth at its potential prior to the shock, then now the real rate of interest is constantly below its natural level (until the effect of productivity boosts subsides), possibly even negative. While deviation of real interest rates from equilibrium for a longer period in time would hurt long-term economic development, the latter (i.e., negative interest rate) is assumed to be a particular "breaking point" as from that level on there is no answer to the "borrower's dilemma". Namely, from that point on the borrower could almost endlessly increase his/her debt.

Contrary to that, it is said that a floating exchange rate could shield the catching-up economic region from this destabilising phenomenon. As policymakers are free to set domestic interest rates, the real interest rate is expected to remain closer to the natural level at all times. Thus, real interest rate is arguably higher under floating exchange rate regime than under the fixed rate regime, and the economy would stabilize smoothly at its potential growth path. Logically, for its part, this should lead to a higher long-term growth trend and should be beneficial for the country.

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[1] This process is often referred to as the Balassa-Samuelson effect. However, one should be careful here as narrowly speaking this effect refers not only to productivity and income differentials between home and abroad, as often wrongly assumed, but also to relative productivity differentials in tradable and non-tradable sectors within the countries themselves. Relevant studies have not found strong empirical proof to claim that all price- and income-level convergence processes are due to this theory. In the following, I refrain from discussing whether this is due to measurement issues (quality aspects, non-tradable elements of tradable goods prices, etc.) or other reasons and, therefore, refer to the price level catch-up process in order to avoid unnecessary discussion about this academic detail.

This could give more credit to the floating exchange rate regime and could take the conclusion even to the point where it overshadows the trade and investment enhancing aspects of the fixed rate of exchange.

Are currency unions bad for growth then?

However, once that is said we come to a weird conclusion. If there is no fundamental difference between currency unions and fixed exchange rates (as explained above), we should get the same result in the analysis of similar supply shocks within currency unions. So, if there are income- and price-level convergence effects within a currency union, we should exclude these countries or regions from the union for their own sake, at least for a while, and not just the laggards that are poorer still but also those who manage to outperform the others from high income levels.

Or we should, by all means, try to avoid relative changes in the incomes of different regions. By saying that, we automatically state that the aim of economic policy in currency unions is to keep the

poor as poor as they are and the rich as rich as they are (see Figure 2), while trying to forestall some region or country from accidentally outperforming the others in terms of productivity growth. Strange, isn't it? So, is there a loophole in our abovementioned argumentation?

Yes, generally speaking there is a loophole in this line of thinking. There are no fundamental reasons why one exchange rate arrangement or another could give a priori better outcome for stable convergence in small open economies. The following explains it on two fronts. First, that the difference in real interest rates is either illusionary or wishful thinking under financial integration. Secondly, that the basic argument, real interest rates, is usually misunderstood in the context of expected income- and price-convergence.

(Real) interest parity – have we forgotten it?

The argument of a lack of an independent interest rate policy in fixed exchange rate countries relies on the assumption of nominal interest rate parity. Barring specific country or credit risk components,
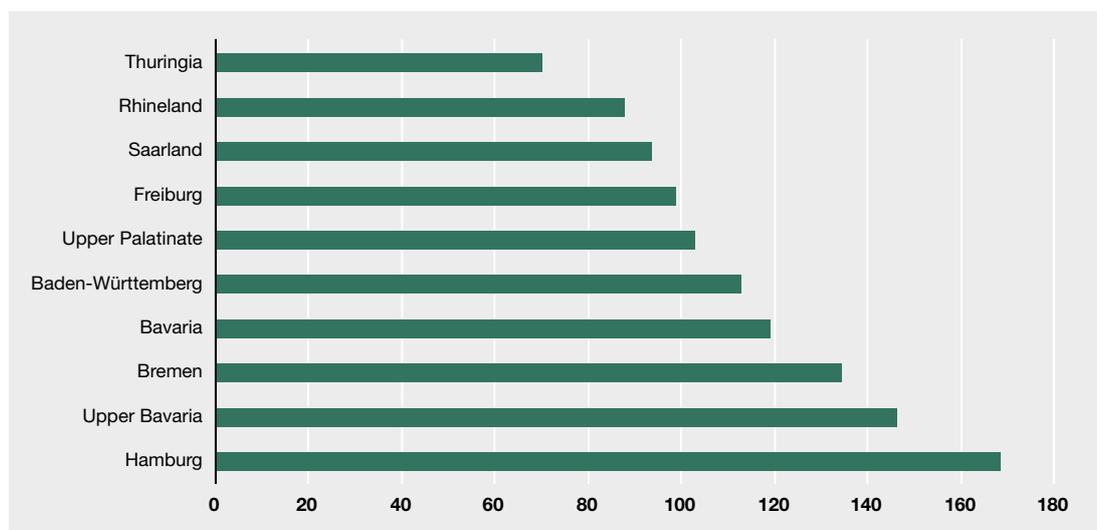

Figure 2. GDP per capita in selected German regions in 2006 (PPP, German average = 100)

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this has also clearly held true for Estonia during its experience with exchange rate targeting. It has been most clear cut in this century when the Estonian banking system has essentially been fully integrated into the Nordic banking system.

However, it is often forgotten that under the same assumptions of capital market integration, parity also holds true for *real* interest rates. Indeed, real interest rates across regions should equalize as long as individuals and firms act on rational expectations and market forces are allowed to function fully in order to equilibrate demand and supply for goods and services as well as production factors.

If we take into account the possibility of borrowing in currencies against which the currency appreciates, cumulative *real* interest rates can be *no* different as the underlying reason for appreciation – relative productivity shock – is no different. In order to take advantage of the (arguably) negative real interest rates, one should simply borrow in a foreign cur-

rency that depreciates against the domestic currency. As the appreciation of the exchange rate can be assumed to be a relatively safe bet (as price-level increase is assumed to be), the expected real interest rate on this borrowing can be very substantially negative. Therefore, an exchange rate regime simply transforms all or part of the potential price increase in one asset class to another.[2]

In practice this can be illustrated by calculating different levels of foreign exchange borrowing as part of real interest rate calculations in the countries that have faced strong nominal appreciation (see Figure 3 for Slovakia's case for purely illustrative purposes). Another way to illustrate this is to follow price level changes in terms of REERs or prices of specific asset classes in the cases of non-EU member states (see Figure 4). As shown on the figures, the picture of real interest rate changes considerably in floating exchange rate regimes if the possibility of borrowing in foreign currency is taken into account.
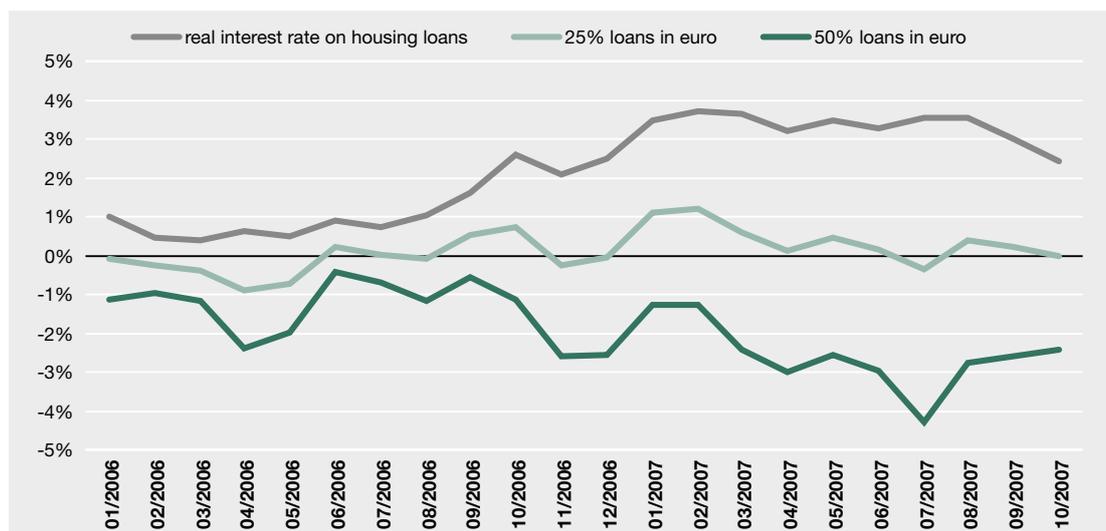

Figure 3. Real interest rate in Slovakia based on different currency basket calculations (ex post, CPI based, housing loan interest rate, assuming either no foreign currency borrowing or 25% and 50% share of borrowing in euros)

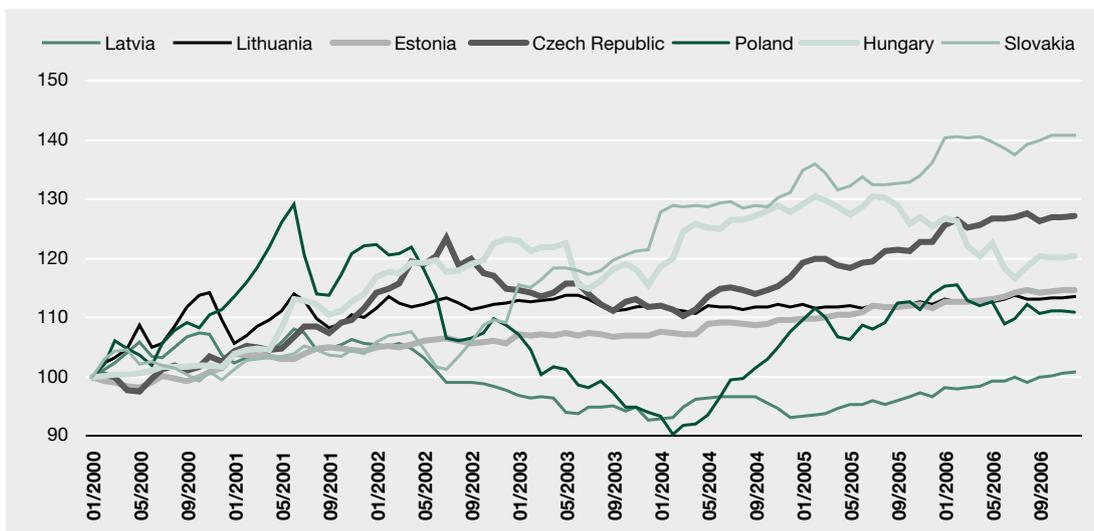[2] See Annex A for a more technical explanation.

Figure 4. Real exchange rates in selected new EU member states (2000 = 100; CPI based)

In conclusion, if financial markets are functioning well and there are no capital controls, an exchange rate policy regime should not matter for the development of real interest rates.

Are we looking for capital controls after all?

However, why is it thought that a floating exchange rate-based monetary policy can insulate a small open economy from external shocks? The usual answer – it increases the risk of borrowing in a foreign currency and, therefore, real interest rates – is not fundamentally right in case of functioning markets, as shown above. Otherwise, we should not talk about "relatively safe bets". Nevertheless, there are two explanations how this could hold true.

The first case is when nominal appreciation leads to overshooting and results in an overvaluation of the currency in the short term. Indeed, if price levels increase too far too fast and the currency becomes overvalued, the case for a 'convergent safe bet' vanishes after this point is reached as there is also a good case for the currency to *depreciate*. Whether strong nominal as well as real exchange rate appreciation in many floating currency mem-

ber states shortly after EU accession is proof of this phenomenon or not is a matter for separate research. However, that is not the aim of this article anyway to evaluate if the foreign exchange market is inherently more prone to initial overshooting than other goods and asset markets, or if it makes any sense to follow this strategy in monetary policy. Therefore, it will be left aside here.

Another reason why exchange rate policy can matter is if a floating exchange rate acts, for one reason or another, as an implicit capital flow restriction. When explicit or implicit capital flow restrictions are even somewhat effective, for instance, due to lack of readily available hedging opportunities, they can indeed limit the supply of capital for the economy and thereby increase the real interest rate.

Ultimately, we should therefore ask ourselves whether it is actually beneficial for countries in the convergence process to introduce one sort of capital controls or another. While this can provide some room for insulating monetary policy, at the same time it constrains financial market integration and efficiency.

If we would like to find out whether a floating exchange rate regime is superior to a fixed exchange rate regime, then we should measure the advantages of independent interest rate policy not just against the loss of stability in trade and price comparability, but also against the loss in efficiency of financial intermediation and related potential growth. Assessing this is beyond the scope of this article, although raising this question within a European Union context sounds counterintuitive anyway as one of the basic ideas of developing the EU has been supporting the free movement of capital.

What is a real interest rate anyway?

However, the dispute about the purposefulness of capital flow restrictions is not the only issue around the real interest rate dilemma in the catch-up process. The other aspect is related to its measurement and might lead to the conclusion that the whole problem is overstated.

At the beginning, in order to clarify this argument, we should ask why we are interested in the real interest rate anyway.

First, it can influence savings. If the rate of return on savings in cash is negative in real terms against the change in the prices of goods, then it is advisable for me to either hoard goods today or at least consume these products immediately rather than keeping that money in bank deposits. Even worse, if the cost of capital I pay is lower than the expected price increase in goods or relatively risk free investments, then it is sensible not just to take money out of my savings, but to actually take loans almost endlessly and thereby increase today's consumption (and dissaving) even further.

However, one should immediately say that the measurement of this critical economic phenomenon

is notoriously difficult.[3] It is not directly comparable to the notion of real spending, for example. In that case we have all the necessary information available, because we can measure the past. For example, we know how many dollars were spent on shoes and we know how much of this transaction compared to the previous period was due to a higher willingness to have more shoes and how much was simply due to higher prices of shoes.

In the case of real interest rates we measure the cost of capital against the *future* decline in the value of assets. More exactly: we try to measure how people *think* these prices will change in the *future*.

Therefore, not knowing this exactly, we usually assume that people think about the future based on the recent past. This is often the best guess, but it remains a cause for considerable friction, particularly during periods where the fluctuations in the prices are known to be caused by temporary factors or, for example, when disinflation is clearly expected. Hence, during the disinflation in Estonia in the 1990s or the infamous sugar price increases after EU accession, the past data was hardly a strong guide to the savings and investment decisions of the public (see Figure 5).

But this is not the whole story about measurement. There is also the question of the relevant basket to use to deflate the nominal interest rate. The calculation of real interest rates is usually done based on the CPI as a benchmark. This is logical, because the CPI should be the easiest indicator for the wider public to take account of.

However, if we return now to the question "Why is the real interest rate so important?", then we should be reminded that it is not a fact that life will become miserable next year because of high inflation. For us it is important whether it makes sense today to

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[3] This aspect is also discussed in the ECB Bulletin 09/2004 (*Box 3. Measuring Real Interest Rates in Euro Area Countries*, http://www.ecb.int/pub/pdf/mobu/mb200409en.pdf) for Eurosystem repercussions.
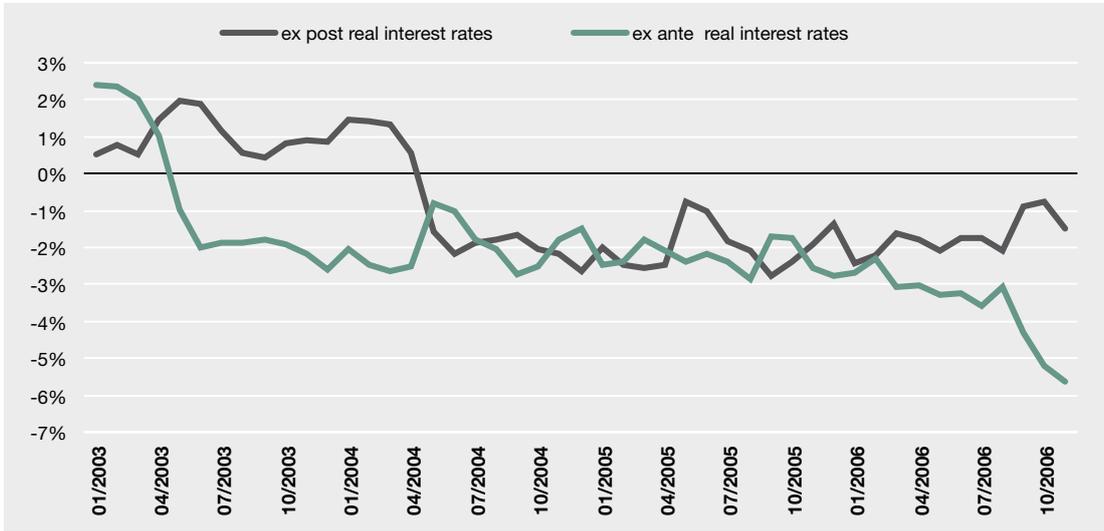
Figure 5. Ex ante and ex post real interest rates of deposits in Estonia (term deposits, 12 months)

change one's consumption and savings behaviour based on this knowledge. Saying that, one should wonder why we are interested in the future prices of hair-dressers, piano lessons, public transport, waste handling and many other services.

Indeed, knowing that the prices of these services will very likely become more costly over the next five years does not push me to visit the service provider twice as much today. Nor does the knowledge that dental treatment is probably going to get more expensive over next few years make me cease my daily dental care in order to be forced to visit the dentist a bit earlier.

Then why do we still use the CPI for real interest rate calculations? First, there is an assumption that these relative price changes are symmetrical over longer periods and sufficiently small anyhow to make a difference for the public. It simply makes our lives probably easier (as economists) and is probably

not very far from actual everyday life under normal circumstances where we do not have convergence related "safe bets".

The anatomy of price convergence and real interest rates

However, this assumption is highly questionable for the processes of real convergence or divergence.

The whole idea of convergence relies on the assumption that everything that is tradable is converging rapidly in terms of price levels and the catch-up in the non-tradables sector takes place hand-in-hand with productivity-led wage growth in the tradables sector later on[4].

But as shown above, when calculating the real interest rate we are actually only interested in goods and services in which consumption is *shiftable* over time[5]. The prices of services that we can or have to

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[4] It should be stressed again that analysing the details of whether it is due to measurement problems or other aspects, such as implicit or explicit trade barriers, why the price level of tradables goods' prices in consumer baskets has not been observed as fully converged to average EU levels is not critical in this context.

[5] The question of investments is not analysed separately here. However, one should mention that while higher inflation of non-tradable prices in the catch-up process primarily expresses cost factors, this does not mean that there is extra profit to be gained in this process by investing in these sectors.

consume only at a specific time (i.e., consumption that is unshiftable) should not be interesting as a rational economic agent. For example, one could think of numerous services going under this classification. However, non-durable goods like many food products (e.g., fresh milk or vegetables) are also natural examples for this. Although this classification is not entirely similar to a tradable vs. non-tradable division of goods and services the similarity is very great. Therefore, one should conclude that price level convergence mirroring productivity and the income catch-up process is over the longer period related mainly to price increases in non-shiftable goods and services.

So, if the public understands the logic of price level convergence, the CPI basket and its ex-post value allows only one possible way to estimate the real interest rate. Most probably it gives only a lower limit for it and a rational individual should not follow it completely, because it underestimates the actual value of saving or the real cost of borrowing money.

An alternative approach, that could be the ceiling, is to calculate the real interest rate only based on the industrial goods basket or even durable goods basket as they are definitely the products that are subject to the shiftability of consumption and, therefore, which price increases could influence the behaviour of the public in their savings and investment decisions (see Figure 6).

However, it is obvious that the "right basket" to use in calculating the real interest rate lies somewhere in-between these two as there are still a number of services in which consumption is sensible and possible to shift forward on the basis of "a relatively safe bet" of their future price increases. One example of this is labour services in construction and the renovation of real estate.

For instance, one could calculate the real interest rate on car leasing in Estonia since 2001 (see Figure 7). As we can see, the argument of negative real interest rates as such cannot be a strong explanatory factor for the boom in car sales during
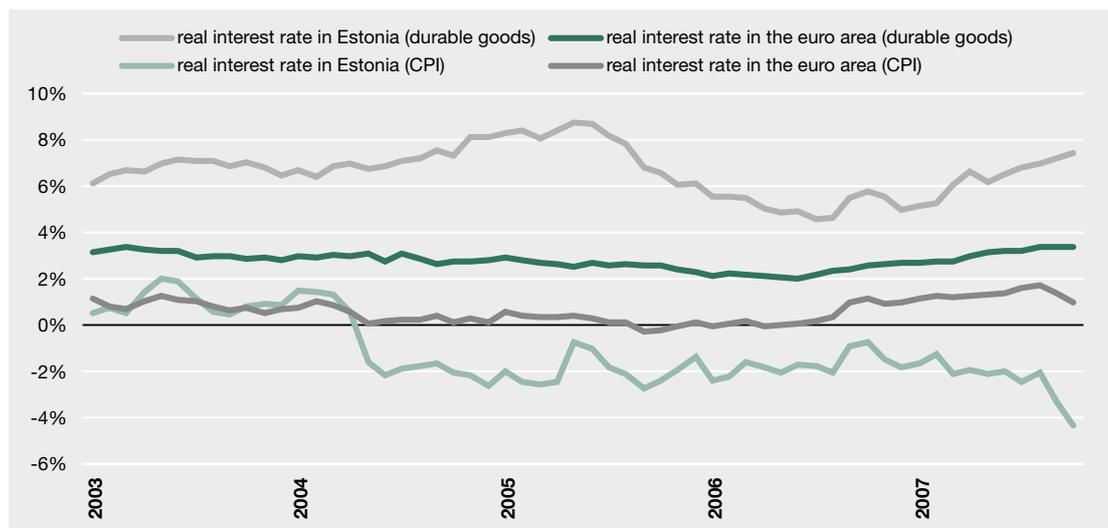

Figure 6. Real interest rates in Estonia and euro area based on different goods baskets (ex post, 12 months, interest rates on private term deposits)
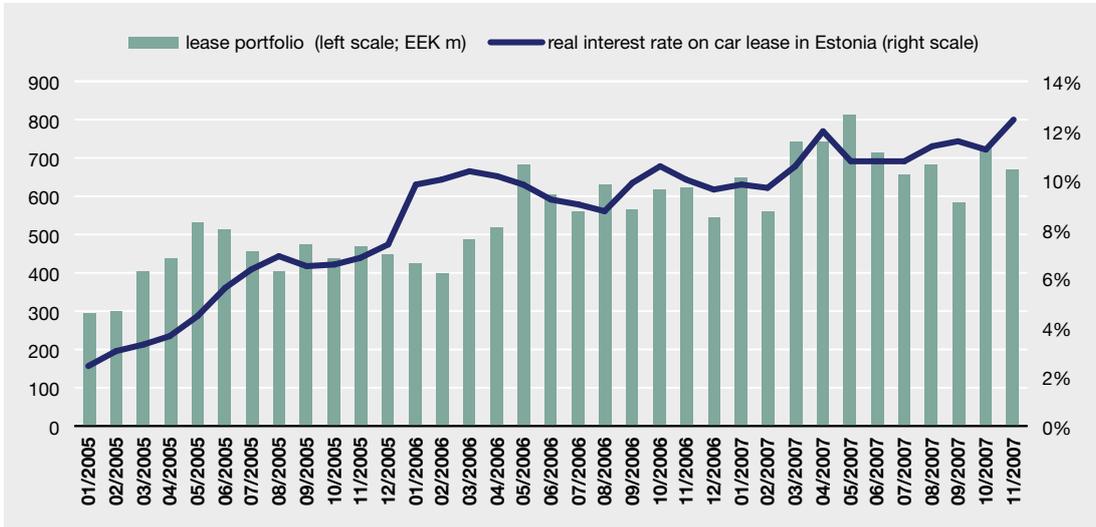
Figure 7. Volume of car lease and real interest rate on car lending (lease interest rates deflated by car prices; ex post)

these years as the real interest rates for these transactions have remained consistently and strongly positive.

To conclude, while there is a good case to think that real interest rates in Estonia have been somewhat lower than optimal during the convergence process, the argument of persistently negative real interest rates under the price- and income-convergence process is either small or non-existent. So, if this is not a big policy problem, then what is there to conclude from this recent economic episode in Estonia and what is the conclusion for policy?

Wasn't there a real estate bubble in Estonia?

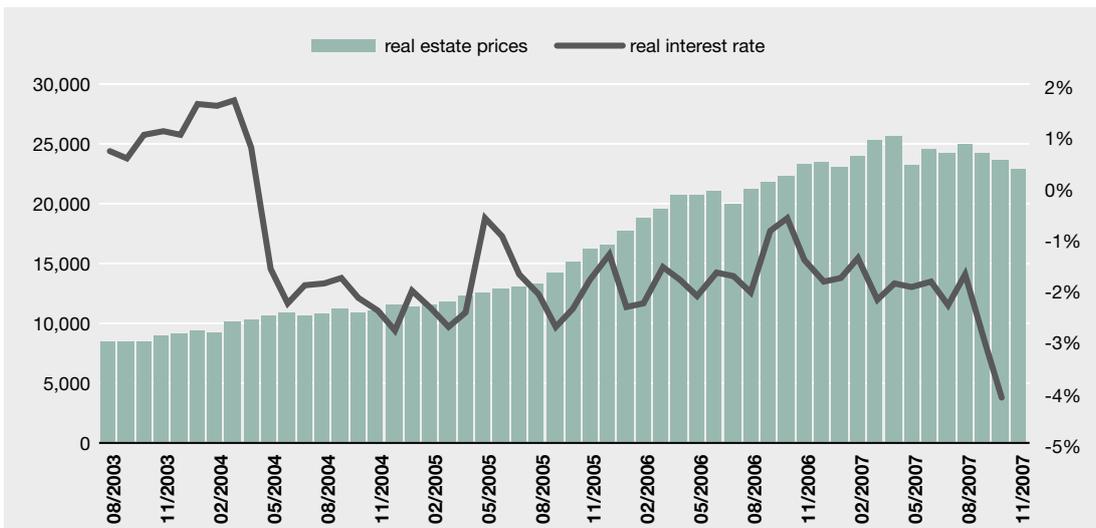Most probably, the development of Estonian real estate prices in late 2005 and early 2006 can be

Figure 8. Real estate prices in Tallinn and CPI based real interest rate (interest rate on private term deposits, ex post, prices EEK/m²)

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ascribed to an asset price bubble. Why is that? Why didn't it occur earlier or later? The argument for negative real interest rates based on the CPI do not fit well into the picture as explained before as well as how it is proven later in 2007 when even more negative real interest rates based on this calculation did not cause real estate prices to increase (see Figure 8).

There are two factors that explain why interest towards this specific asset class changed so abruptly in 2005. The first is related to the actual and expected rise in future incomes. One reason for that was that the reforms in the Estonian economy had already been continuing for a decade and growth had remained very solid. In this context the profits of companies had grown to their highest level compared to their output in history. Additionally, a large role was played by the opening of the labour market after the EU accession. While there had already been cross-border labour movement before 2004, it intensified noticeably after the EU accession. In addition to the direct effects on incomes, an even more important result was that workers got reassurances of future income convergence as they were

given proof of their competitiveness in European markets with considerably higher incomes.

The second critical change was related to the fast growth of financial integration. Based on the higher credibility of the economic environment, the Nordic banks that essentially form the financial system in Estonia extended the maturities of housing loans to the parameters prevalent in their traditional home markets. One should take into account that extending maturities from 15 to 30 years gives the borrower leverage to absorb up to 50% higher price levels in mortgages without currently increasing their debt servicing burden.

As a result of higher income expectations and better financing conditions, it is not surprising to see very strong short term pressure on real estate prices as an asset class and it is not surprising that in a relatively short period of time it was very profitable to speculate in this market. As this demand also reflected "real demand" for better living conditions and as the Estonian housing stock remained much smaller than the EU average until recently, these also obviously led to a short-term spurt in supply in 2006-2007.

Figure 9. Change in real estate prices and real interest rate of housing loan (mortgage lending interest rates deflated by change in house prices; ex post)

To "balance" the short-term price increases in underlying assets, interest rates should have been at one point approximately 60-70% in order to guarantee positive real interest rates on lending against real estate as collateral. However, based on the data on the transaction prices in the real estate market, the picture changed rapidly and from the middle of 2006 onward the return has been low and turned negative in 2006-07 with ex ante knowledge (see Figure 8 for that). As nominal interest rates continued to increase hand-in-hand with Eurozone interest rates, the actual real interest rate of borrowing against real estate as collateral turned markedly positive. That is in stark contrast with the ordinary CPI basket-based real interest rate calculation (see Figure 9).

How to cope with "over-optimistic" expectations?

This kind of investment smoothing per se is not bad for monetary stability as it can reflect equilibrium developments in the economy. However, as it has happened numerous times elsewhere it is unlikely that the underlying expectations of the public will remain perfectly realistic throughout the whole process. For example, as the smoothing itself generates a short-term growth spurt it can cause, in the early phase, excessively optimistic income expectations in the medium-term. That in turn can cause asset prices to grow faster in the beginning and possibly to overshoot.

However, as everywhere else the checking of excessively optimistic expectations is a tricky part of policy making. Countercyclical fiscal policy or structural policies, while as such are a most welcome policy response, can through their cred-

ibility in enhancing channels actually add to the over-optimistic outlook of the public and in this way even add to the problem in the short term. Of course, politicians should at least try to downplay overly fast convergence expectations in their public statements or forecasts.

Equally, monetary policy itself has been relatively unsuccessful in checking the build-up of overly optimistic future expectations. In addition, under a floating exchange rate regime the so-called independent interest rate policy has been in many cases unsuccessful in keeping this cycle optimally smooth.

Therefore, from the monetary policy perspective the core issue arising here is not necessarily its ability to run short-term countercyclical interest rate policy but rather to provide medium-term anchors for the public that would cut off excessively optimistic expectations early on or at least as soon as possible. The faster the over-optimistic expectations normalize, the less concern there is of excessive fluctuations in the economy.

Consequently, there is actually a good case that a fixed exchange rate policy, or furthermore, a currency union can provide this tool in a small open integrated economy. If credible, this policy provides natural benchmarks for the public from the external sector through price comparisons and if, for example, wages or asset prices like real estate overshoot, "market realism" is quicker to re-emerge. After all, the real estate market boom remained relatively short-lived in Estonia in 2005 and 2006.

However, for that the jury is still out…

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Annex A
Do real interest rates depend on the selection of the exchange rate regime?

We set up a simple analytical model of an open economy to see whether real interest rates are dependent on the exchange rate regime in operation. In this model, inflation rate π is the weighted average of the price increase in tradable sector π_T and in non-tradable sector π_N, the weights being ß and $(1-ß)$ respectively (see equation *a*). Internationally competitive markets ensure that the domestic price of tradables is equal to the price of foreign substitutes. Therefore, the inflation of tradable goods equals the inflation of foreign tradables, π^*_T, plus the change in the nominal exchange rate Δe (positive Δe corresponds to currency depreciation) (see equation *b*). Inflation in the non-tradable sector is described by the Balassa-Samuelson effect; i.e., the prices of non-tradable goods tend to grow faster than the prices of tradable goods and the inflation differential is given by the difference in productivity growth in both sectors. As characteristic of converging economies, productivity growth in tradable sector γ_T is higher compared to productivity in non-tradable sector γ_N caused by the technological catch-up. This positive gap transmits into a higher inflation of non-tradables via wage equalization between the sectors and, therefore, by an increase in production costs. The effect is bigger the more labour intensive the non-tradable sector is compared to the tradable sector. This relative labour intensity is given by $\eta=\mu_{LN}/\mu_{LT}$, where μ_{LN} and μ_{LT} are the respective labour shares in the two sectors' products (see equation *c*). The model also assumes an uncovered interest rate parity (*UIP*) to hold, which is captured by equation *d*. UIP states that domestic nominal interest rate i has to equal foreign nominal interest rate i^* plus a change in the nominal exchange rate in order to avoid arbitrage earnings. Equation *e* represents an identity according to which real interest rate r equals the nominal interest rate minus inflation.

(a) $\pi=ß\pi_T + (1-ß)\pi_N$
(b) $\pi_T = \pi^*_T+\Delta e$
(c) $\pi_N=\pi_T+\eta\gamma_T-\gamma_N$
(d) $i=i^*+\Delta e$
(e) $r=i-\pi$

Based on the model presented above and combining equations *a, b* and *c*, inflation in a country with a fixed exchange rate regime ($\Delta e=0$) is given by

(f) $\pi= \pi^*_T+ (1-ß)(\pi_T+\eta\gamma_T-\gamma_N)=+ \pi^*_T(1-ß)(\eta\gamma_T-\gamma_N)$

Inflation in a country with a floating exchange rate is given by

(g) $\pi=ß(\pi^*_T+\Delta e)+ (1-ß)(\pi^*_T+\Delta e+\eta\gamma_T-\gamma_N)= \pi^*_T+\Delta e+ (1-ß)(\eta\gamma_T-\gamma_N)$

The above shows that inflation in both cases equals foreign inflation rate, π^*_T, plus the rate of nominal convergence explained by the Balassa-Samuelson effect, $(1-ß)(\eta\gamma_T-\gamma_N)$, which is stronger the greater the share of the non-tradable sector is. In addition, inflation in a country with a fixed exchange rate is higher by $-\Delta e$, which corresponds to the degree of nominal appreciation of a national currency. But does it also mean that real interest rates are higher in an economy with a floating exchange rate? It can be seen by employing equations d and e, taking the inflation rates as calculated above in *f* and *g*. In the case of a

floating exchange rate regime, the real interest rate becomes

(h) $r=i-\pi$
        $=i^*+\Delta e-\pi$
        $=i^*+\Delta e-\pi^*_T-\Delta e-(1-\text{ß})(\eta\gamma_T-\gamma_N)$
        $=i^*-\pi^*_T-(1-\text{ß})(\eta\gamma_T-\gamma_N)$

An important implication of the real interest rate expression as given above is that the term of nominal exchange rate appreciation drops out. What remains is foreign real interest rate, $i^*-\pi^*_T$, minus the additional inflation caused by the catch-up process as it is passing through the Balassa-Samuelson effect. More interestingly, following the same way and calculating the real interest rate in the case of a fixed exchange rate, the result is exactly the same:

(i) $r=i-\pi$
        $=i^*-\pi$
        $=i^*-\pi^*_T-(1-\text{ß})(\eta\gamma_T-\gamma_N)$

Therefore, it can be concluded here that if the UIP condition is satisfied (there are no capital controls and the financial markets are efficient), nominal convergence brings along low or even negative real interest rates no matter which exchange rate regime is used.

The alternative approach to prove the same thing is to employ only the UIP condition, as it is expressed in equation d. In the following, π is extracted from both sides and $-\pi^*+\pi^*$ are added to the right hand side of the equation for future calculations:

(j) $i-\pi=i^*-\pi^*+e-e_{-1}-\pi+\pi^*$

The left hand side equals real interest rate r. The right hand side could also be written as $i^*-\pi^*+(e+p^*-p)-(e_{-1}+p^*_{-1}-p_{-1})$, where inflation is defined as the difference between the current and previous log price levels $\pi=p-p_{-1}$. Now the expressions in brackets are current and previous real exchange rates, q. Using this in equation j, we get

(k) $r=i^*-\pi^*+q-q_{-1}$
        $=i^*+\Delta q$

As a negative change of q $(q(\Delta q<0))$ means real appreciation, equation j states that the real interest rates of a country are equal to the real interest rate abroad, r^*, minus the real appreciation rate of a currency. To put it another way — a floating exchange rate regime may partially accommodate nominal convergence in the nominal appreciation of a currency and, therefore, face lower inflation but it *does not* increase real interest rates because under the UIP condition *real interest rates* only depend on *real exchange rate* movements.

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