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The European Commission's Scoreboard of Macroeconomic Imbalances – The Impact of Preferences on an Early Warning System

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Abstract

The European Commission's Scoreboard of Macroeconomic Imbalances is a rare case of a publicly released early warning system (EWS). That allows for analyzing the preferences of the involved politicians with regard to the two potential errors of an EWS – missing a crisis and issuing a false alarm. This is done for the first time for EWS in general by using a standard signals approach including a preference-based optimization approach to set thresholds. It is shown that in general, the thresholds of the scoreboard are set low (resulting in more alarm signals) as compared to a neutral stand.

Keywords: early warning system, scoreboard, preferences, incentives, political economy

JEL Classification: G01, F47, F53

Das Scoreboard der Europäischen Kommission zu makroökonomischen Ungleichgewichten – Der Einfluss von Präferenzen auf ein Frühwarnsystem

Zusammenfassung

Das Scoreboard der Europäischen Kommission zu makroökonomischen Ungleichgewichten ist ein seltenes Beispiel für ein veröffentlichtes Frühwarnsystem. Es ermöglicht die Analyse von Präferenzen der involvierten Politiker bezüglich möglicher Fehler in einem Frühwarnsystem – eine Krise zu verpassen oder falschen Alarm auszulösen. Diese Untersuchung wird hier zum ersten Mal für Frühwarnsysteme insgesamt durchgeführt. Dazu wird eine Standardmethode, ein Signalansatz mit einem präferenzbasierten Optimierungsansatz zur Bestimmung von Schwellenwerten verwendet. Es wird gezeigt, dass die Schwellenwerte des Scoreboards im Allgemeinen recht niedrig angesetzt werden, was sich im Vergleich zu einer neutralen Position in mehr Krisensignalen ausdrückt.

Schlagwörter: Frühwarnsysteme, Scoreboard, Präferenzen, Anreize, Politische Ökonomie

JEL-Klassifikation: G01, F47, F53

The European Commission's Scoreboard of Macroeconomic Imbalances – The Impact of Preferences on an Early Warning System

1. Introduction

On February 15th 2012 the European Commission (EC) published its Scoreboard of Macroeconomic Imbalances (Scoreboard). It reports a set of macroeconomic indicators and provides thresholds that, if crossed, indicate imbalances (EC 2012a, 2012b). If imbalances are indicated, the EC undertakes in-depth analysis on whether imbalances are present or not. If imbalances are found to be present, member states are asked to develop strategies on how to overcome the imbalances and might, if strategies are found to be inappropriate or unsuccessful, be fined.[1] The whole effort is undertaken as a reaction to public debt crises in Europe and has been decided on within the "six-pack" of measures to reshape and tighten fiscal and macroeconomic supervision.[2]

While the EC published some comments on why certain thresholds for indicators are chosen (EC 2012b), it is unclear to which extent the choice of thresholds is driven by specific preferences of the EC, which are not necessarily in line with preferences of politicians in the member states or other stakeholders. The preferences of the EC with regard to specifying thresholds are unveiled in this paper. The work is done for the first time for early warning systems in general. Additionally we compare the forecasting results of the official thresholds of the Scoreboard with thresholds derived from neutral preferences and suggest adjustments for thresholds. While recent contributions have found that, in general, the Scoreboard approach might be promising as an early warning system for public debt crises (Knedlik and von Schweinitz 2012), it has not been tested so far whether or not the Scoreboard in its current construction is an appropriate early warning system. This is undertaken in this paper.

1 Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011.

2 Regulations (EU) No 1173-1177/2011 and Council Directive 2011/85/EU.

The paper is structure as follows. In section two the methodology is outlined. In section three results regarding the Commission's preferences are presented and the forecasting performance of the Scoreboard indicators with official thresholds is compared to a neutral stand. Section 4 concludes.

2. Method and data

Early warning systems play a prominent role in both the academic literature and in practical policies to anticipate financial crises. However, it is only quite recently that authors have rediscovered to model aspects of politicians' preferences in the construction of early warning systems.[3] They show that politicians' preferences regarding risk-averseness have a strong impact on the choice of crisis thresholds.

2.1 The signals approach and preferences

One of the most simple and widely used methods to construct early warning systems is the signals approach developed by Kaminsky and Reinhart (1999)[4], which has also been shown to produce statistically significant results even if it follows a non-parametric approach (El-Shagi et al. 2012). It assumes a strong non-linearity in the relationship between indicator variables and financial crises. Indicator variables send a signal, if their level crosses a certain threshold. The signal is interpreted as a sign for a looming crisis that can be expected to emerge within a predefined period of time. The thresholds are set in a way that optimizes the forecasting performance within a sample. In most of the earlier contributions, the forecasting performance has been optimized by minimizing a noise-to-signal ratio (e.g. Kaminsky and Reinhart, 1999). In Demirgüç-Kunt and Detragiache (2000) and more recent contributions[5] thresholds are set in a way that minimizes the weighted sum of two potential forecasting errors. First, if thresholds are set too high, looming crises might be overlooked (Type I errors). Second, if thresholds are set too low, false alarms might be produced (Type II errors). In particular, an early

3 The original contribution is Demirgüç-Kunt and Detragiache (2000).

4 The signals approach has since been employed in many studies e.g. Alessi and Detken (2011), Edison (2003), Knedlik and von Schweinitz (2012).

5 E.g. Alessi and Detken (2011), Bussière and Fratzer (2008), Knedlik and von Schweinitz (2012), Duca and Peltonen (2012).

warning system can have four potential results: first, a signal is issued and a crisis follows (State *A*); second, a signal is issued and no crisis follows (State *B*); third, no signal is issued and a crisis follows (State *C*); fourth, no signal is issued and no crisis follows (State *D*). States *A* and *D* are the desired results; State *C* constitutes Type I errors; State *B* constitutes Type II errors. Thus, $C/(A+C)$ is the share of Type I errors in pre-crisis periods, while $B/(B+D)$ is the share of Type II errors for tranquil periods.

All politicians may well be interested in accurate early warning systems, but in optimizing an early warning system, there is a trade-off between the two potential errors that could occur (e.g. Alessi and Detken, 2011). The minimization of one type of error leads to an increase in errors of the other type. Thus, the relative importance of both error types has to be defined. Early warning systems are instruments for decision-making (in other words, deciding whether or not pre-emptive action should be initiated), so the relative relevance of the two error types should be decided in line with politicians' preferences. Preferences tend to depend on the costs of an error type to a politician. Type I errors imply costs because politicians could be blamed for not foreseeing and reacting to an emerging crisis with potentially high social costs. Type II errors have costs attached because politicians might be blamed for taking unnecessary and costly pre-emptive action.

The utility function for the politician is given by Allesi and Detken (2011):

$$U_I(\theta_I) = \min(\theta_I, 1-\theta_I) - \left(\theta_I \frac{C}{A+C} + (1-\theta_I)\frac{B}{B+D}\right) \quad (1)$$

The relative preference of a politician for avoiding the two types of errors with regard to indicator I is given by $\theta_I \in (0,1)$. Thus, $\theta_I = 1$ implies total ignorance of Type II errors, whilst $\theta_I = 0$ implies total ignorance of Type I errors. The weighted sum of both error types gives the loss to the policy maker which enters the utility function negatively. The first term of the equation (1) represents the secure loss to the policy maker for two cases. In the case of $\theta_I > 0.5$ the policy maker might set the threshold extremely low, resulting in no periods without signals (C=B=0) and a loss of $(1-\theta_I)$. In the case of $\theta_I < 0.5$ the policy maker might set the threshold extremely high so the no signal is send at all (A=D=0) and a loss of θ_I will result. Thus, $\min(\theta, 1-\theta_I)$ can

always be ensured and employing an indicator only adds value if the utility function is positive. Indicators with negative utility are better left out of consideration. For a given θ_I, one can calculate the utility for all potentially meaningful thresholds (which leads to different compositions with regard to the four states):

$$U_I(\theta_I) = \min(\theta_I, 1-\theta_I) - \left(\theta_I \frac{C}{A+C}[threshold_I] + (1-\theta_I)\frac{B}{B+D}[threshold_I]\right) \quad (2)$$

and would then choose the threshold that maximizes utility as the optimal threshold ($threshold_I^*$):

$$U_I(\theta_I) \rightarrow \max: \frac{\delta U_I}{\delta threshold_I} = 0 \quad (3)$$

$$threshold_I^* = threshold_I^*(\theta_I) \quad (4)$$

Accordingly the derived optimal thresholds can be used in early warning systems. The current literature on preferences in early warning systems stops here.

In this study it is assumed that also different incentive systems might lead to different preferences among politicians, e.g. the costs of both error types to a politician vary with regard to the institutional setting. While the relevance of institutions for the guiding of political action is beyond doubt (e.g. Laffont, 2000) its importance has not been stressed in the context of early warning systems, which are employed by an international organization and have a serious impact on policy in member countries. If, for example, a central bank is responsible for both anticipating a currency crisis and for taking pre-emptive action (e.g. increasing foreign exchange reserves, and tightening banking regulations), the preference for one or the other of the two error types might be more balanced than if there is an "early warning committee" which might be held responsible for failing to forecast a crisis, but which is not responsible for undertaking costly actions (and might, therefore, attach a lower relative weight to Type II errors). For the EC, which takes rather the shape of an early warning committee, because its responsibilities with regard to costly precautionary action in cases of a looming crisis are very limited (and basically left to member states), a stronger preference for avoiding Type I errors as compared to preferences of the member state politicians can be hypothesised.

2.2 Unveiling preferences in early warning systems

If the construction of an early warning system is known, and in particular if indicators and thresholds are known, it is possible to unveil politicians' preferences. This is done for the first time in this study. Usually early warning systems are kept secret, for good reasons, including the risk of making self-fulfilling prophecies. The Scoreboard on macroeconomic imbalances of the EC is an exception to this tendency and allows decision-makers' preferences in an international organization to be uncovered. This is of high political relevance, since the EC's preferences might differ from those of politicians in individual member states.

To unveil politicians' preferences we turn the modelling of preferences in an early warning system upside-down. We run a standard approach for early warning systems, a signals approach, with the specific feature of a utility function to reflect relative error preferences (Kaminsky and Reinhart, 1999; Alessi and Detken, 2011). We then check at which specific relative preference the known threshold of the Scoreboard is also the optimal threshold, as derived from the model. We can then conclude that the respective relative preference is the relative preference of the politician(s) concerned. More formally we build the inverse function of equation (4):

$$\theta_I^* = threshold_I^*(\theta_I^*)^{-1} \quad (5)$$

Thus, in a case where the threshold is given, we can calculate the utilities for all $\theta_I - threshold_I$ combinations and pick the θ_I for which the utility has a maximum at the given threshold. We call this θ_I the implicit θ_I^* or the implicit weight of Type I errors. Since there is an infinite number of potential θ_I^*, we restrict our calculations to two decimal places, in other words, 101 calculations per meaningful threshold of an indicator. If there is no hit (a given threshold is always either smaller or larger than the optimal threshold at any calculated θ_I), we assume the implicit θ_I^* to be between the two θ_Is, where the optimal thresholds switch from above to below the given threshold. If the hit range comprises more than one θ_I (the given threshold is optimal for various θ_I), we assume that the implicit θ_I^* is the average θ_I of all θ_I within the hit range. With that information, we can assign one implicit θ_I^* to each given indicative threshold.

2.3 Assessing the usefulness of the Scoreboard for politicians

Once the preferences of the politicians involved in the construction of the Scoreboard are unveiled we can compare the official threshold with that derived (as described in section 2.1) from a neutral stand of preferences, which we assume to be θ=0.5, i.e. equal weights for both error types.[6] This allows politicians with other preferences than the EC to judge the usefulness of the Scoreboard for their own purposes. It might also hint to potential adjustments of the thresholds of the Scoreboard to gain a wider acceptance among the members of the European Union.

2.4 Data

We use the original EC data set with no transformations. The dataset covers 29 countries and 10 indicators[7] and is available at an annual frequency. We employ the data from 1999 to 2010 for all indicators, except for the house price panel, which only started in 2006. Crises that the early warning system is meant to signal are defined as years in which a new IMF lending arrangement is instituted. We expect early warning signals in the year when the programme starts and in the two years preceding the lending arrangement. We do not consider the two years following a new arrangement. For countries where there is no current crisis, we also ignore the data for 2010, because we cannot know at the time of writing whether or not a crisis will follow. This results in crises windows as shown in table 1.

6 This assumption is in line with e.g. Alessi and Detken (2011), Knedlik and von Schweinitz (2012).

7 The indicators are listed in table 2 and described in section 3.2.

Table 1: Definition of crisis windows

Crisis countries	Crisis windows
Bulgaria	2000-2004
Estonia	1999-2000
Greece	2008-2010
Hungary	2006-2008
Ireland	2008-2010
Latvia	1999-2001, 2006-2008
Lithuania	1999-2002
Portugal	2009-2010
Romania	1999-2004, 2007-2010

Source: own definition based on IMF program data.

We conduct our analysis for the whole set of countries, but also for two sub-groups: the euro area countries and the Central and Eastern European countries (CEEC). To avoid overlapping of the groups a CEEC that entered the euro area is from that time on counted as euro area country. For the remaining group of non-CEEC, non-euro countries cannot be controlled for, since there was no incidence of a crisis in that sub-sample.

3. Results

3.1 General results concerning the European Commission's preferences

The results from the calculation of implicit preferences are shown in Table 2. The table shows that, on average, the weights on Type I and Type II errors are 0.56 and 0.44 respectively. Running a one-sided t-test shows that the weight on Type I errors is significantly larger (at a ten per cent level) than 0.5. Thus, the EC seems to put a larger weight on Type I errors than on Type II errors. Taking 0.5 as a reference weight, the EC chooses rather low thresholds, resulting in more crisis signals. The highest weights on Type I errors are found in the cases of export market share and the house price index with θ_I^* of 0.79 and 0.82 respectively. There are however, two exceptions from this general finding of relatively low thresholds. In the cases of the international investment position and the unemployment rate the EC seems to take Type II errors more serious and chooses rather high thresholds. In almost all cases there are differences of implicit

preferences between the two sub-samples. One could assume that the Commission has specific country groups in mind, when designing the thresholds. This becomes more evident when looking specifically at the different indicators.

Table 2: Implicit preferences for avoiding Type I errors (θ_I^*)

Indicators	All countries	Euro-area	CEEC
Three-year backward moving average of the **current account balance** in percent of GDP	0.59	0.61	0.59
Net **international investment position** in percent of GDP	0.35	1.00	0.45
Three-year percentage change of the **real effective exchange rate**	0.51	0.47	0.61
Five-year percent change of **export market shares**	0.79	0.52	1.00
Three-year percent change in nominal **unit labour costs**	0.53	0.47	0.62
Year-on-year changes in the **house price index** relative to a consumption deflator	0.82	0.76	1.00
Private sector credit flow in percent of GDP	0.58	0.63	0.49
Private sector debt in percent of GDP	0.53	0.69	0.35
Public sector debt in percent of GDP	0.53	0.71	0.39
Three-year backward moving average of the **unemployment rate**	0.45	0.34	0.49
Average over all indicators	0.56	0.62	0.60

Source: own calculations.

3.2 Results for the different indicators

In tables 3 to 5 we compare the thresholds set by the EC with the thresholds that would have to be chosen if θ was 0.5. Table 3 shows that, first, in half of the cases, the official thresholds lead to negative utility. This implies that for forecasting purposes, half of the set of indicators with those thresholds are not delivering useful insights. Second, utility is positive in all cases, if equal weights of the error types are assumed. In only two cases, the unemployment rate and the current account balance, thresholds as proposed by the EC would be even lower. In the other eight cases, thresholds would have to be increased. Similar results are derived for the two sub-samples (see Tables 4 and 5). Looking at the different indicators in more detail reveals the picture outlined in the following subsections.

Table 3: Thresholds and utility for all countries

	Official threshold	**Utility at implicit θ_I^* of official threshold**	**Optimal threshold at θ=0.5**	**Utility at optimal threshold for θ=0.5**
Current account balance	Above +6% or below -4%	0.16	Above +6% or below -4%	0.25
International investment position	-35%	0.05	-20%	0.27
Real effective exchange rate	-/+5% for euro-area countries, -/+11% for non-euro-area countries	-0.01	-/+22% for euro-area countries, -/+28% for non-euro-area countries	0.00
Export market shares	-6%	-0.48	-19%	0.02
Unit labour costs	+9% for euro-area countries, +12% for non-euro-area countries	0.11	+18% for euro-area countries, +21% for non-euro-area countries	0.15
House price index	6%	-0.50	26%	0.08
Private sector credit	15%	-0.08	27%	0.05
Private sector debt	160%	0.00	240%	0.05
Public sector debt	60%	-0.01	110%	0.03
Unemployment rate	10%	0.06	6%	0.15

Source: European Commission, own calculations.

Table 4: Thresholds and utility for euro-area countries

	Official threshold for euro-area	**Utility at implicit θ_I^* of official threshold**	**Optimal threshold at θ=0.5**	**Utility at optimal threshold for θ=0.5**
Current account balance	+6% / -4%	0.16	+16.5 / -11	0.30
International investment position	-35%	0.00	-70%	0.45
Real effective exchange rate	-/+5%	0.00	-/+4%	0.03
Export market shares	-6%	0.19	-8%	0.21
Unit labour costs	+9%	0.13	+7%	0.17
House price index	6%	-0.53	19%	-0.00
Private sector credit	15%	-0.20	39%	0.05
Private sector debt	160%	0.03	240%	0.29
Public sector debt	60%	0.06	80%	0.27
Unemployment rate	10%	0.00	5%	0.19

Source: European Commission, own calculations.

Table 5: Thresholds and utility for CEEC

	Official threshold	Utility at implicit θ_I^* of official threshold	Optimal threshold at θ=0.5	Utility at optimal threshold for θ=0.5
Current account balance	+6% / -4%	0.10	+6% / -4%	0.15
International investment position	-35%	0.04	-20%	0.13
Real effective exchange rate	-/+11%	-0.20	-/+28%	0.00
Export market shares	-6%	-0.96	-12.5%	0.00
Unit labour costs	+12%	-0.06	+22%	0.09
House price index	6%	-0.50	26%	0.22
Private sector credit	15%	0.03	13%	0.04
Private sector debt	160%	0.00	100%	0.07
Public sector debt	60%	0.03	60%	0.07
Unemployment rate	10%	0.02	6%	0.04

Source: European Commission, own calculations.

3.2.1 Current account balance

The first indicator of the Scoreboard is the current account balance. The EC proposes the three-year backward moving average of the current account balance in percent of GDP, with a two-sided threshold of +6% and -4%. Given the data and the threshold we can calculate the implicit $\theta_I^* = 0.59$. Thus, the EC seems to worry more about Type I errors as compared to Type II errors. However, since the hit range of the given threshold with regard to implicit preferences is very broad (ranging from 0.38 to 0.79) also other combinations of preferences (in this range) would lead to identical thresholds. The positive utility derived, if this indicator is employed, indicates its usefulness in an early warning system. The results of the Scoreboard allow identifying three groups of countries. In the first country group no signal has been issued at any time (Belgium, Denmark, France, Italy, Austria, and United Kingdom). The second group consist of countries with almost permanent signals (maximum of 2 out of 12 periods with no crisis signal). This group consists of Bulgaria, Estonia, Greece, Latvia, Lithuania, Luxemburg, Hungary, Malta, Portugal, Romania, and Slovakia. The third group, swingers between signals and no signals, consist of the Czech Republic, Germany, Ireland, Spain, Cyprus, the Netherlands, Poland, Slovenia, Finland, and Sweden. All countries of the "no signals"-group also belong to the group of countries that never experienced a crisis in

the sample. Countries that have experienced crises are almost entirely found in the "permanent signals"-group. The only exception is Ireland where signals are only sent between 2007 and 2009, reflecting quite good the Irish crisis window of 2008 to 2010. Another case stands out in this group: Luxemburg. There signals are sent almost throughout the sample, but a crisis never occurred. The reason is that the signals in Luxemburg are sent because the current account *surplus* exceeds the two-sided threshold, not the deficit. Similar examples can be found in the "swinging"-group of countries. In Germany (2007-2009), in the Netherlands (2005-2008), in Finland (2000-2004), and in Sweden (2004-2010) signals are sent for too large surpluses. In none of these countries a crisis has emerged. This hints that the current account balance indicator would increase its forecasting performance largely, if it would just be used as a one-sided indicator, focusing on deficits. The recent signals in Spain and Cyprus hint to risk for upcoming debt crisis in these countries. Since we do not observe false alarms in CEEC due to surplus-signals, the threshold of +6%/-4% seems to be the appropriate threshold for these countries. However, if looking at the euro area countries, the threshold should be widened (if for any reason a two-sided threshold is preferred). A widening of the threshold to +16.5%/-11% would eliminate all wrong signals from current account surpluses and would at the same time reduce the number of too early signals in the group of "permanent signals"-countries and would also increase the forecasting performance with regard to the current debt crises in the EMU. However, it must be warned that such a change would deteriorate the forecasting performance for the CEEC, because the earlier crises of these countries have been signalled from lower current account deficit levels already. For the current account balance indicator three conclusions can be drawn. First, considering the current account balance as early warning indicator for debt crises is very helpful. Second, instead of a two-sided threshold, a one-side threshold for current account deficits should be used. Third, thresholds should be more specific with regard to the country groups.

3.2.2 International Investment Position

The second indicator is the net international investment position. It is expressed in percent of GDP. The given one-sided threshold is -35%. Based on the data, we can

calculate the implicit preference for Type I errors: $\theta_I^* = 0.35$. It seems that in the case of the net international investment position, the EC is more concerned about type II errors and sets the threshold relatively high as compared to a reference situation with equal weights on both error types. Taking a θ=0.5 as reference, the optimal threshold would be -20%. However, also the higher threshold leads to a positive utility, making the net international investment position a valuable indicator. With the given threshold of -35% eleven out of 27 countries do not show any signal during the period of observation. The group of "permanent signals"-countries comprises Estonia, Greece, Spain, Latvia, Hungary, and Portugal. The "swinging"-group includes Bulgaria, Czech Republic, Ireland, Cyprus, Lithuania, Poland, Romania, Slovenia, Slovakia, and Finland. Thus, the crisis countries are again mostly found in the group with almost permanent signals, except for Bulgaria, Ireland, Lithuania, and Romania. In Bulgaria and Lithuania crisis signals are sent in all periods outside the crisis window and none is sent within. Thus, the international investment position is a perfectly wrong indicator for these countries. For Ireland and with regard to the second crisis episode in Romania the signals are sent as desired. The only country in "permanent signals"-group that did not experience a crisis so far (according to the definition used) is Spain. Among the eleven countries with no signal at all, there is no country that ever experienced a crisis in the sample. Reducing the threshold to -20% obviously leads to more signals (174 instead of 112). Better results are yielded in Romania, where also the first crisis episode would have been forecasted. In Lithuania and Bulgaria crisis signals would be sent also during the crisis window. However, also some more falls alarms would be issued, for example in Austria and Sweden at the beginning of the sample and in Spain and Italy at the end of the sample period. The later might again hint to unfolding crises in these countries. In sum, however, performance measures are better again for the threshold derived with an equal weight on both error types. One interesting feature of the international investment position is that whilst for all countries the threshold should be reduced, that is not the case if the threshold is optimized for the euro area alone. As mentioned above, the reduction of the threshold would lead to better results in CEEC countries only, and would lead to more false alarms in euro area countries. Thus, for euro area countries the optimal threshold (assuming equal weights on both error types) would be -70%. Thus,

for the case of the euro area, the official threshold would be too low. In sum, the international investment position is a good crisis indicator. However, as compared with the neutral stand, the official threshold is set too high if all countries or CEEC are considered but is set too low if the euro area is considered only.

3.2.3 Real effective exchange rates

The real effective exchange rate indicator is the percentage change over three years of the real (deflated by the consumer price index) effective (trade weighted) exchange rate. The Commission proposes in the case of this indicator to use different two-sided thresholds for euro area countries (+/-5%) and non-euro area countries (+/-11%). The use of these thresholds indicates that over all countries the EC is a bit less worried about Type II errors, which indicates that the threshold tend to be set relatively low as compared to equal weights on the error types. Employing the indicator with the given thresholds leads to a utility of below zero, meaning that the indicator has no use to forecast crises. Why that is the case becomes clear when looking at the results for different countries over time. We find that the group of countries with almost permanent signals is empty. The group of countries with no signals at all just amounts to two (Denmark and Cyprus). All other countries belong to the swinging group and show some signals sometimes. This is astonishing when remembering that only eight out of 27 countries ever experienced a crisis in the sample period. Looking at the crisis countries delivers: In Bulgaria we have an almost equal number of correct signals and false alarms; in Ireland more false alarms then correct signals are sent; in Estonia, Greece, Hungary, Portugal only wrong signals are sent; in Lithuania some more good then wrong signals are sent; and in Latvia and Romania only correct signals are sent. Over all countries signals since 2003 are only sent due to large real appreciations of the exchange rates, except for three signals in Poland and the UK. Before 2003 in the euro area signals are only sent because of large real depreciation of the exchange rates, while in the CEEC signals are again only sent due to large real appreciations. Since the crises in euro area countries happened at the later part of the sample, all signals due to real depreciations in the euro area are wrong. Regarding CEEC there is only one signal due to real depreciations (Poland in 2004), which is also wrong. Thus, the use of a two-sided

indicator is worsening dramatically the forecasting performance of the real effective exchange rate indicator. The Scoreboard should, therefore, use a one-sided indicator, focusing on real appreciations. However, even if a one-sided indicator is used, the real effective exchange rate might not be an appropriate indicator for the euro area, since for these countries the real effective exchange rate is to a large extent driven by developments of the nominal euro exchange rate, which limits its ability to differentiate between different euro area countries. If, for some reason, a two-sided indicator needs to be used, it should be used with much higher thresholds for CEEC (+/-28%). For the euro area, the threshold should be reduced to +/-4%, resulting in better forecasts for the crisis episodes in Ireland and Greece. That would at least increase the negative utility to around zero. To have a useful competitiveness indicator, one would need to consider a one-sided indicator that takes intra-euro area imbalances more effectively into account. Elsewise, real effective exchange rates should not be used to judge the performance of countries with regard to crisis probabilities.

3.2.4 Export market shares

The export market share indicator is the five year percentage change of the export market share. The threshold is set at -6%. At a first glance that indicator seems to be one of the worst performing indicators of the Scoreboard, the utility is very low, the θ_I^*=0.79 over all countries indicates that the threshold is set much lower as compared to a neutral stand regarding the weights of the error types, where it would be set at -19%. The picture looks very different if only euro area countries are considered. In that case, the forecasting performance is among the better once and the threshold derived based on equal weights of the error types, -8%, is also not far from the official threshold. It seems that the Commission tailored this indicator specifically for the euro area countries, while still employing it for all countries. Regarding the euro area program countries we get some correct signals in all cases, while false alarms are limited. For the CEEC crisis countries we get none but one correct signal for an upcoming crisis (Bulgaria in 2000). The only countries with almost permanent (wrong) signals are France and Italy. No signals are sent over time in Czech Republic, Estonia, Latvia, Lithuania, Luxemburg, Hungary, Poland, Romania, and Slovakia. The remaining 18 countries belong to the

swinging group, including the before mentioned euro area crisis countries (Greece, Ireland, Portugal) with rather correct signals. Assuming that the indicator works quite well for the euro area, we get current (2010) alarm signals in all euro area countries, except for Estonia, Malta, Slovenia, and Slovakia. Increasing the threshold to -12.5% for CEEC, as derived by a neutral stance regarding error types for these countries, would result in some correct crisis forecast in Bulgaria and would produce limited false alarms, increasing utility to just zero. The indicator works so poorly in CEEC, since the countries experienced a period of integration into the world markets, where increases in the export market shares have been reached in almost all countries in almost all periods, regardless of the incidence of crises.

3.2.5 Unit labour costs

The unit labour costs indicator is defined as the three year percentage change of nominal unit labour costs. The one-sided thresholds are +9% for euro area countries and +12% for non-euro area countries. Regarding the Commissions preferences, it seems that for unit labour costs, we have similar picture as for most of the indicators. The EC shows a higher preference for not missing a crisis as compared to avoiding false alarms. As in the case of real effective exchange rates, the findings vary over the sub-samples of the EU member countries. While we find that for euro area countries the threshold of +9% is rather high as compared to a neutral stand, the threshold for CEEC of +12% is too low. As with the case of export market shares, the phenomenon can be explained by the catching-up process of the CEEC. According to the Balassa-Samuelson effect prices can be expected to grow faster in a catching-up process, thus also labour cost might increase at a higher rate without signalling risks for crises. For the EC, which only allows itself to differentiate between euro and non-euro area members, it is difficult to find a threshold for the later group, which comprises CEEC as well as the more mature economies of Denmark, Sweden and the UK. Taking a look on the signals reveals that there is just one country with permanent signals, Romania. There are also only a few countries (Germany, France, and the UK (with the higher threshold of non-euro-area countries)) that show not a single signal. The remaining countries show at least some signals. The crisis episodes in CEEC have been signalled in about half of the periods

(and all periods in Romania). In Ireland and Greece in two thirds of the pre-crisis periods signals are sent, whilst none is sent in the Portuguese case. We have a total of 85 false alarms, mainly occurring in CEEC, but also notably also in Spain and in non-crisis window periods in Ireland and Portugal. Decreasing the threshold to +7% for the euro area (as derived if equal weights are assumed for both error types) would lead to better forecasts in Greece and Portugal, with limited additional false alarms. Increasing the threshold for CEEC to +22% (as derived from equal weights) a lot of false alarms would be avoided so that utility of the indicator could turn positive for this country group. In sum, unit labour costs are indeed one of the better indicators for crises. However, while the threshold values for euro area countries are almost adequate (thought a bit too high), they are far too low for CEEC in the current setting. That limits the overall performance of the indicator in its current setting.

3.2.6 House prices

The house price indicator is defined as the annual growth rate of the real house prices index. The Commission uses a one-sided threshold of +6% to indicate imbalances. The indicator performs exceptionally poor to forecast crises in our sample. In particular it performs very poor in the euro area, also if adjusted thresholds would be used. It seems to have some explanatory power for CEEC, if the threshold would be increased by large. The used threshold shows, that for house prices the EC seems to almost ignore the risk of false alarms to the advantage of missing as less as possible crisis signals. However, that is still not very successful. All signals of the indicator are false alarms with the exceptions of Latvia in 2006 and 2007. There are two main problems relating the house price indicator: First, the data sample starts only in 2006 and the panel is not balanced, e.g. there is no data for Hungary and Romania during their respective crisis windows. Thus, this very limited amount of data does not allow for a comprehensive judgement of the indicator. Second, it is very unclear, why (except for the first problem) in the case of house prices the Commission used the year-on-year percentage change instead of a change over a longer period, say of three years (as with the real effective exchange rate and the unit labour costs) or five years (as in the case of export market shares). That would be much more appropriate as the cases of the current crisis in

Ireland might show exemplary. The crisis that is indicated by the start of the IMF/EU program for Ireland emerged only a few years after the crash of the property market. Thus, price increases of houses could only have been observed before that. Thus, while the bursting property price bubble in Ireland is probably one of the main causes of the crisis, an annual change of the house price is not a good indicator in the two-year early warning horizon. Because of both problems, the house price indicator should be dropped from the Scoreboard until appropriate data is available.

3.2.7 Private sector credit flow

The indicator measures private sector credit flows in percent of GDP. The threshold is set at 15%. The analysis shows that also in the case of private sector credit flows, the EC aims to avoid Type I errors at the cost of Type II errors (θ_I^*=0.58 over all countries of the sample). Thus, the threshold is set relatively low as compared to a neutral stand. However, there are, as with other indicators, differences between country groups. While a neutral threshold would be 27% for all countries and even 39% for the euro area, it would be just 13% if the CEEC would be considered only. The overall poor performance of the indicator at the given threshold is expressed by negative values for the utility. That could however be turned into slightly positive values, if the thresholds based on neutral stands would be used – rendering the indicator a useful tool for the anticipation of risk, though it would still not range among the best performing indicators. Taking the 15% threshold, the indicator signals quite well the more current crisis episodes in Latvia, Hungary, and Romania, but misses to signal the less recent crises in Latvia and Romania and also the crises episode in Estonia, Lithuania, and Portugal. Some indications are provided in the cases of Bulgaria, Ireland, and Greece. Almost permanently (wrong) signals are sent for the UK and Spain. However, there are also of few countries with (correctly) no signals at all: Czech Republic, Germany, France, Italy, Poland, and Slovakia. Increasing the threshold considerably (to 27%) would lead to much less false alarms but also reduces correct signals (to a lower extent). As mentioned above, for CEEC the threshold should actually be lower. That would ensure even more correct crisis signals by relatively low numbers of false alarms – which were mainly produced in euro area countries but also in the UK, Denmark and

Sweden. In sum, the indicator would profit substantially from using regionally differentiated thresholds. However, its performance remains limited as compared to other indicators of the Scoreboard.

3.2.8 Private sector debt

The eighth indicator of the Scoreboard is private sector debt. It is measured as the stock of private sector debt (the sum of non-consolidated loans and securities other than shares) in percent of GDP. The threshold is set at 160%. The calculated θ_I^*=0.53 indicates again a preference for avoiding Type I errors. Even thought that the calculated value is not far from equal weights, the usage of θ=0.5 would result in a largely increased threshold of 240% over all countries, which would also be optimal if euro area countries would be considered only. For the CEEC subsample, however, the threshold would have to be decreased to 100%. Accordingly, if the implicit weight of error type preferences would be calculated for CEEC only, the EC would seem to care little about missing a crisis (θ_I^*=0.35 for CEEC only). Taking the given threshold of 160%, the indicator would indicate the current crises in Portugal and Ireland, but no other crisis. The indicator would produce false alarms almost constantly in Belgium, Denmark, Cyprus, Malta, the Netherlands, Sweden, and the UK. In nine countries no signals are sent throughout the sample period, including the crisis countries Greece and Romania. For CEEC, a reduction of the threshold to 100% would mean that the recent crises in Hungary, Romania and Latvia would have been signalled with an acceptable level of additional false alarms, so that the negative utility of the 160% threshold for CEEC would turn into positive if 100% are used as threshold. However, if the 100%-threshold would be employed for the euro area, permanent (wrong) signals would be produced for almost all countries in almost all years. However, increasing the threshold to 240% would still signal the crises of Ireland and Portugal (with indicator values of up to above 330% in Ireland), while reducing the number of false alarms to zero. Thus, the level of private debt is a very good and accurate indicator for crises in some cases; it does not play a central role in all crises. Again, the divergence of European countries needs to be considered in order to make the indicator useful. For the euro area, private sector debt would be the third best performing indicator (after the international

investment position and the current account balance) – if appropriate threshold would be employed.

3.2.9 Public sector debt

The public sector debt indicator is defined as the general government debt in percent of GDP. In line with the Maastricht criteria, the threshold is set to 60%. The indicator threshold is again chosen by focusing more on Type I errors as compared to Type II errors (θ_I^*=0.53 over all countries). The 60%-threshold leads to almost permanent crisis signals in Austria, Belgium, Germany, Greece, and Italy, which have – except for Greece – not experienced a crisis. On the other hand, no signals are sent in eight countries, including the crisis episodes in Estonia and Romania. The only correctly signalled crises are that of Greece, Hungary and Portugal and to some extent also the crises of Bulgaria and Ireland. For that reasons, the indicator (with the given threshold) performs poor in forecasting crises and produces negative utility if the whole sample of countries is considered. That would change, if adjusted thresholds would be used. Over all countries, the neutral threshold would be 110%. With this indicator-threshold, only the crisis in Greece would have been predicted, but false alarms would be reduced to two. With that, utility would turn positive but the indicator would still remain among to poorest performing indicators. These results seem to be contraire to common thought, but can be (again) reasoned by the very different applicability of threshold to the different country groups. The 110% threshold would be chosen to minimize false alarms that are also occurring among the non-euro area, non-CEEC countries. For the euro area countries, the loss of correct crisis signals would not be outweighed by more correct predictions of non-crises periods. Accordingly, the threshold would be set lower, if the euro area countries are considered only, to 80%. That would restore crisis signals in the cases of Portugal, Greece and to some extent in the case of Ireland, by still producing less false alarm as compared to the 60%-threshold, e.g. the false alarms for Germany would disappear. Thus, the indicator would be the fourth best performing indicator for the euro area at the 80%-threshold. Regarding the CEEC, the 60%-threshold corresponds with a wide hit-range regarding the error preferences. For preferences for Type I errors of between θ_I=0.23 and θ_I=0.54, 60% would be the optimal threshold.

Thus, also for the neutral stand of θ=0.5, the given threshold is optimal for these countries.

3.2.10 Unemployment rate

The final indicator of the Scoreboard is the unemployment rate, measured as the three year backward moving average of Eurostat's unemployment rate. The threshold is set at 10%. The unemployment rate is one of the few indicators with positive utility also in the case of using the official threshold. It is also one of two indicators (besides the international investment position) where the Commission seems to have a higher preference for avoiding Type II errors (false alarms) – indicated by θ_I^*=0.45. Thus, as compared to a neutral stand, the threshold is set too high for the all-country case, but also if the two subsamples of the euro area (θ_I^*=0.37) and the CEEC (θ_I^*=0.49) are considered separately. With a 10%-threshold, only the earlier crises in Latvia and Lithuania would have been correctly forecasted, with some indication also given for the crises in Estonia, Ireland, and Portugal. The crisis periods in Romania, Hungary, Greece and the later episode in Latvia would have been missed. With this high threshold, false alarms are limited, occurring mainly in Slovakia, Poland and Spain. With reducing the threshold to 6%, which would be optimal based on a neutral stand for the samples of all countries and the CEEC subsample, basically all crisis periods (with just two exceptions) would be correctly called. This leads to an increased number of false alarms, but overall utility would be largely positive. Reducing the threshold even further, to 5% as it would be optimal for euro area countries, would eliminate the remaining two periods with no signal before a crisis, by producing only a few additional false alarms in the euro area. Still the number of false alarms is high, including almost permanently (wrong) signals in Belgium, Germany, Spain, France, Italy, and Finland, if such a low threshold is used. The indicator is characterized by limited variations over time, but quite excessive variations over countries. However, if unemployment is rising, it is a good indicator for a crisis to come.

3.3 Discussion of results

3.3.1 Discussion of the European Commission's preferences

Thus far, academia has had to speculate about politicians' preferences regarding Type I and Type II errors in the construction of early warning systems. With regard to costly asset price booms, Alessi and Detken (2011) state that they "believe a θ smaller than 0.5 is a realistic description of central bankers' loss functions", while Bussière and Fratzscher (2002) assume that in the case of currency crises "Type 2 errors may be less worrisome from a policy-maker's perspective". With regard to the European Commission's Scoreboard, we can now state that, on average, Type II errors do indeed seem to be less worrisome to policy-makers. This provides evidence for the hypothesis, that the EC, acting more as an early warning committee than as a full-fledged crisis preventer (that would also be responsible to undertake costly action), bothers more about missing a crisis than about calling alarm if there is indeed only limited evidence of an upcoming crisis. However, preferences also seem to vary with regard to the indicators employed. While in most cases thresholds are set lower, than if both error types were equally important, there are also cases in which the thresholds that are set seem to be rather high. In the case of the international investment position, the relative high threshold might be due to a compromise between the CEEC group and the euro area country group. Whilst in the former the indicator works very well with a low threshold, in the later case a higher threshold would be optimal. In the case of the unemployment rate, it might have been of relevance that false alarms due to a lower threshold would mainly be found in the largest euro area economies (e.g. in Germany, France, Italy, and Spain). That might indicate that the Commission uses some weighting scheme of countries when deriving thresholds. Additionally there are also differences with regard to the different sub-samples.

3.3.2 Discussion of forecasting performance and threshold adjustment

The general picture that most indicators (using official thresholds) perform poorly could be changed in most cases, if thresholds would be adjusted. Already the use of optimal threshold based on equal weights of the error types would result in positive utility for all indicators, and would, thus, increase their relevance for early warning system

fundamentally. However, also the consideration of country group specifics would increase the forecasting performance of the Scoreboard indicators further. While the differentiation between euro and non-euro countries, as used by the Commission in some cases, can be considered as a first step into that direction, it is not going far enough. In particular, the grouping does not allow to differentiate between different levels of economic development and ignores catching-up processes in CEEC. Also the characteristics of the non-euro, non-CEECs are ignored. These countries are in many characteristics closer to the euro-area countries than to the CEEC (which whom they are grouped by the Commission).

There is just one indicator, unemployment, for which the derived optimal thresholds are at least almost the same for the two subsamples of the analysis. A threshold of about 6% would do a proper job for the whole region, though the indicator performs still relatively poor in CEEC. With all other indicators different threshold for CEEC and the euro area would increase the performance substantially. For the two indicators for which the Commission proposed a higher threshold for non-euro area countries, this would also be suggested by the present results. However, the differentiation should be even stronger: Instead of -/+5% for the euro area and -/+11% for non-euro-area countries for the real exchange rate indicator, we should have -/+4% the euro area and -/+28% for CEEC. Also in the other case, unit labour costs, the neutral stand would lead to an even lower threshold for the euro area and a much higher threshold for the CEEC. Moreover, also with regard to export market shares and house prices, the CEEC need higher thresholds as compared with the euro area. These indicators have in common, that they reflect price developments that might be more dynamic in emerging market economies without causing crisis risks (the exception are export shares, which are a poor indicator for CEEC anyway, as stated above). For all other indicators counts, that the euro area should have higher thresholds as compared to CEEC. This concerns the foreign trade indicators (current account balance and international investment position) and public debt, where larger imbalances can be burdened by the more mature economies, and private sector debt and credit. The latter cases might reflect the general development of financial markets, which results in both higher flows and stock of loans. In both cases much higher figures could be allowed for euro area countries. If the derived thresholds

of country groups would be employed (taking the whole sample as reference for the non-euro, non-CEEC) the Scoreboard results for 2010 (the most recent incidence) would change as presented in Table 6. It shows that only in three country cases results would remain unchanged as compared to the original Scoreboard. Overall 28 additional signals would be sent and 26 original signals would be scratched. The additional signals result mainly from two indicators, unit labour costs and the unemployment rate, which should gain more attention. The scratches are more spread over different indicators, with 14 scratches happening for the public and private debt indicators. In most country cases some signals are added while also some are scratched. There are three country cases with two additional signals: France, Italy, and Hungary, which should be looked after more carefully.

4. Conclusions

The current construction of the Scoreboard allows for unveiling the preferences of the involved policy makers with regard to their error preferences. In general, the EC shows a higher relative preference for avoiding Type I errors as compared to avoiding Type II errors. This can be explained by the Commission's specific design as an early warning mechanism without direct responsibilities to undertake costly action if an emerging crisis is signalled. Assuming that politicians that also have to account for costs of potentially unnecessary pre-emptive action might have different preferences and would put a higher weight on avoiding Type II errors, we use equal weights for both error types as a reference system. This results in the finding that the current Scoreboard is in most cases too alarmistic, while threshold for two indicators (unit labour costs and the unemployment rate) are set rather high. Thus, preferences have an important influence on thresholds in early warning systems. To avoid the setting of threshold in accordance with the preferences of just a part of the stakeholders and thereby limiting its acceptance for others they should be openly discussed.

Table 6: Original and adjusted Scoreboard results for 2010

	Current account	International investment	Real effective	Export market	Unit labour costs	House price index	Private sector credit	Private sector debt	Public sector debt	Unemployment rate
Belgium	0/0	0/0	0/0	1/1	0/1	0/0	0/0	1/0	1/1	0/1
Bulgaria	1/1	1/1	0/0	0/0	1/1	0/0	0/0	1/1	0/0	0/1
Czech Rep.	0/0	1/1	1/0	0/0	0/0	0/0	0/0	0/0	0/0	0/1
Denmark	0/0	0/0	0/0	1/0	0/0	0/0	0/0	1/1	0/0	0/0
Germany	0/0	0/0	0/0	1/1	0/0	0/0	0/0	0/0	1/1	0/1
Estonia	0/0	1/1	0/0	0/0	0/0	0/0	0/0	1/1	0/0	1/1
Ireland	0/0	1/1	1/1	1/1	0/0	0/0	0/0	1/1	1/1	1/1
Greece	1/1	1/1	0/0	1/1	1/1	0/0	0/0	0/0	1/1	0/1
Spain	1/0	1/1	0/0	1/1	0/0	0/0	0/0	1/0	1/0	1/1
France	0/0	0/0	0/0	1/1	0/1	0/0	0/0	0/0	1/1	0/1
Italy	0/0	0/0	0/0	1/1	0/1	0/0	0/0	0/0	1/1	0/1
Cyprus	1/1	1/0	0/0	1/1	0/1	0/0	1/0	1/1	1/0	0/1
Latvia	0/0	1/1	0/0	0/0	0/0	0/0	0/0	0/1	0/0	1/1
Lithuania	0/0	1/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/1
Luxemburg	1/0	0/0	0/0	0/0	1/1	0/0	0/0	1/1	0/0	0/0
Hungary	0/0	1/1	0/0	0/0	0/0	0/0	0/0	0/1	1/1	0/1
Malta	1/0	0/0	0/0	0/0	0/1	0/0	0/0	1/0	1/0	0/1
Netherlands	0/0	0/0	0/0	1/1	0/1	0/0	0/0	1/0	1/0	0/0
Austria	0/0	0/0	0/0	1/1	0/1	0/0	0/0	1/0	1/0	0/0
Poland	1/1	1/1	0/0	0/0	1/0	0/0	0/0	0/0	0/0	0/1
Portugal	1/1	1/1	0/0	1/1	0/0	0/0	0/0	1/1	1/1	1/1
Romania	1/1	1/1	0/0	0/0	1/1	0/0	0/0	0/0	0/0	0/1
Slovenia	0/0	1/0	0/0	0/0	1/1	0/0	0/0	0/0	0/0	0/1
Slovakia	1/0	1/0	1/1	0/0	1/1	0/0	0/0	0/0	0/0	1/1
Finland	0/0	0/0	0/0	1/1	1/1	1/0	0/0	1/0	0/0	0/1
Sweden	1/1	0/0	0/0	1/0	0/0	1/0	0/0	1/0	0/0	0/1
UK	0/0	0/1	1/0	1/1	0/0	0/0	0/0	1/0	1/0	0/1

Note: Signals using the original thresholds (1 signal is issued, 0 no signal is issued)/Signals of using adjusted thresholds; grey shaded segments indicate changes to the original signals.
Source: European Commission, own calculations.

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