

## **Real Effective Exchange Rates: a comparison of the data published by the European Commission (DG ECFIN) with data published by other international institutions (ECB, OECD, IMF and BIS)**

### Introduction

DG ECFIN has been publishing Effective Exchange Rates data since 1996 for all EU Member States, for the euro area (since 1999) and the EU aggregates and for selected third countries.

This note presents a comparison of the data sets calculated and published by five international organisations (EC (DG ECFIN), ECB, OECD, IMF and BIS).

All institutions calculate data for various partner baskets and deflators, but this comparison focuses on REER, Consumer Price deflated, broad group of trading partners.

The Real Effective Exchange Rate for a country or aggregate is defined as an index number time series of weighted bilateral exchange rates with the trade partners (NEER: Nominal Effective Exchange Rate), adjusted by a weighted average of relative prices (or costs).

The basic data used in the calculations are:

- the bilateral exchange rates,
- a suitable deflator, here the Consumer Price Index (HICP where available, CPI otherwise),
- trade data (value of exports and/or imports of all goods (ECFIN), manufactured goods (ECB, OECD, BIS) or goods and services (IMF),  
(Note: due to data unavailability of trade in services by origin/destination, almost all institutions limit trade data to goods only. Only the IMF includes a crude estimate of services, but assumes the same partner distribution as for goods.)
- and a suitable measure of the domestic market, in order to capture third market effects.

The weights used reflect the relative importance of the trading partners, and are calculated according to the double exports scheme (DG ECFIN), a weighted average of double exports and bilateral imports (ECB, OECD, BIS), or other methods (IMF).

Furthermore, these weights can be fixed over the whole period under consideration, fixed but discretely adjusted (ECB, IMF, BIS), or adjusted annually (DG ECFIN, OECD).

The choice and number of trading partners is a trade-off between representative final results, data availability and the marginal cost of adding one more country in terms of calculation complexity (especially trade matrices). In these broad index series, the basket size ranges from 42 partners (DG ECFIN), over 52 (OECD), 61 (BIS), 57 (ECB) to 184 (IMF).

In ECFIN's case, the current basket of 42 countries covers over 80% of extra Euro area exports.

## Comparison of REER produced and used by the major international organisations

All published data series are to be considered –a priori– as complying with comparable high quality standards. Hence, in the comparison, none of the data sets is taken as the reference set.

The method used in the comparison is a pairwise simple OLS regression (through the origin, on economic considerations). For each country and the euro area, each series is regressed on every other series. As one is primarily interested in the correlations and not in an econometric model, an A-B regression is not repeated for B-A (although the slope coefficient in the second case will differ from the inverse of the first regression slope, the  $R^2$  as a measure of correlation remains the same).

**Part A** summarises the comparisons by presenting the availability of data and the sample mean  $R^2$  for each pair of available time series.

**Part B** presents the detailed comparisons between data from the five institutions for the euro area and for the 42 countries covered by DG ECFIN, both for the index numbers and for the corresponding y-o-y evolutions: graphs of actual data, pairwise regressions presented in scatter diagrams with trend line, as well as the  $R^2$  for each pair of data for the period 1999-2014 for the index numbers and 2000-2014 for the year-on-year changes.

The results show a **remarkable good match between series**; levels and time path evolutions are very much similar, both for the index number series and the y-o-y changes, with highly significant t-values for the regression coefficients, and  $R^2$  values typically well above 0.90.

## Some comments on the findings; possible explanations for apparent discrepancies

While the differences between series are overall small, a couple of seemingly discrepant results called for further investigation and justification.

(Data were taken as published: **spikes** in series are obviously the result of typos in the files.)

Although data since 1994 are available, 1999 was chosen as starting year, corresponding to the introduction of the euro.

Pre-99 basic data quality for a number of countries may be sometimes questionable anyway.

Furthermore the issue of severe currency devaluation shocks was felt as to be avoided: the **Russian currency crisis** (end 1998) for instance is very prominent.<sup>1</sup>

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<sup>1</sup> Due to the extreme rate of RUB devaluation, the REER results for all countries are affected to a certain extent, not only the traditional Russian trading partners. In the case of Cyprus for instance, the weight of Russia in the ECFIN trade matrix for 1998 amounted to about 20%, and results in a spectacular jump in EERs, formally implying a dramatic deterioration of Cyprus' competitiveness.

The effect is clearly less pronounced in the global weighting scheme than in the double exports scheme (a confirming test was run through ECFIN's calculation program). In the regressions this could have been dealt with by introducing a dummy variable; however obtaining perfect regressions was not the purpose of the exercise, but only a method to check the consistency of published calculated REER data.

Excluding this Russian crisis period,  $R^2$  values improve (often dramatically) as do the correlations.

In this context, we note that crawling devaluations e.g. in Turkey seem to be immediately offset by inflation, and do not distort REER in the same way as they affect NEER results.

Concerning the **United Kingdom**: the time series presented by the IMF differs very much from the other institutions. Results for 1999-2009 even seem uncorrelated. Further investigation revealed that this discrepancy is due to the use of an erroneous deflator: IFS line 64, which is presented as CPI, is in fact RPI (these data are utterly incomparable and uncorrelated with HICP). However, the y-o-y evolution shows a remarkable good fit.

For several countries, a pronounced **seasonal pattern** is observed in DG ECFIN data (e.g. Greece, Malta), but not observed in results by other institutions. The ECB claims that a seasonal adjustment on their HICP/CPI deflator data is performed, which explains the smoothed REER results in these cases. From the outset, DG ECFIN decided to use original data throughout, when available.

Anyway, y-o-y evolutions are not affected by the presence or not of these seasonal patterns.

For all countries, a **small drift (bias?) of the index number series** is observed, implying in most cases a slightly more favourable competitiveness position according to DG ECFIN's results than by other organisations. This can be explained by several factors:

- the use of fixed weights matrices ignore among other things possible substitution shifts: this is a known phenomenon when using Laspeyres indices (use of quantities of the base period).
- the use of global weights instead of mere double export weights (a test run through DG ECFIN's calculation program seems to confirm this).
- the addition of more high-devaluation trading partners in the larger baskets. The question arises however whether the inclusion of countries with unstable currencies such as Venezuela (a 2000% devaluation in several shocks between 1994 and 2006), Argentina, Indonesia, etc. would not rather unnecessarily distort the results. Experience has shown that even low-weighted contributions in the basket from such currencies could lead to (economically unfounded) biased EER results.

## Conclusions

Apart from a couple of obvious explainable discrepancies, no convincing evidence could be found of a significant difference between any pair of the five presented series. Although the approach in the five cases is different, be it in the basket of trading partners, the choice of trade data and the weighting schemes or even the use of slightly different data for the CPI or HICP deflator, the results are broadly similar.

Apparently not much additional information or significant value added is obtained by increasing the number of partner countries in the calculations.

On the other hand, the global weighting scheme seems to cope better with extreme shocks (currency crises in hyper-devaluation countries: Russia 98, Bulgaria 97, ...)

**Each of the five calculation methods can be seen as a robust estimator of the REER, and each published series as a consistent estimate of the true (unobserved) REER.**



## Part A

REER, CPI deflated, broad group: comparison of data published by five institutions  
Data availability; sample mean pairwise R<sup>2</sup> for index numbers and y-o-y evolutions

	EC Ecfm	ECB	OECD	IMF	BIS	R <sup>2</sup> index 99-14	R <sup>2</sup> y-o-y 00-14
<a href="#">Euro area</a>	☑	☑	☑	☑	☑	0.99	0.99
<a href="#">Belgium</a>	☑	☑	☑	☑	☑	0.97	0.97
<a href="#">Bulgaria</a>	☑	☑	☒	☑	☑	1.00	0.94
<a href="#">Czech Republic</a>	☑	☑	☑	☑	☑	0.99	0.94
<a href="#">Denmark</a>	☑	☑	☑	☑	☑	0.92	0.98
<a href="#">Germany</a>	☑	☑	☑	☑	☑	0.97	0.99
<a href="#">Estonia</a>	☑	☑	☑	☒	☑	0.99	0.95
<a href="#">Ireland</a>	☑	☑	☑	☑	☑	0.98	0.96
<a href="#">Greece</a>	☑	☑	☑	☑	☑	0.94	0.96
<a href="#">Spain</a>	☑	☑	☑	☑	☑	0.98	0.96
<a href="#">France</a>	☑	☑	☑	☑	☑	0.94	0.98
<a href="#">Croatia</a>	☑	☑	☒	☑	☑	0.94	0.91
<a href="#">Italy</a>	☑	☑	☑	☑	☑	0.95	0.98
<a href="#">Cyprus</a>	☑	☑	☒	☑	☑	0.89	0.81
<a href="#">Latvia</a>	☑	☑	☑	☑	☑	0.96	0.94
<a href="#">Lithuania</a>	☑	☑	☒	☒	☑	0.99	0.96
<a href="#">Luxembourg</a>	☑	☑	☑	☑	☑	0.94	0.88
<a href="#">Hungary</a>	☑	☑	☑	☑	☑	0.99	0.99
<a href="#">Malta</a>	☑	☑	☒	☑	☑	0.88	0.90
<a href="#">Netherlands</a>	☑	☑	☑	☑	☑	0.93	0.96
<a href="#">Austria</a>	☑	☑	☑	☑	☑	0.83	0.97
<a href="#">Poland</a>	☑	☑	☑	☑	☑	0.98	1.00
<a href="#">Portugal</a>	☑	☑	☑	☑	☑	0.96	0.97
<a href="#">Romania</a>	☑	☑	☒	☑	☑	1.00	1.00
<a href="#">Slovenia</a>	☑	☑	☑	☒	☑	0.91	0.94
<a href="#">Slovakia</a>	☑	☑	☑	☑	☑	1.00	0.98
<a href="#">Finland</a>	☑	☑	☑	☑	☑	0.89	0.96
<a href="#">Sweden</a>	☑	☑	☑	☑	☑	0.94	0.98
<a href="#">United Kingdom</a>	☑	☑	☑	☑/☒	☑	1.00	1.00
<a href="#">USA</a>	☑	☑	☑	☑	☑	0.99	0.99
<a href="#">Japan</a>	☑	☑	☑	☑	☑	0.99	1.00
<a href="#">Switzerland</a>	☑	☑	☑	☑	☑	0.98	0.98
<a href="#">Norway</a>	☑	☑	☑	☑	☑	0.91	0.98
<a href="#">Turkey</a>	☑	☑	☑	☒	☑	0.99	0.99
<a href="#">Canada</a>	☑	☑	☑	☑	☑	1.00	0.99
<a href="#">Australia</a>	☑	☑	☑	☑	☑	1.00	0.99
<a href="#">New Zealand</a>	☑	☑	☑	☑	☑	0.99	0.99
<a href="#">Mexico</a>	☑	☑	☑	☑	☑	0.98	0.99
<a href="#">Russia</a>	☑	☑	☑	☑	☑	1.00	0.98
<a href="#">China</a>	☑	☑	☑	☑	☑	0.99	0.98
<a href="#">Hong Kong</a>	☑	☑	☒	☒	☑	0.99	0.96
<a href="#">Korea</a>	☑	☑	☑	☒	☑	1.00	1.00
<a href="#">Brazil</a>	☑	☑	☑	☑	☑	0.98	0.96

Note: United Kingdom: IMF not included in comparison: data not comparable (see text).

## Part B

REER, CPI/HICP deflated, broad group: pairwise comparison of data published by five institutions

Index numbers:

- Comparative graphs

- Regressions presented in scatter diagrams with trend line, 1999-2014

- Regression equations (with t-value), 1999-2014

- $R^2$  for each pair of data series, 1999-2014

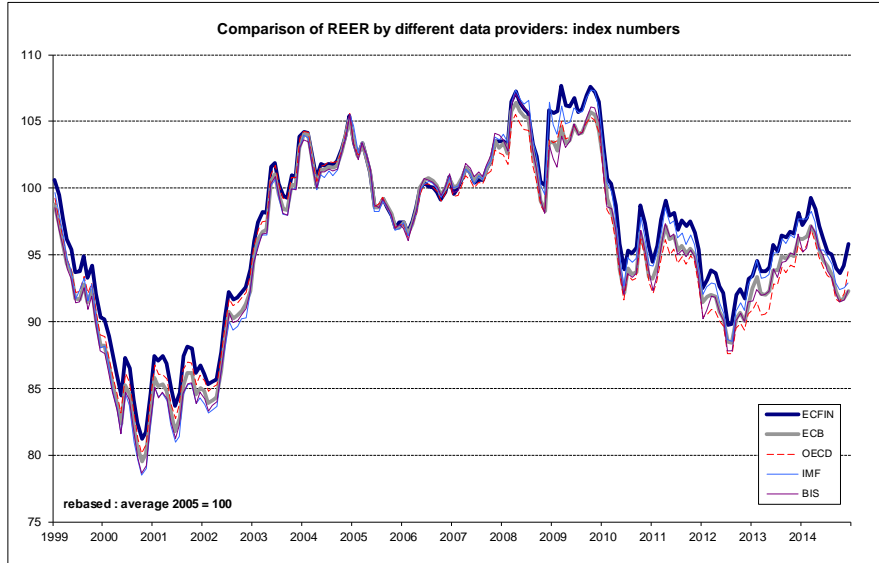
Year-on-year evolutions:

- Comparative graphs

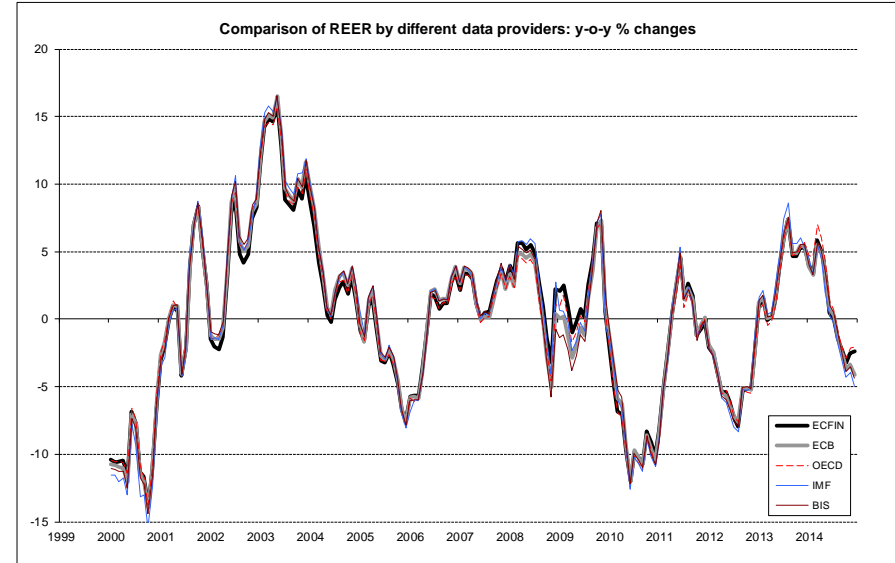
- Regressions presented in scatter diagrams with trend line, 2000-2014

- $R^2$  for each pair of data series, 2000-2014

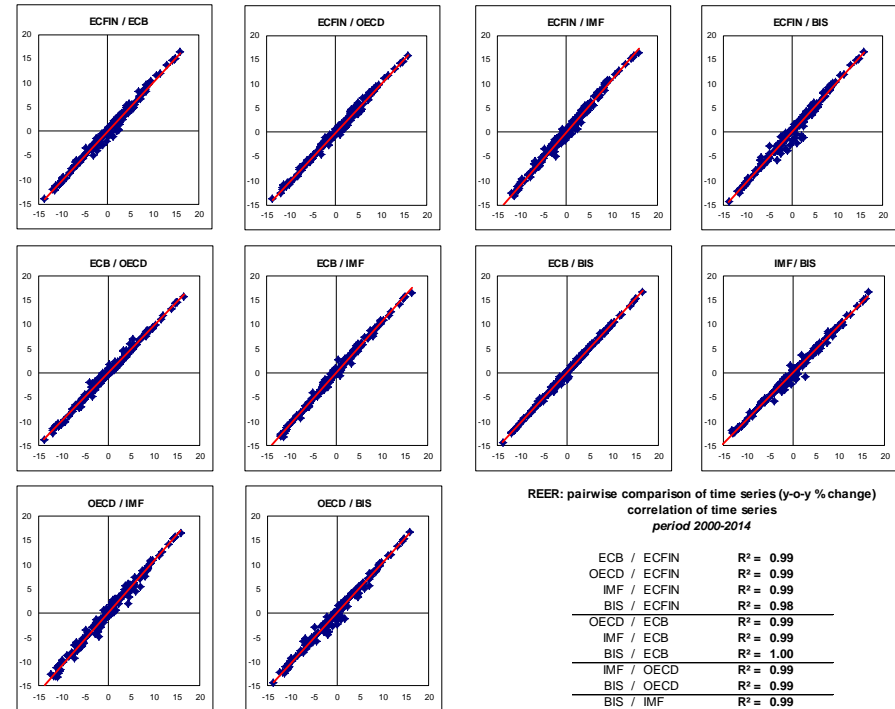
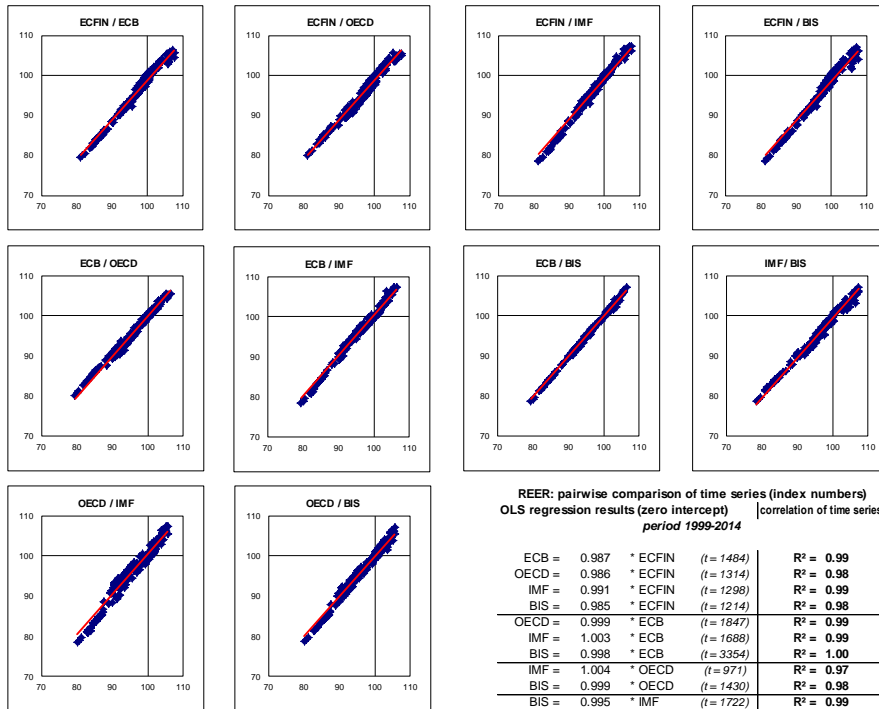
Euro area: Real Effective Exchange Rates, deflated by HICP/CPI



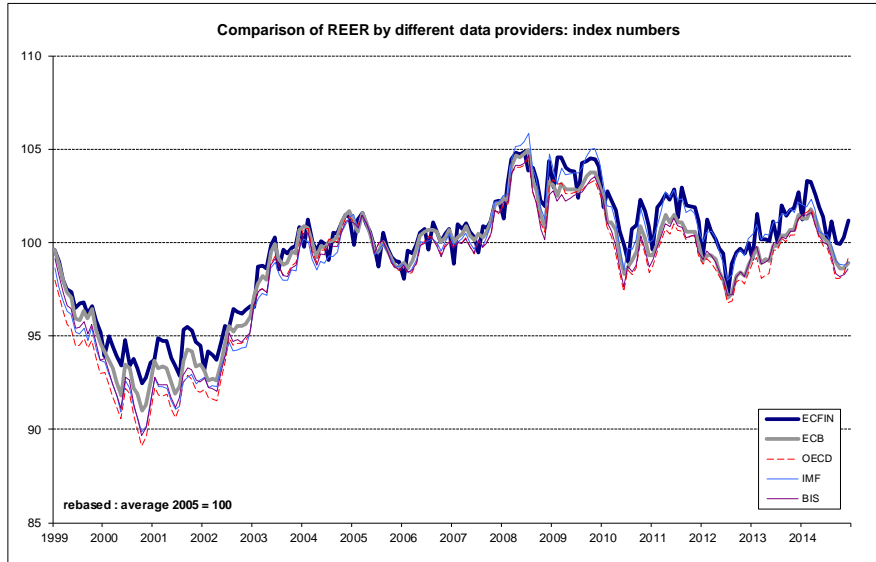
Euro area: Real Effective Exchange Rates, deflated by HICP/CPI



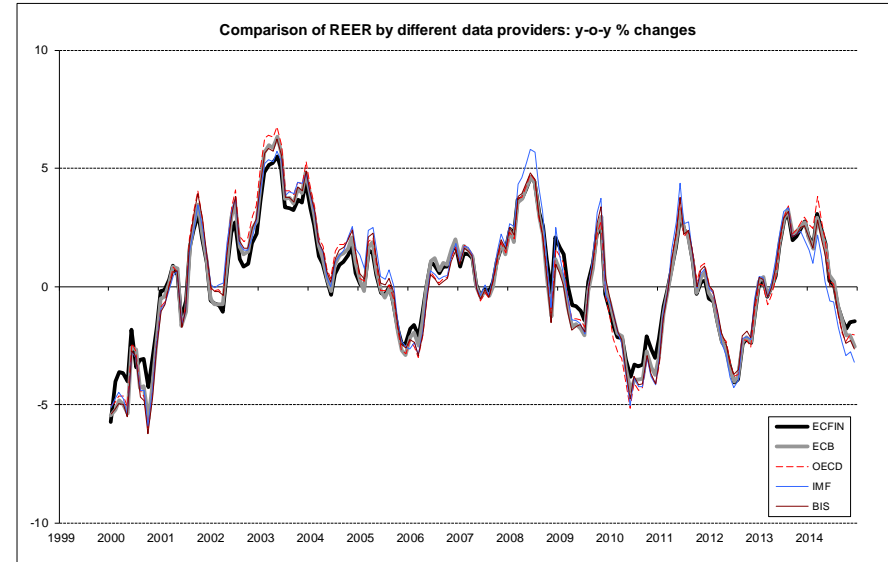
scatter diagrams and fitted trendline (OLS, zero intercept)



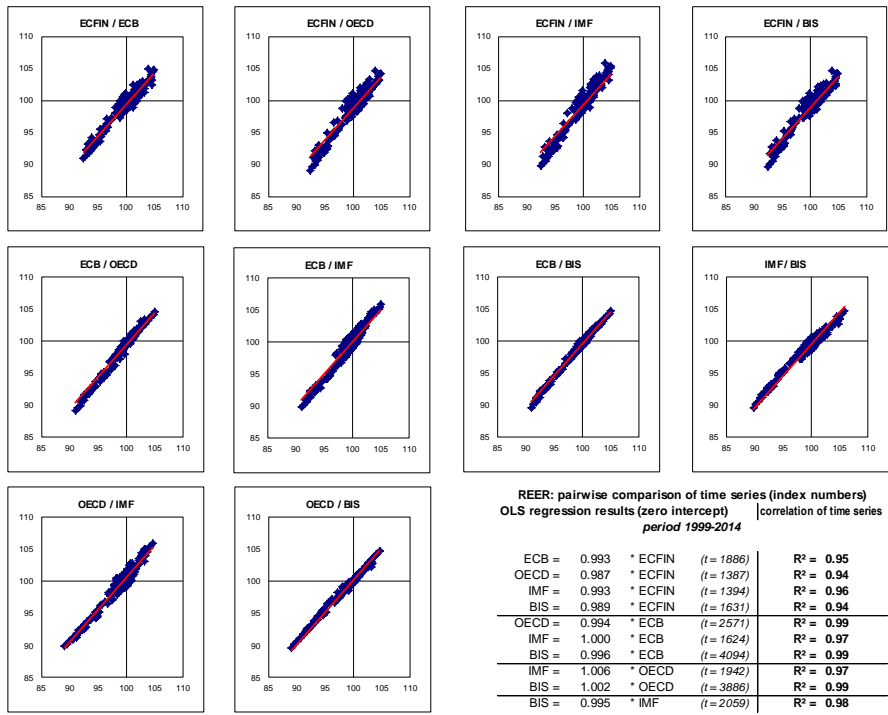
Belgium: Real Effective Exchange Rates, deflated by HICP/CPI



Belgium: Real Effective Exchange Rates, deflated by HICP/CPI



REER: pairwise comparison of time series: scatter diagrams and fitted trendline (OLS, zero intercept)

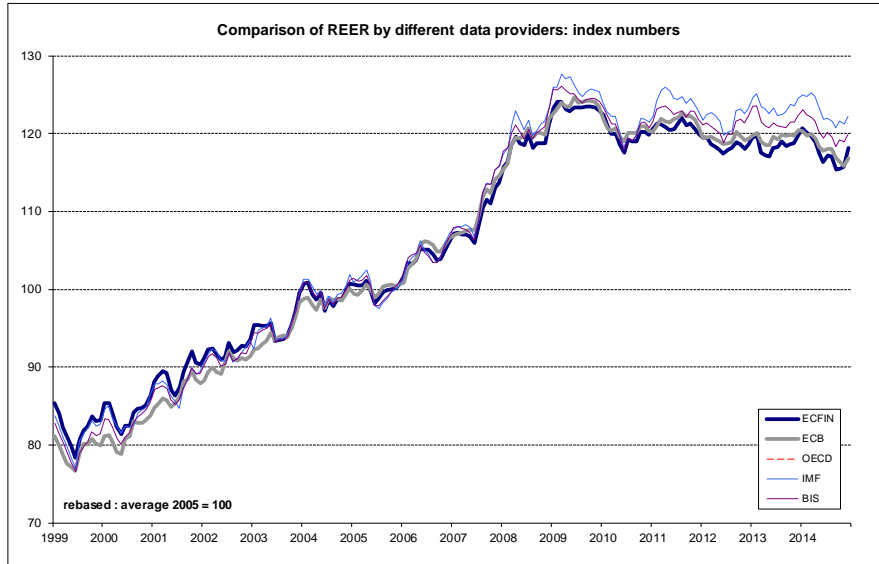


REER: pairwise comparison of time series (y-o-y % change)  
correlation of time series  
period 2000-2014

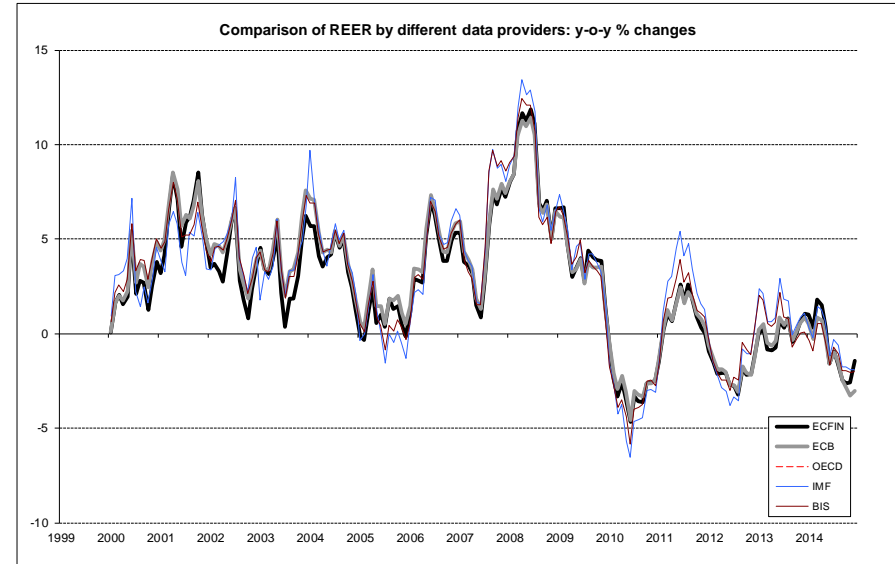
ECB / ECFIN	R <sup>2</sup> = 0.98
OECD / ECFIN	R <sup>2</sup> = 0.97
IMF / ECFIN	R <sup>2</sup> = 0.95
BIS / ECFIN	R <sup>2</sup> = 0.95
OECD / ECB	R <sup>2</sup> = 0.98
IMF / ECB	R <sup>2</sup> = 0.97
BIS / ECB	R <sup>2</sup> = 0.99
IMF / OECD	R <sup>2</sup> = 0.96
BIS / OECD	R <sup>2</sup> = 0.99
BIS / IMF	R <sup>2</sup> = 0.98



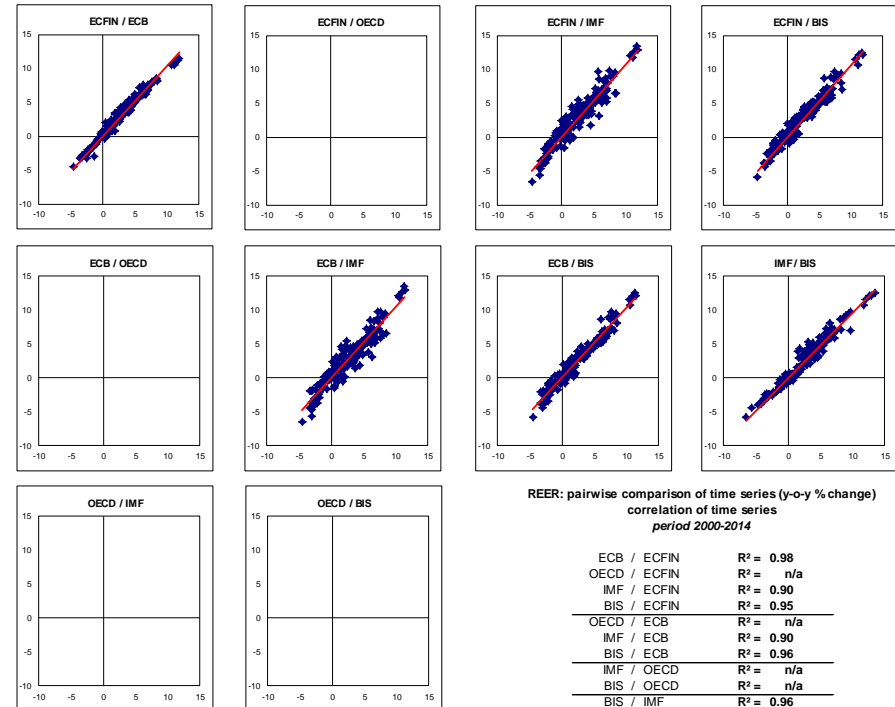
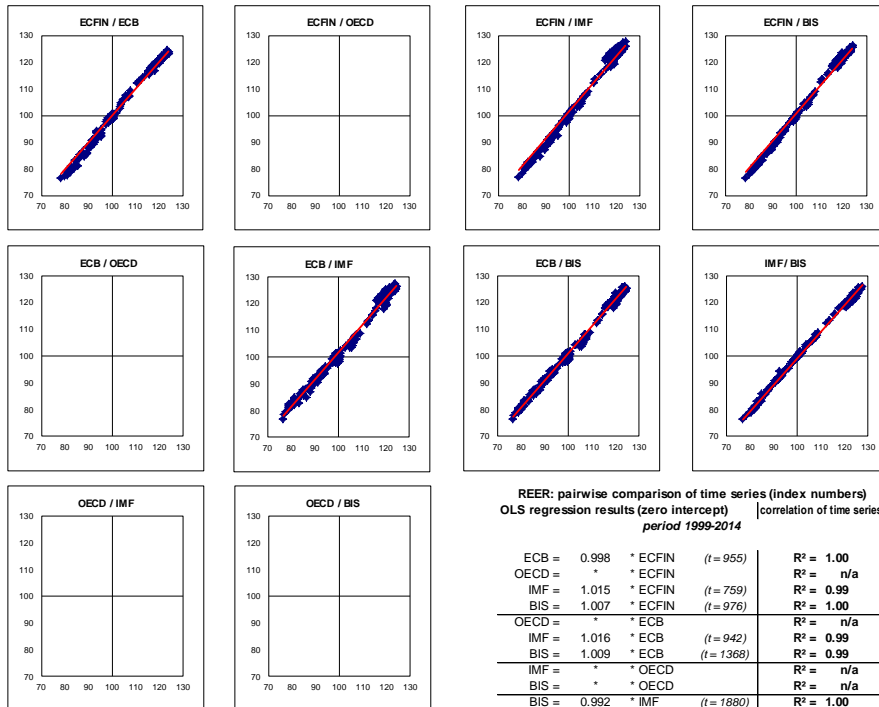
Bulgaria: Real Effective Exchange Rates, deflated by HICP/CPI



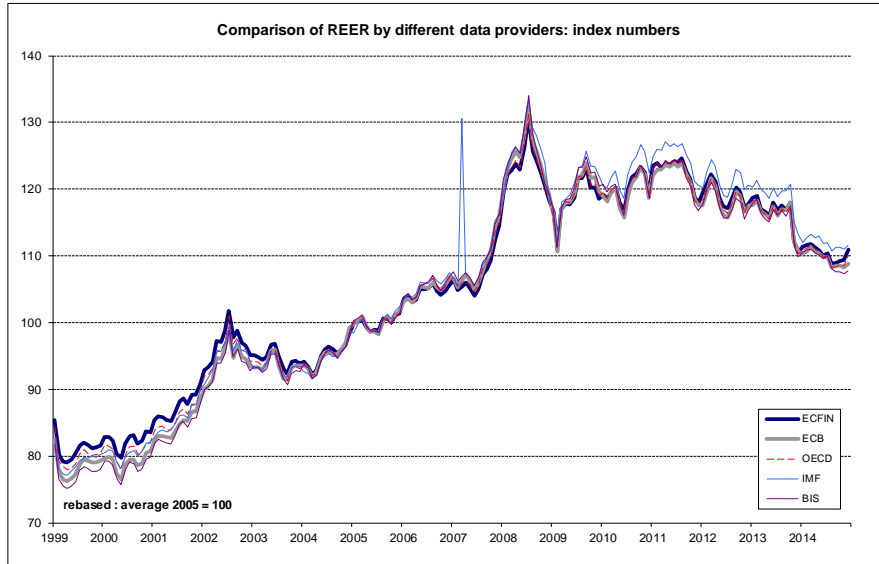
Bulgaria: Real Effective Exchange Rates, deflated by HICP/CPI



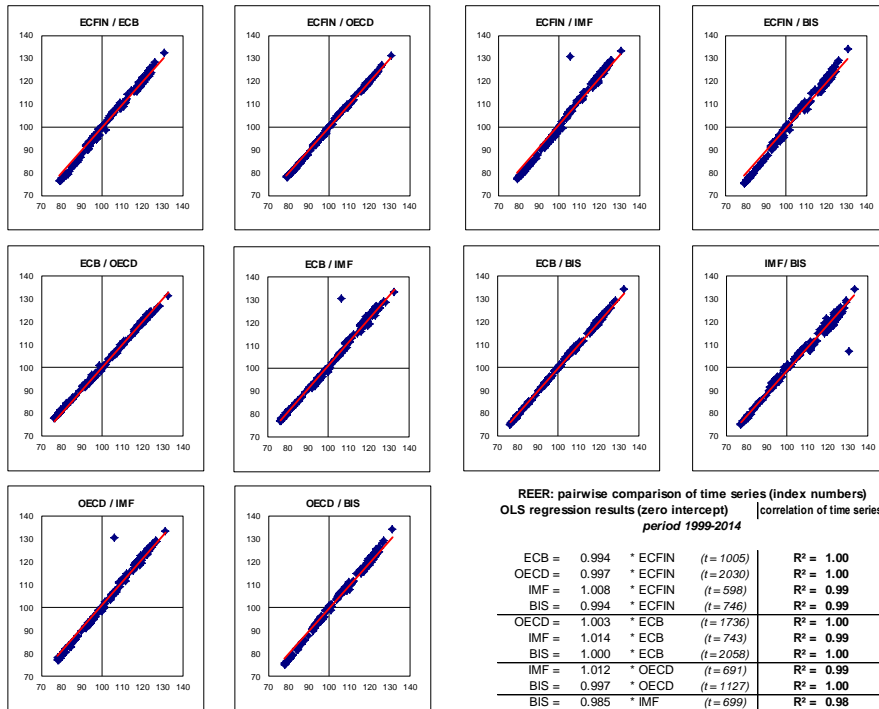
scatter diagrams and fitted trendline (OLS, zero intercept)



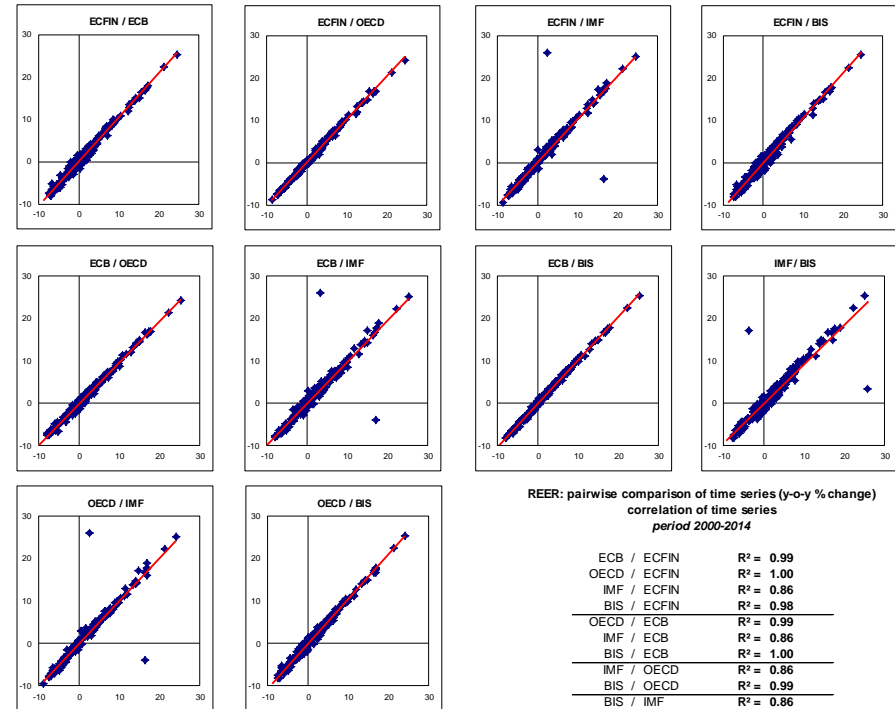
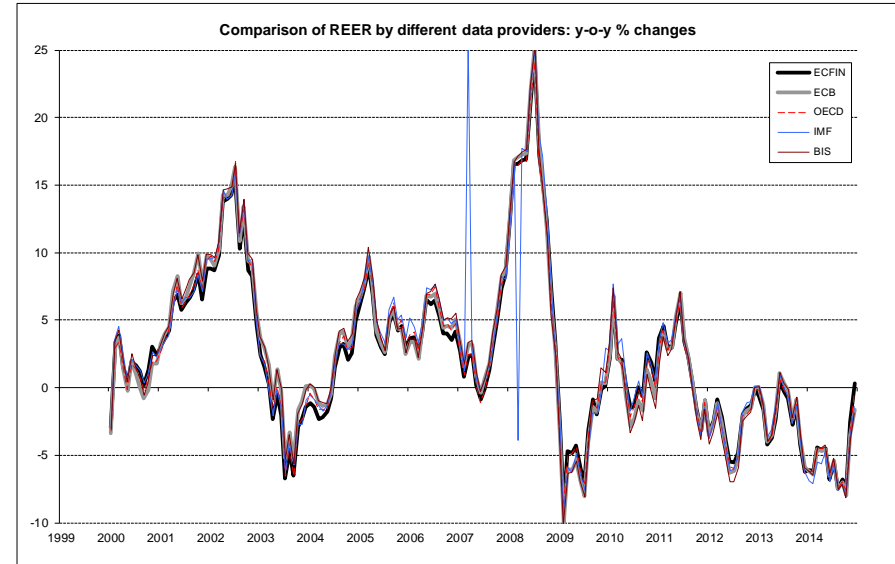
Czech Republic: Real Effective Exchange Rates, deflated by HICP/CPI



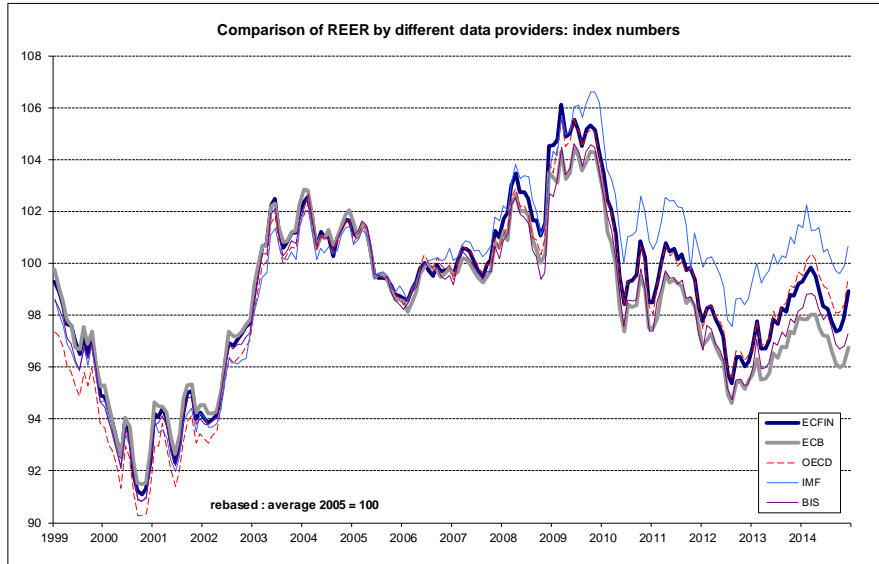
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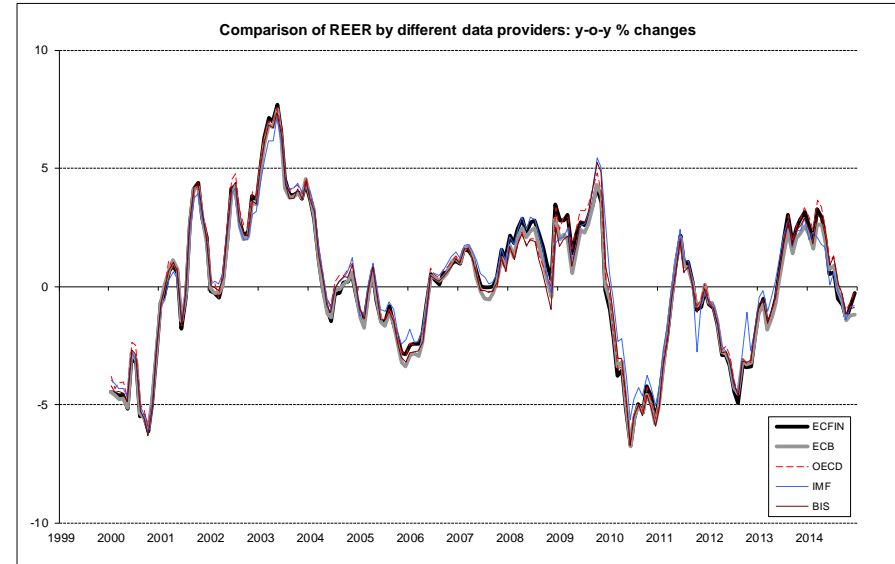
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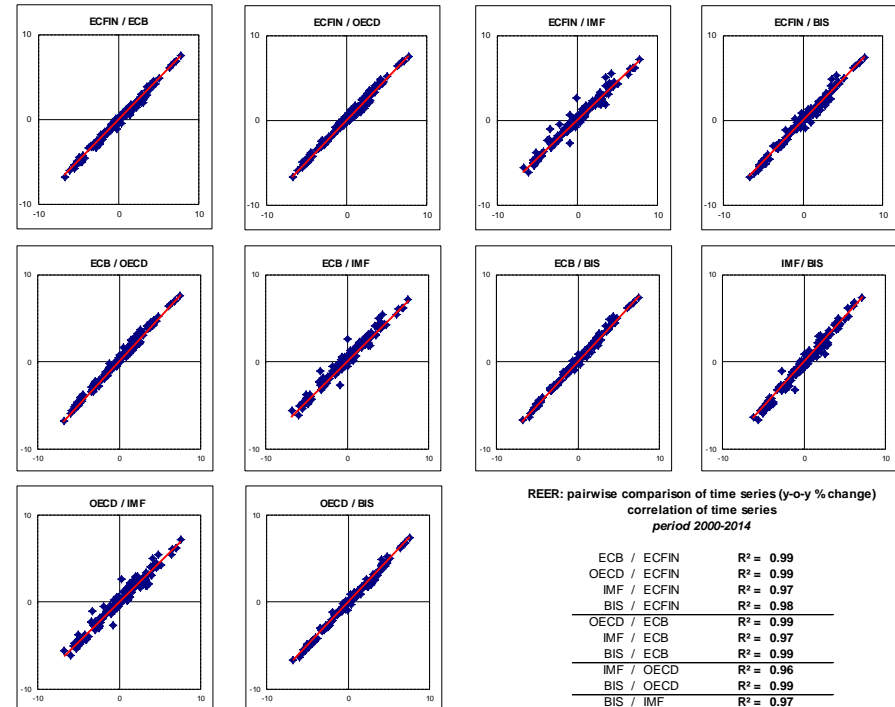
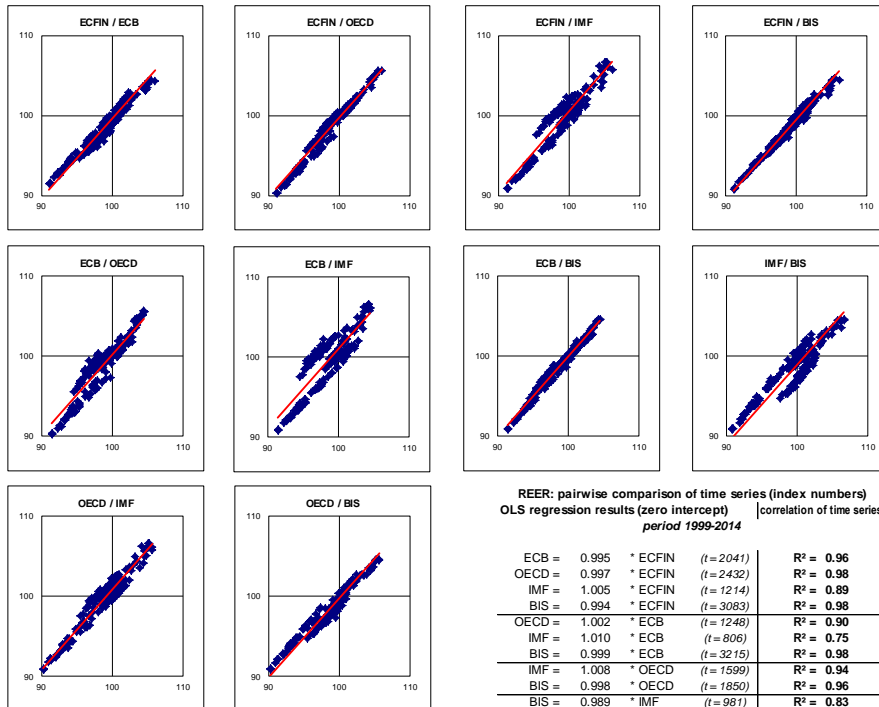
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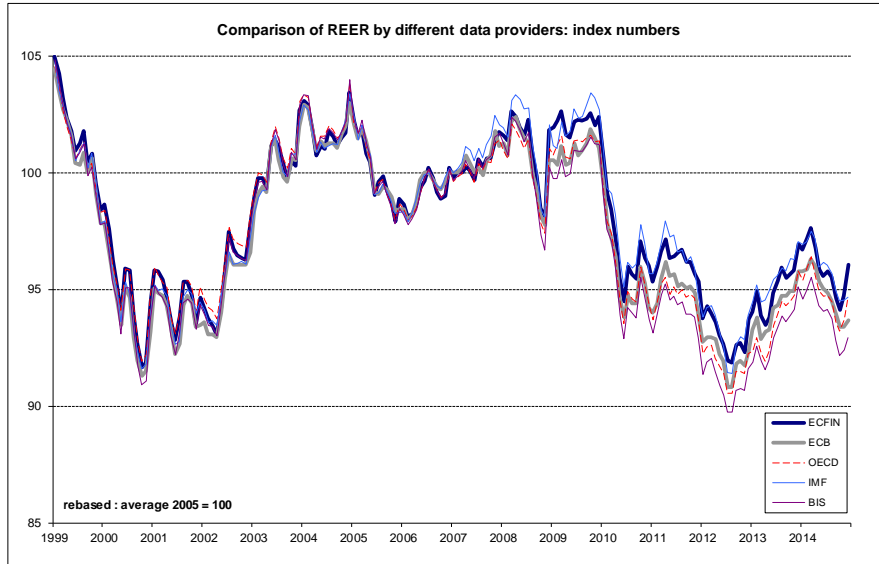
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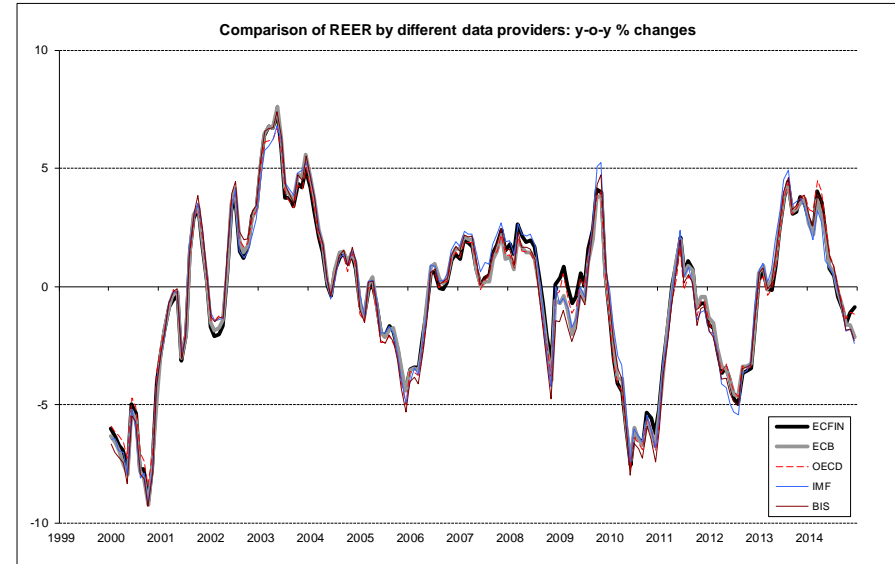
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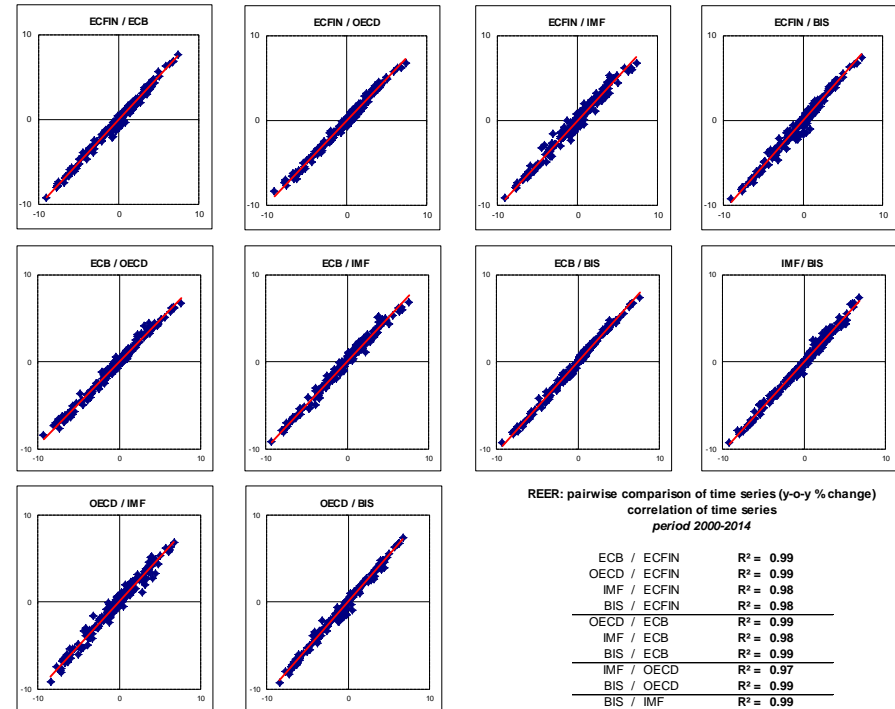
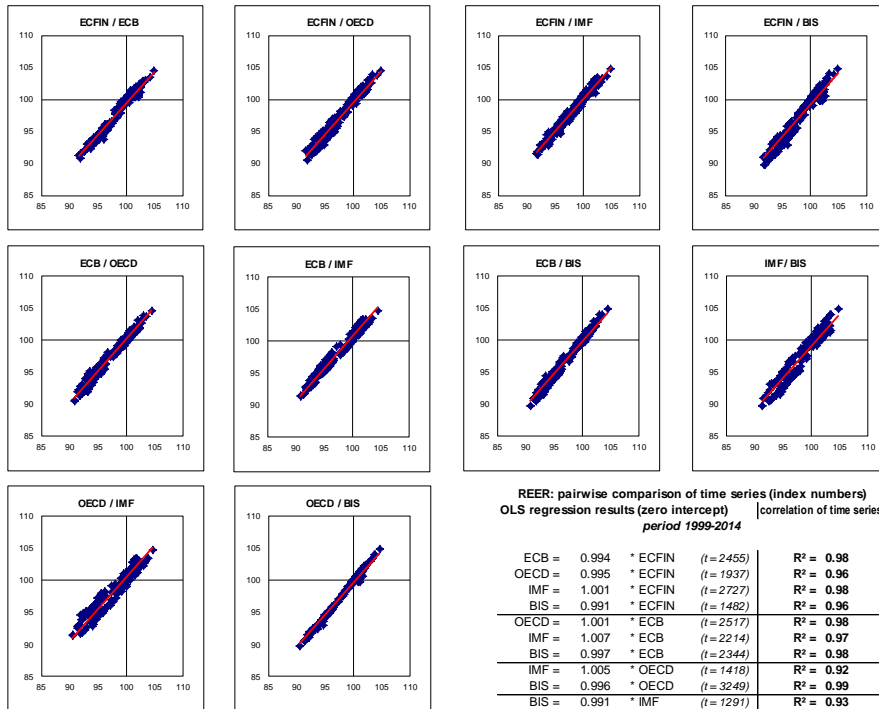
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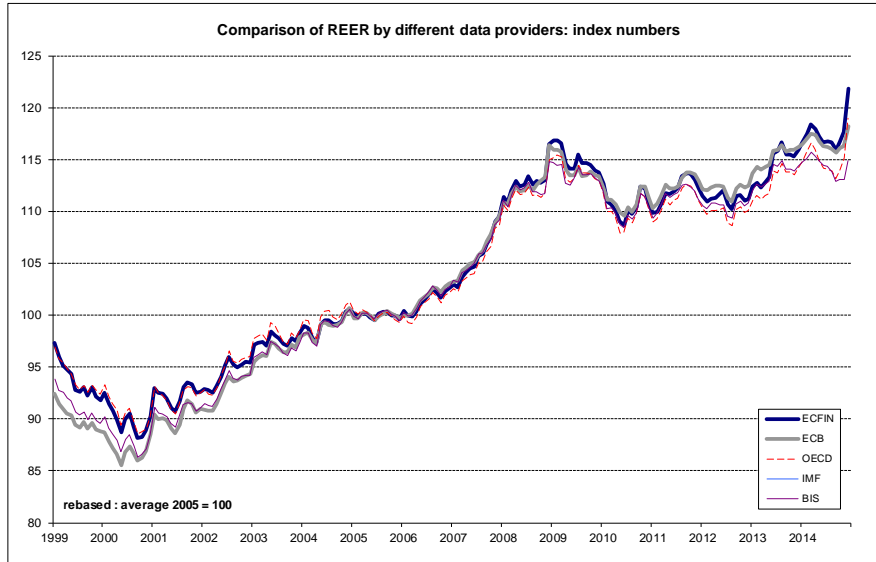
Germany: Real Effective Exchange Rates, deflated by HICP/CPI



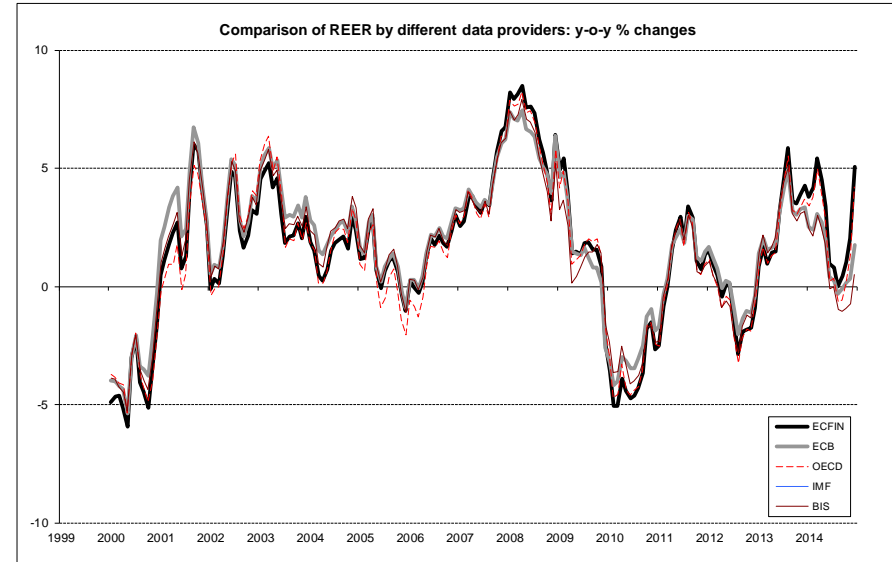
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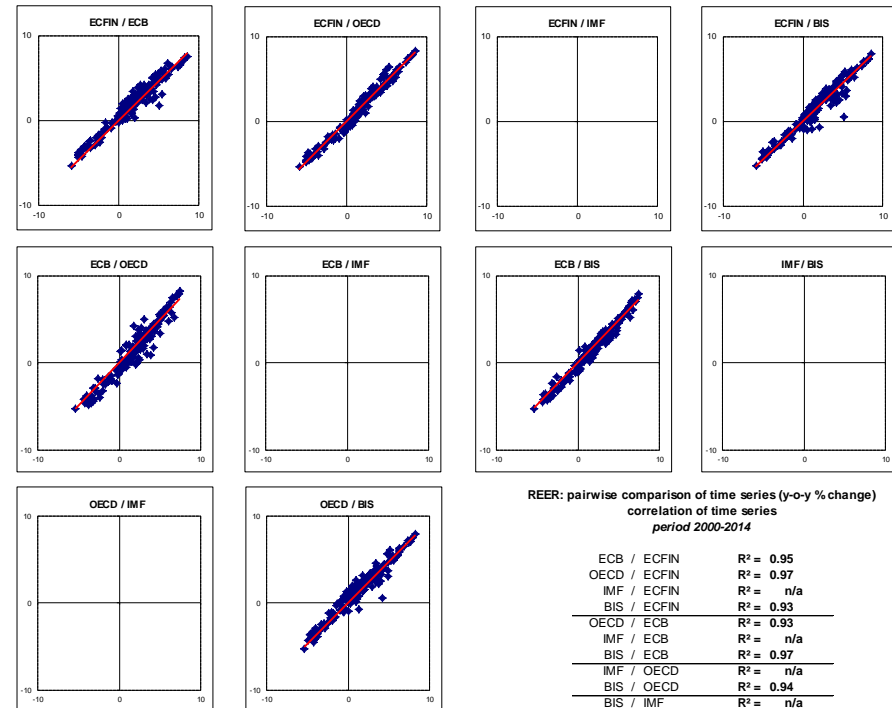
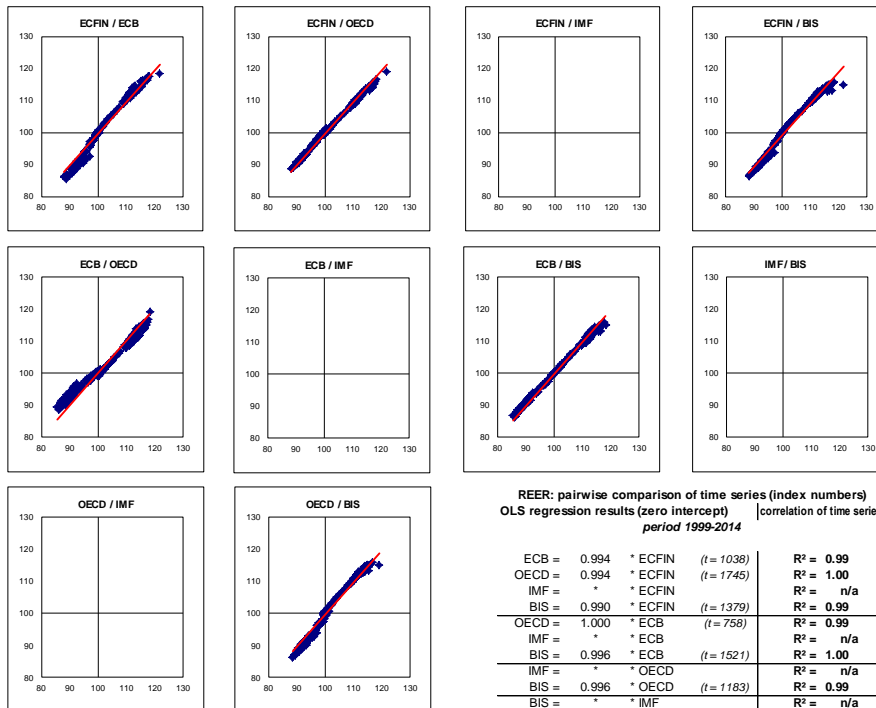
Estonia: Real Effective Exchange Rates, deflated by HICP/CPI



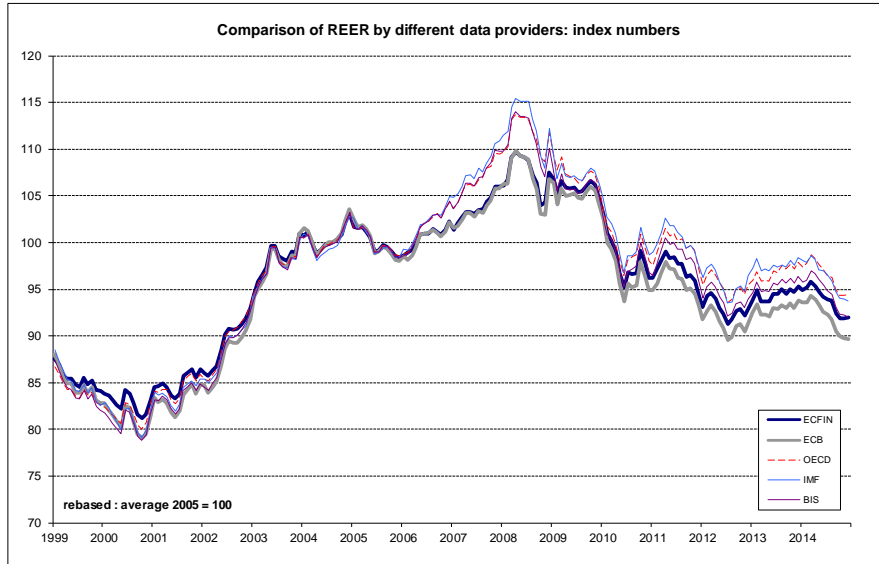
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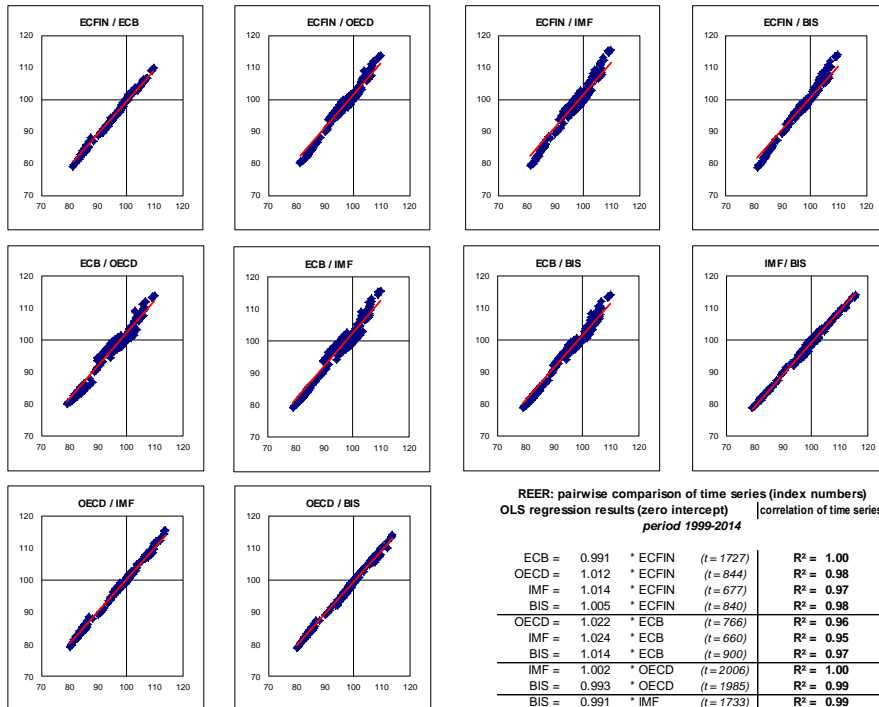
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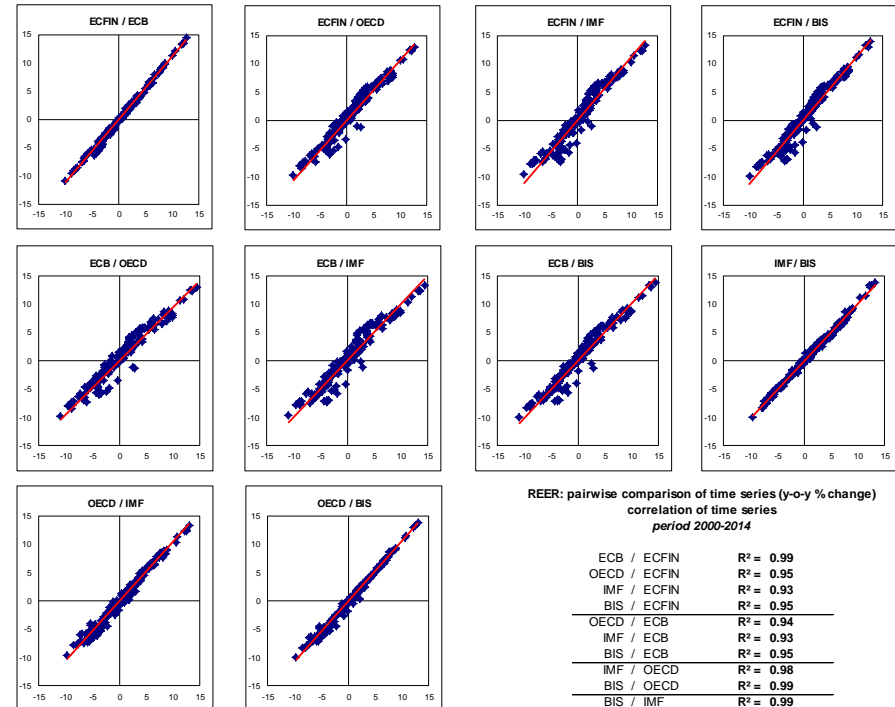
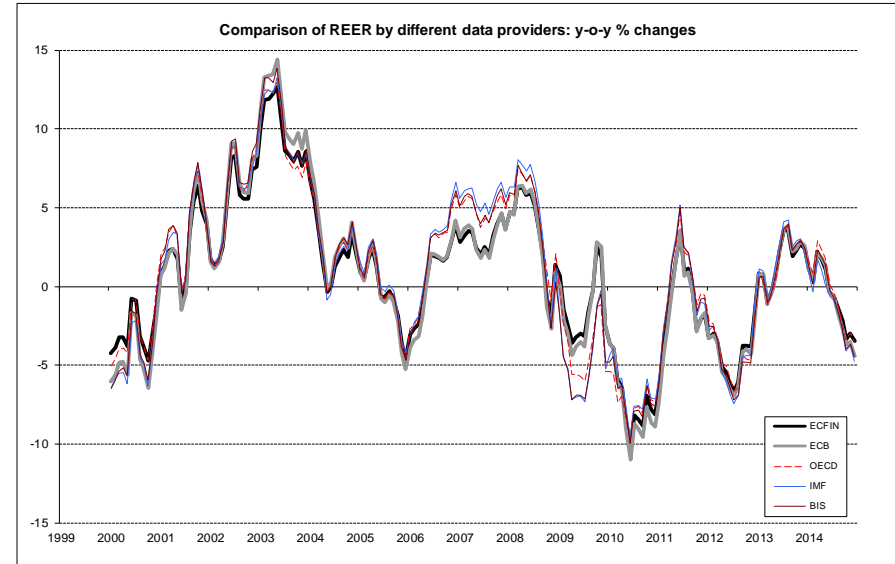
Ireland: Real Effective Exchange Rates, deflated by HICP/CPI



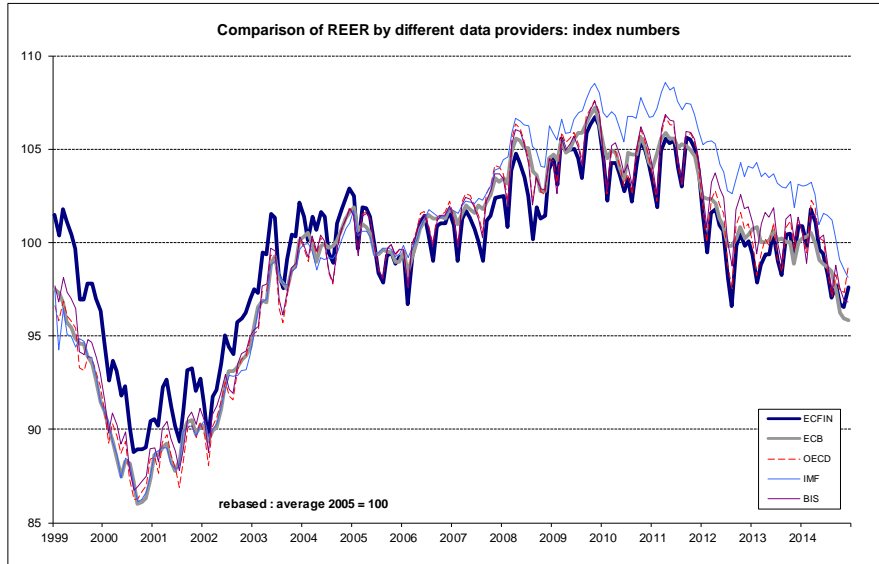
scatter diagrams and fitted trendline (OLS, zero intercept)



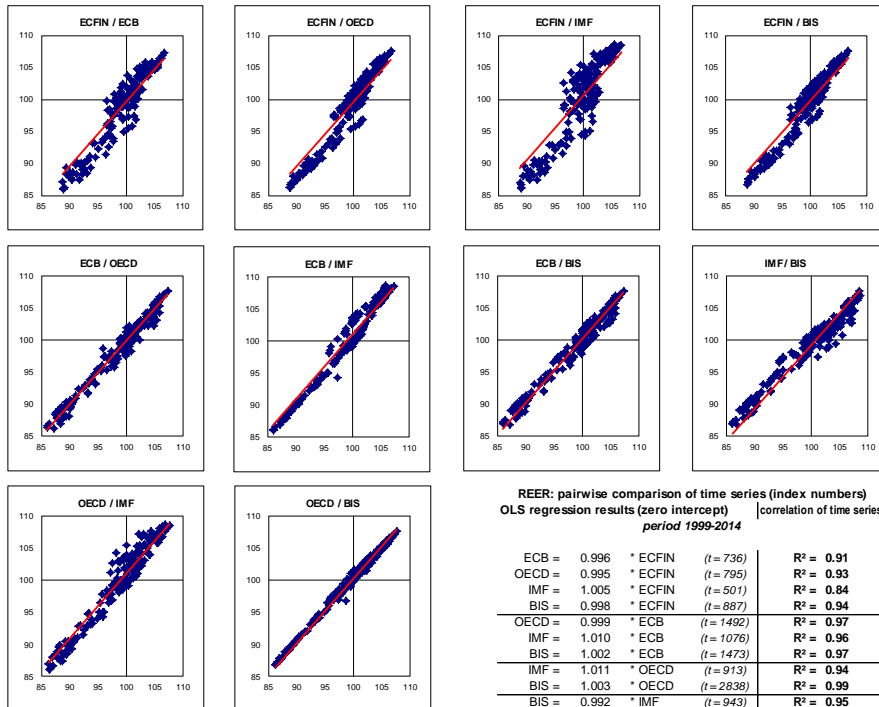
Ireland: Real Effective Exchange Rates, deflated by HICP/CPI



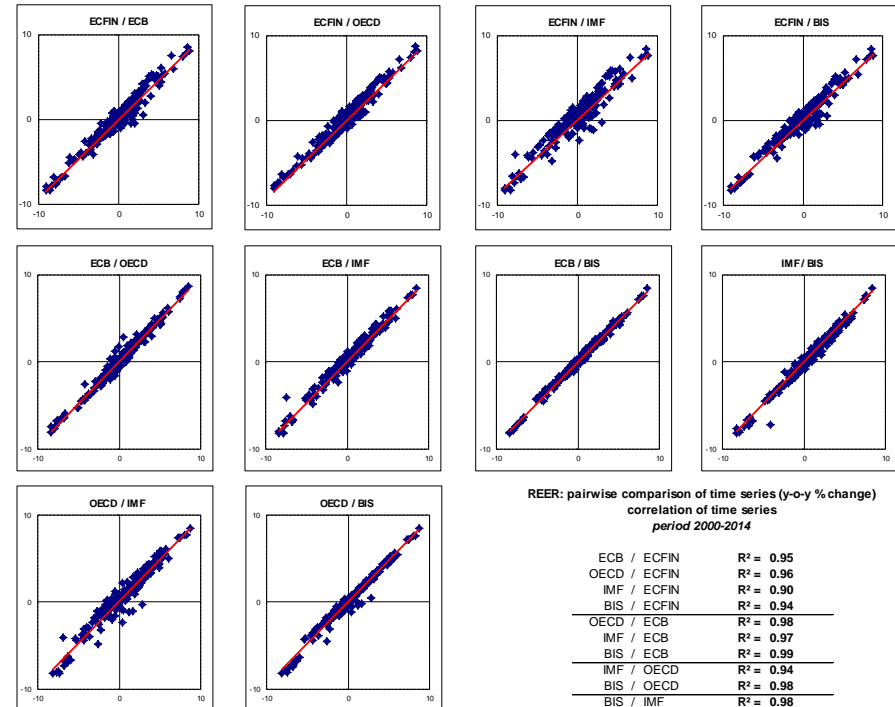
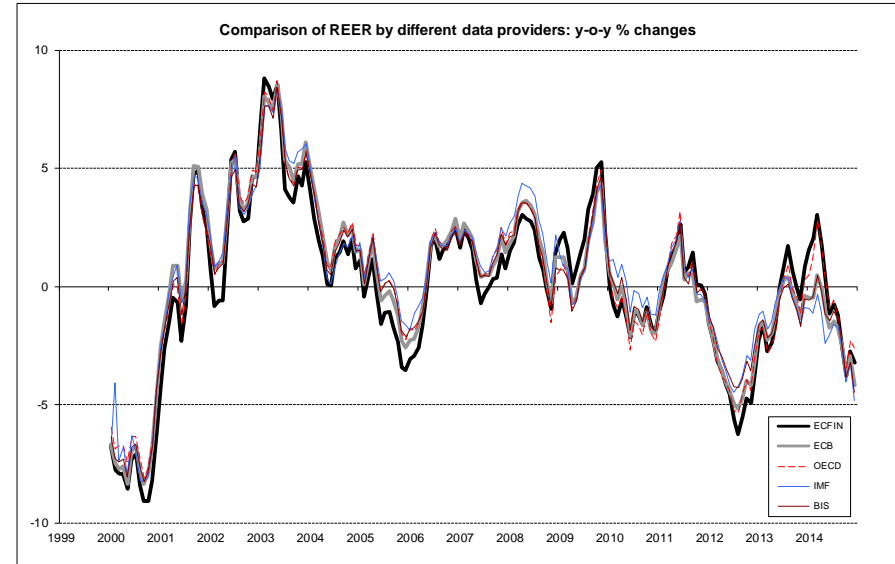
Greece: Real Effective Exchange Rates, deflated by HICP/CPI



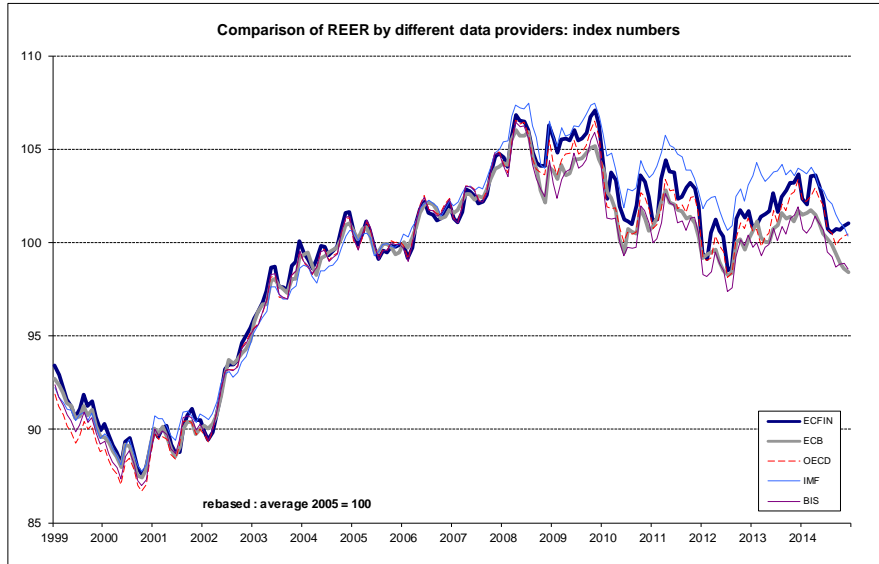
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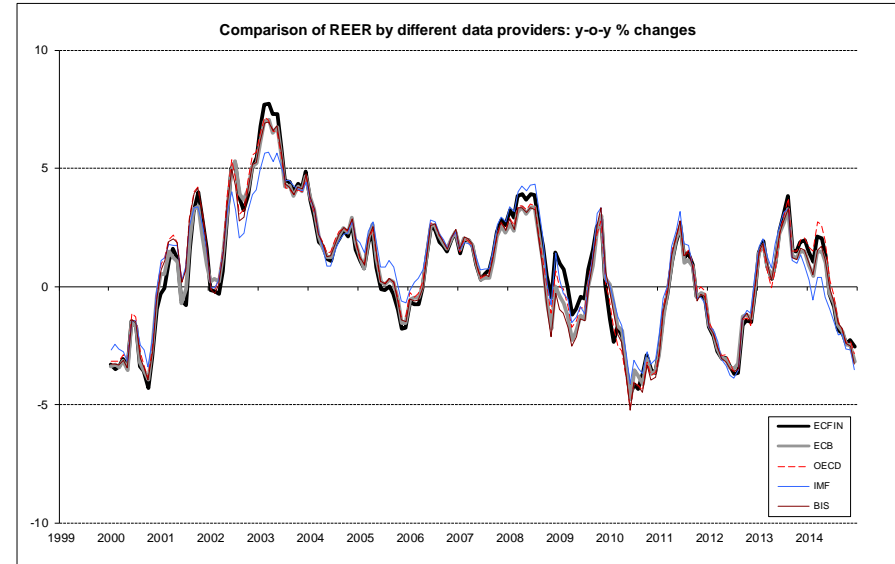
Greece: Real Effective Exchange Rates, deflated by HICP/CPI



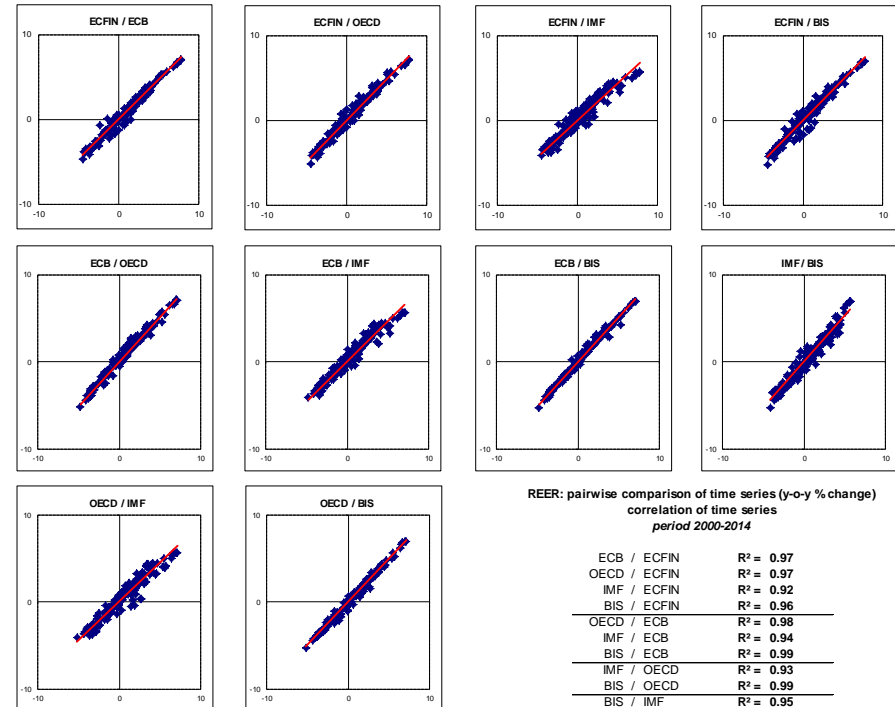
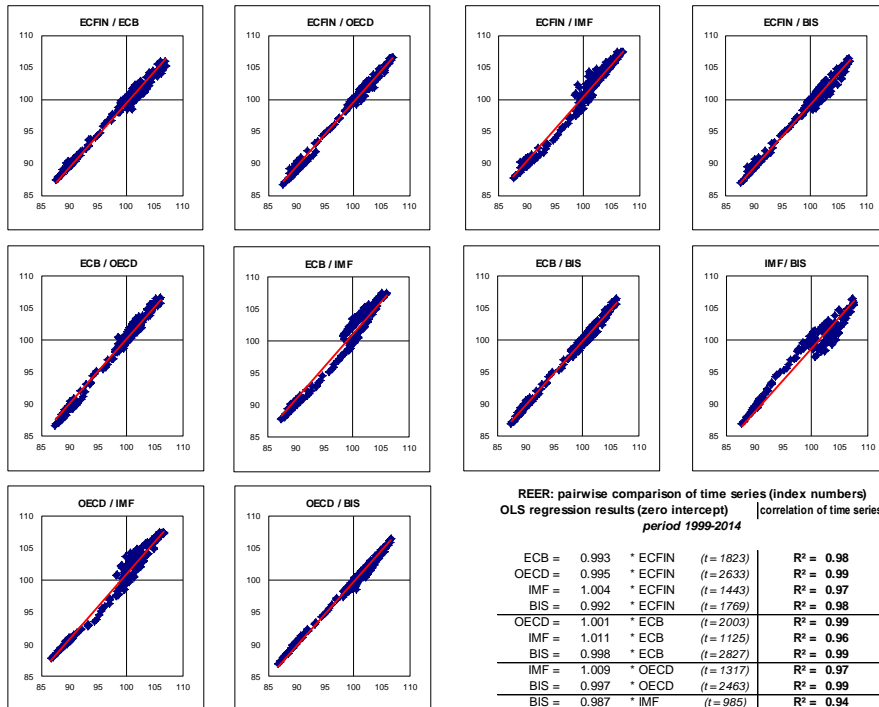
Spain: Real Effective Exchange Rates, deflated by HICP/CPI



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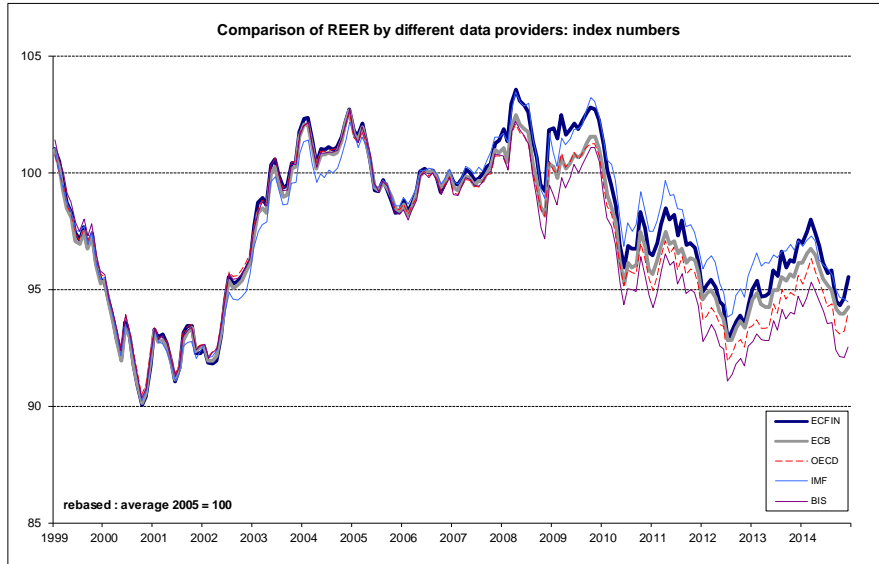


scatter diagrams and fitted trendline (OLS, zero intercept)

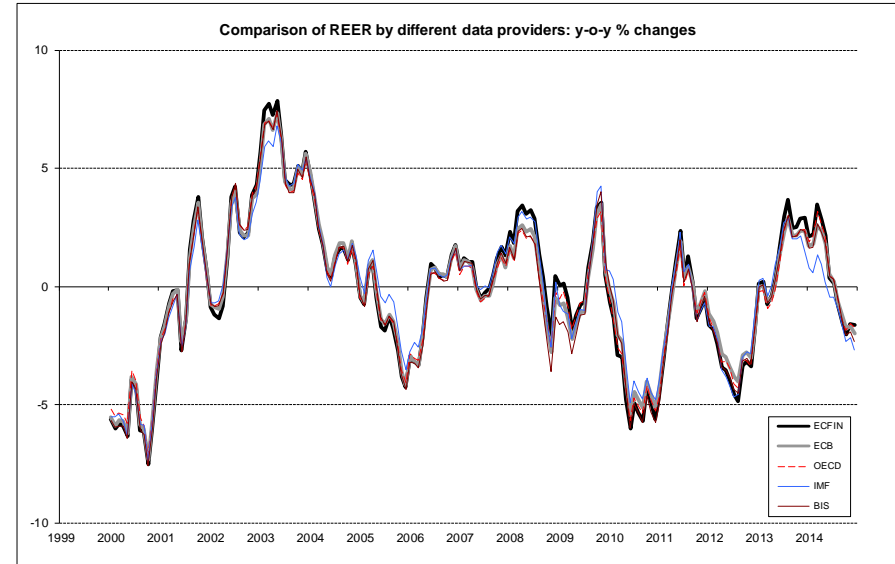




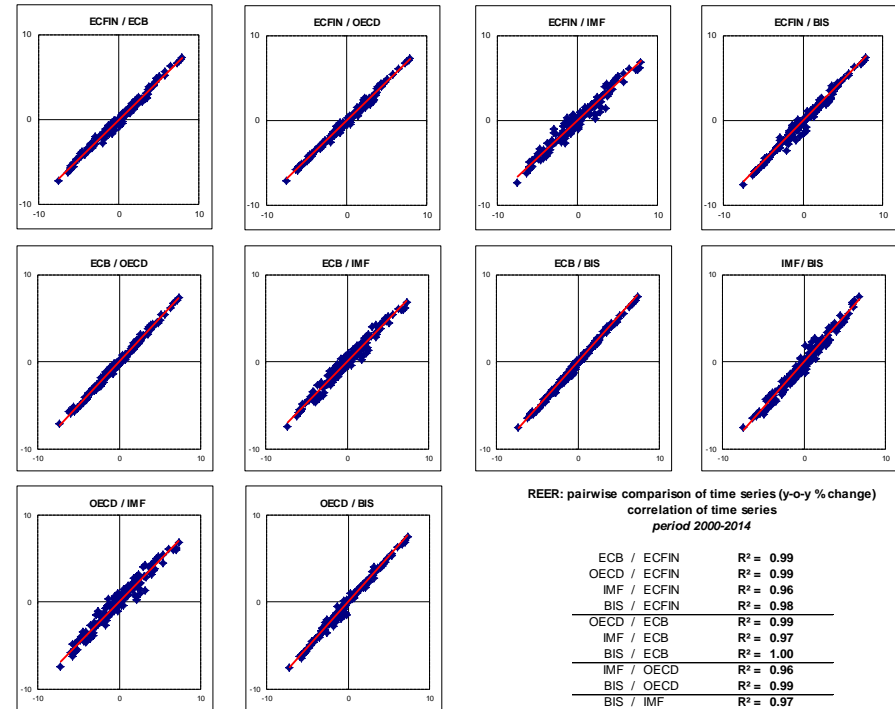
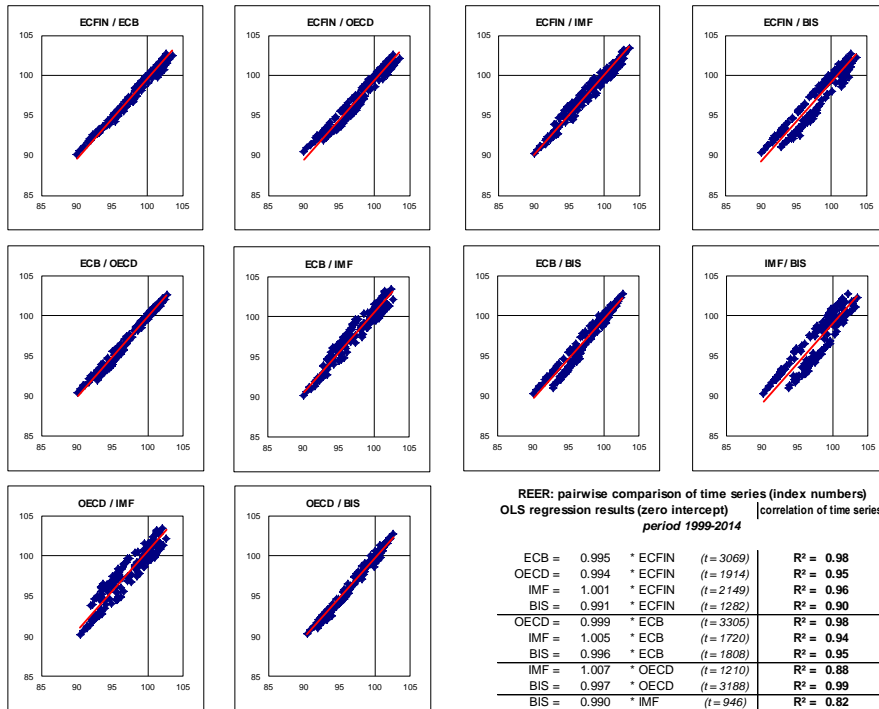
France: Real Effective Exchange Rates, deflated by HICP/CPI



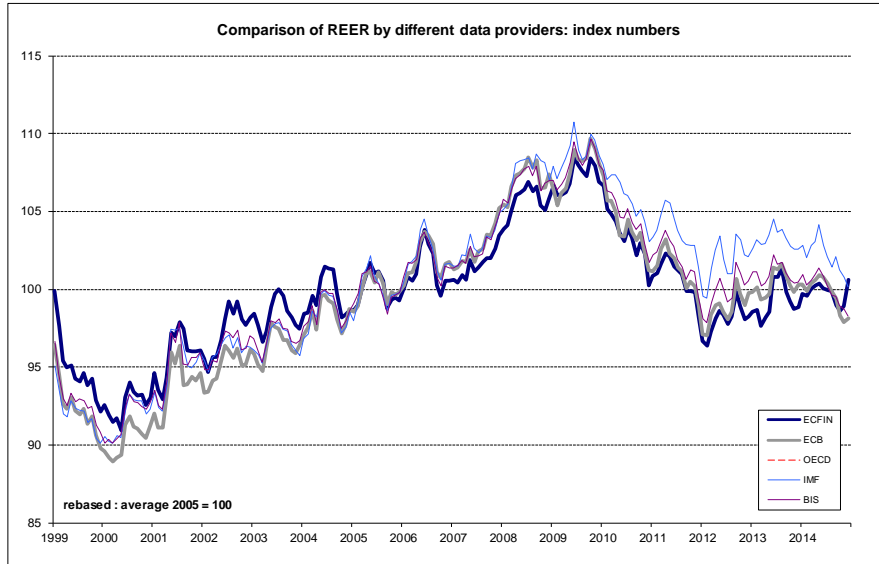
France: Real Effective Exchange Rates, deflated by HICP/CPI



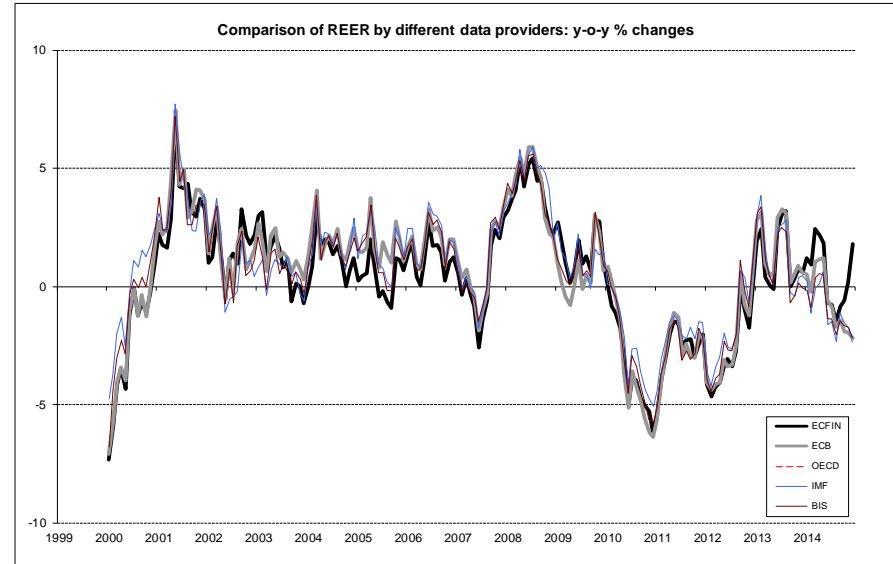
scatter diagrams and fitted trendline (OLS, zero intercept)



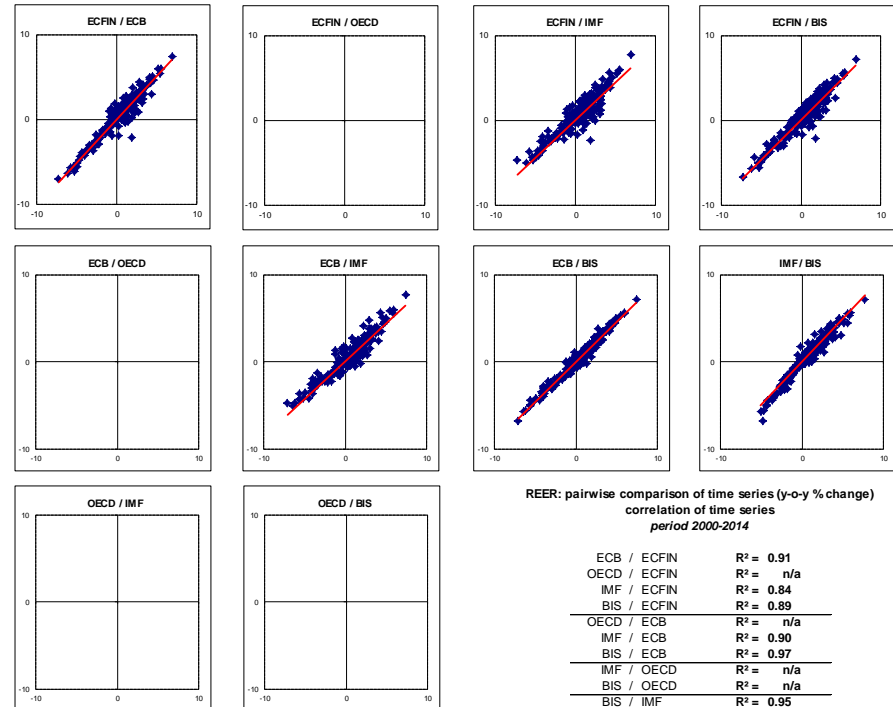
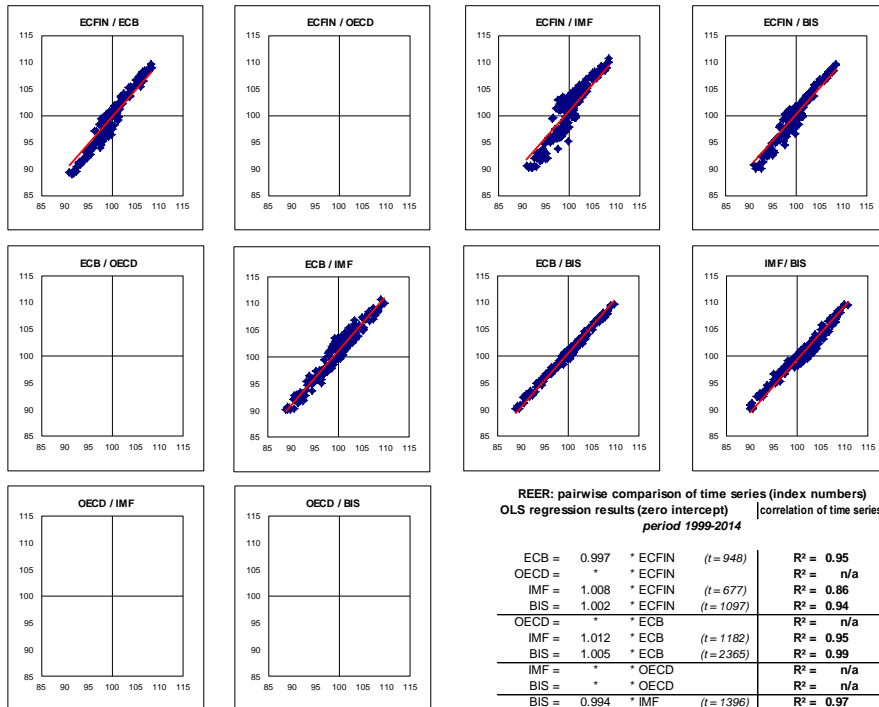
Croatia: Real Effective Exchange Rates, deflated by HICP/CPI



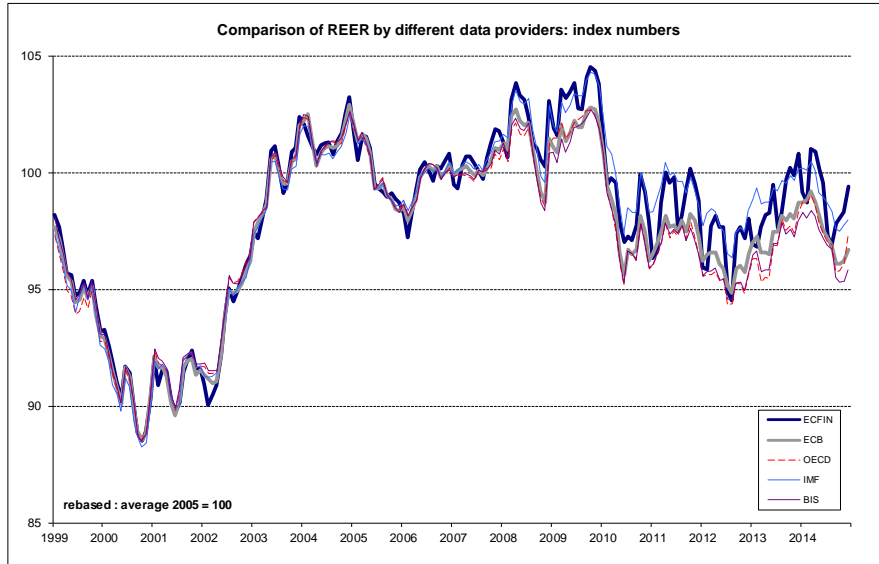
Croatia: Real Effective Exchange Rates, deflated by HICP/CPI



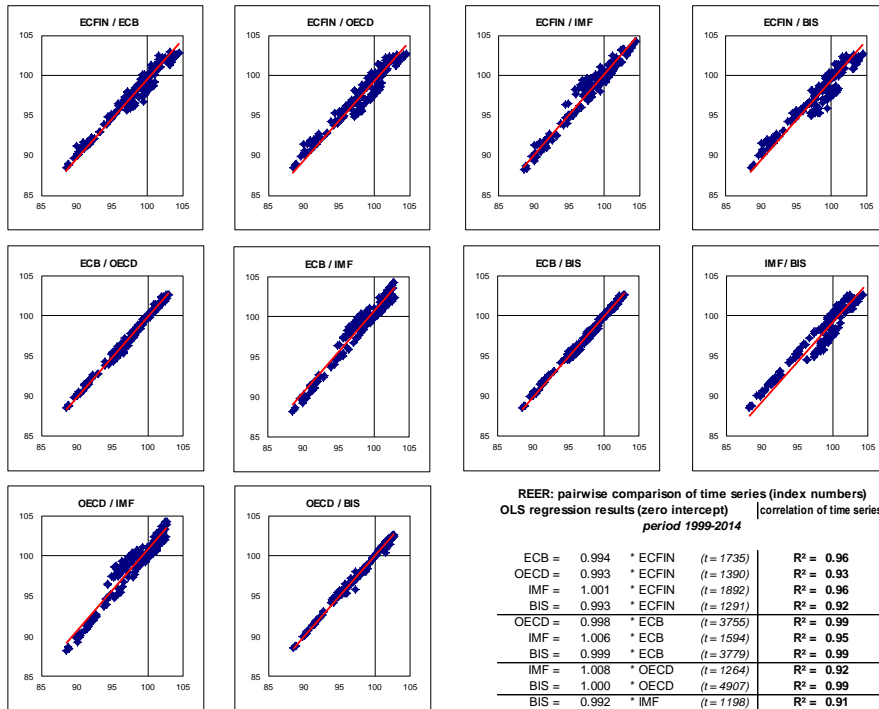
scatter diagrams and fitted trendline (OLS, zero intercept)



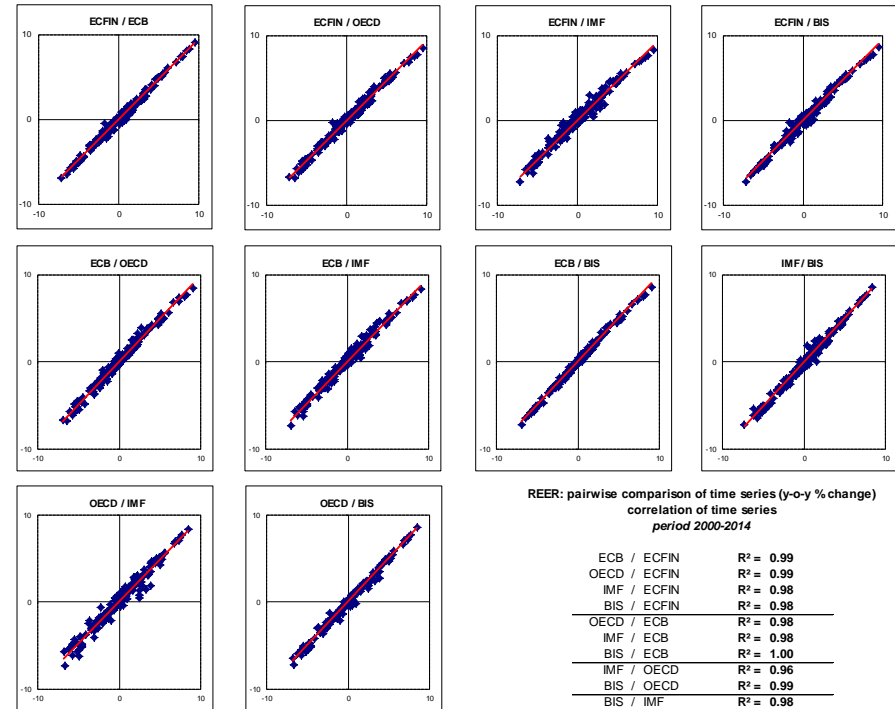
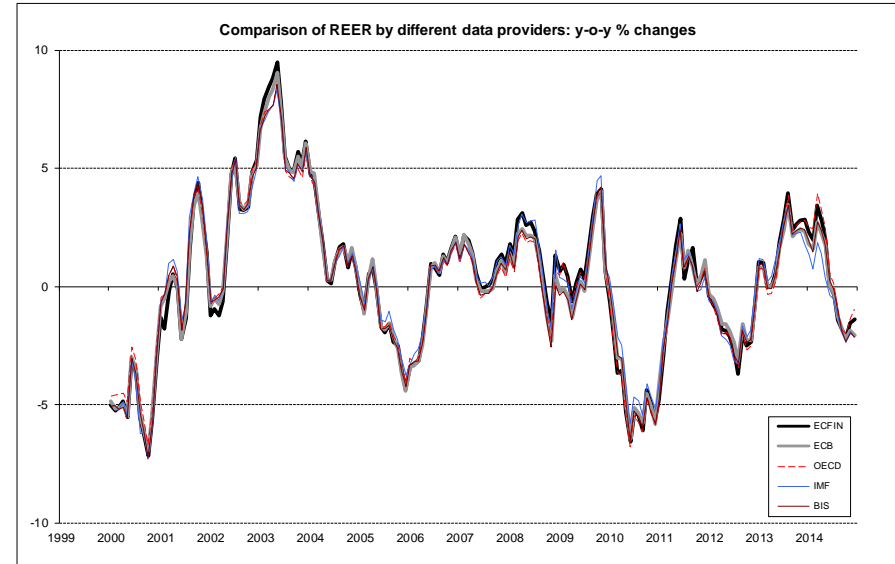
Italy: Real Effective Exchange Rates, deflated by HICP/CPI



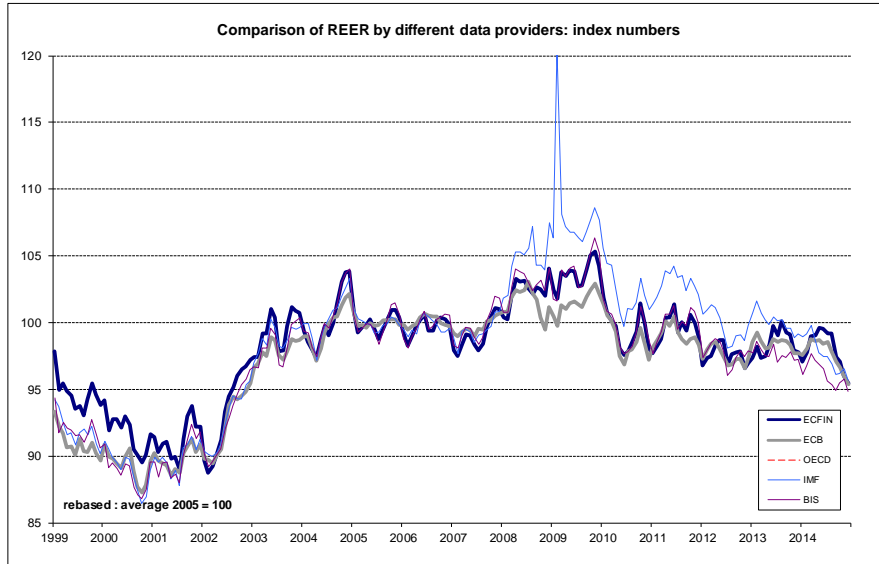
scatter diagrams and fitted trendline (OLS, zero intercept)



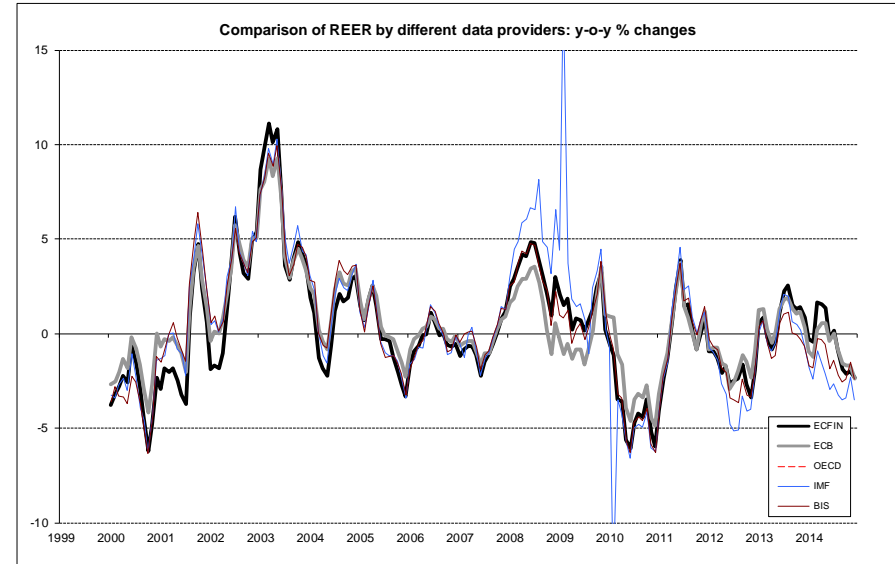
Italy: Real Effective Exchange Rates, deflated by HICP/CPI



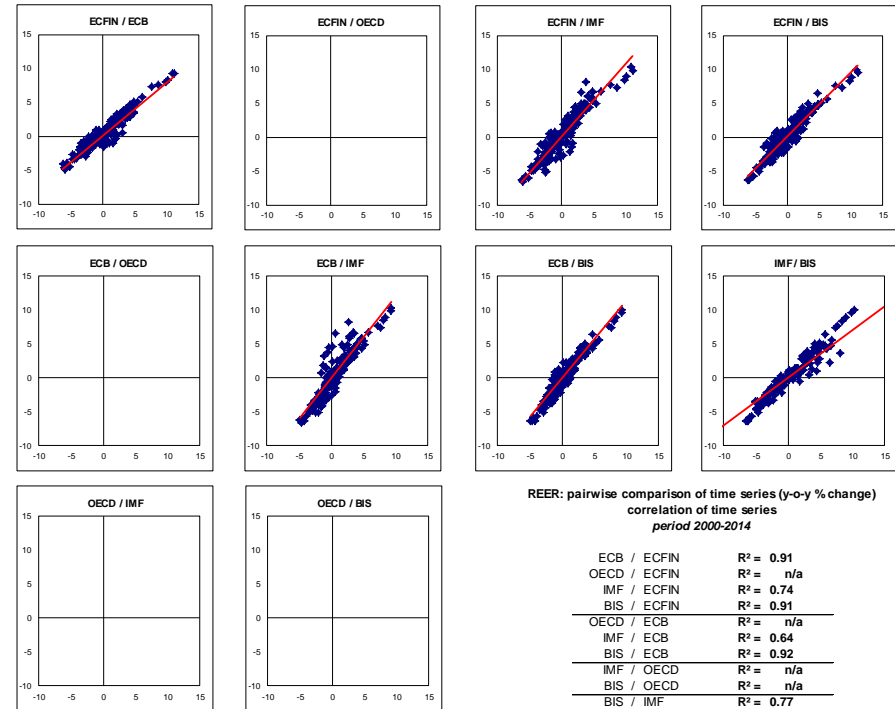
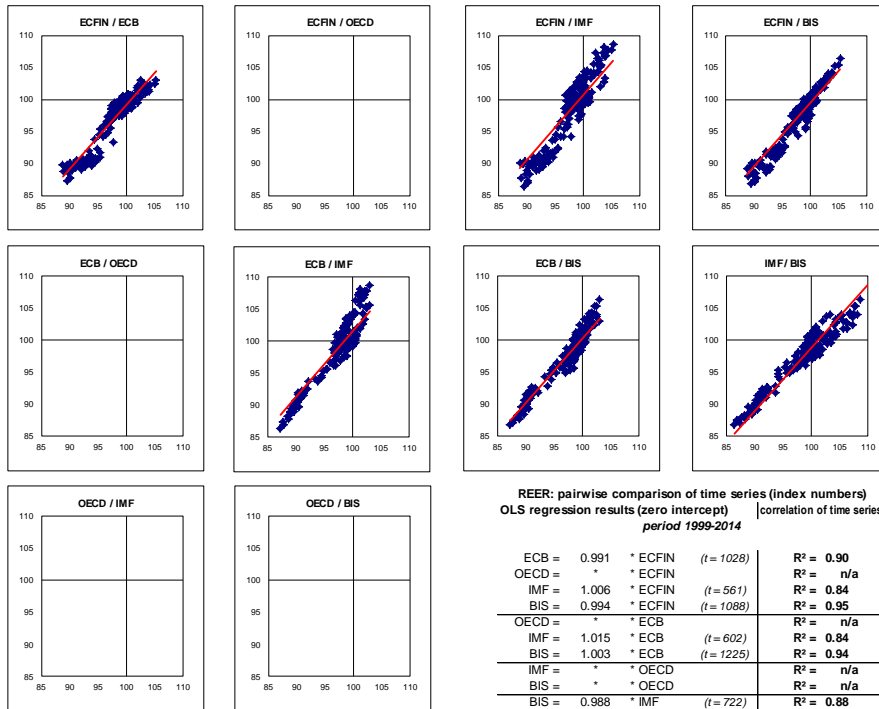
Cyprus: Real Effective Exchange Rates, deflated by HICP/CPI



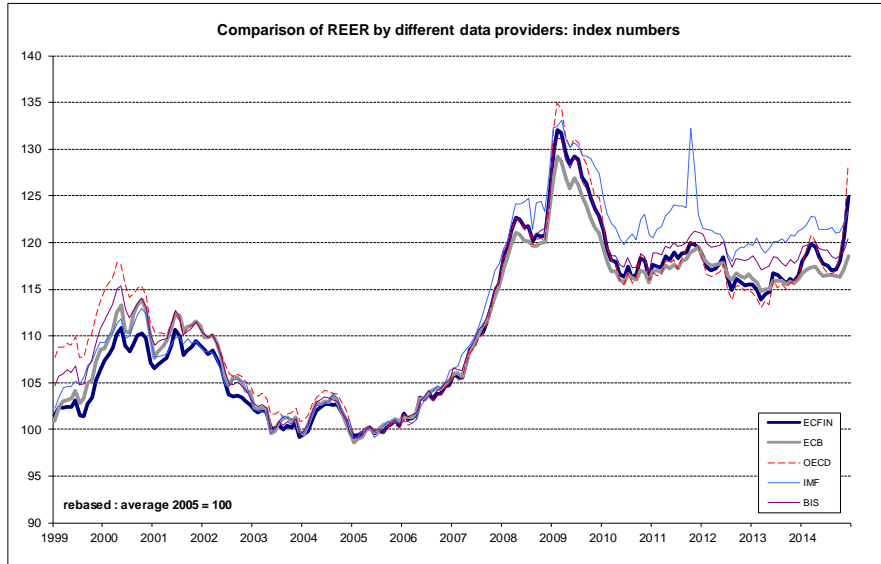
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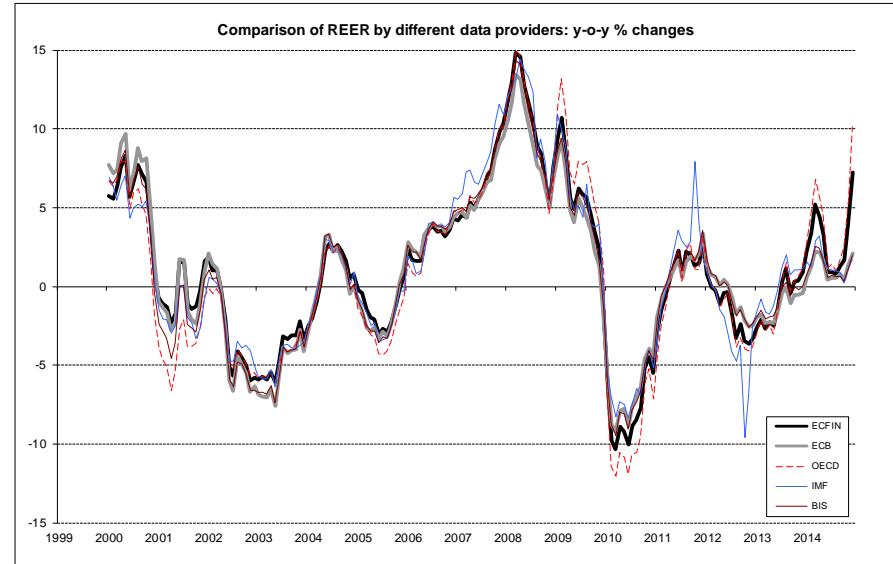
scatter diagrams and fitted trendline (OLS, zero intercept)



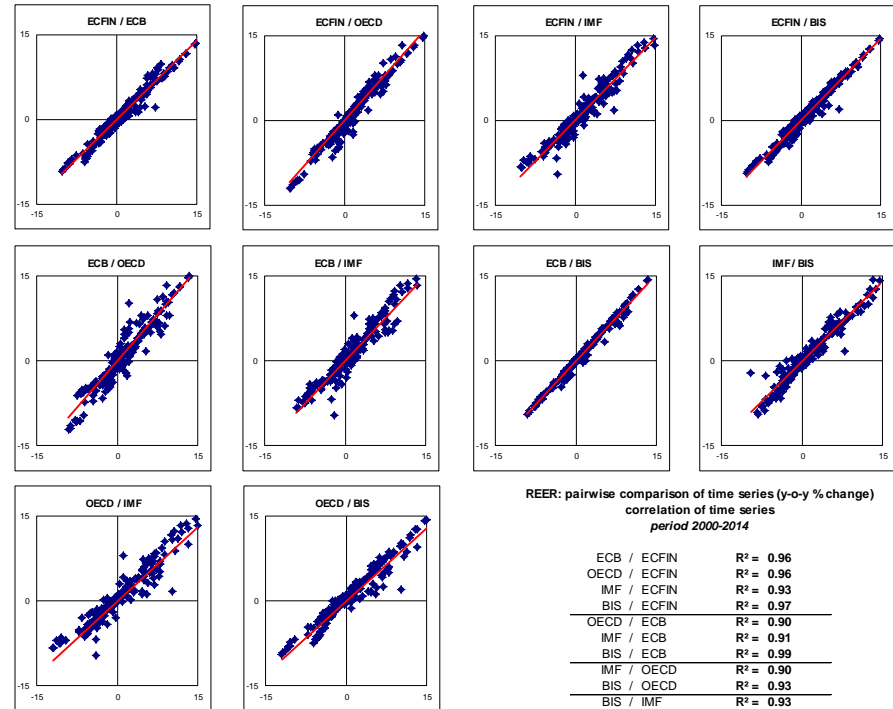
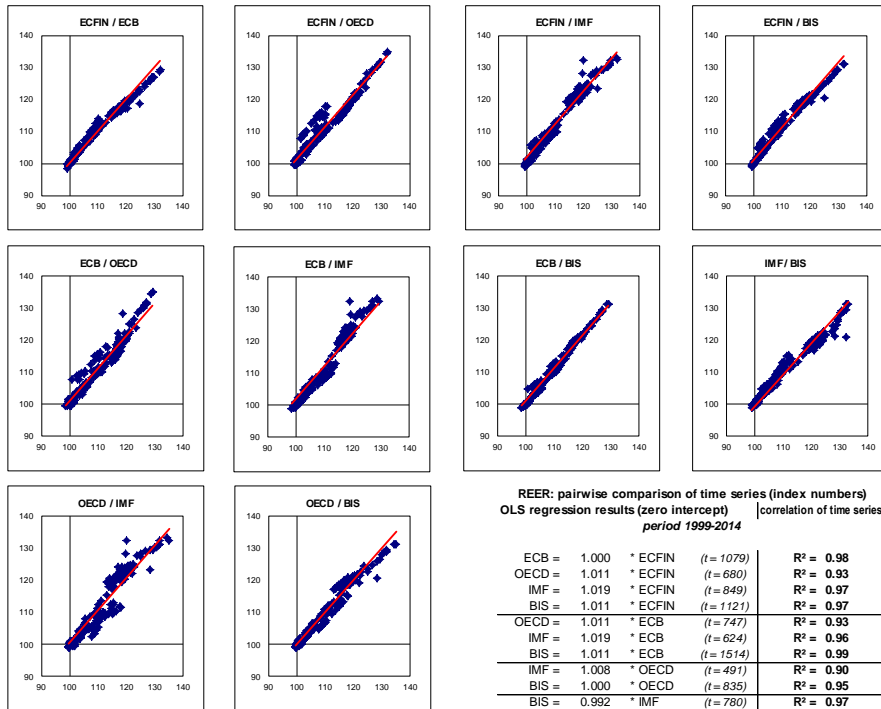
Latvia: Real Effective Exchange Rates, deflated by HICP/CPI



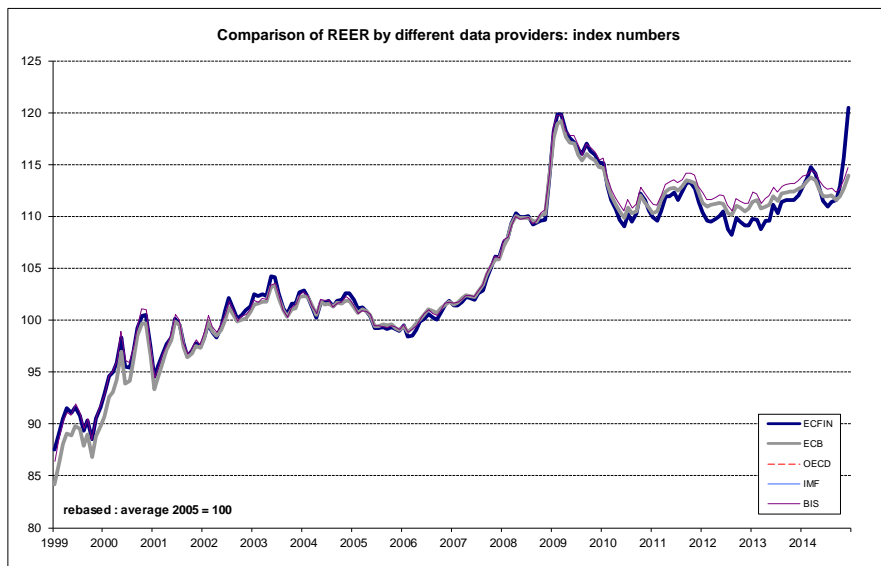
Latvia: Real Effective Exchange Rates, deflated by HICP/CPI



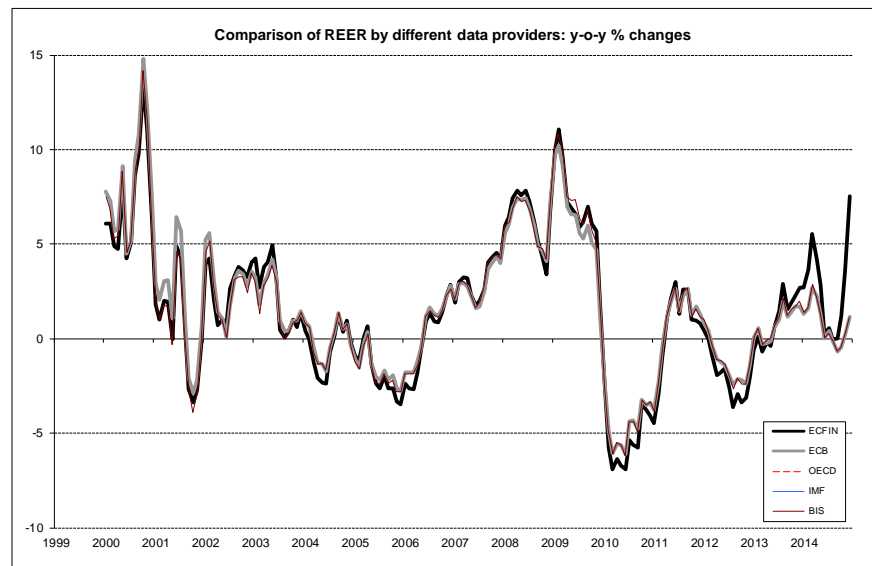
scatter diagrams and fitted trendline (OLS, zero intercept)



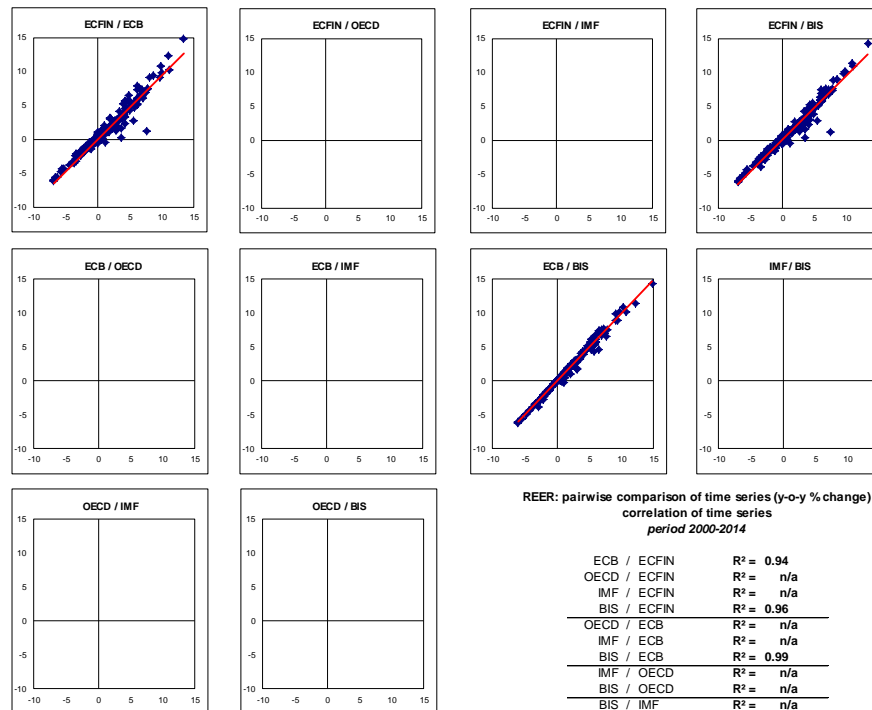
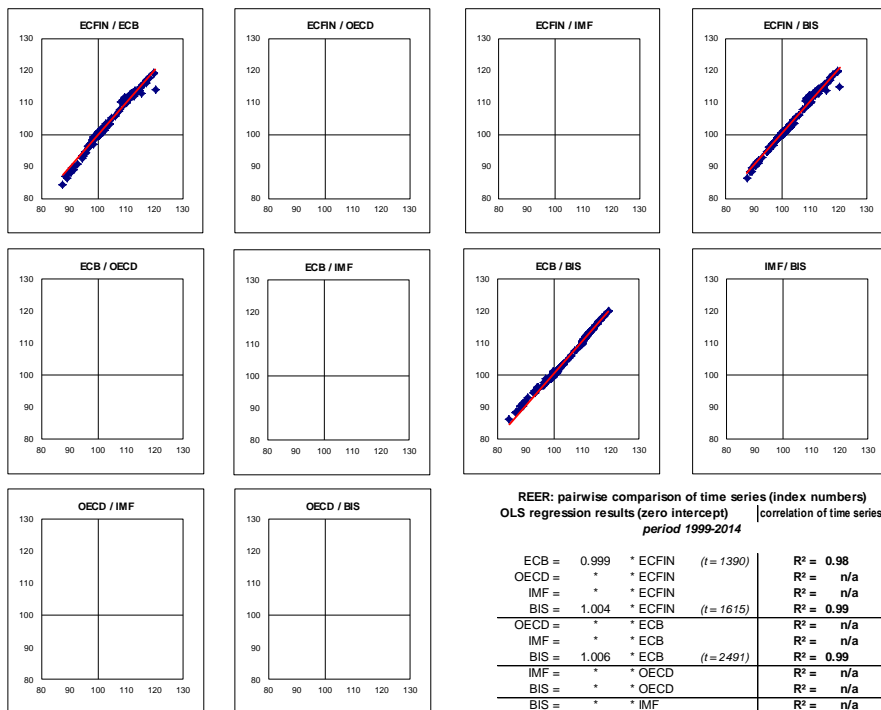
### Lithuania: Real Effective Exchange Rates, deflated by HICP/CPI



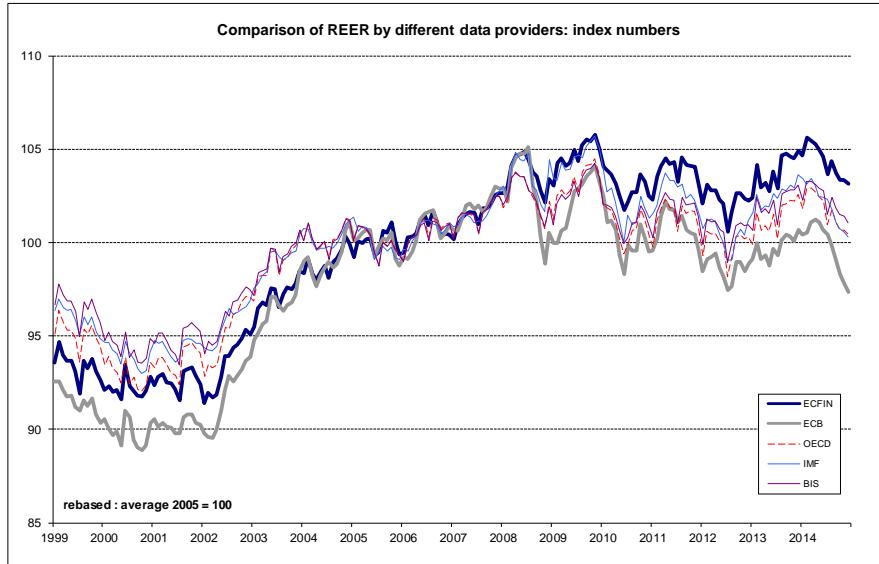
### Lithuania: Real Effective Exchange Rates, deflated by HICP/CPI



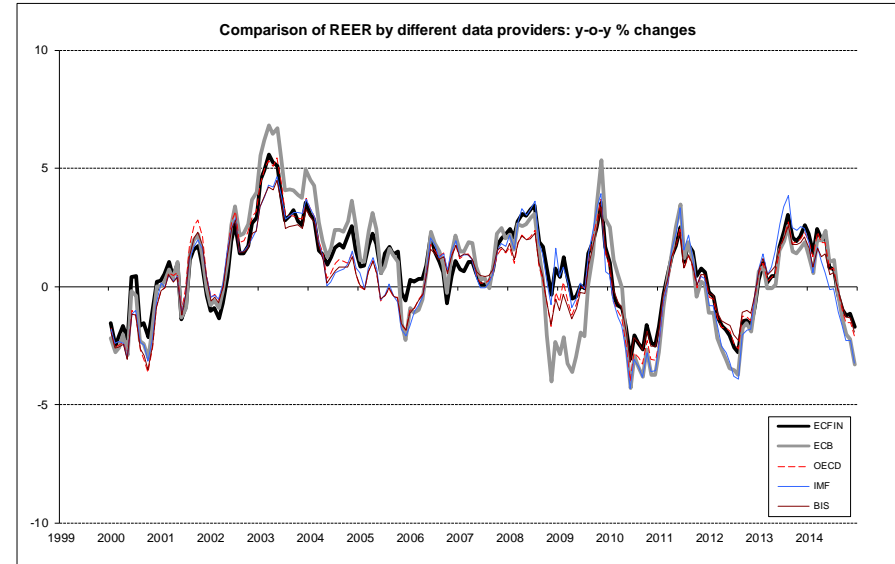
scatter diagrams and fitted trendline (OLS, zero intercept)



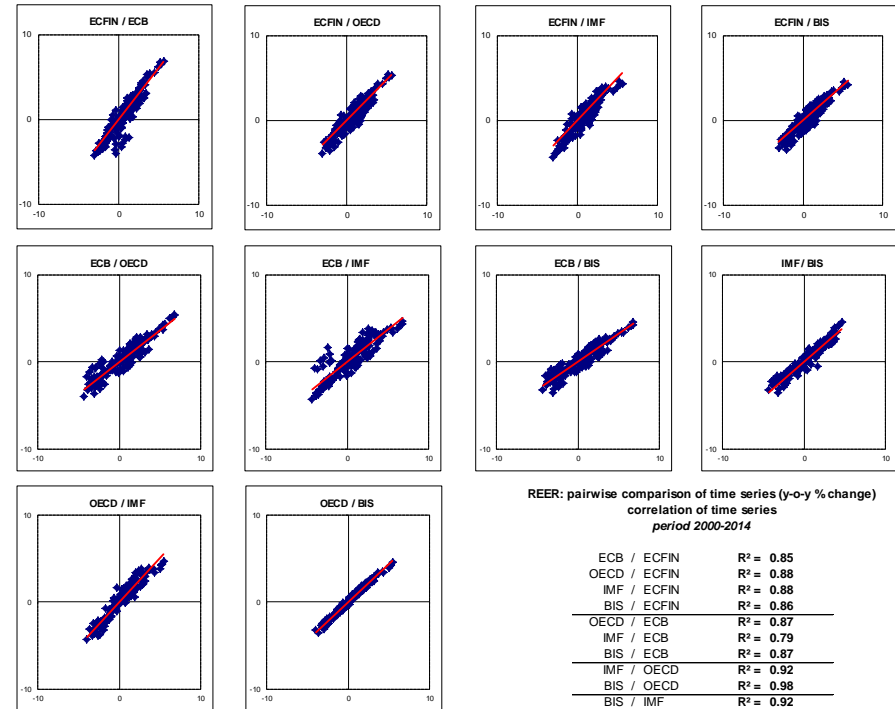
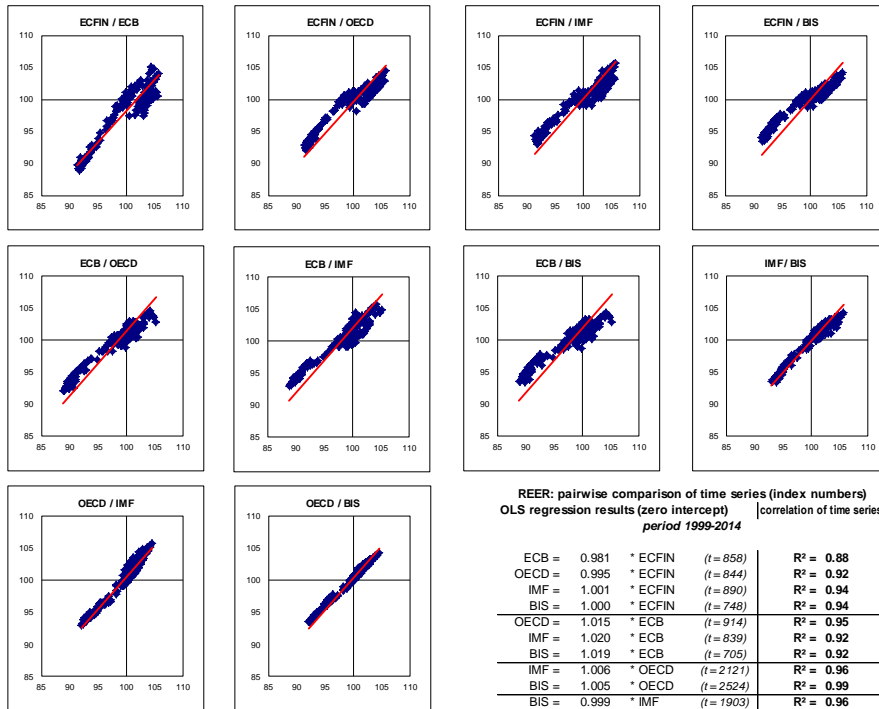
Luxembourg: Real Effective Exchange Rates, deflated by HICP/CPI



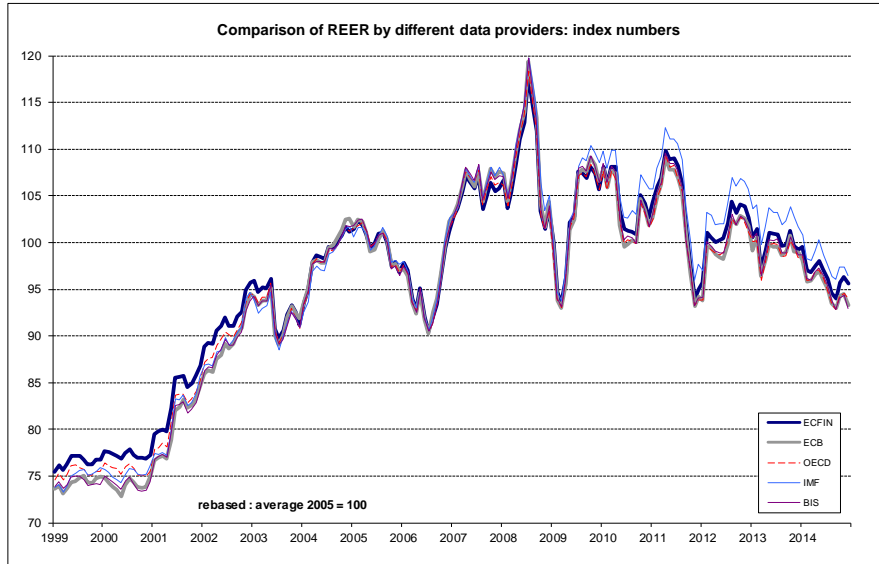
Luxembourg: Real Effective Exchange Rates, deflated by HICP/CPI



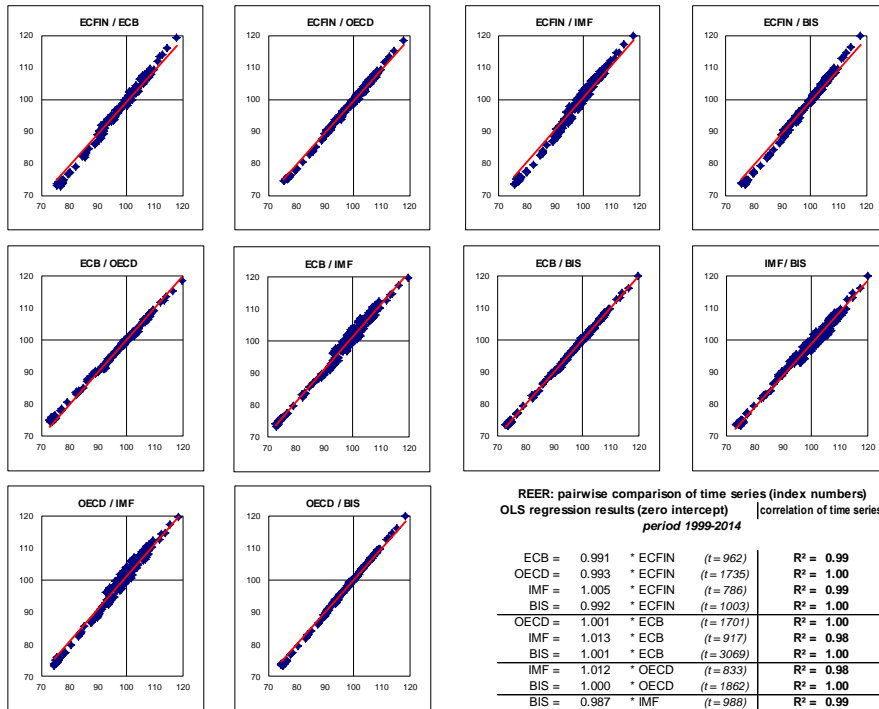
scatter diagrams and fitted trendline (OLS, zero intercept)



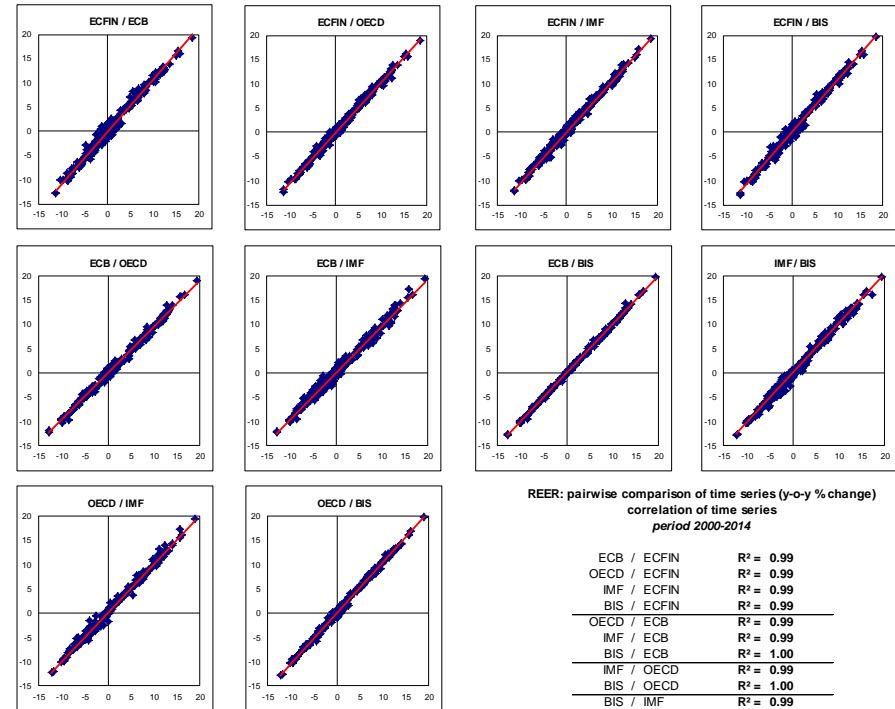
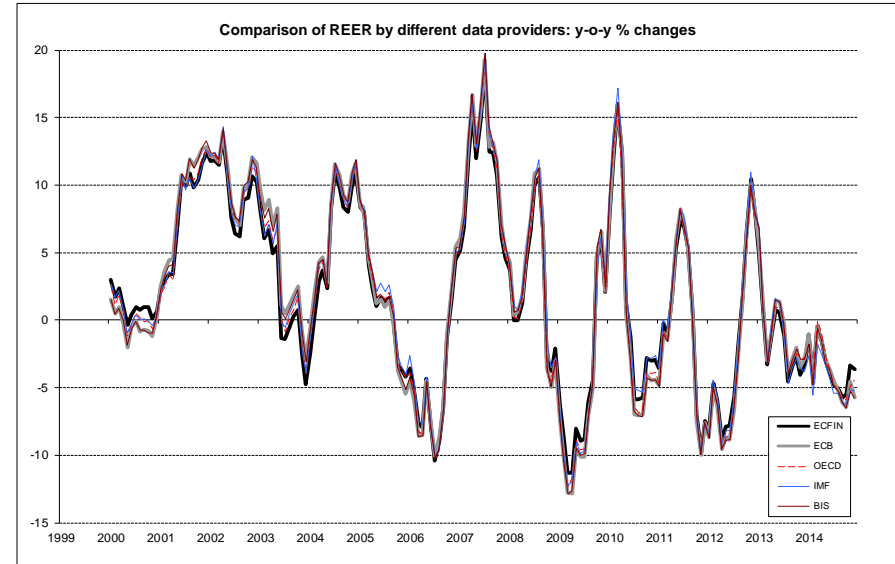
Hungary: Real Effective Exchange Rates, deflated by HICP/CPI



scatter diagrams and fitted trendline (OLS, zero intercept)

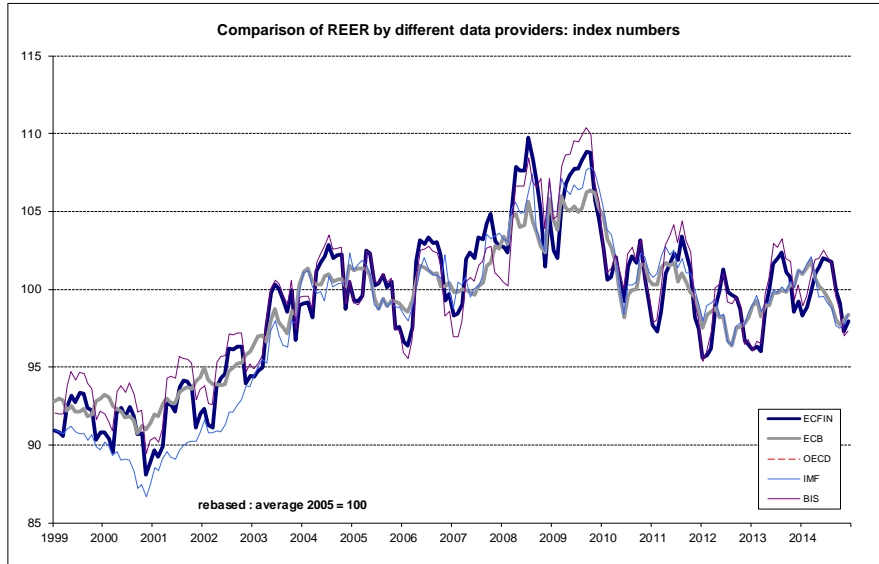


Hungary: Real Effective Exchange Rates, deflated by HICP/CPI

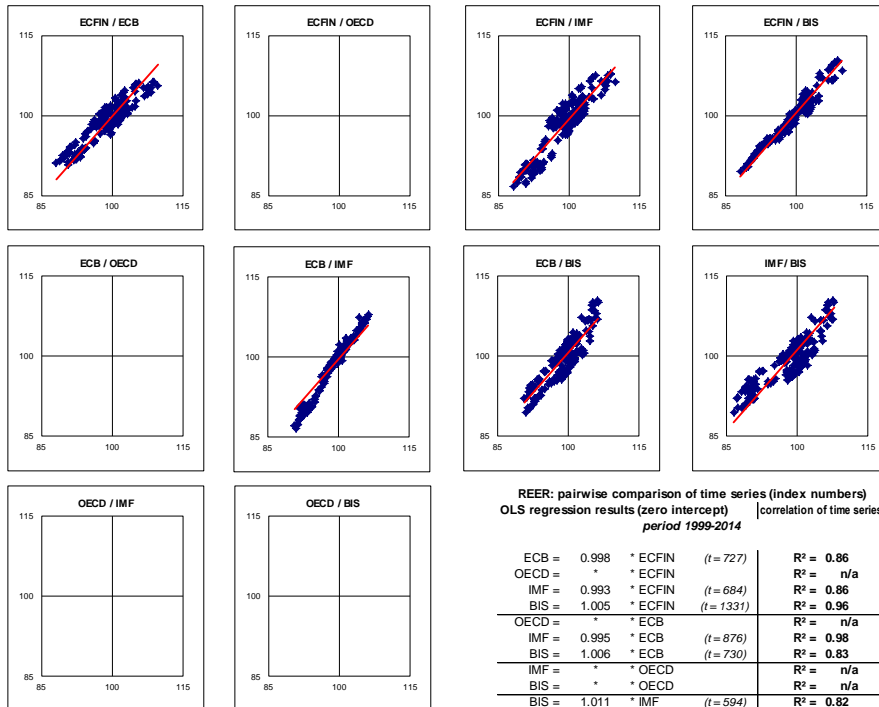




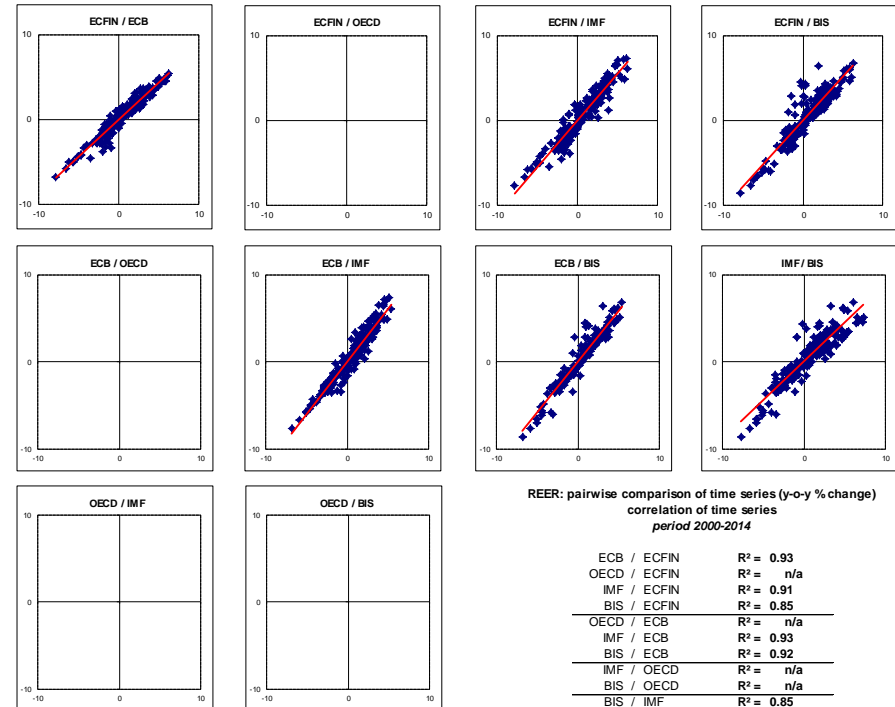
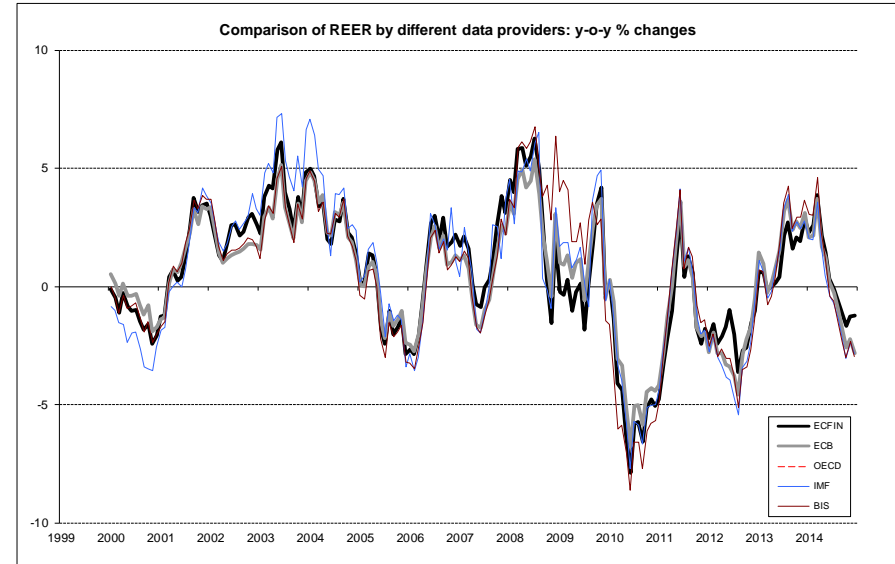
Malta: Real Effective Exchange Rates, deflated by HICP/CPI



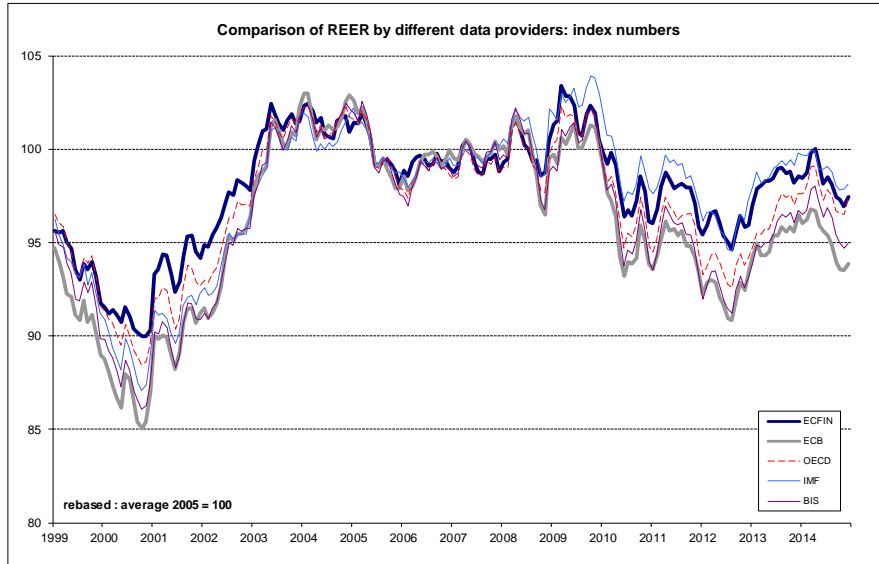
scatter diagrams and fitted trendline (OLS, zero intercept)



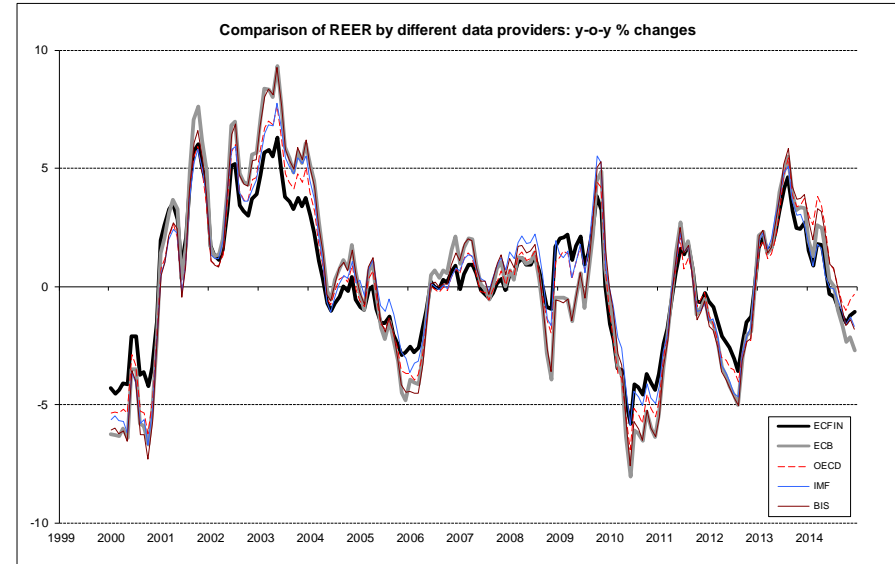
Malta: Real Effective Exchange Rates, deflated by HICP/CPI



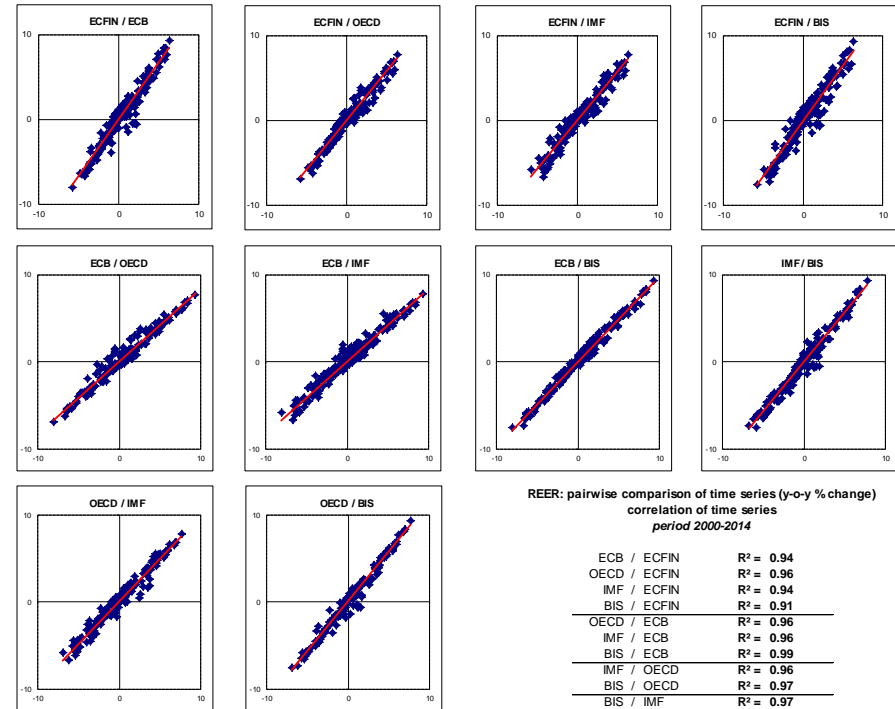
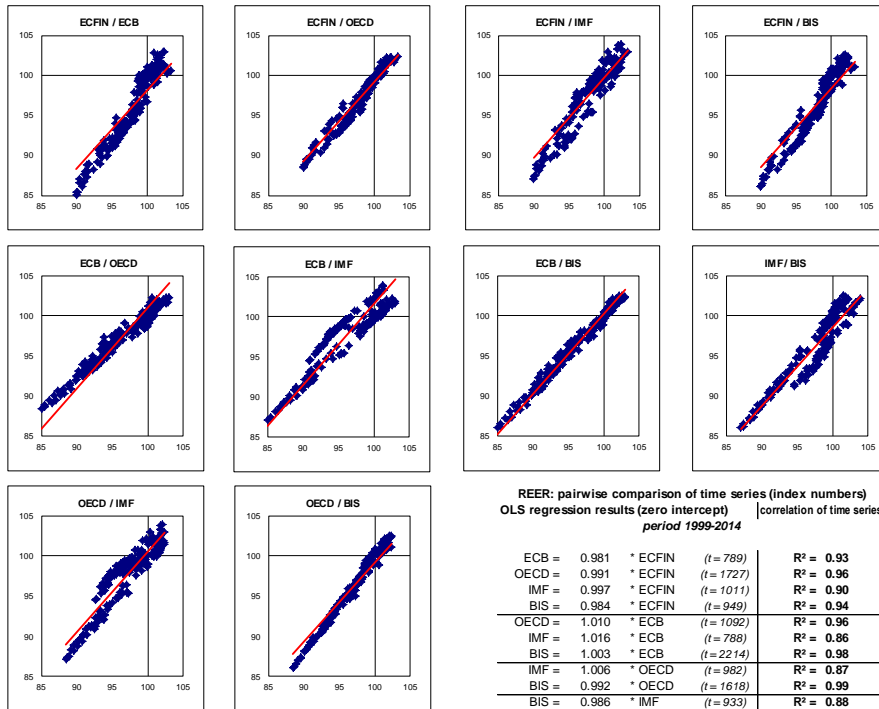
Netherlands: Real Effective Exchange Rates, deflated by HICP/CPI



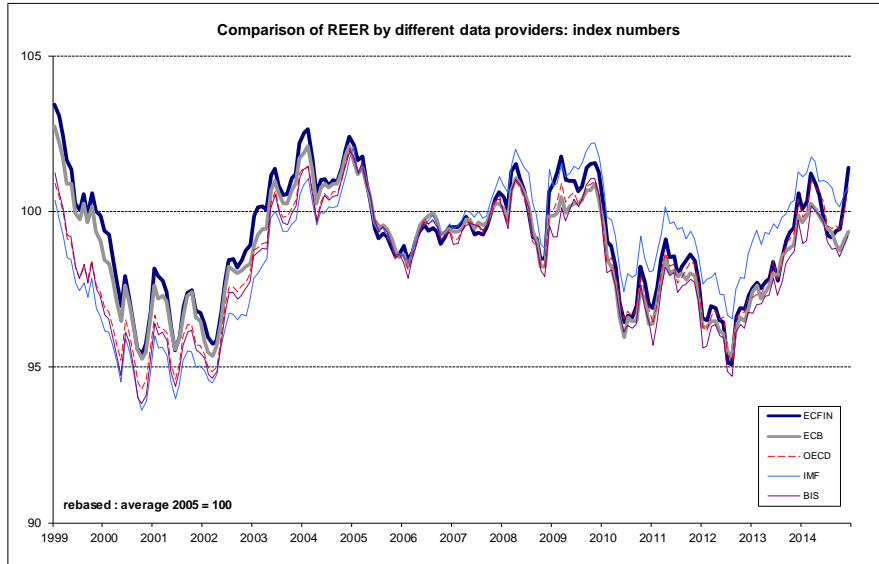
Netherlands: Real Effective Exchange Rates, deflated by HICP/CPI



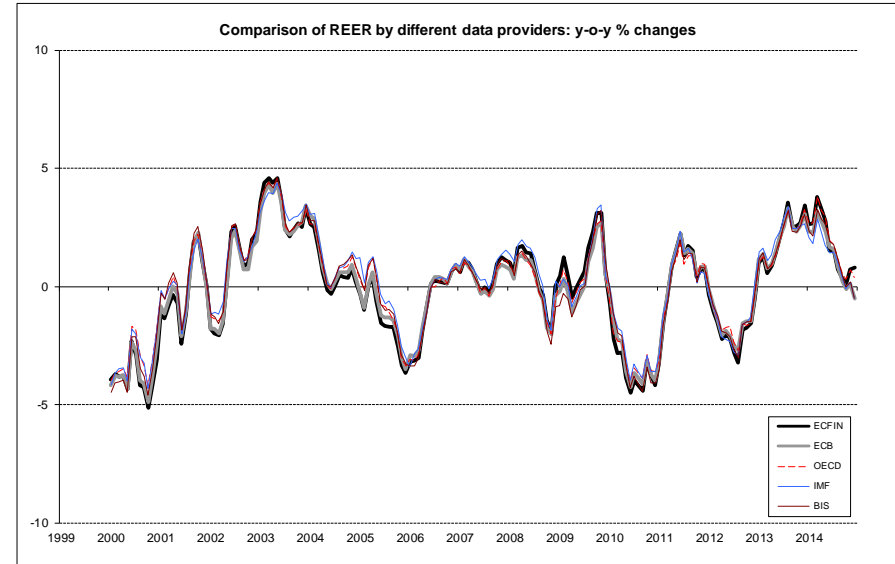
scatter diagrams and fitted trendline (OLS, zero intercept)



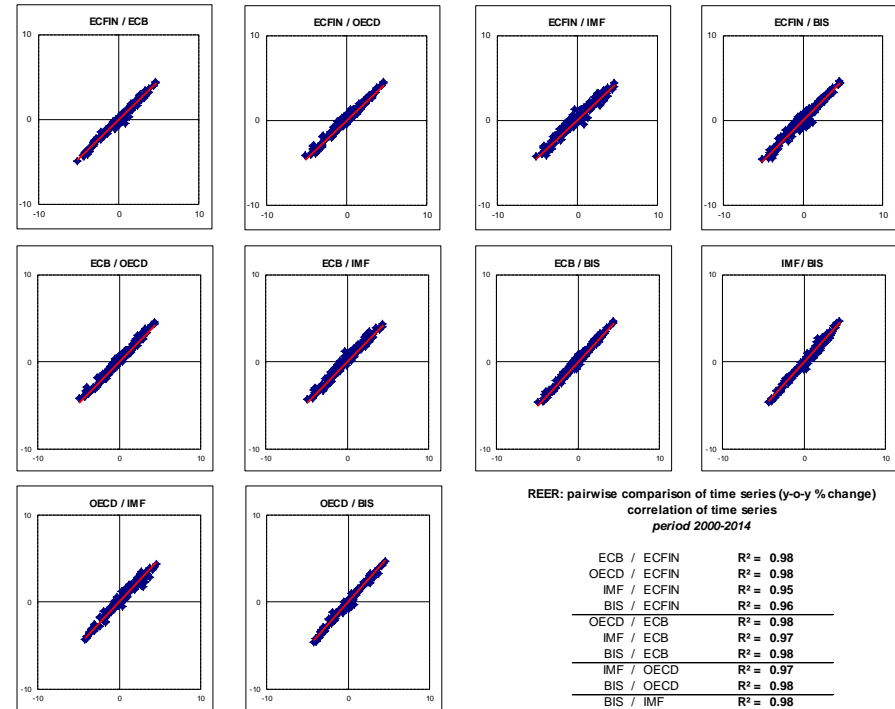
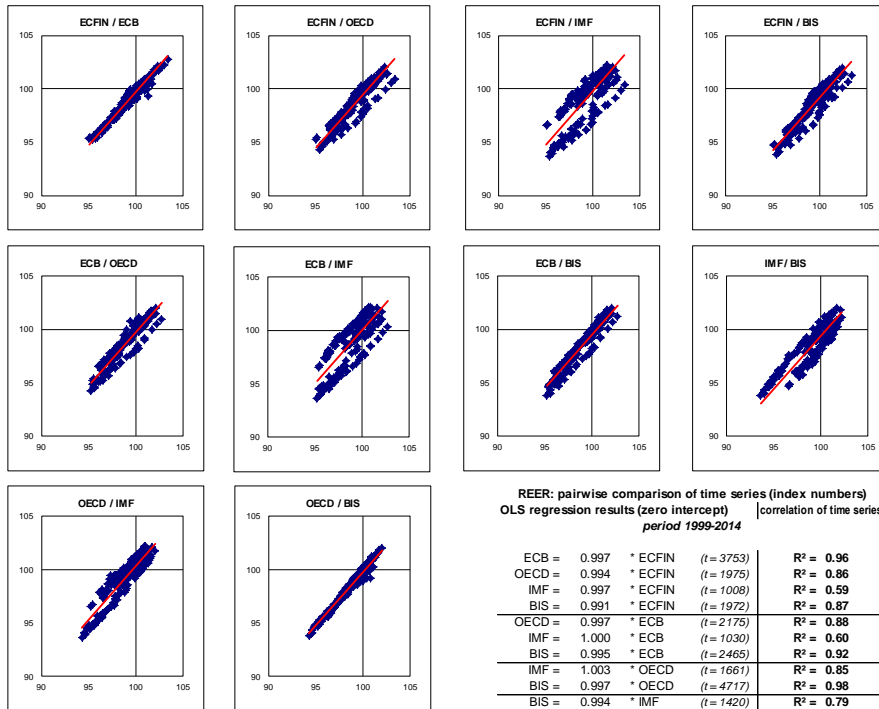
Austria: Real Effective Exchange Rates, deflated by HICP/CPI



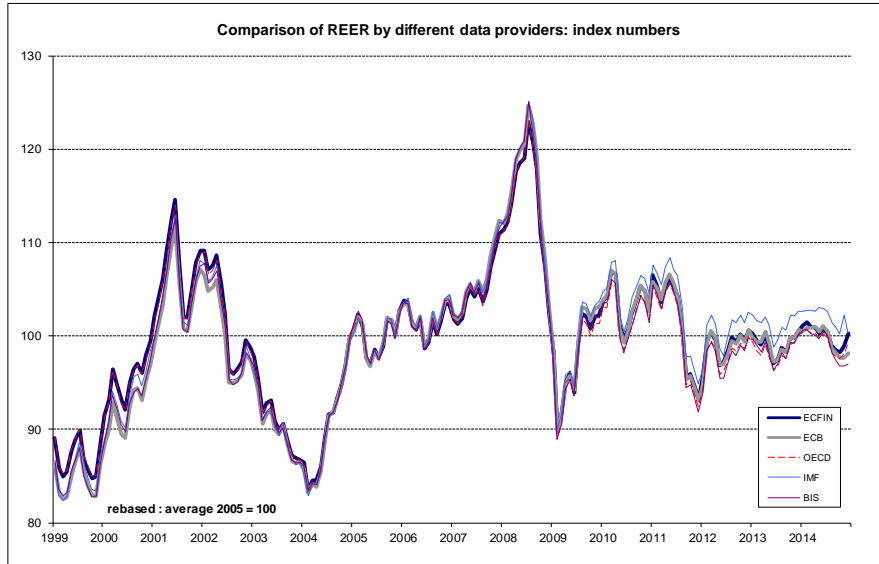
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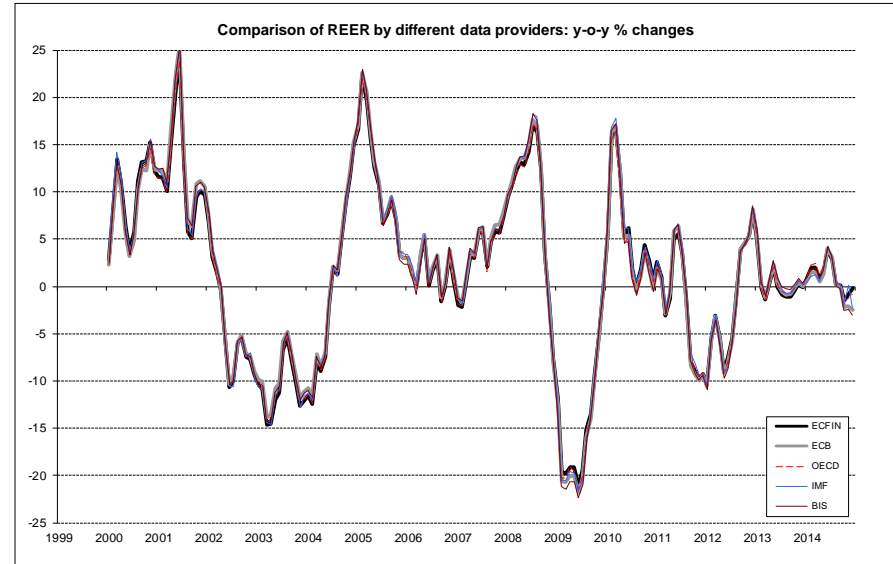
scatter diagrams and fitted trendline (OLS, zero intercept)



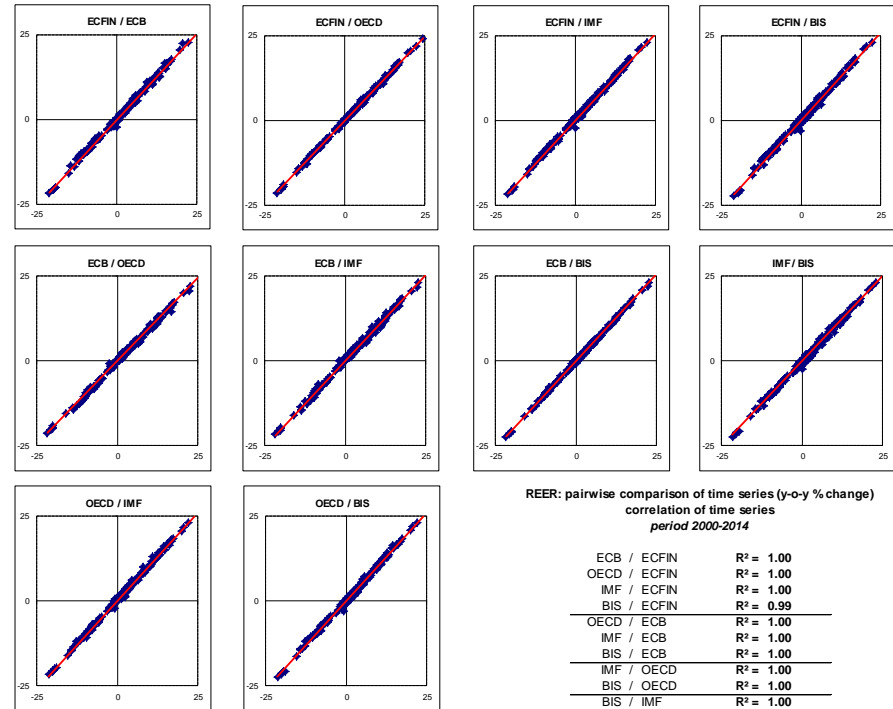
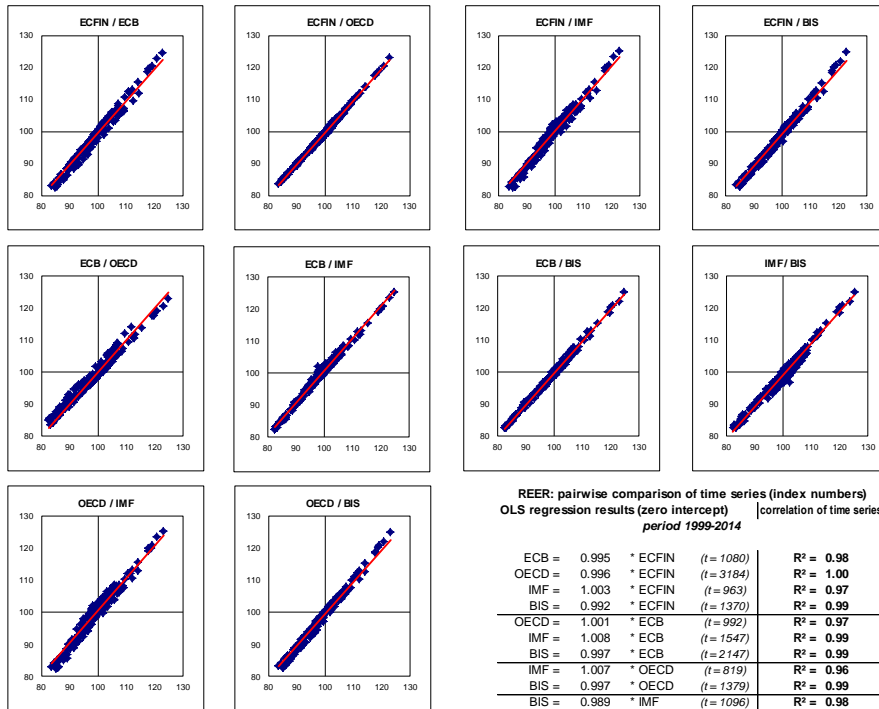
Poland: Real Effective Exchange Rates, deflated by HICP/CPI



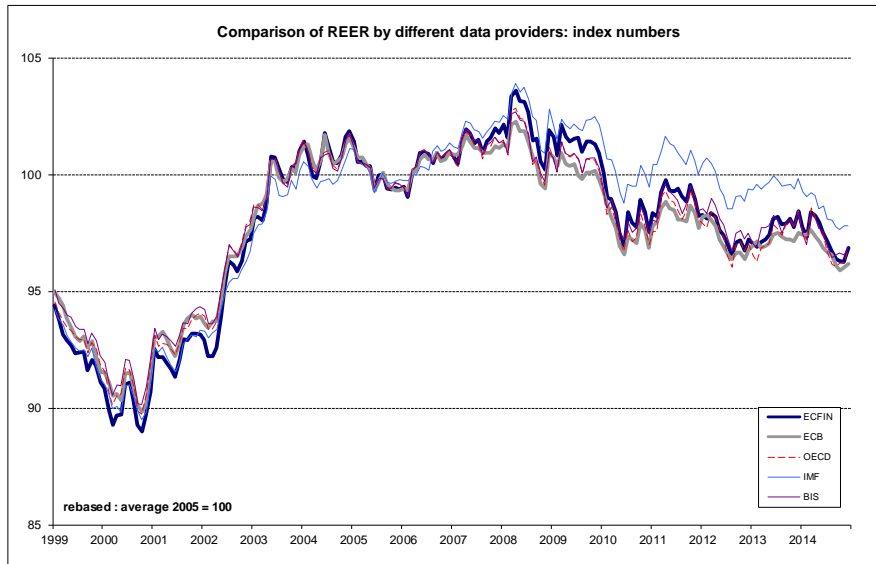
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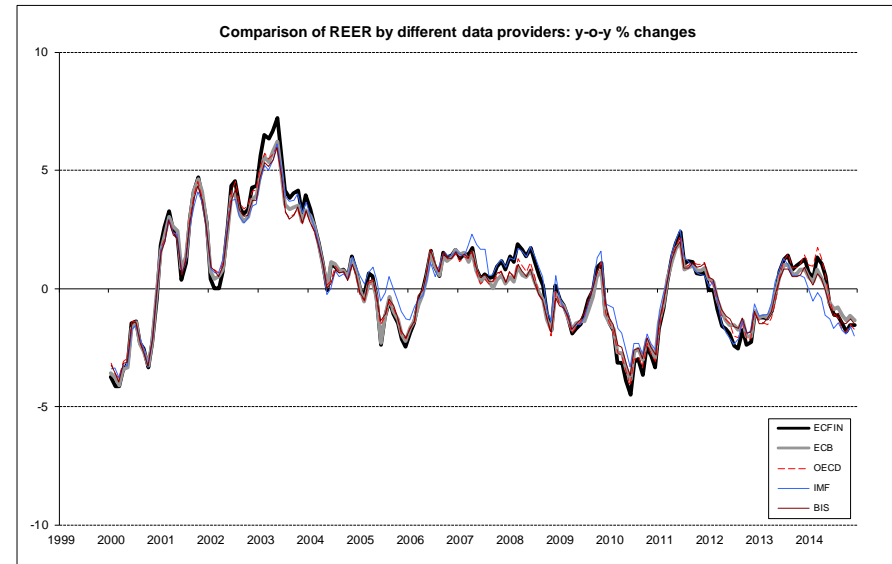
scatter diagrams and fitted trendline (OLS, zero intercept)



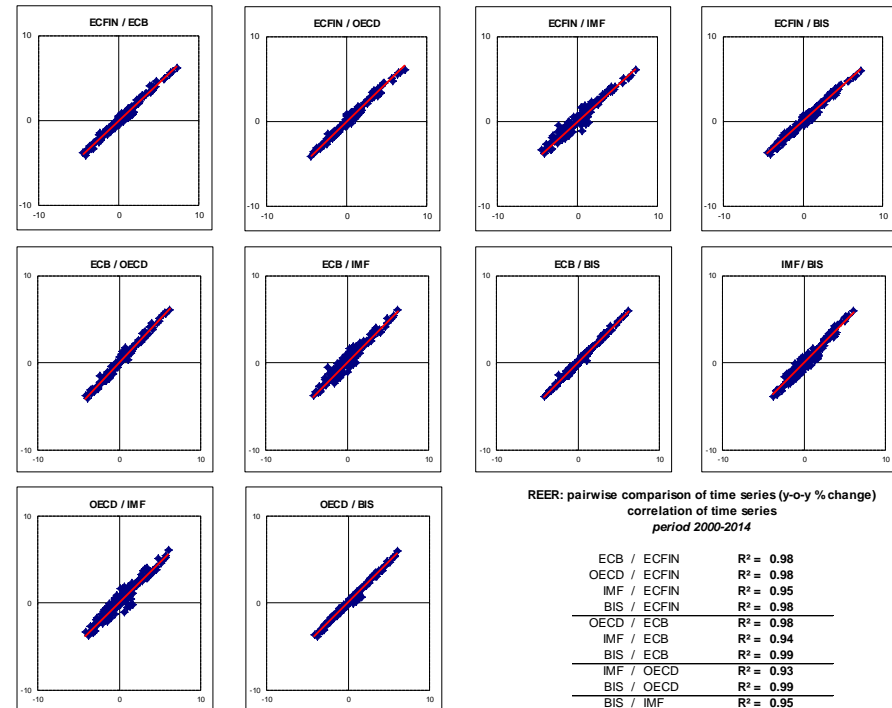
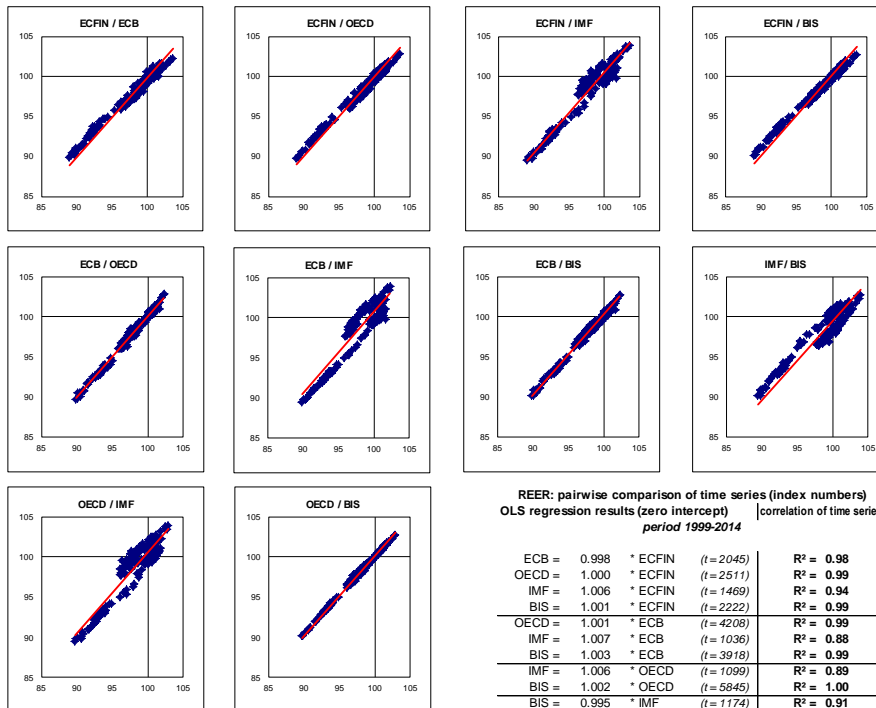
Portugal: Real Effective Exchange Rates, deflated by HICP/CPI



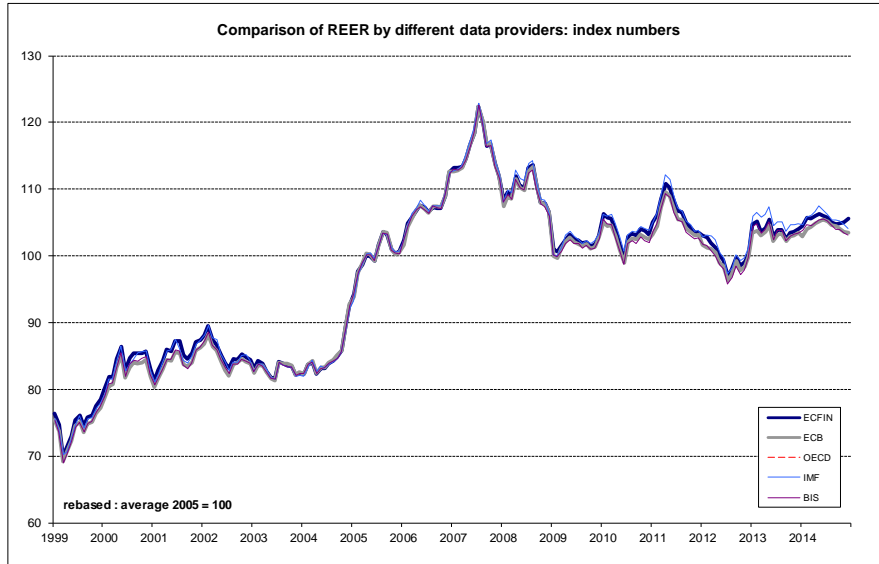
Portugal: Real Effective Exchange Rates, deflated by HICP/CPI



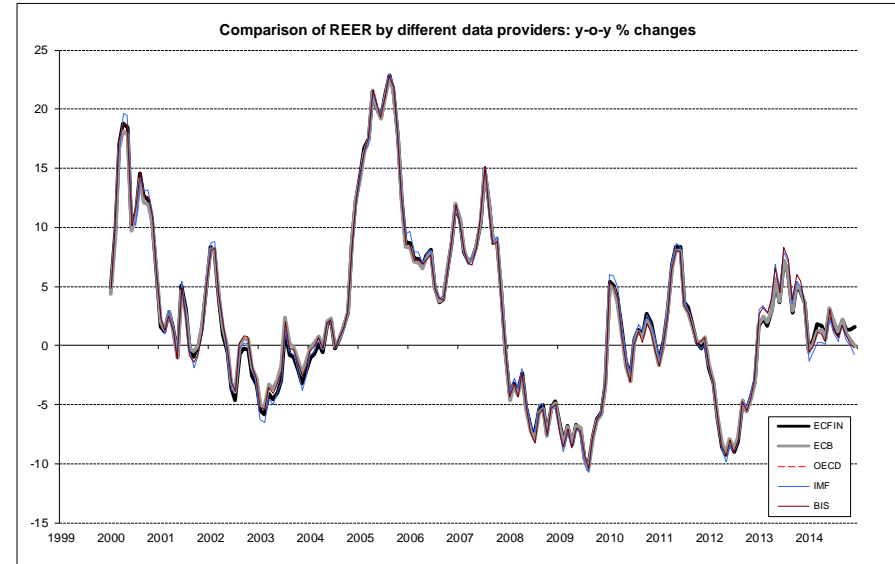
scatter diagrams and fitted trendline (OLS, zero intercept)



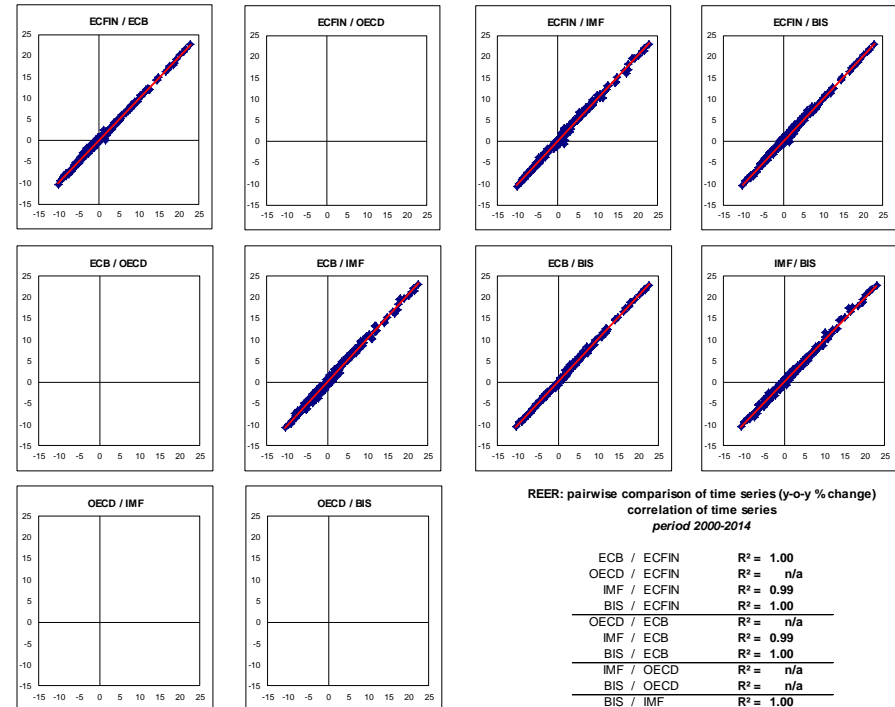
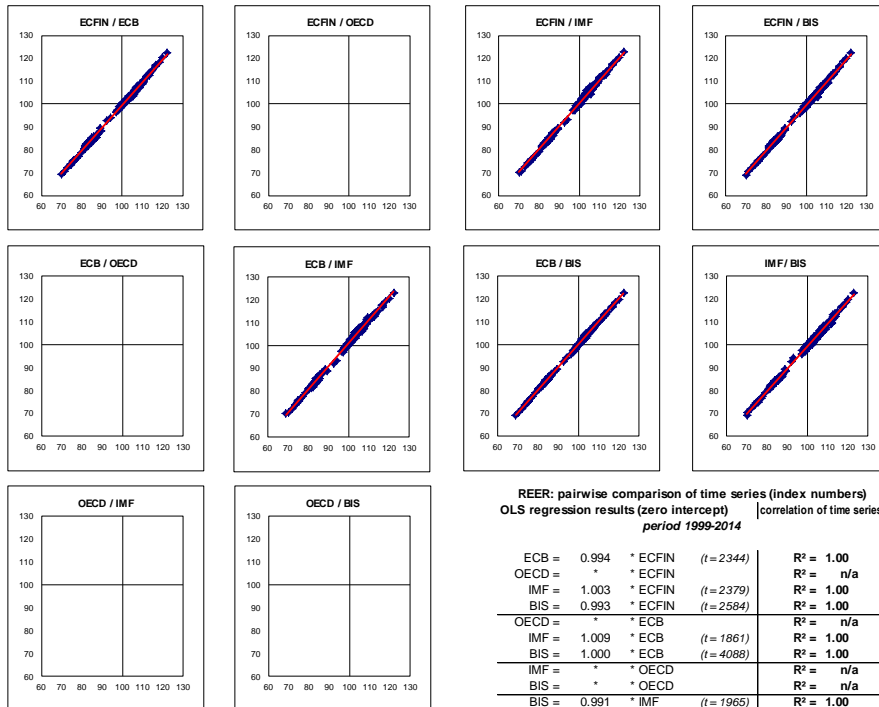
Romania: Real Effective Exchange Rates, deflated by HICP/CPI



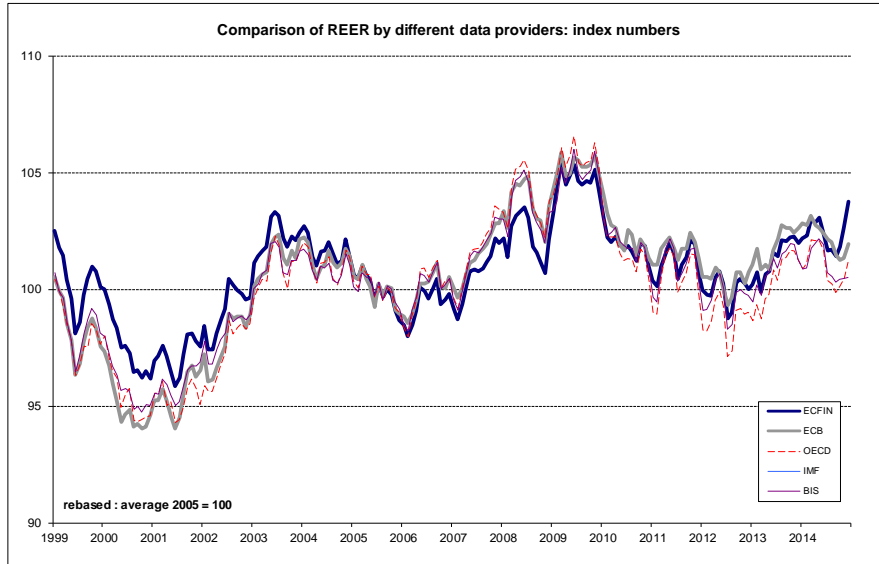
Romania: Real Effective Exchange Rates, deflated by HICP/CPI



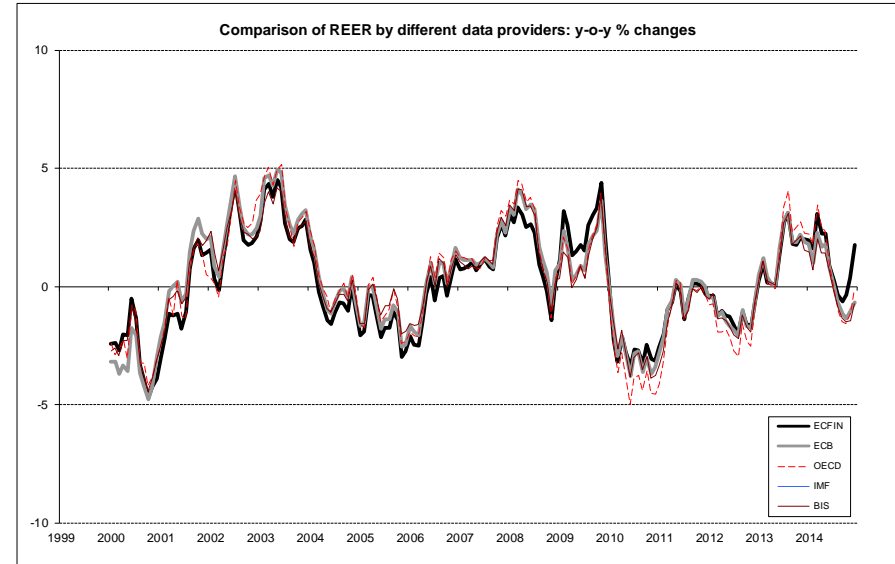
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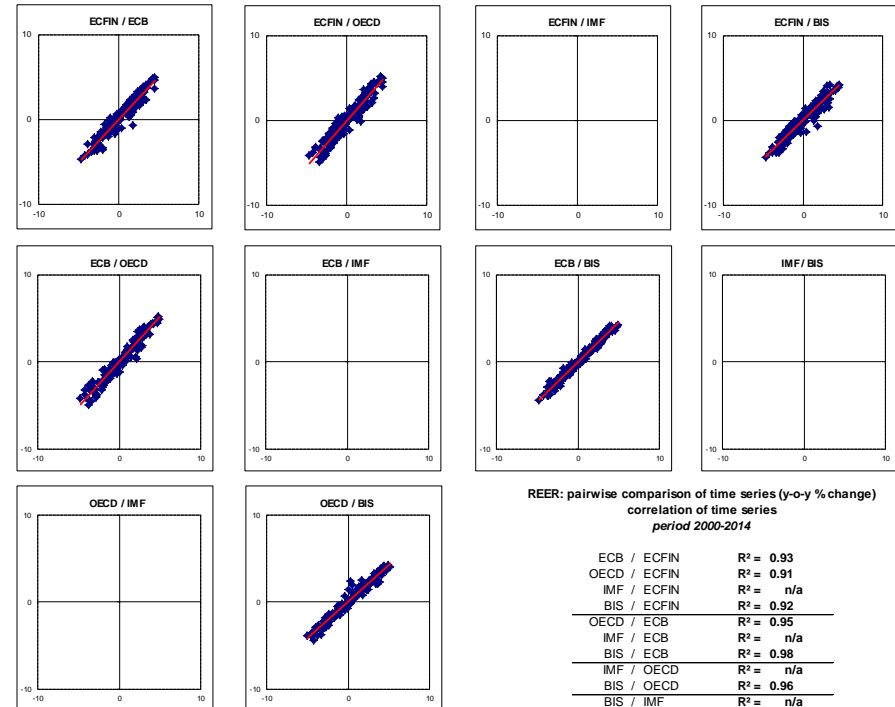
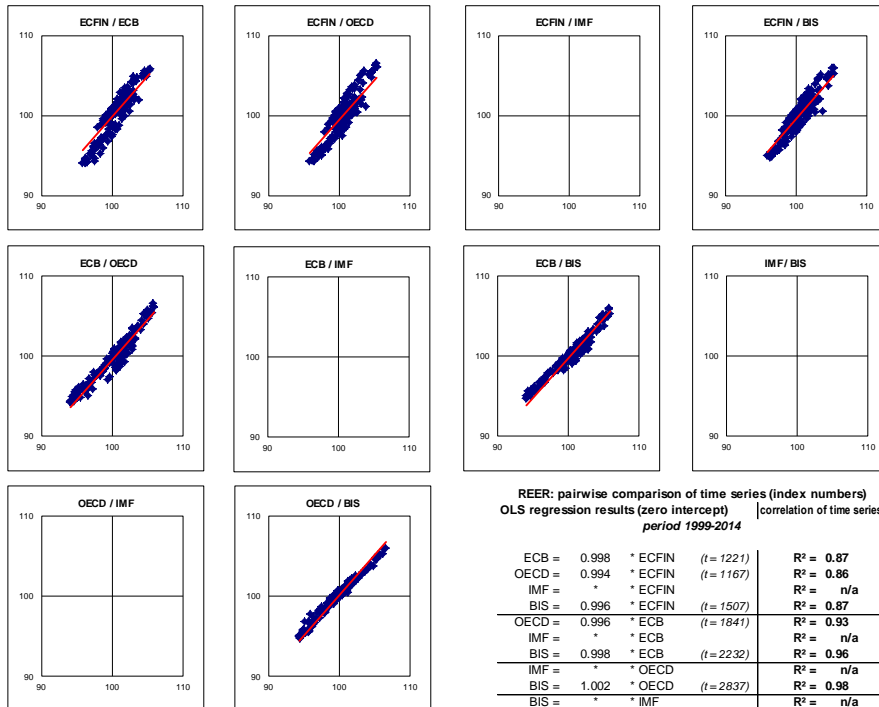
Slovenia: Real Effective Exchange Rates, deflated by HICP/CPI



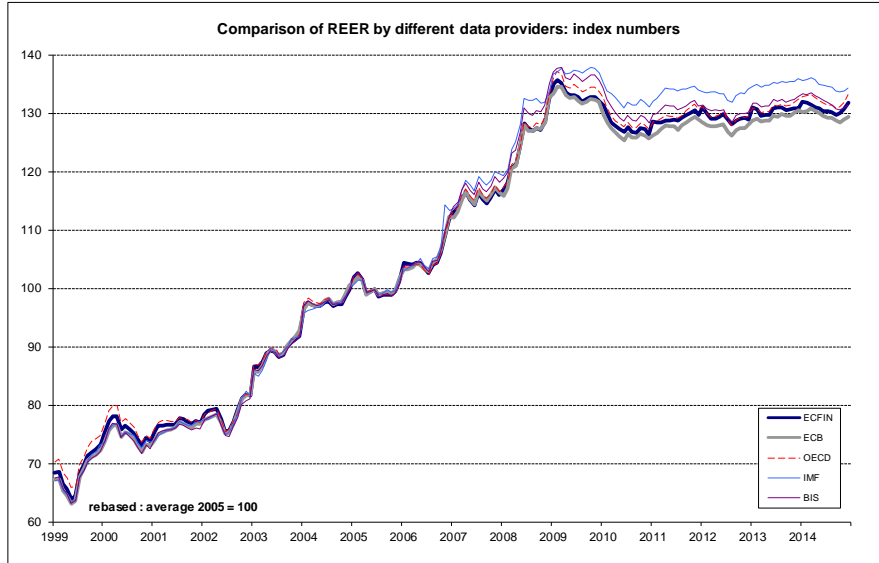
Slovenia: Real Effective Exchange Rates, deflated by HICP/CPI



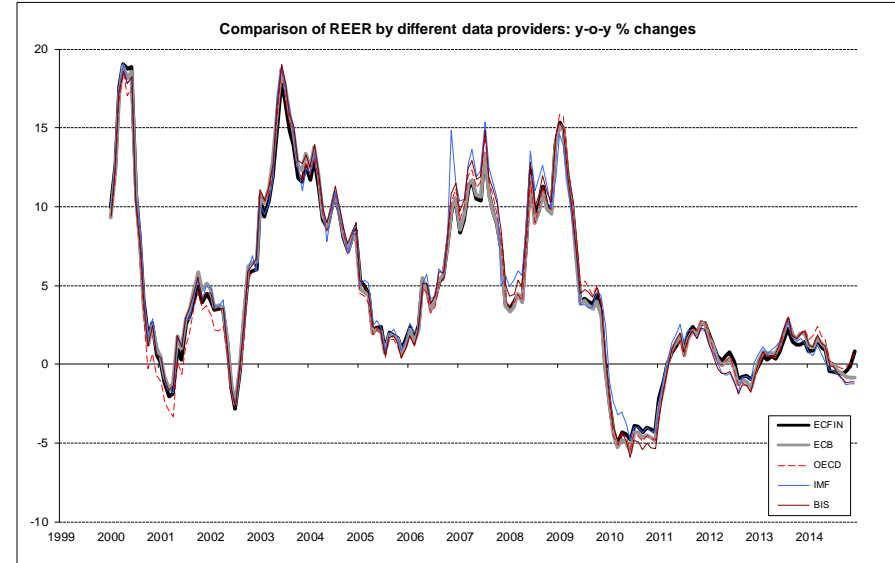
scatter diagrams and fitted trendline (OLS, zero intercept)



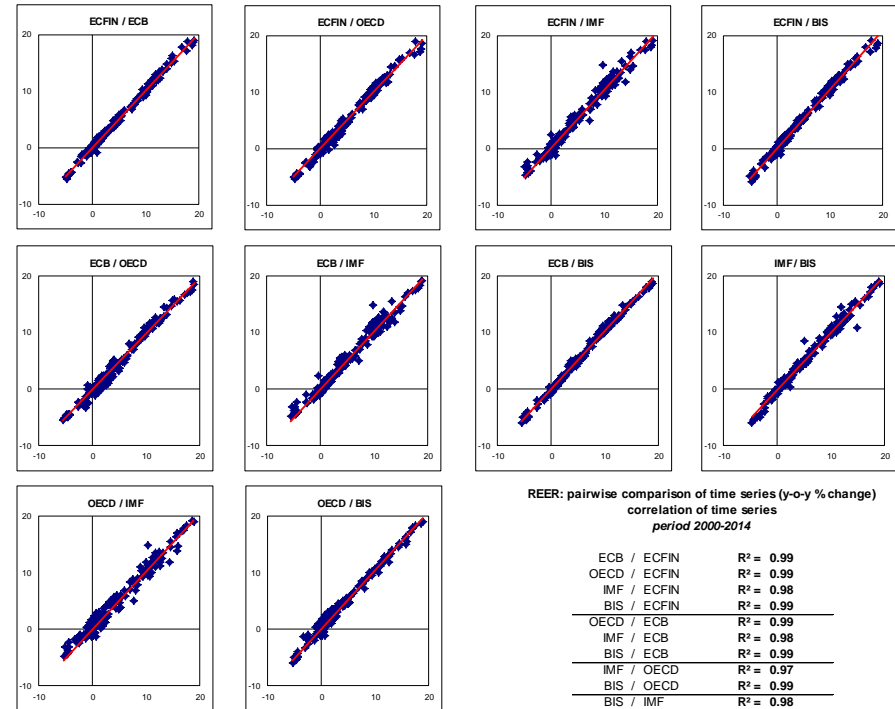
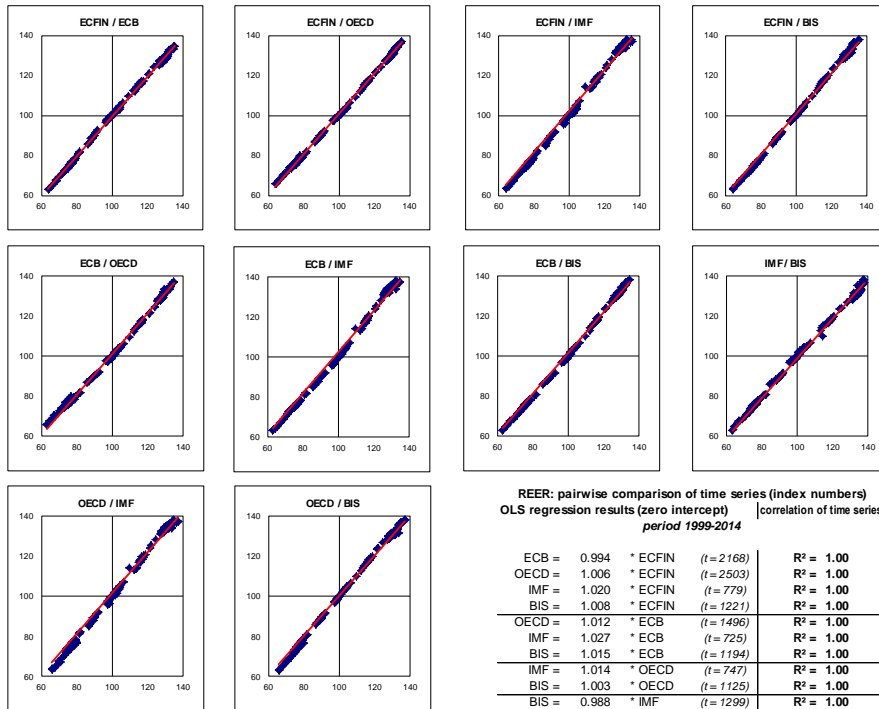
Slovakia: Real Effective Exchange Rates, deflated by HICP/CPI



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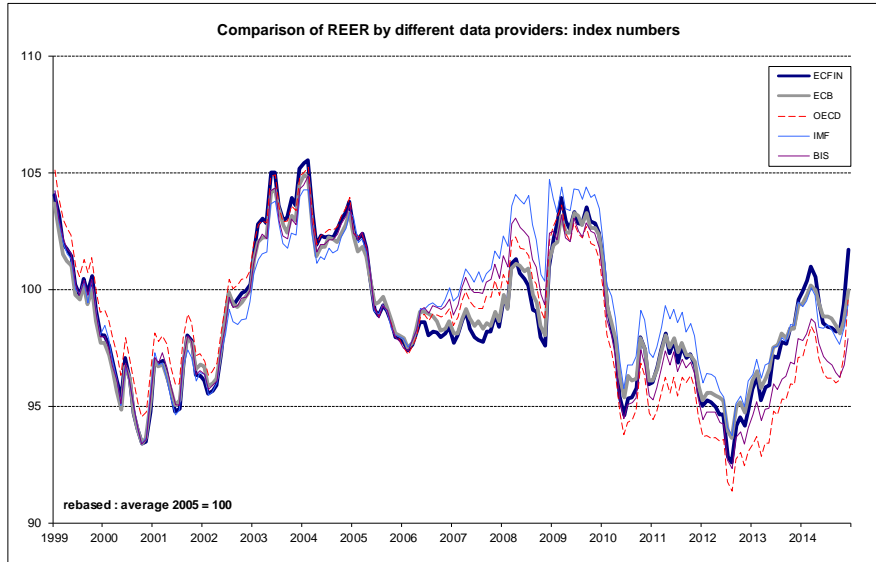


scatter diagrams and fitted trendline (OLS, zero intercept)

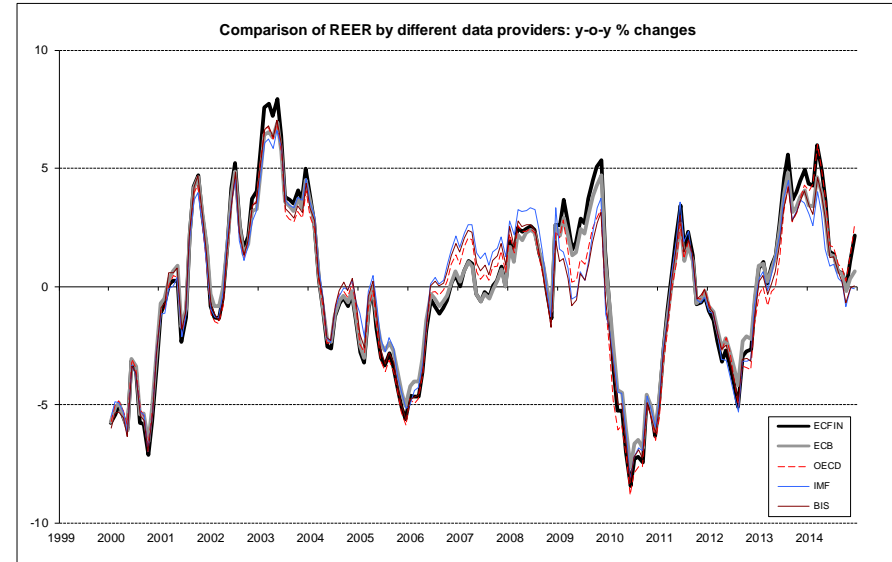




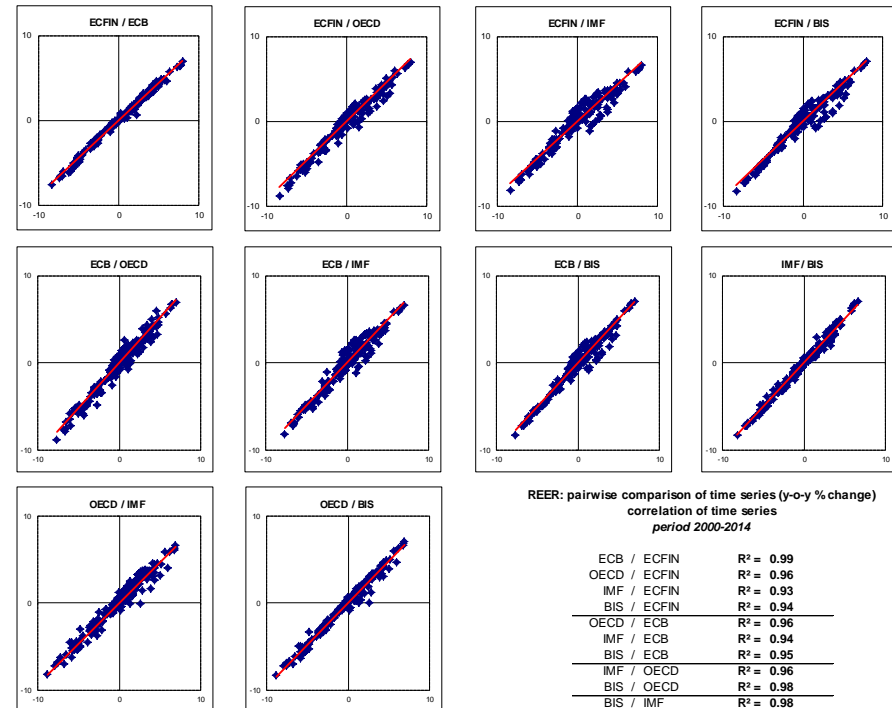
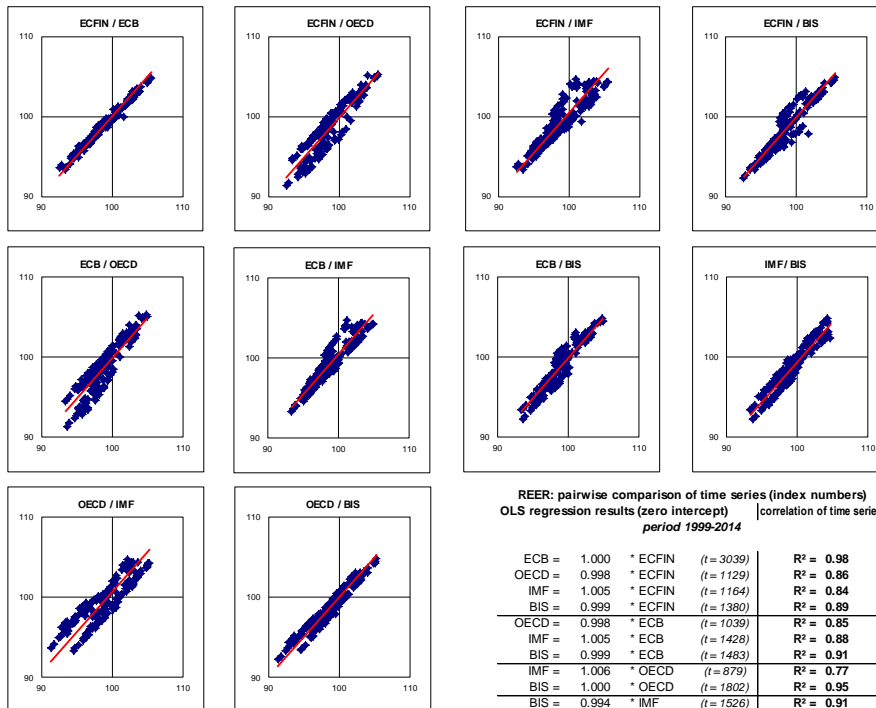
Finland: Real Effective Exchange Rates, deflated by HICP/CPI



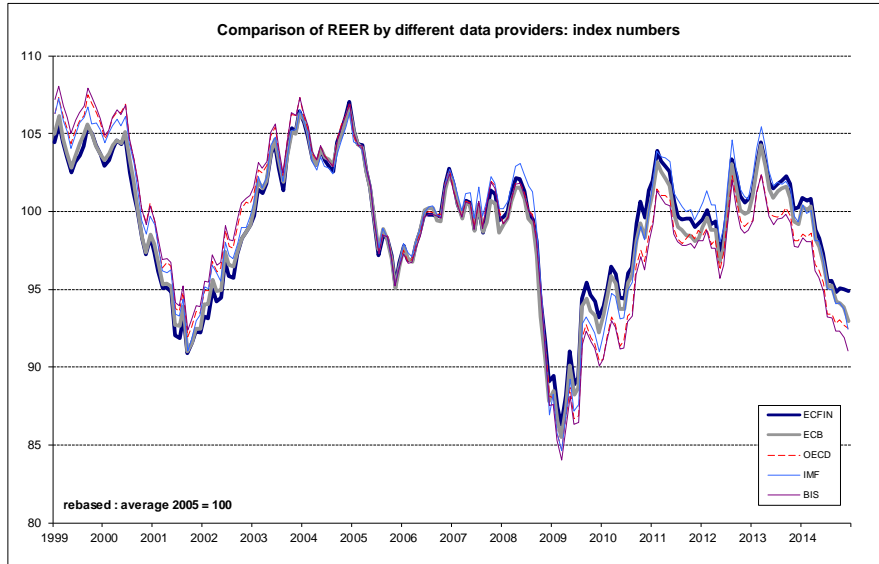
Finland: Real Effective Exchange Rates, deflated by HICP/CPI



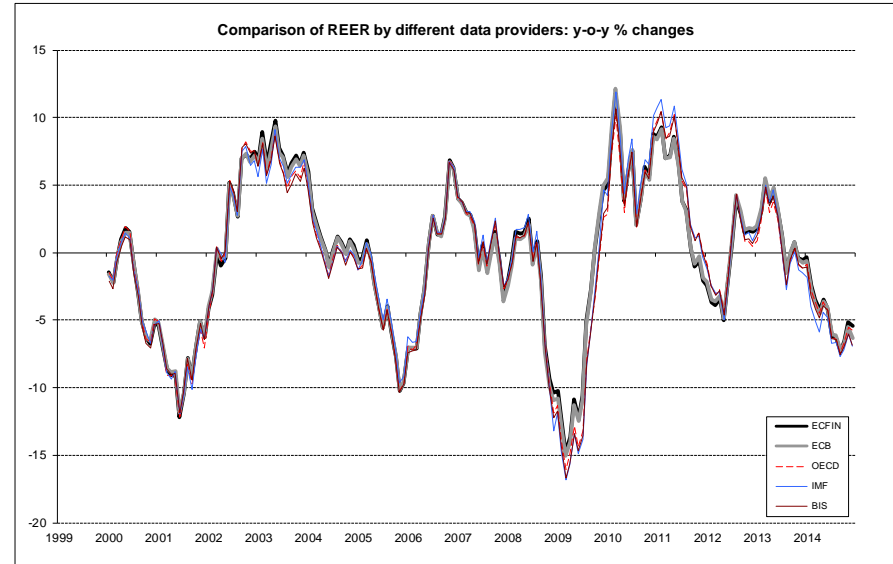
scatter diagrams and fitted trendline (OLS, zero intercept)



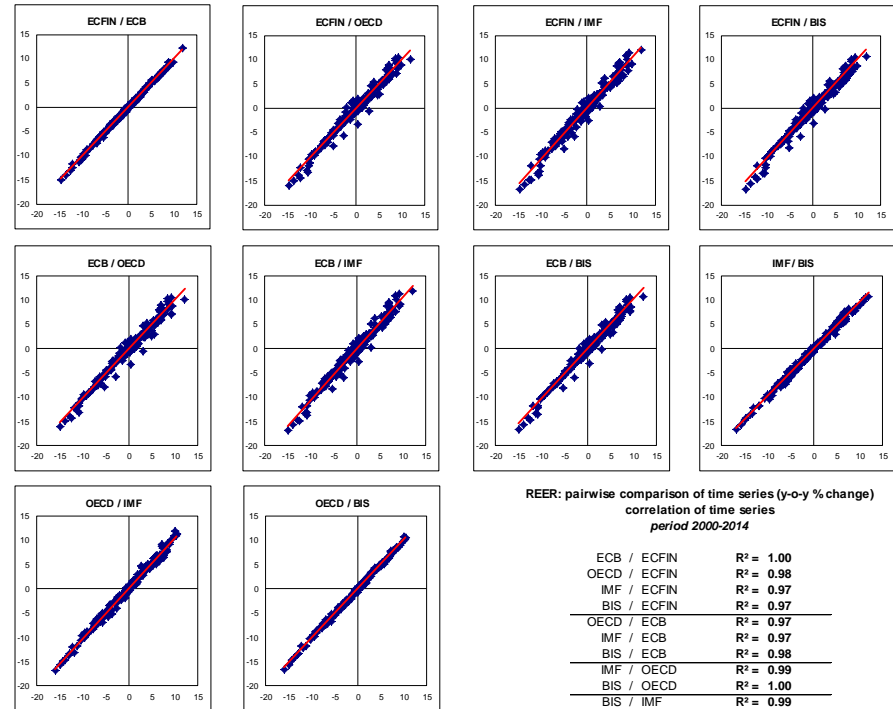
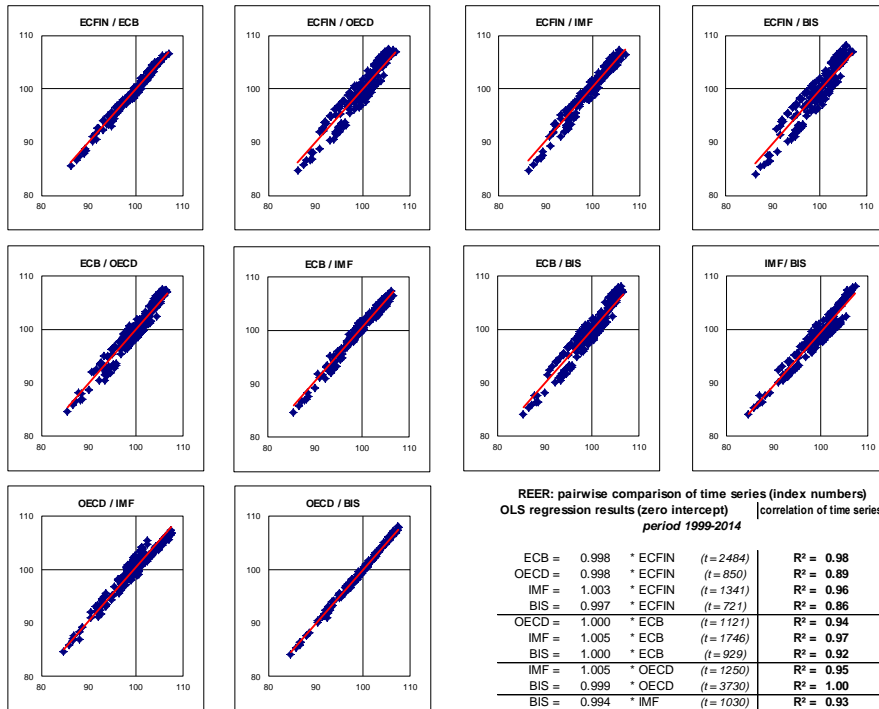
Sweden: Real Effective Exchange Rates, deflated by HICP/CPI



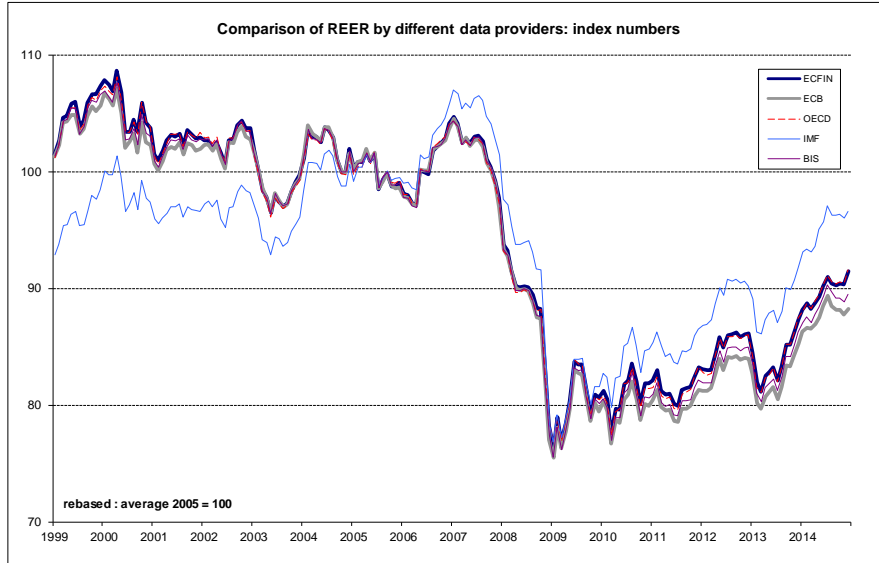
Sweden: Real Effective Exchange Rates, deflated by HICP/CPI



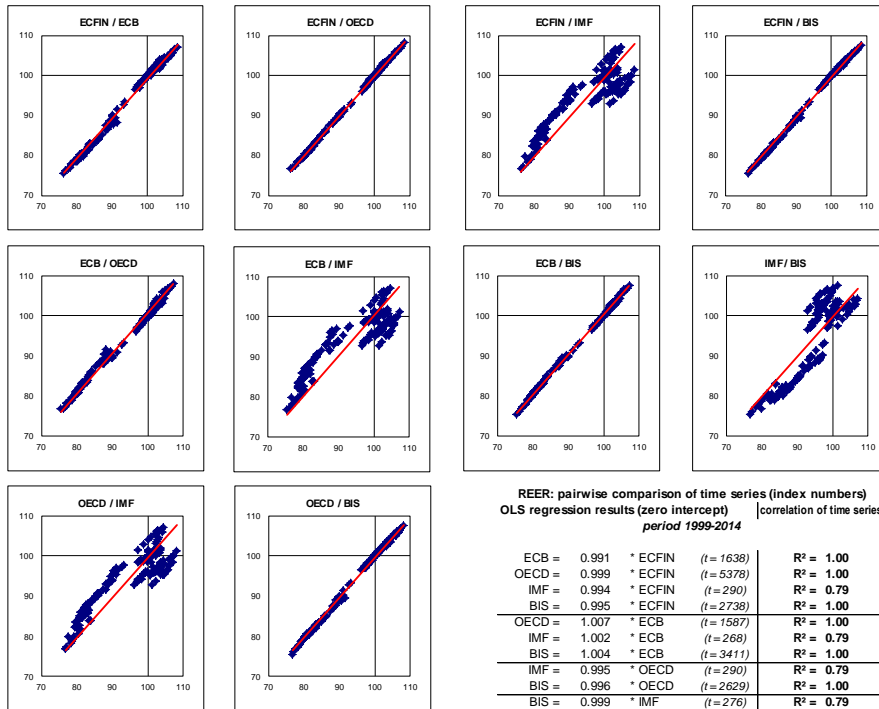
scatter diagrams and fitted trendline (OLS, zero intercept)



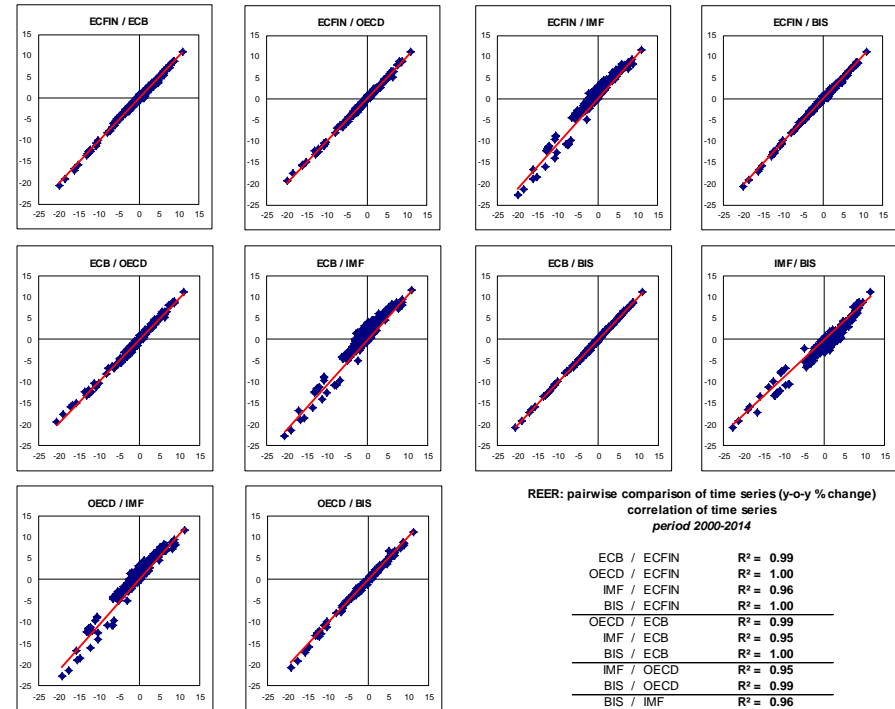
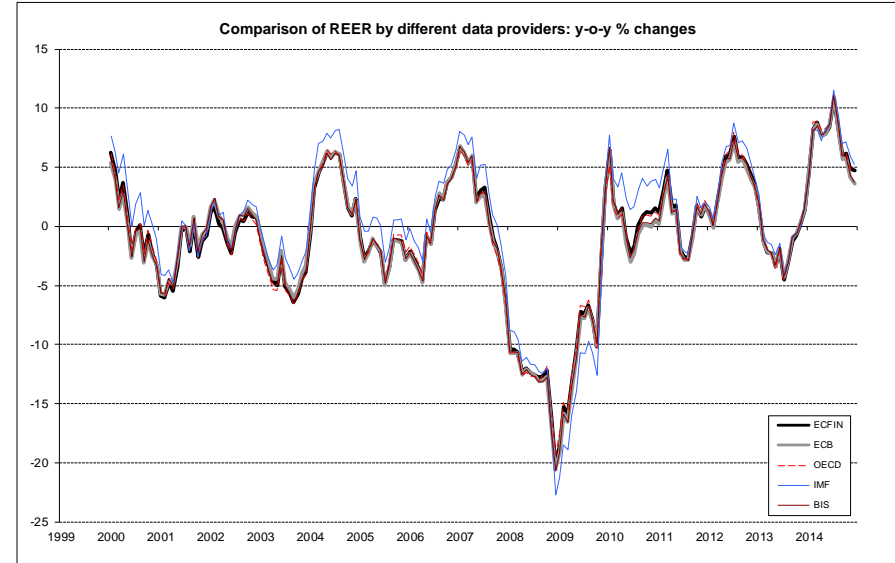
United Kingdom: Real Effective Exchange Rates, deflated by HICP/CPI



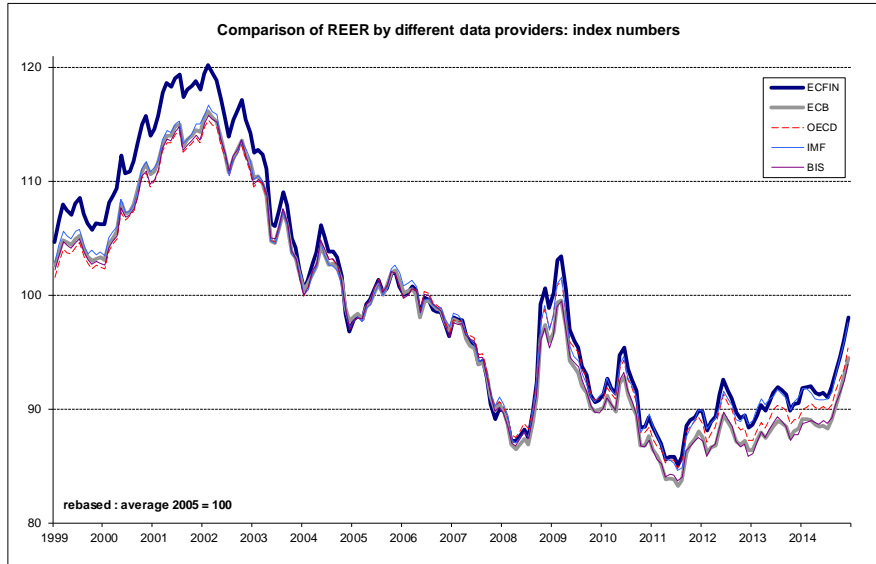
scatter diagrams and fitted trendline (OLS, zero intercept)



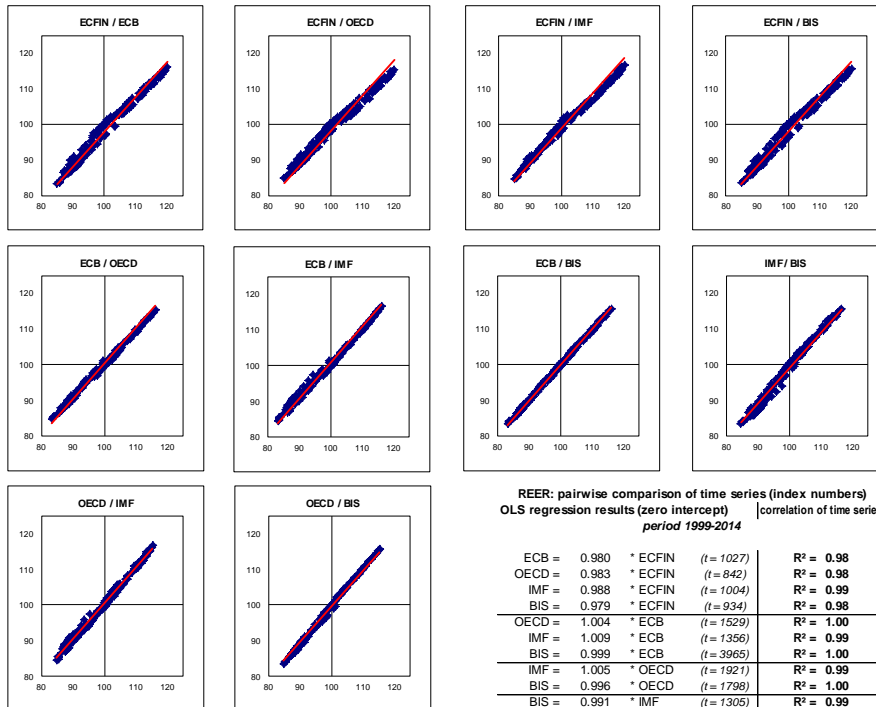
United Kingdom: Real Effective Exchange Rates, deflated by HICP/CPI



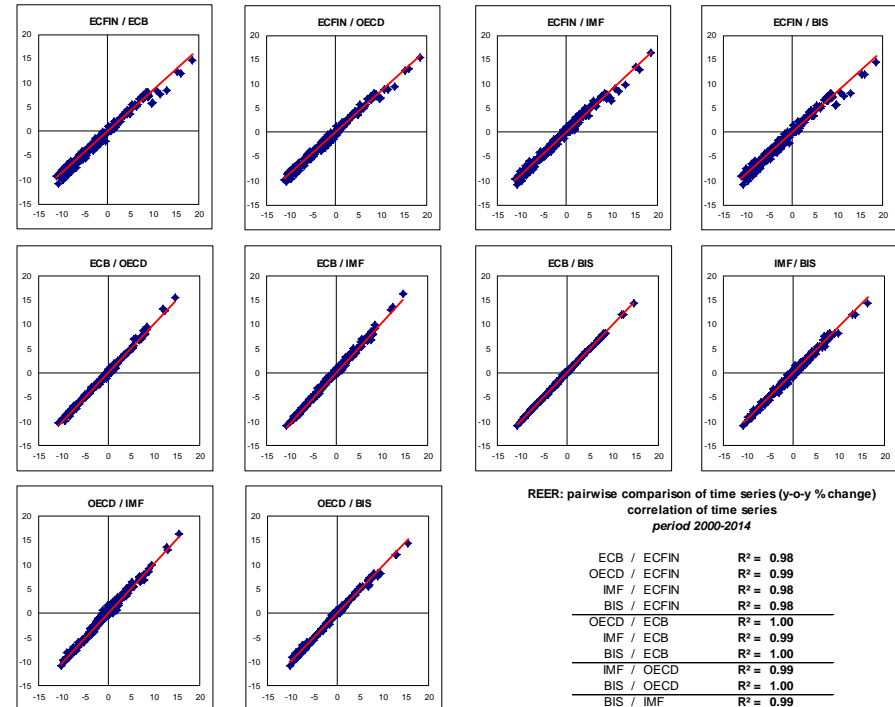
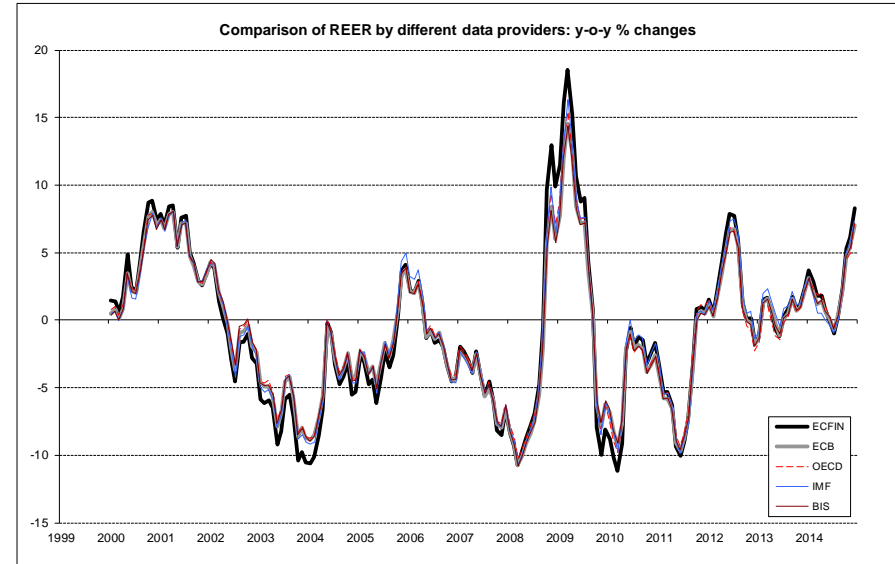
United States: Real Effective Exchange Rates, deflated by HICP/CPI



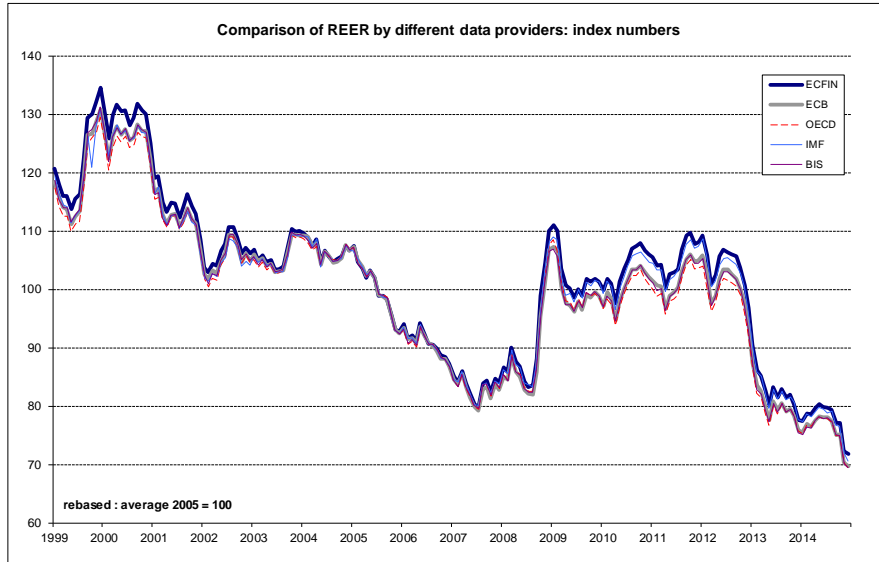
scatter diagrams and fitted trendline (OLS, zero intercept)



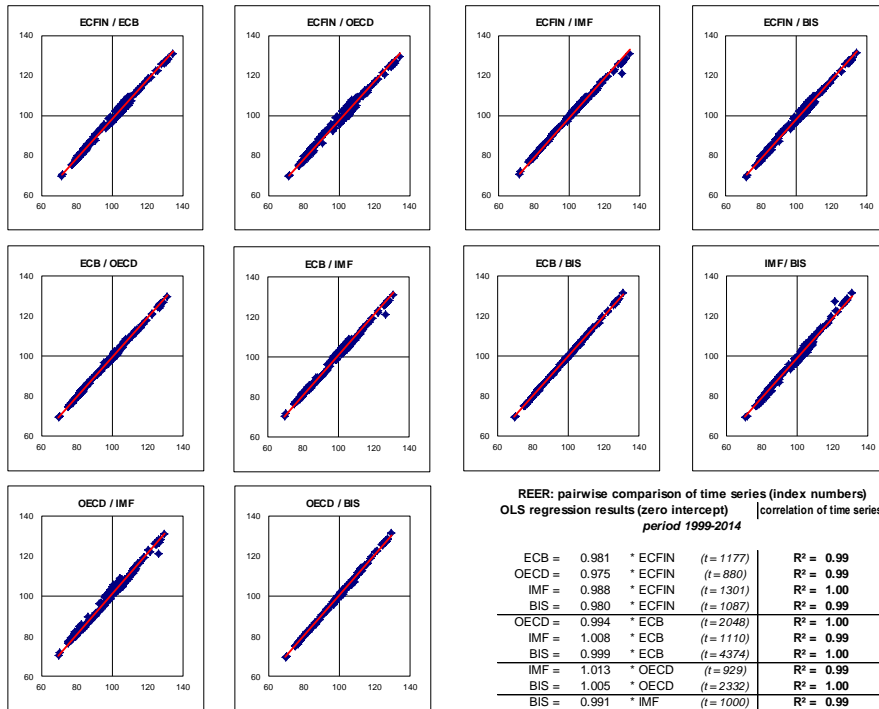
United States: Real Effective Exchange Rates, deflated by HICP/CPI



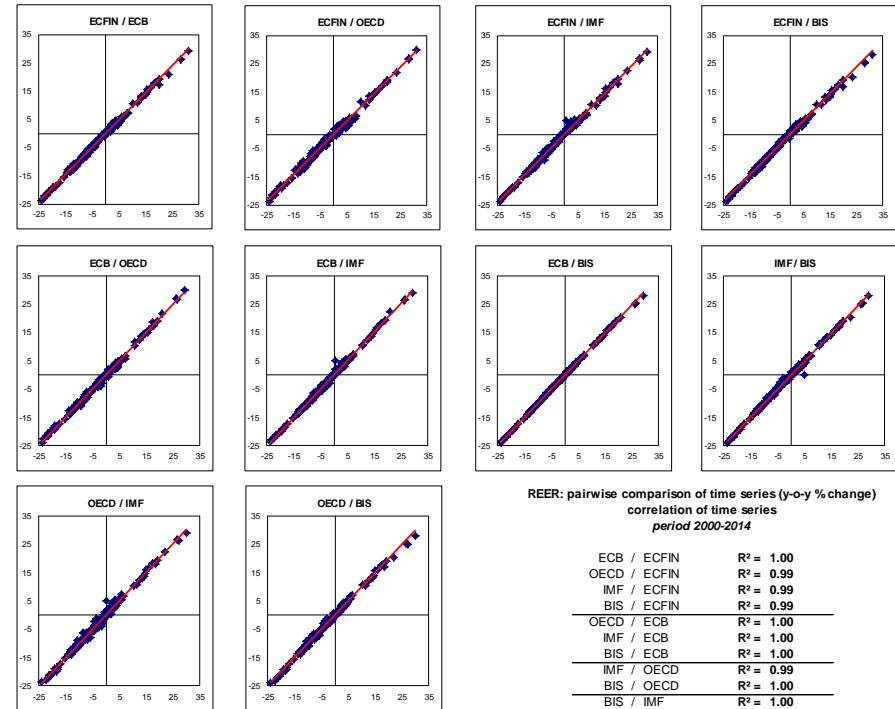
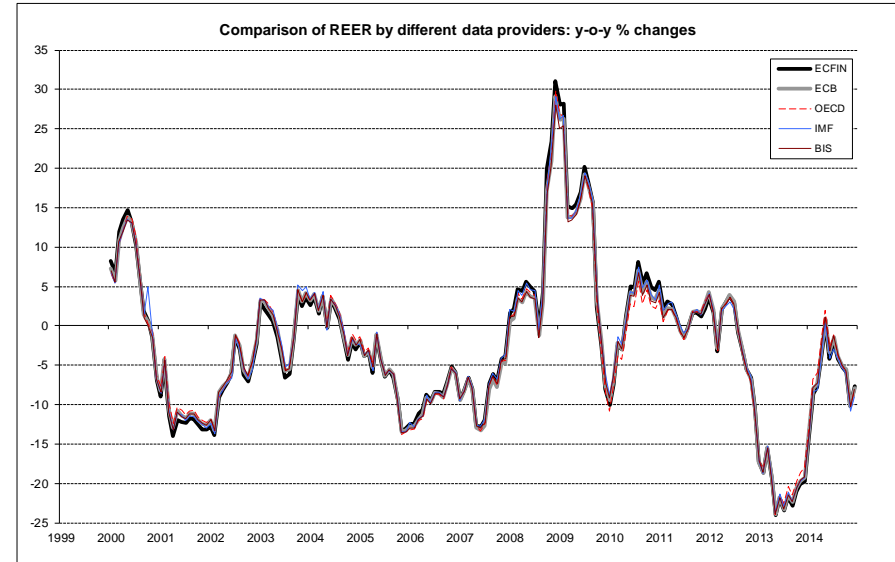
Japan: Real Effective Exchange Rates, deflated by HICP/CPI



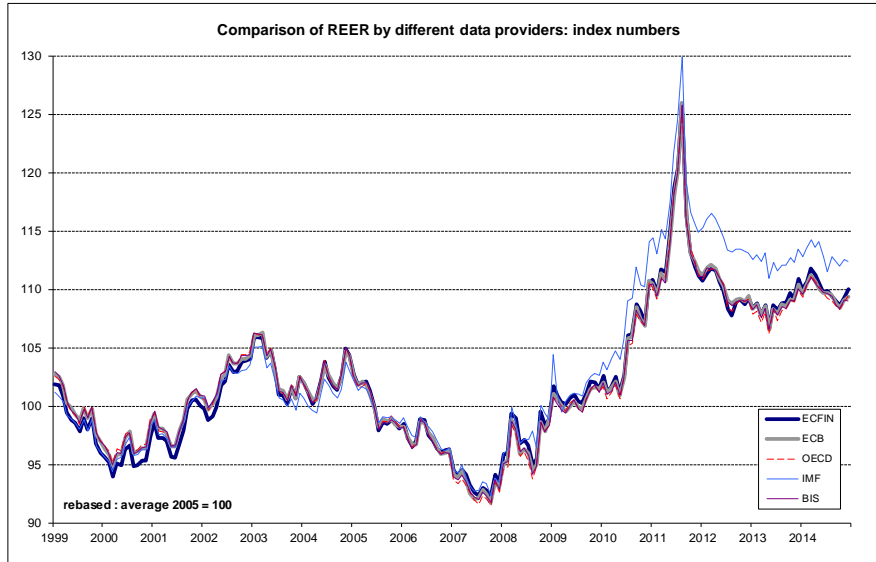
scatter diagrams and fitted trendline (OLS, zero intercept)



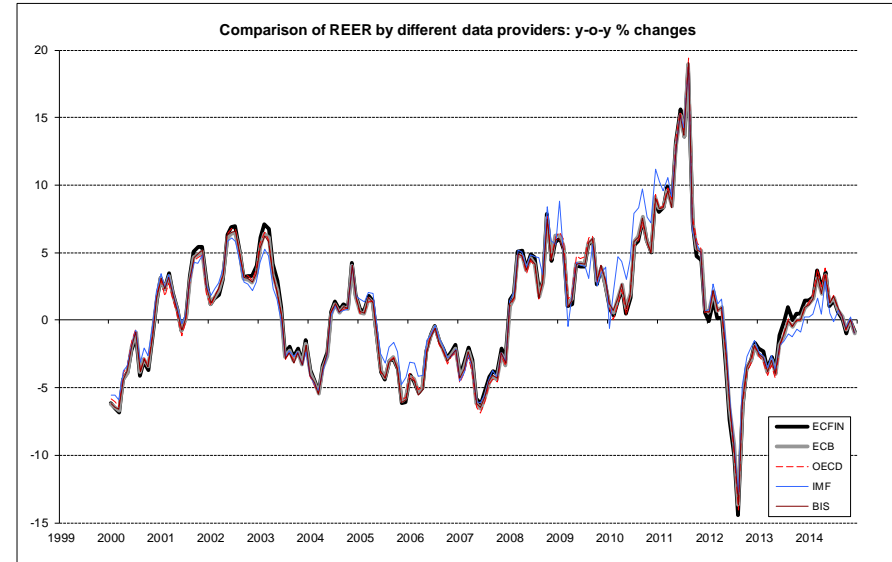
Japan: Real Effective Exchange Rates, deflated by HICP/CPI



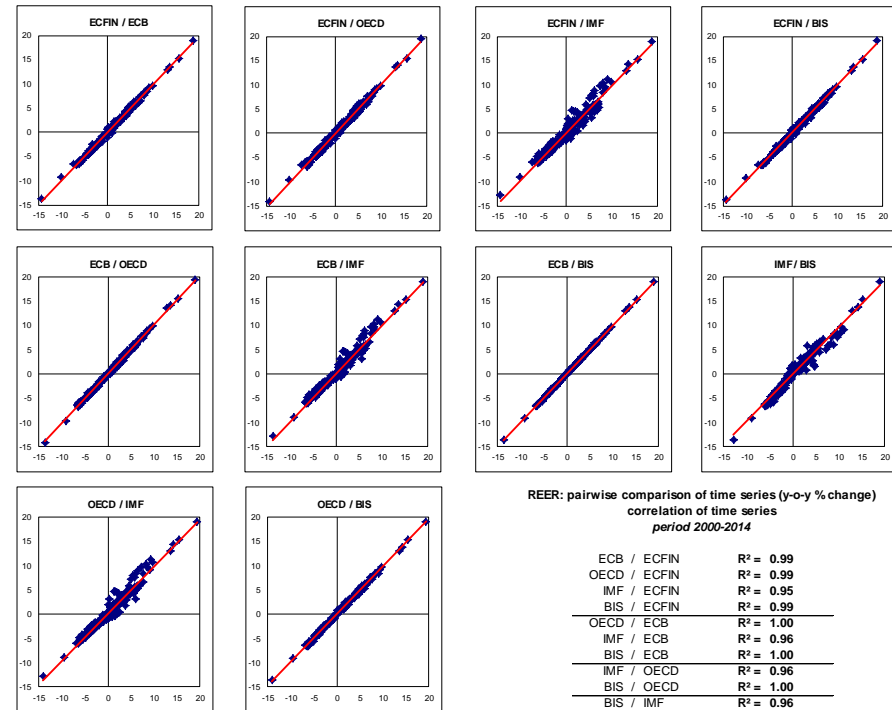
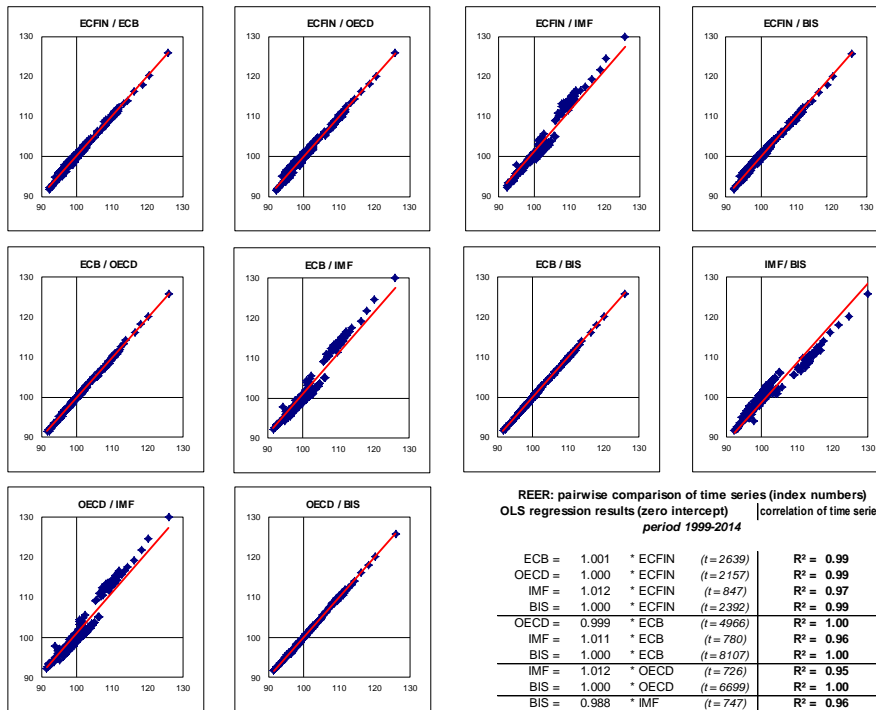
Switzerland: Real Effective Exchange Rates, deflated by HICP/CPI



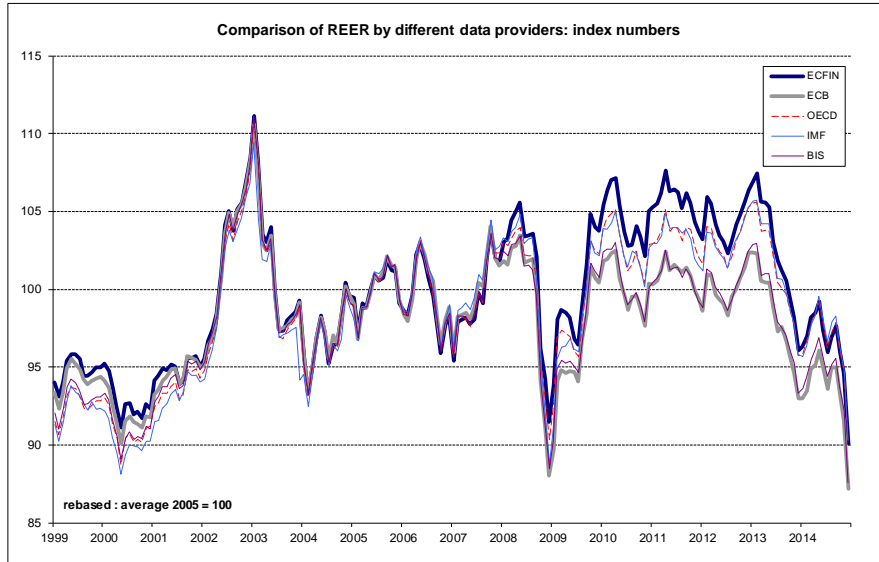
Switzerland: Real Effective Exchange Rates, deflated by HICP/CPI



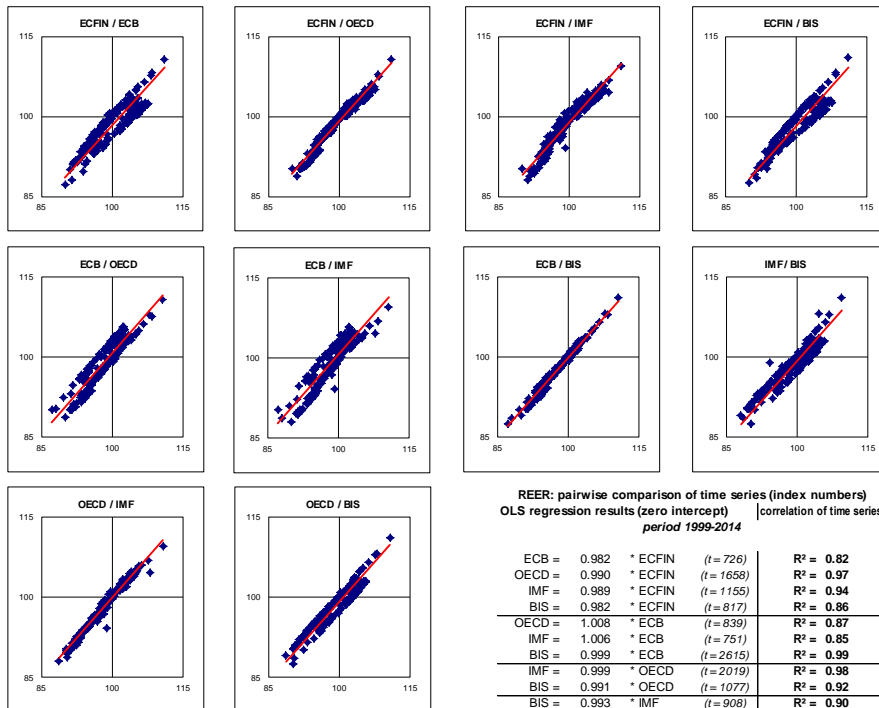
scatter diagrams and fitted trendline (OLS, zero intercept)



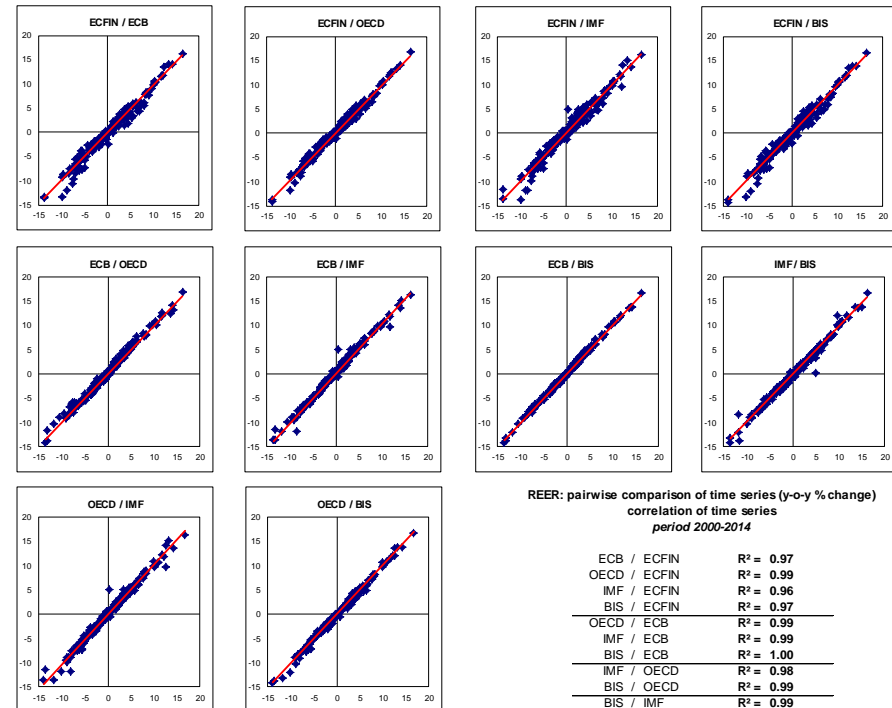
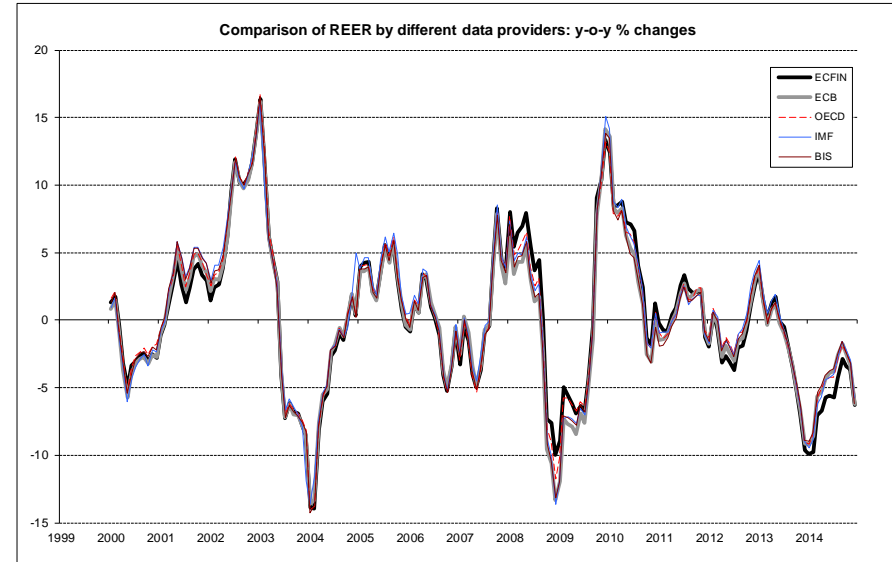
Norway: Real Effective Exchange Rates, deflated by HICP/CPI



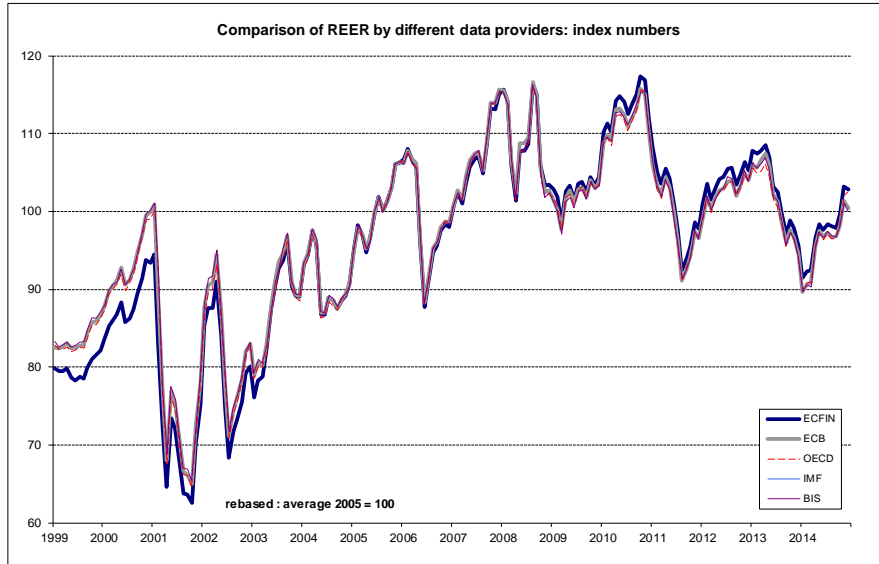
scatter diagrams and fitted trendline (OLS, zero intercept)



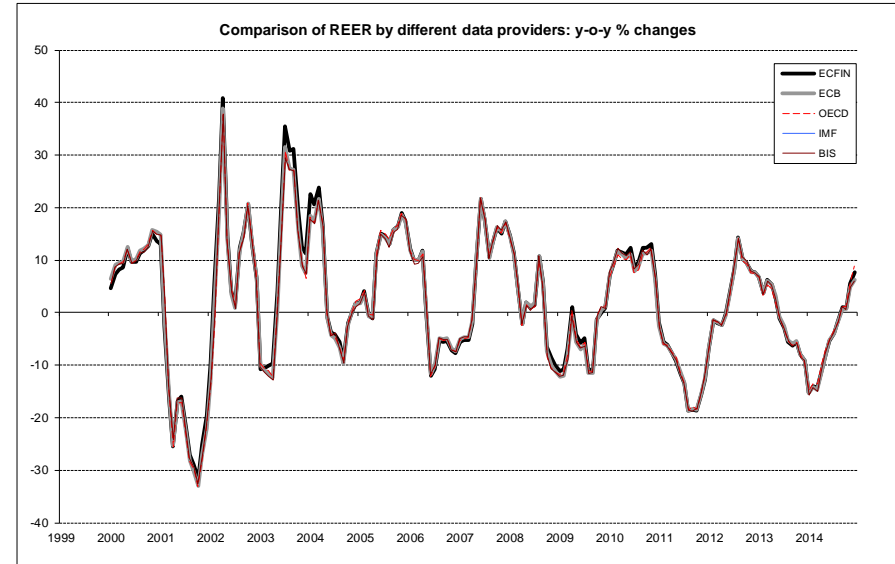
Norway: Real Effective Exchange Rates, deflated by HICP/CPI



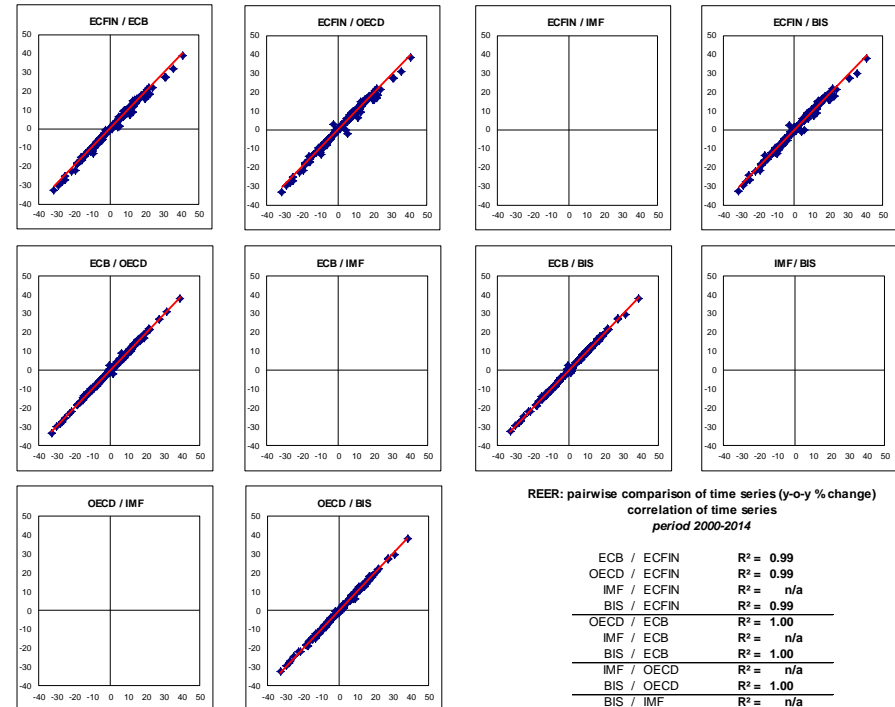
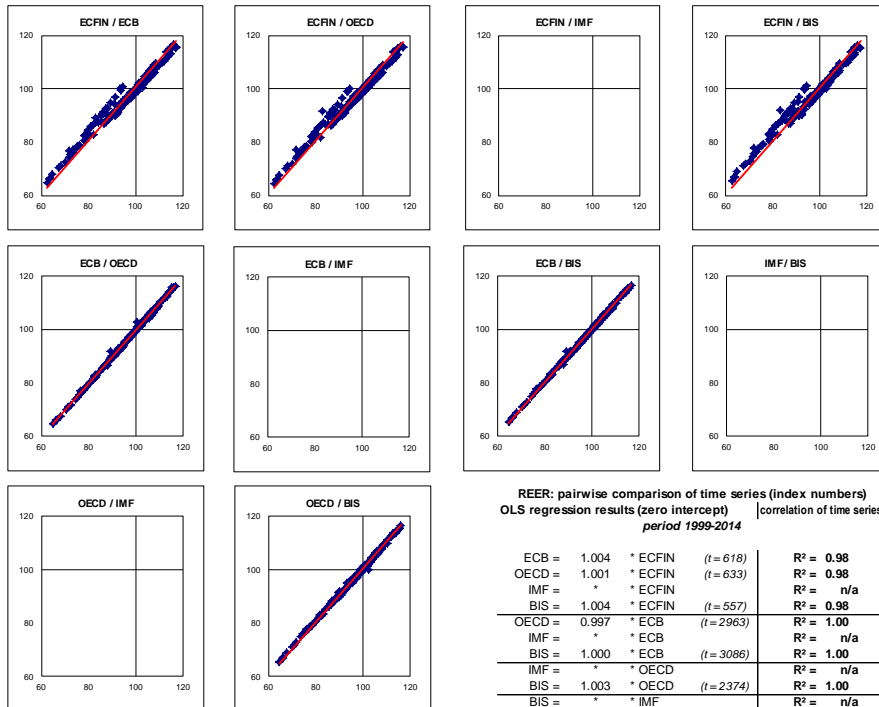
Turkey: Real Effective Exchange Rates, deflated by HICP/CPI



Turkey: Real Effective Exchange Rates, deflated by HICP/CPI

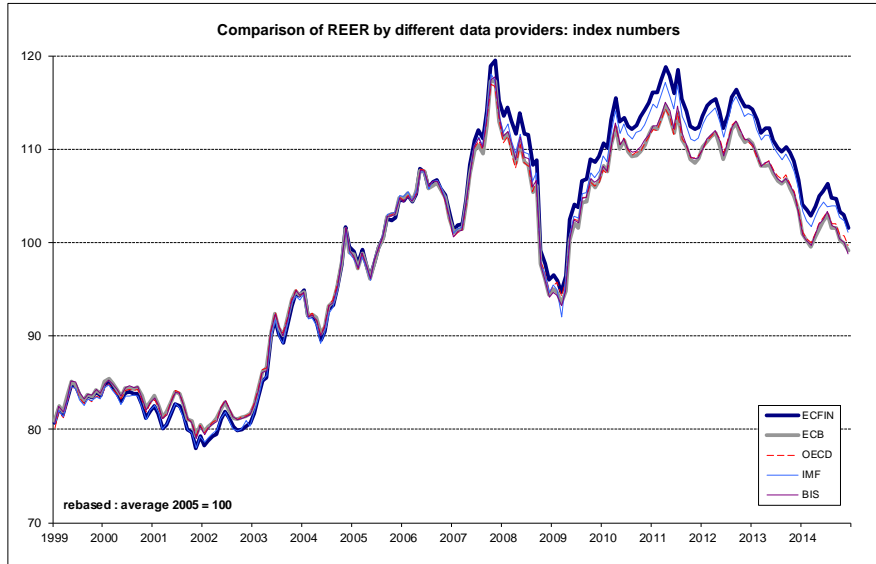


scatter diagrams and fitted trendline (OLS, zero intercept)

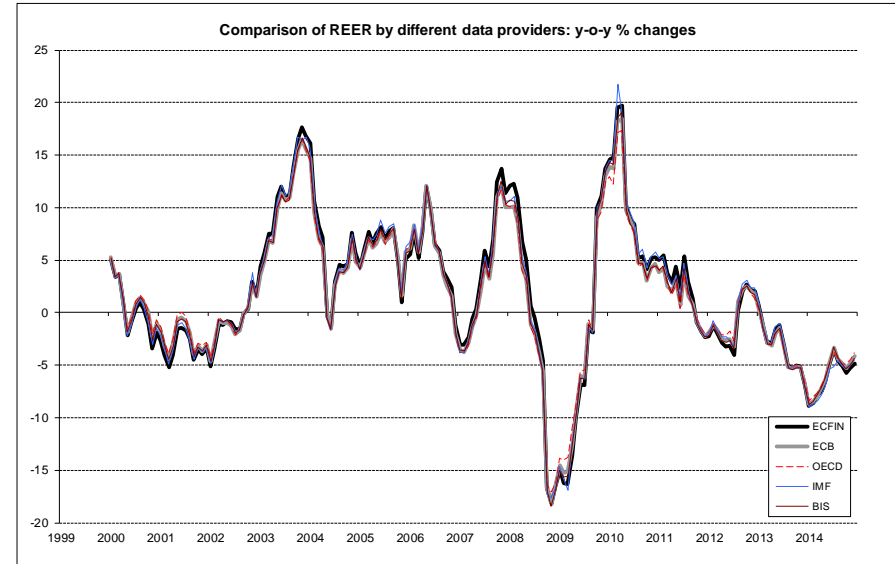




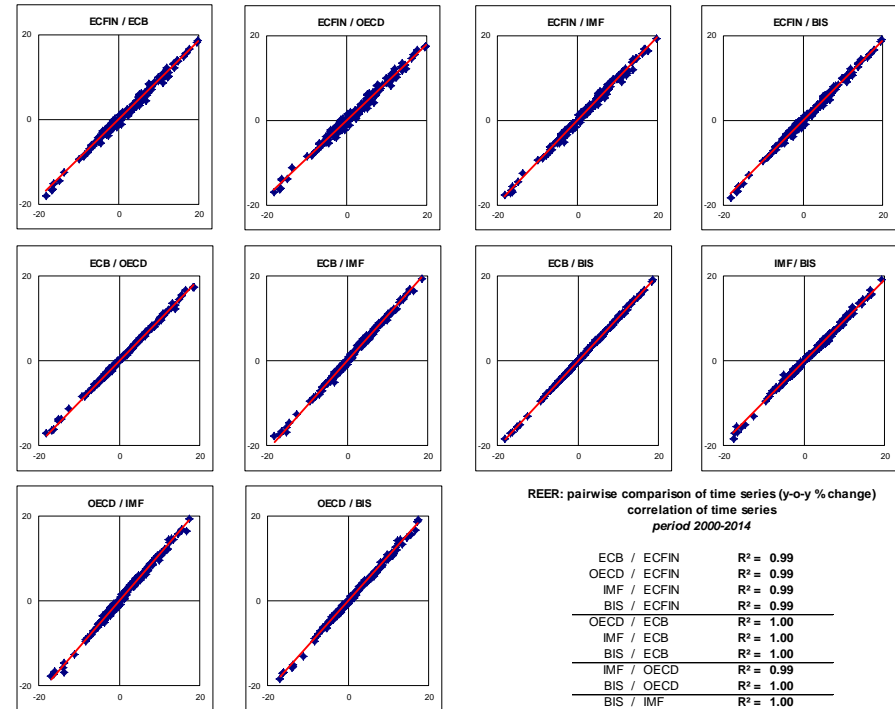
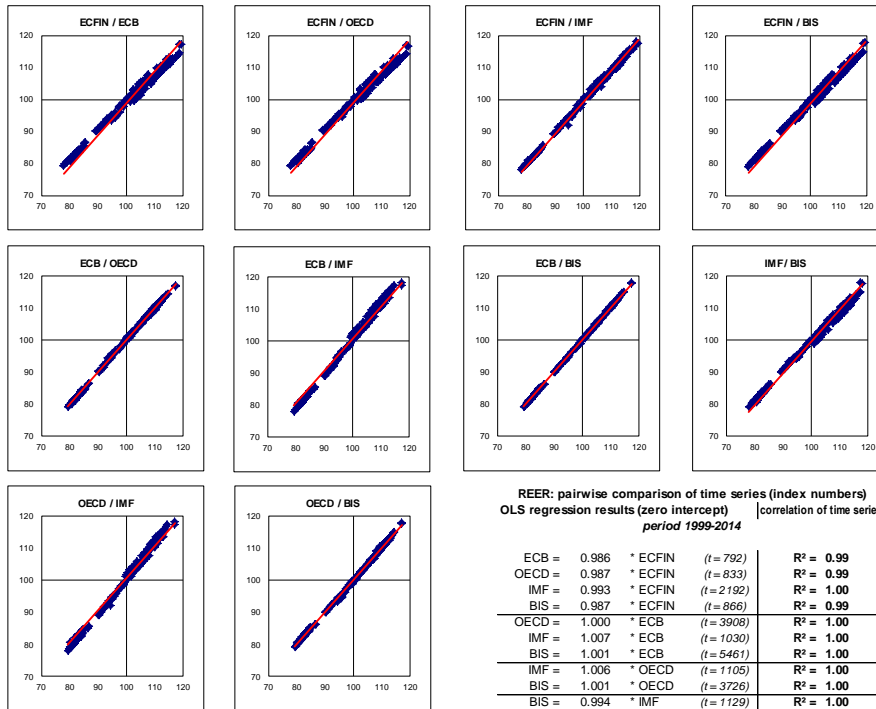
Canada: Real Effective Exchange Rates, deflated by HICP/CPI



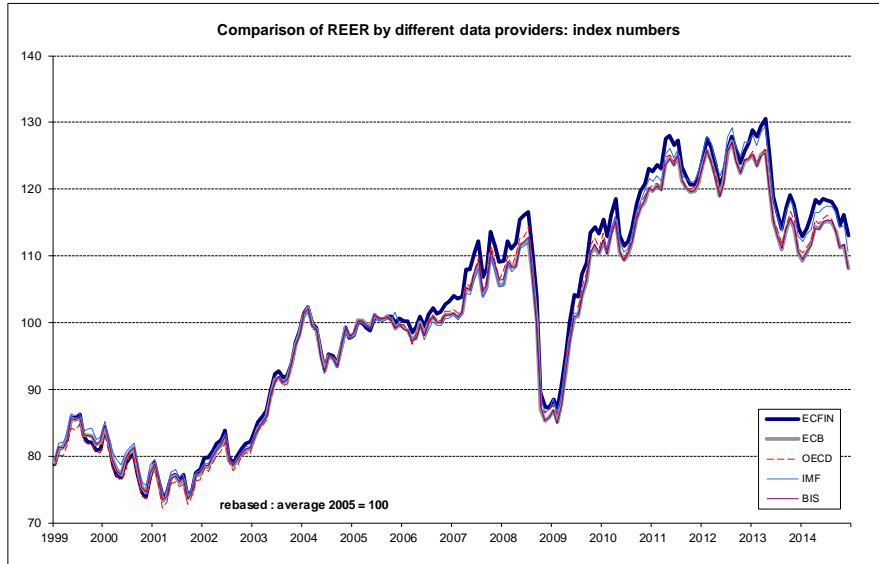
Canada: Real Effective Exchange Rates, deflated by HICP/CPI



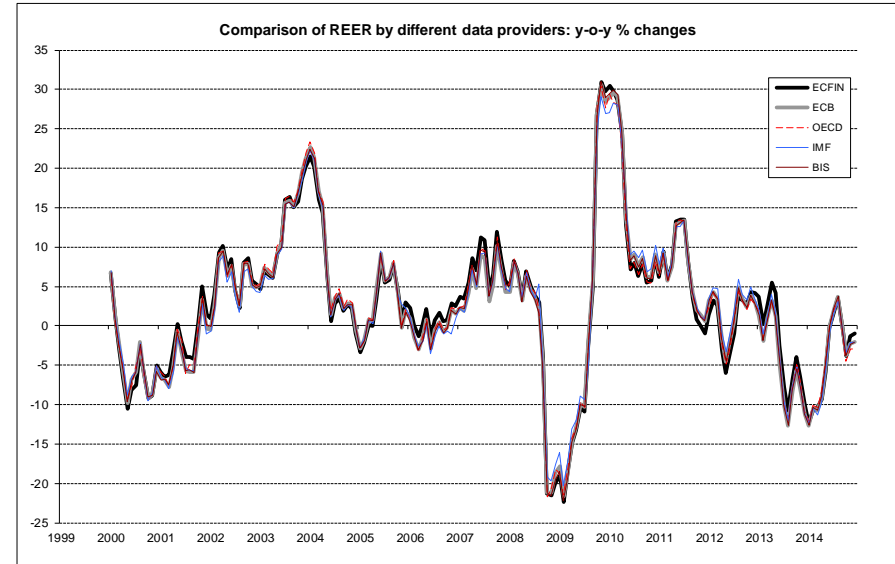
scatter diagrams and fitted trendline (OLS, zero intercept)



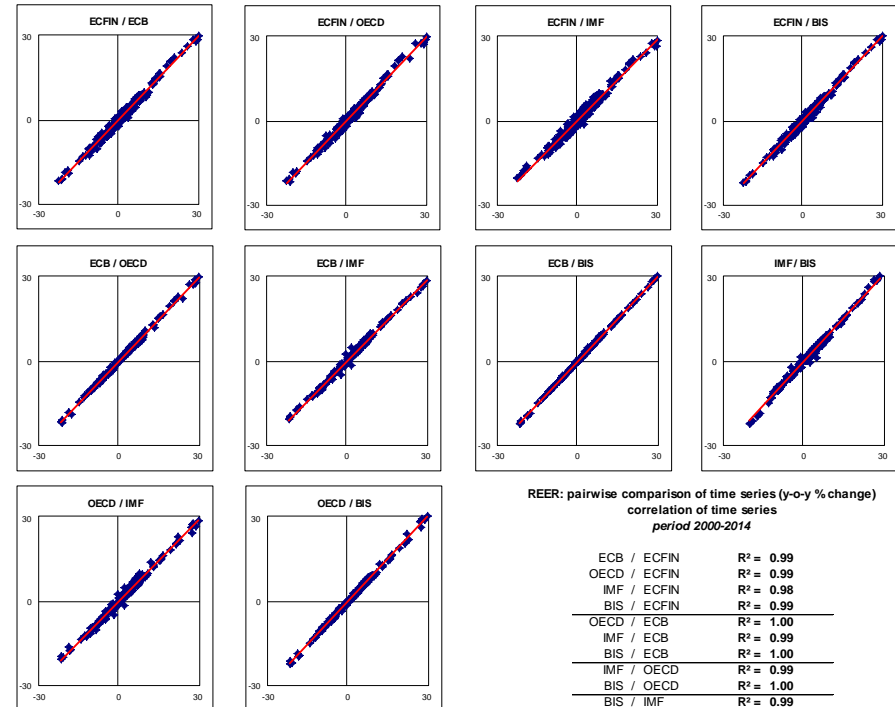
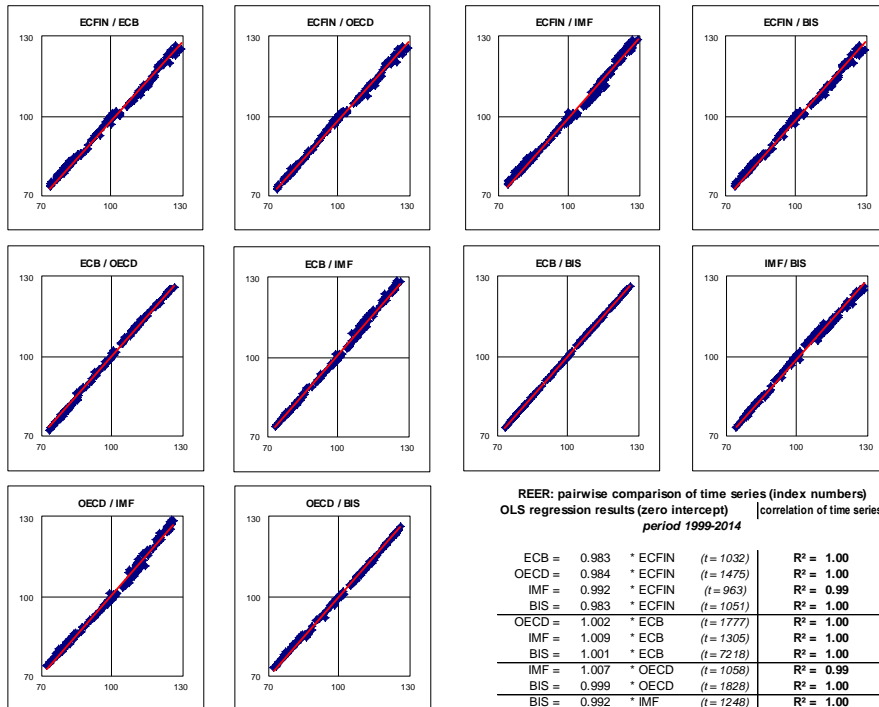
Australia: Real Effective Exchange Rates, deflated by HICP/CPI



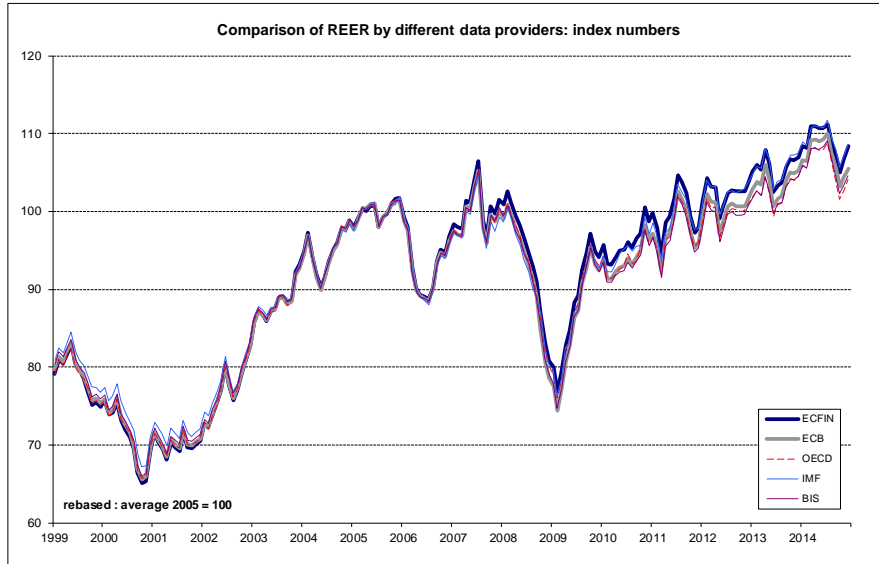
Australia: Real Effective Exchange Rates, deflated by HICP/CPI



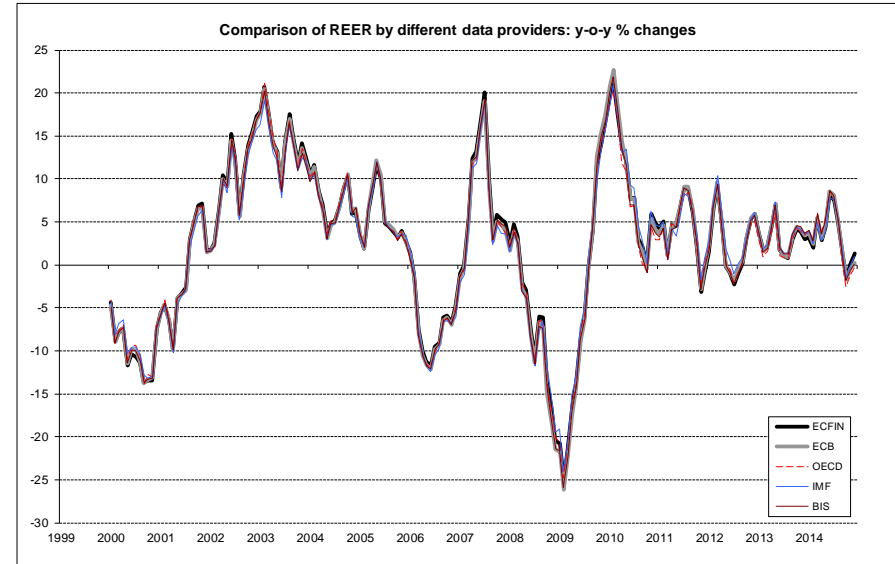
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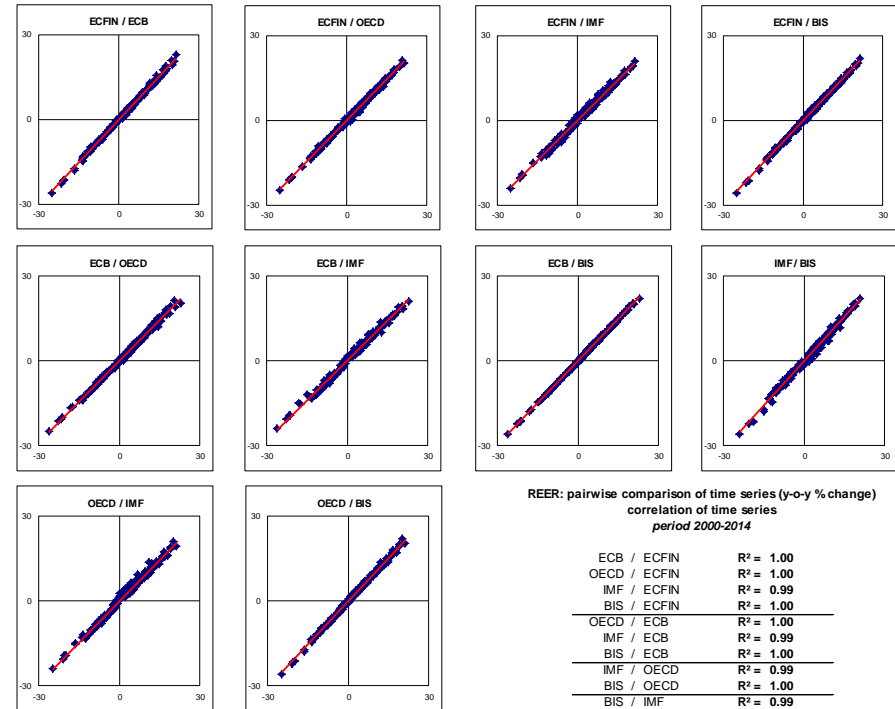
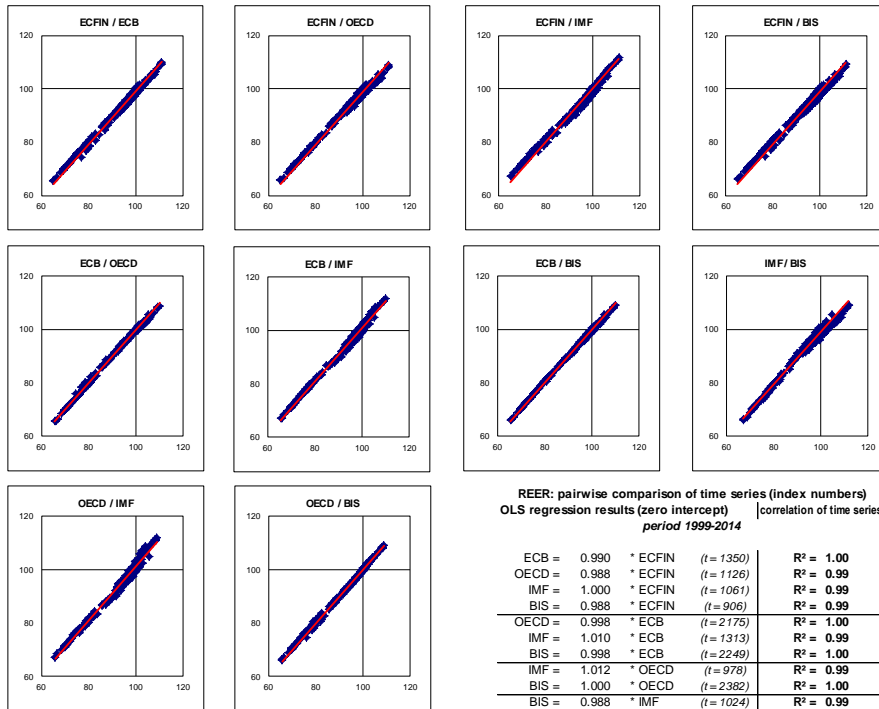
New Zealand: Real Effective Exchange Rates, deflated by HICP/CPI



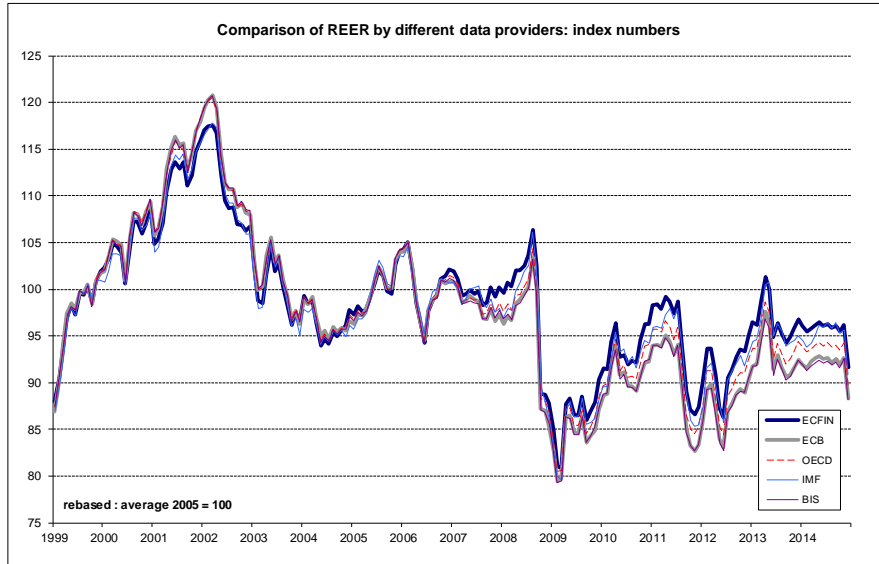
New Zealand: Real Effective Exchange Rates, deflated by HICP/CPI



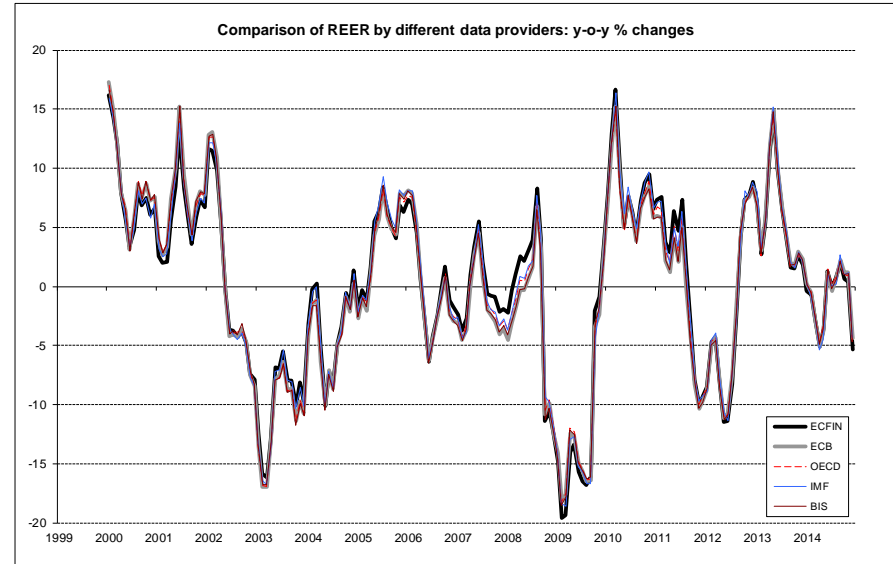
scatter diagrams and fitted trendline (OLS, zero intercept)



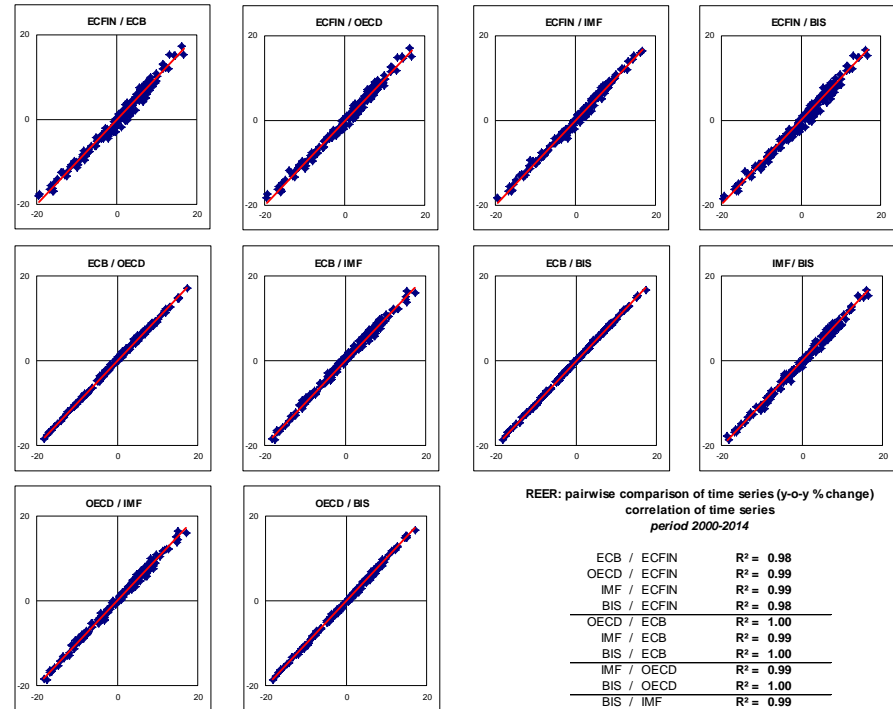
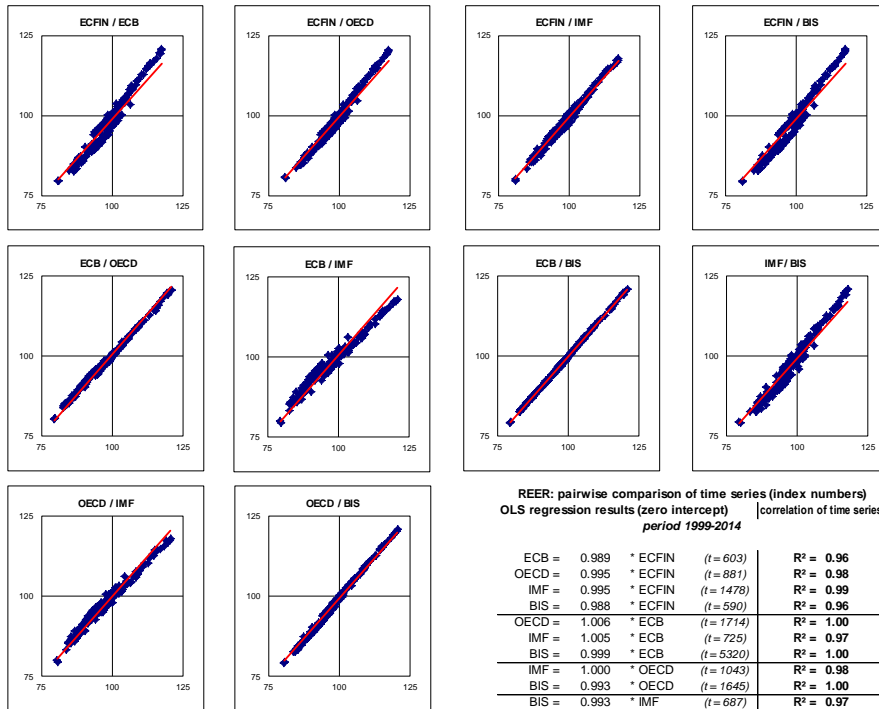
Mexico: Real Effective Exchange Rates, deflated by HICP/CPI



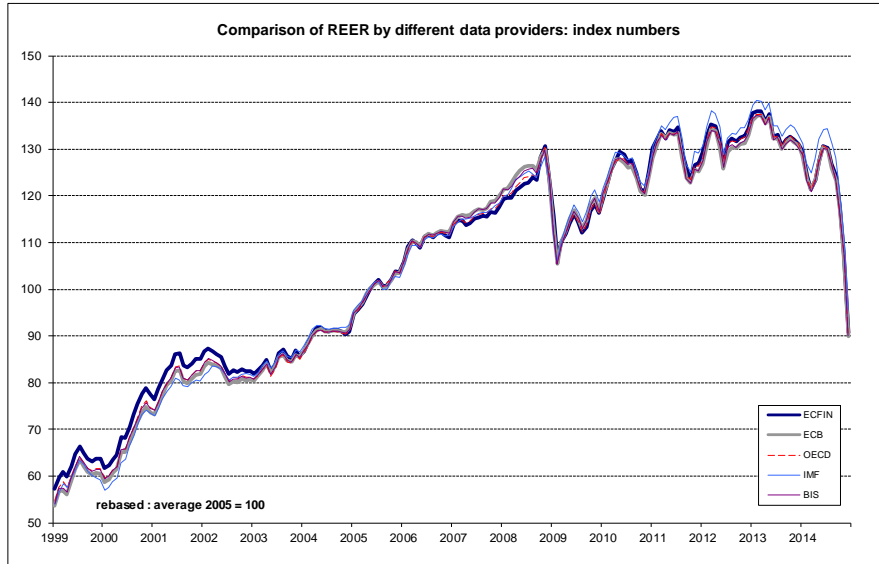
Mexico: Real Effective Exchange Rates, deflated by HICP/CPI



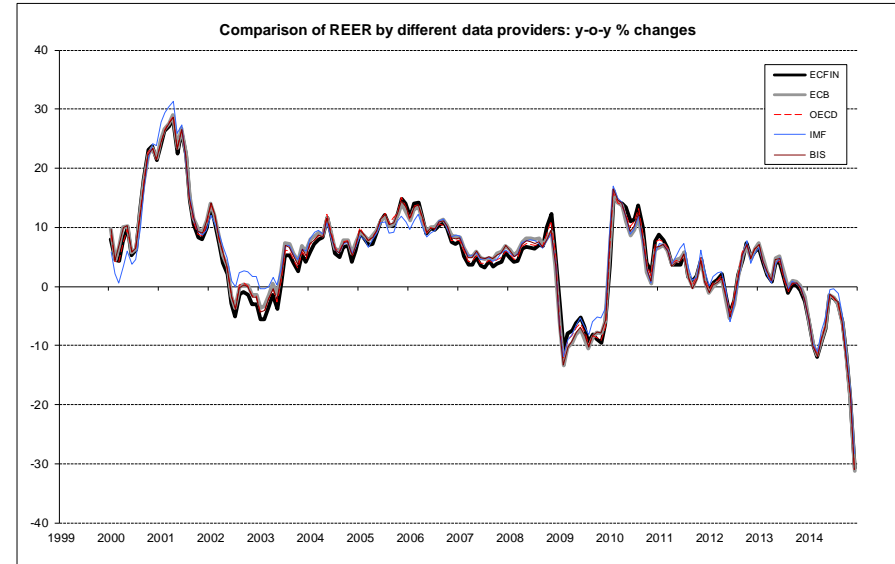
scatter diagrams and fitted trendline (OLS, zero intercept)



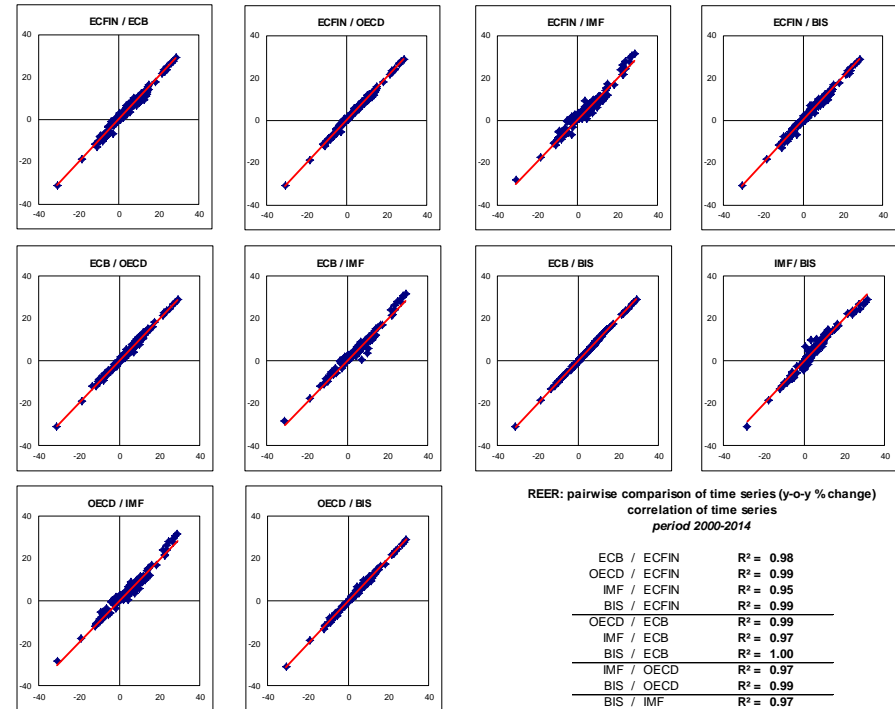
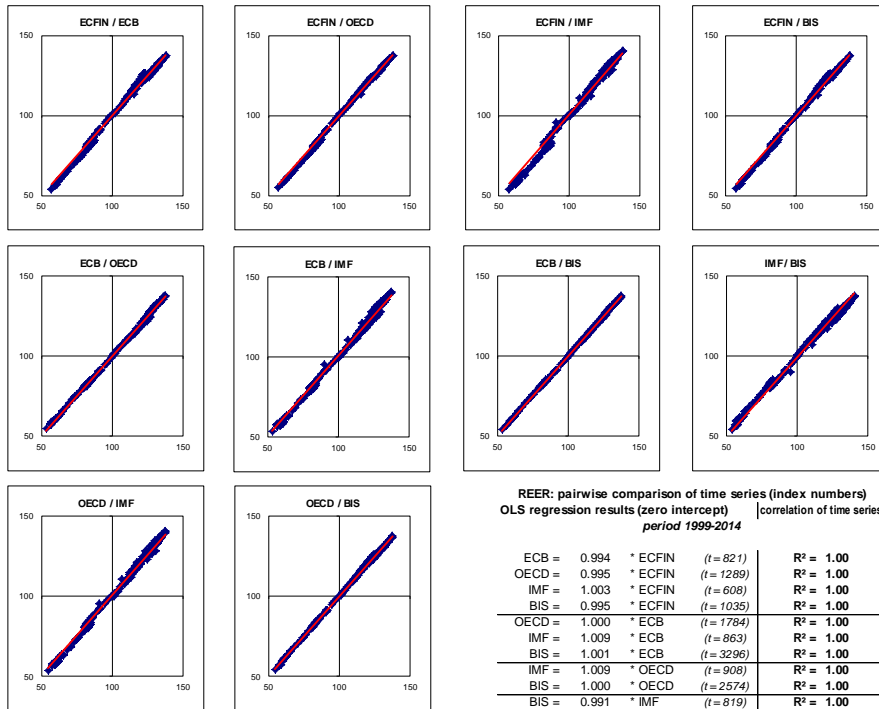
Russia: Real Effective Exchange Rates, deflated by HICP/CPI



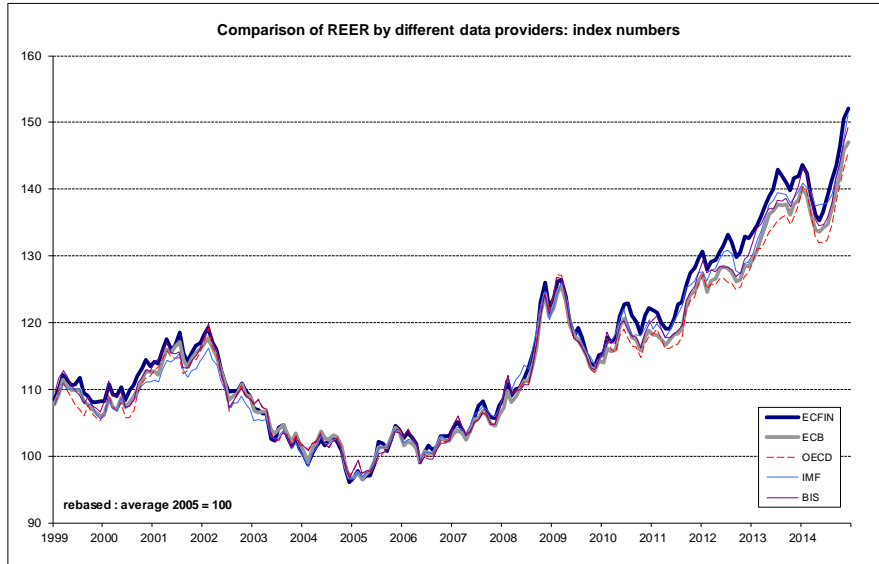
Russia: Real Effective Exchange Rates, deflated by HICP/CPI



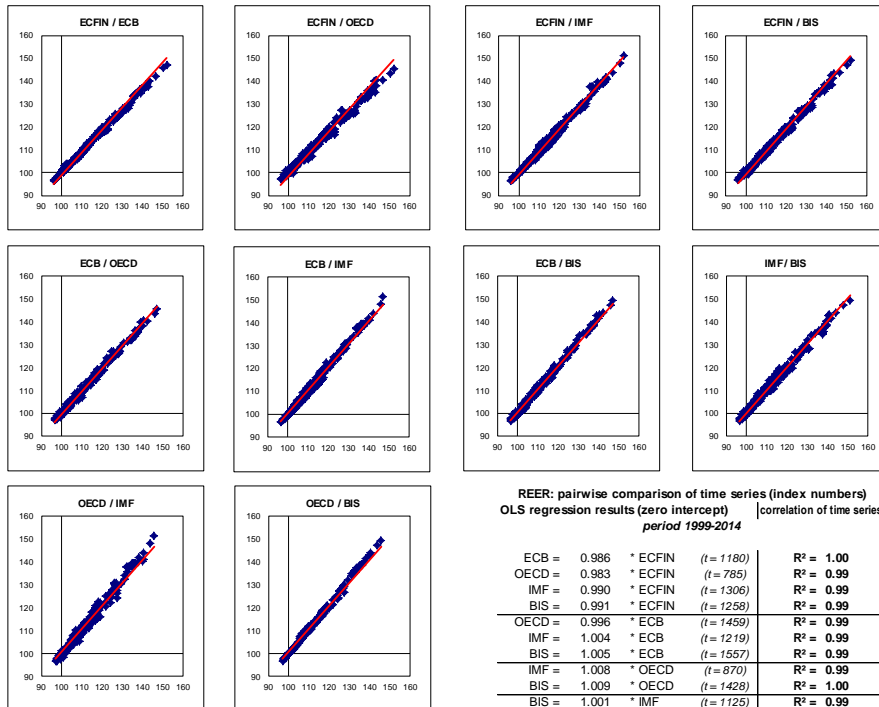
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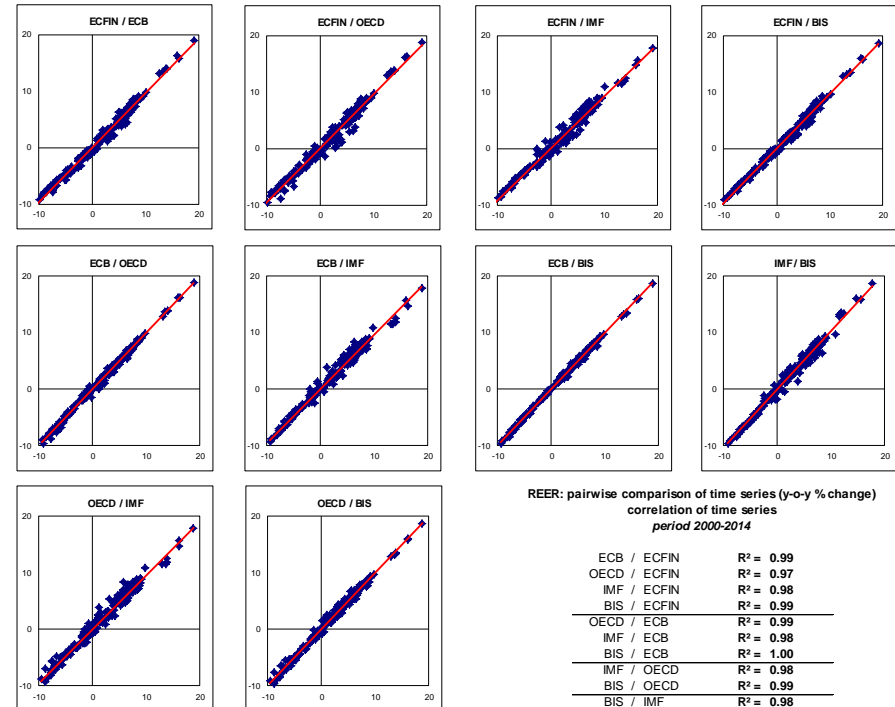
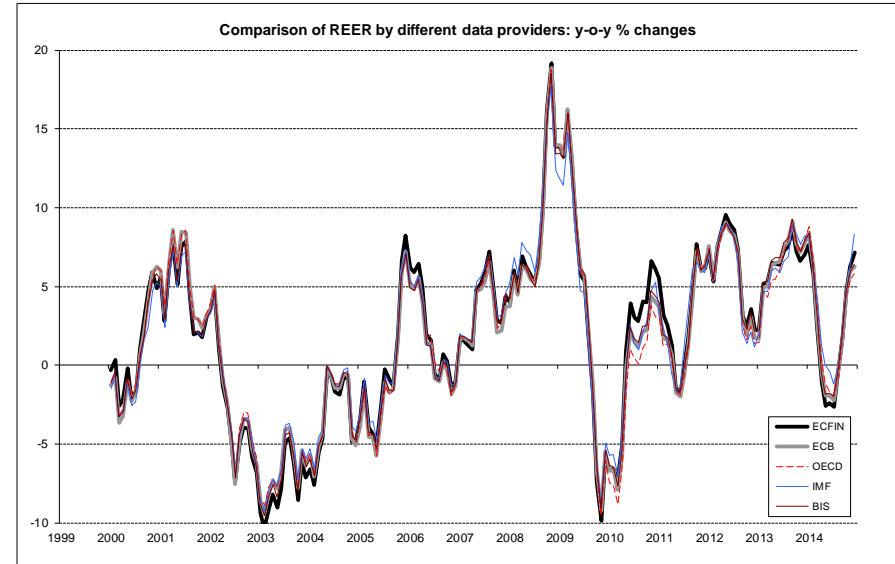
China: Real Effective Exchange Rates, deflated by HICP/CPI



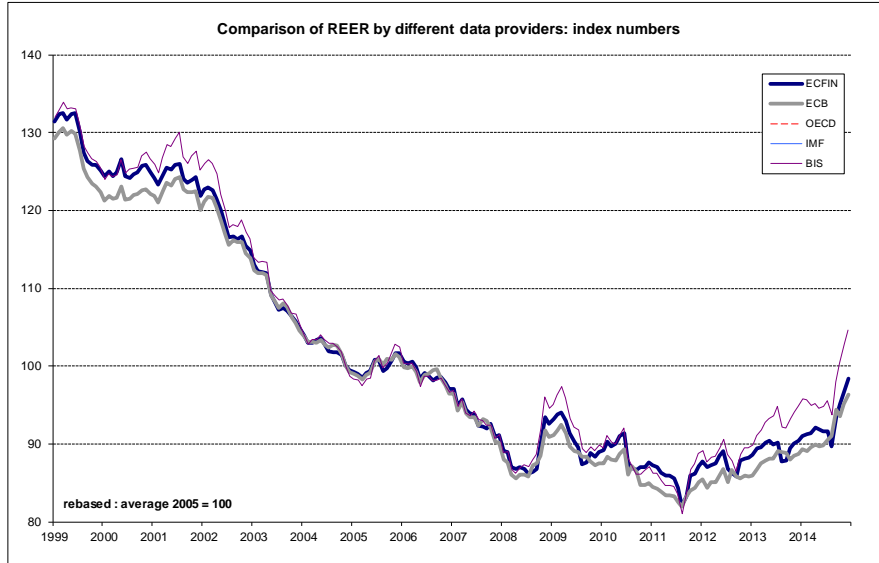
scatter diagrams and fitted trendline (OLS, zero intercept)



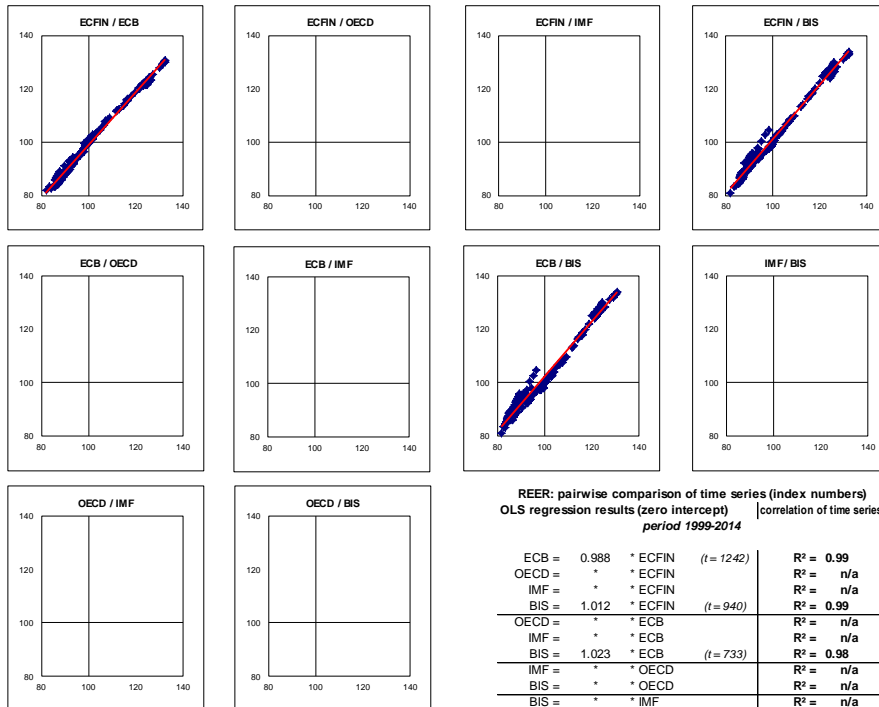
China: Real Effective Exchange Rates, deflated by HICP/CPI



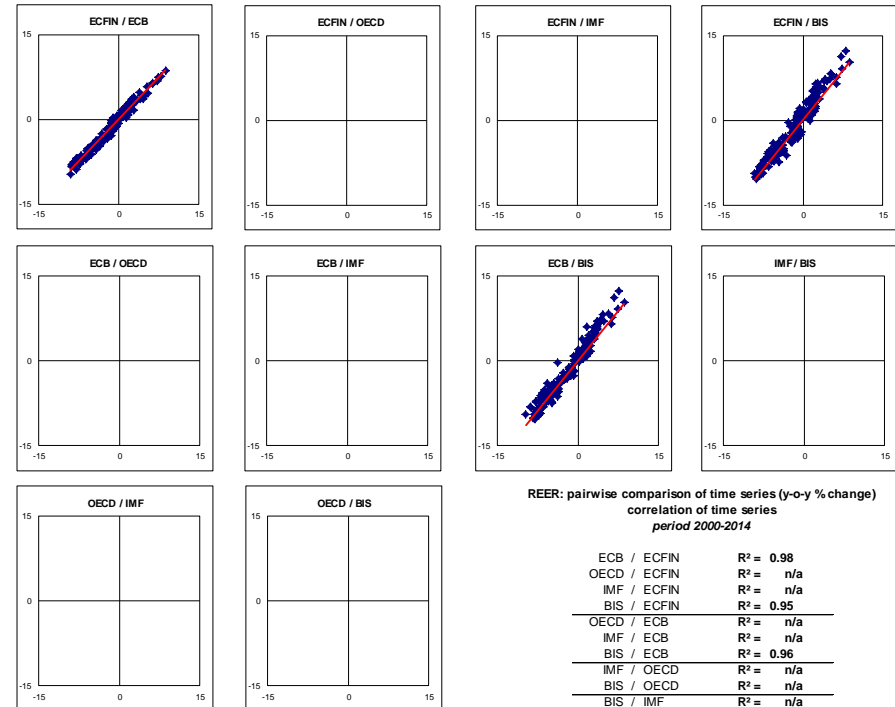
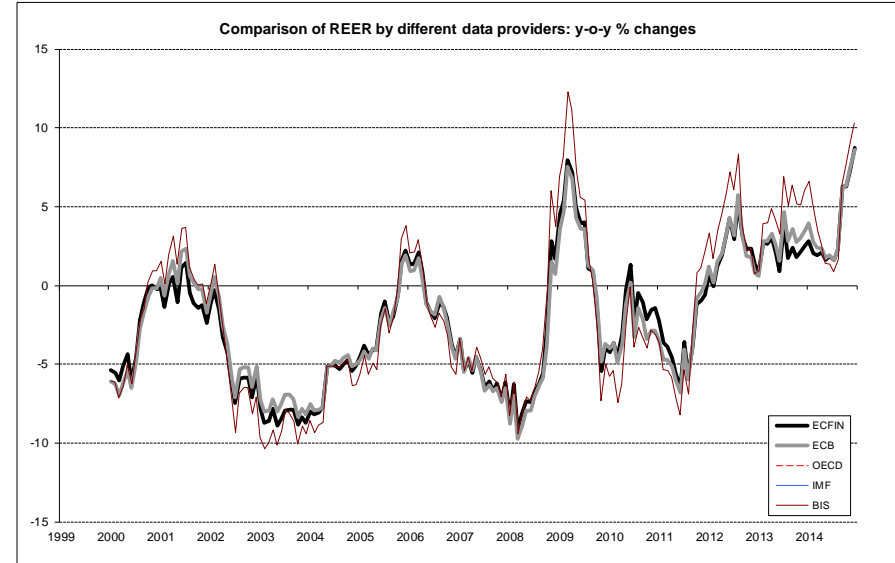
### Hong Kong: Real Effective Exchange Rates, deflated by HICP/CPI



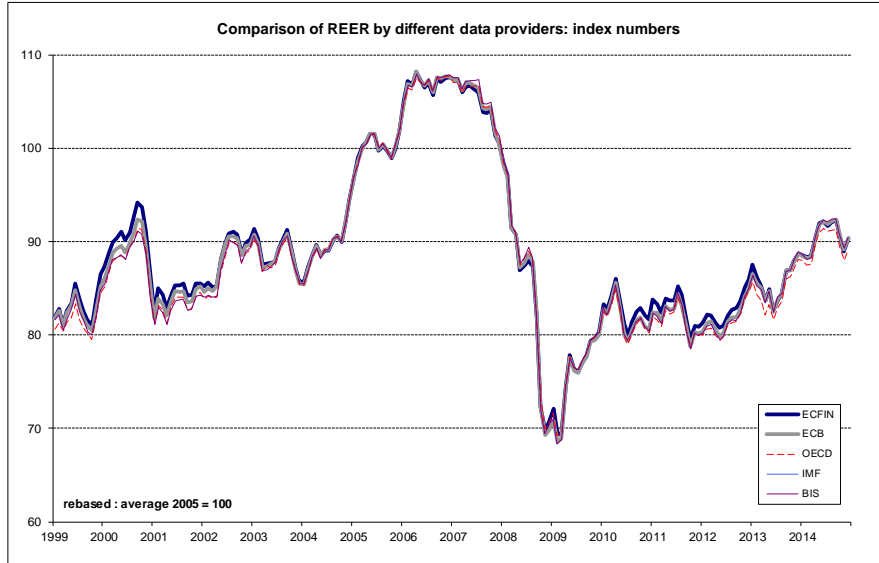
scatter diagrams and fitted trendline (OLS, zero intercept)



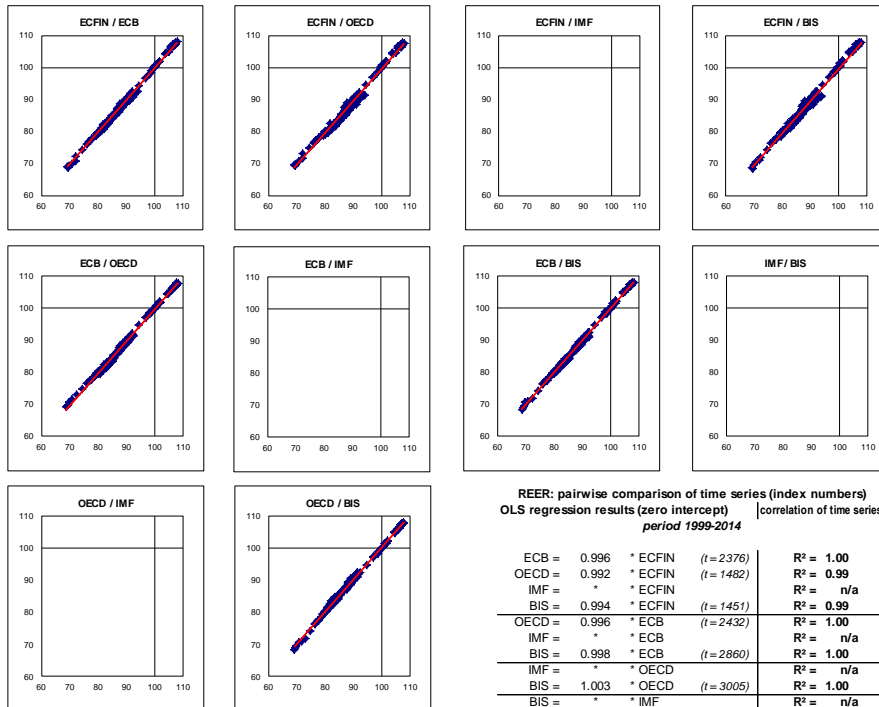
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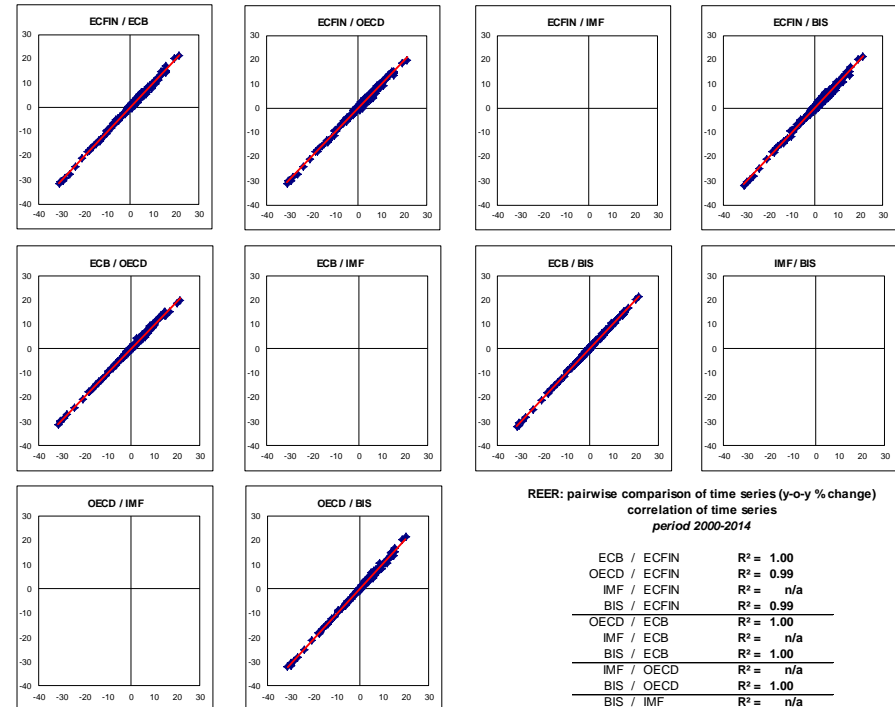
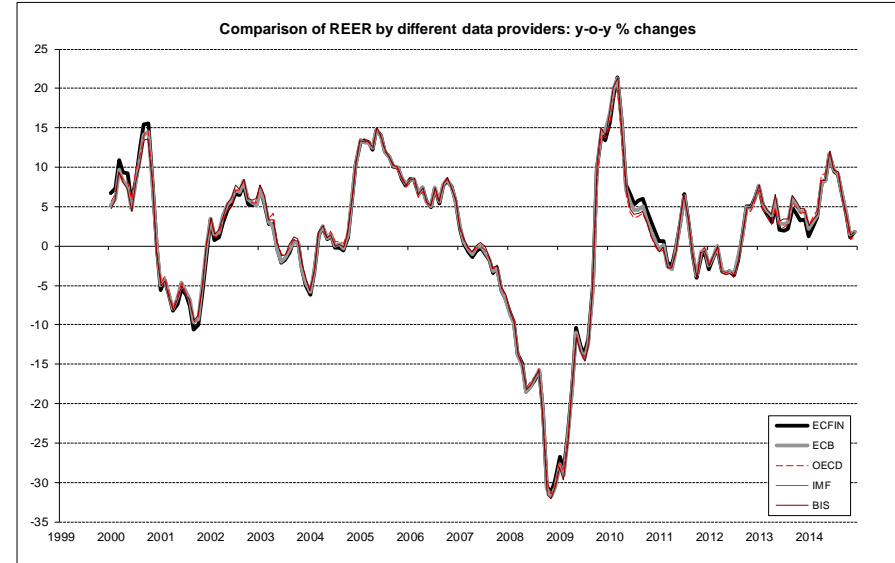
Korea: Real Effective Exchange Rates, deflated by HICP/CPI



scatter diagrams and fitted trendline (OLS, zero intercept)

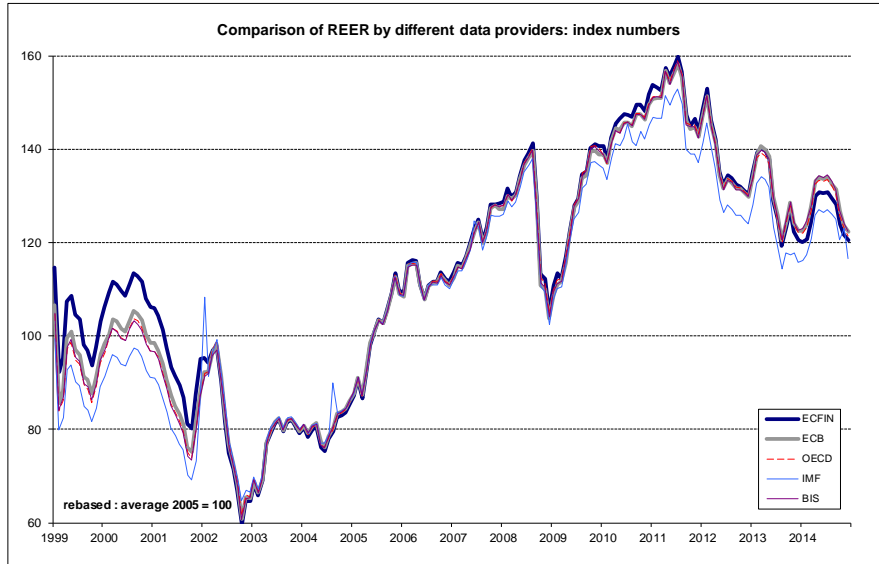


Korea: Real Effective Exchange Rates, deflated by HICP/CPI

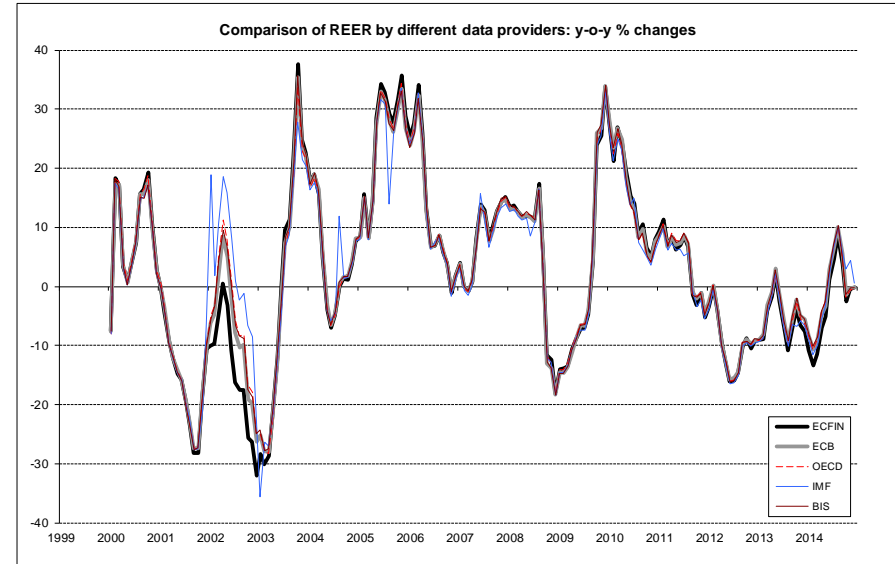




Brazil: Real Effective Exchange Rates, deflated by HICP/CPI



Brazil: Real Effective Exchange Rates, deflated by HICP/CPI



scatter diagrams and fitted trendline (OLS, zero intercept)

