

CZK: Valuation not a barrier to further gradual depreciation

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- In this note, we consider a behavioral-equilibrium-exchange-rate (BEER) model for the CZK's real effective exchange rate
- We find that variables such as productivity growth relative to the eurozone, the degree of openness, government debt as a percentage of GDP, net foreign assets and investment as a share of GDP do a decent job of explaining past movements in the CZK's real effective exchange rate.
- According to our models, the CZK is between 2% and 4% overvalued, whereas it was shown to be 5-6% overvalued in 1Q18. Comparing past valuations, the results appear to be roughly in line with the CNB's own BEER models published in past inflation reports.
- Valuation does not appear to be a barrier to further currency depreciation. The CZK's value has oscillated historically by up to +/-6% on either side of fair value. If external fundamentals become less favorable, there will still be scope for the CZK to further weaken.
- A weaker trend in global trade volumes should weigh on the currencies of small, open economies, like the CZK. While the CZK has held reasonably well recently given the upside surprise in inflation and more-hawkish tone from the CNB, we believe further depreciation is likely from here.
- We recommended going long EUR-CZK by using options; we are long a 28 June 26.10-26.70 call spread. The tenor covers two more CNB meetings. We also like long USD-CZK positions.

1. Tying the CZK to longer-term macroeconomic fundamentals

In this note, we attempt to place the movements of the CZK within the context of longer-term anchors of valuation based on a behavioral-equilibrium-exchange-rate (BEER) model.

Using econometric techniques, a model is estimated based on a set of macro variables that are thought to influence the fair value of the currency over long periods.

For the purposes of valuing the CZK, we chose to model the trade-weighted real effective exchange rate (REER). We believe this makes sense for EM currencies, which often have undergone large shifts in the nominal-exchange-rate regime.

This is true for the CZK, which hit its floor and stayed there in the period from November 2013 to its eventual rise from the floor in March 2017.

Given that the real exchange rate can always shift as a result of relative price effects (even with a currency peg) we believe it makes more sense to model this directly.

BEER methodology was also used in panel-data form in UniCredit's G10 fair-value analysis (see [UniCredit Global Themes series – Introducing BEER by UniCredit](#), September 2013).

2. BEER valuation: what macroeconomic fundamentals did we include to model the real exchange rate?

We used a number of explanatory variables, which are also cited in relevant literature, including the CNB's own analysis of the exchange rate¹.

We narrowed these down to the following macro variables in the following order of preference:

1. relative productivity vis-à-vis the eurozone (PROD)
2. degree of openness of the economy (OPEN)
3. net foreign assets as a percentage of GDP (NFA)
4. government debt/GDP (GD)
5. investment as a share of GDP (INV)

All explanatory variables and the real exchange rate were expressed in logarithm form for the purpose of our econometric valuation exercise (for more, see the appendix).

3. What results did we get?

Here is what we found in terms of explanatory variables:

PROD: We found that a rise in productivity (vis-à-vis the eurozone) leads to an appreciation of the CZK REER, as expected. Specifically, a one-percentage-point rise in CZK labor productivity (vis-à-vis the eurozone) increases the CZK REER fair value by 1.84 percentage points.

OPEN: An increase in degree of openness weighs on exchange-rate fair value. We interpret this as a negative sign, as it suggests that small, open-economy currencies (like the CZK) often act as shock-absorbers in that they tend to dampen swings in global economic forces.

NFA: The net-foreign-asset position (NFA) enters negatively when we consider the entire sample, including the period when the EUR-CZK floor was in place and afterwards (2000-18).

¹ See [CNB Working Paper Series 5: The behavioural equilibrium exchange rate of the Czech Koruna](#) by Luboš Komárek and Martin Melecký [here](#) as well as a 2017 presentation from the CNB's Luboš Komárek [here](#).

However, it enters with a modest positive coefficient before the floor was imposed. This may suggest that, when the NFA was modest, it reflected potentially positive balance-sheet effects. However, following the imposition of the floor, when reserves were accumulated (resulting in the NFA rising), it depressed valuation.

GD: The government debt term (GD) enters as a modest positive. A one-percentage-point rise in government debt (as a percentage of GDP) resulted in a 0.10 point increase in the fair value. This seems to suggest that with the ratio of Czech government debt to GDP still healthy (32% of GDP), more fiscal stimulus would have a positive effect – such stimulus could improve growth and result in higher interest rates. This interpretation is different than it is for other EM currencies, where government debt is very high (above 50% of GDP) and hence is negative for a currency's fair value (like in Brazil and South Africa, for example).

INV: A one-percentage-point rise in investment (as a share of GDP) was associated with a 0.70-percentage-point increase in fair value.

4. How did we shortlist our favored models?

We examined using various combinations of the aforementioned macro variables in assessing the fair value of the CZK's real effective exchange rate.

Specifically, we wanted the results to show the coefficients on macro variables as having the intuitively correct sign (as per economic theory), where the explanatory power of the regression was reasonably high and where the currency shows a clear sign of reversion to equilibrium following any divergence (or shock) from fair value. More information on this can be found in the appendix.

Overall, we came up with three model specifications:

M1: which includes PROD, OPEN, NFA and GD

M2: which includes PROD, NFA, GD and INV

M3: which includes PROD, OPEN, GD and INV

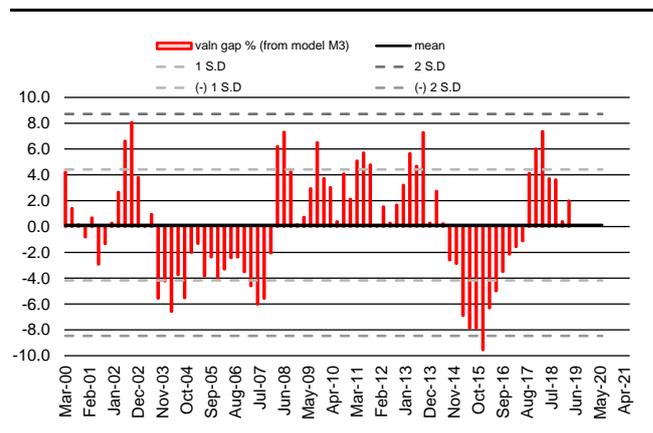
The charts for the three models as well as further details on relevant statistical diagnostic tests can be found in the tables in the appendix.

The models suggest that CZK is overvalued to the tune of 2-4%. However, valuation was more stretched in 1Q18, when the real exchange rate was found to express the CZK as 6.0-6.5% overvalued.

While we plan to use all three models in our analysis, we are somewhat more partial to model M3 since the diagnostics are somewhat cleaner with the error term appearing to be stationary as per the Engle granger methodology (see table 2 in the appendix).

Charts 1 present the valuation gap for this model which suggests the CZK was about 2% overvalued as of March-end. In general, we find that the real exchange rate has historically oscillated by up to +/-6% on either side of fair value.

CHART 1: VALUATION BASED ON PROD, OPEN, NFA, GD AND INV.



Source: Bloomberg, Haver, UniCredit Research

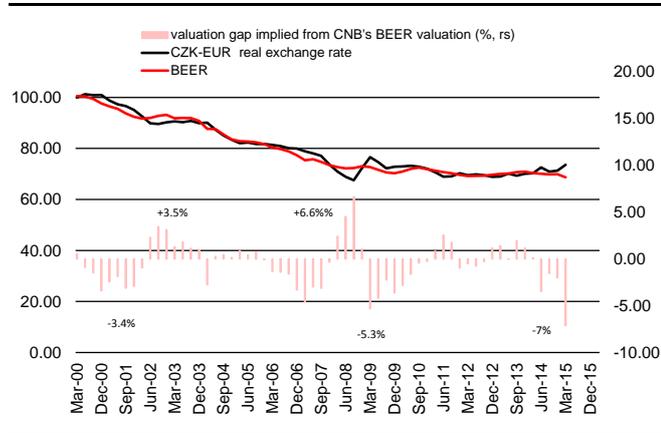
What message would we draw from the above? While the currency peaked in 1Q18, we would suggest that, if external fundamentals become less favorable, there will still be scope for the currency to show further weakness. In that sense, valuation is not a barrier to further depreciation if fundamentals become more negative.

5. How does it compare to other estimates of CZK fair value?

In its 3Q15 Inflation report, the CNB modelled the equilibrium value of the EUR-CZK real effective exchange rate (having been deflated by Czechia's manufacturing producer price index). The CNB used two modelling methodologies: the BEER (similar to the method we refer to in this paper) and the FEER, which attempts to model under/overvaluation as a function of how much the exchange rate needs to adjust to bring the external balance back to sustainable levels. An examination of the data underlying the CNB's calculations reveals that the CNB found the CZK REER to be 7% and 2% undervalued as per the BEER and FEER methodologies respectively (the CNB's analysis can be found [here](#)).

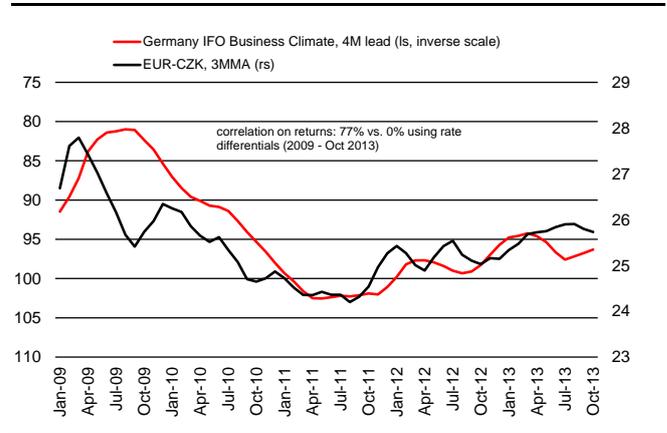
Chart 2 recreates the BEER valuation from the CNB's analysis. According to the results of the CNB's model from 2015, the CZK was 7% undervalued in 1Q15 and up to 6.5% overvalued in 2008, with both sets of results resembling the results yielded by our three models.

CHART 2: REPLICATION OF CNB BEER MODEL RESULTS IN 2015 INFLATION REPORT, WHICH ALSO FOUND REER 7% UNDERVALUED IN 2015



Source: CNB, UniCredit Research

CHART 3: INDICATORS OF EUROZONE GROWTH SENTIMENT HAVE DONE A BETTER JOB AT OFFERING DIRECTIONAL CLUES ON THE CZK...



Source: Bloomberg, Haver, UniCredit Research

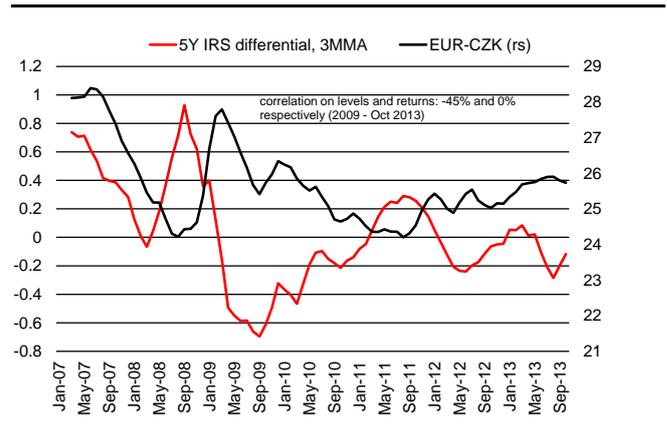
6. What is our current strategy stance on the CZK?

The CNB implicitly assumes that structural-appreciation pressures will persist for the CZK, and that the tightening in overall monetary conditions will be driven by a lower EUR-CZK, which it projects will hit 24.5 by the end of 2019. This is a level that would be the equivalent of the CNB conducting five hikes of 25bp each.

Our economists have a much more conservative view and assume that the CZK will only marginally appreciate over a 1Y period. Our official forecast for EUR-CZK projects that it will hit 25.60 in 2Q19 before edging down to 25.40 by the end of 2019. Our end-2020 forecast shows EUR-CZK reaching 24.80. For more information, see pages 46-49 in our recently released [CEE Quarterly: Bracing for external headwinds](#), 26 March.

From a strategy point of view, we believe that EUR-CZK will face upside risks in the months ahead. The currency has held reasonably well given the upside surprise in Czechia's consumer price index and given the period when more-hawkish messaging was coming from the CNB. That said, we see three reasons why the CZK could weaken in the months ahead.

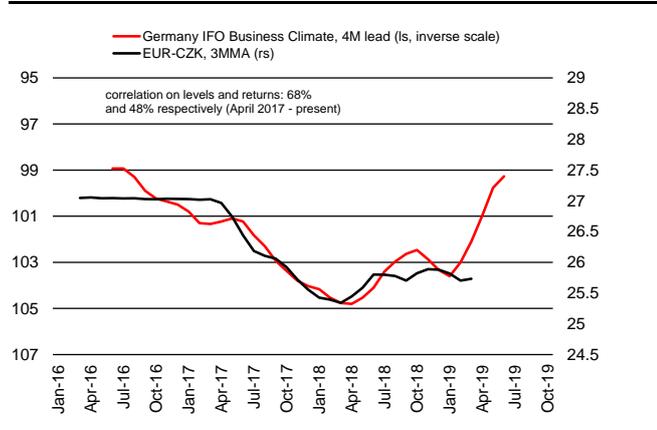
CHART 4: ...THAN INTEREST-RATE DIFFERENTIALS...



Source: Bloomberg, Haver, UniCredit Research

First, we found that global growth indicators (like the German Ifo Business Climate Index) give a better indication of spot direction than interest-rate differentials and hence downplay the significance of the rate hike for the CZK when global growth looks soft (see Charts 3-5).

CHART 5: ...AND THE PRESSURE ON THE CZK SHOULD BE LOWER ACCORDING TO TRENDS IN EUROZONE DATA



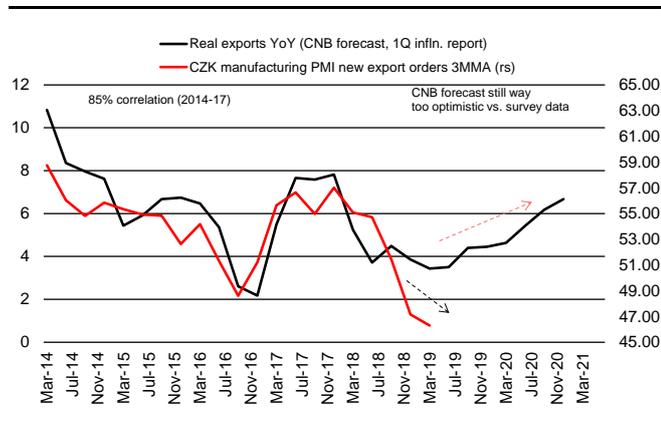
Source: Bloomberg, Haver, UniCredit Research

Second, the CNB's assumptions of external demand appear overly optimistic compared to historically well-correlated survey indicators like PMIs of export orders. If this is re-assessed, then a significant shift to a more-dovish tone should become plausible (Chart 6).

Finally, while our economists expect core inflation to grind higher towards the end of the year, they flag that the measure excluding food and fuel is likely closer to a peak. Certain leading activity indicators, which have traditionally given good leading signals on turns in inflation historically, continue to flag the risk of an earlier decline.

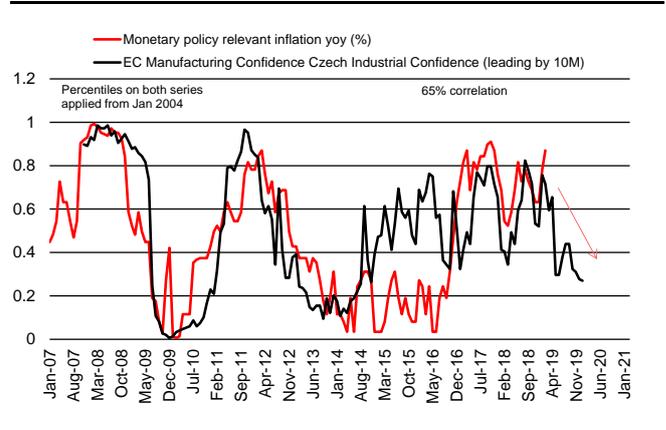
The European Commission's industrial manufacturing confidence sub-component is a case in point, with the survey appearing to lead troughs and peaks in inflation by roughly ten months (chart 7). Currently, the signal being sent by this indicator is that inflation could well be close to reaching a peak.

CHART 6: CNB ASSUMPTION ON EXTERNAL DEMAND IS TOO OPTIMISTIC RELATIVE TO SURVEY DATA



Source: Bloomberg, Haver, UniCredit Research

CHART 7: LEADING ACTIVITY INDICATORS SUGGEST DOWNSIDE RISKS TO INFLATION

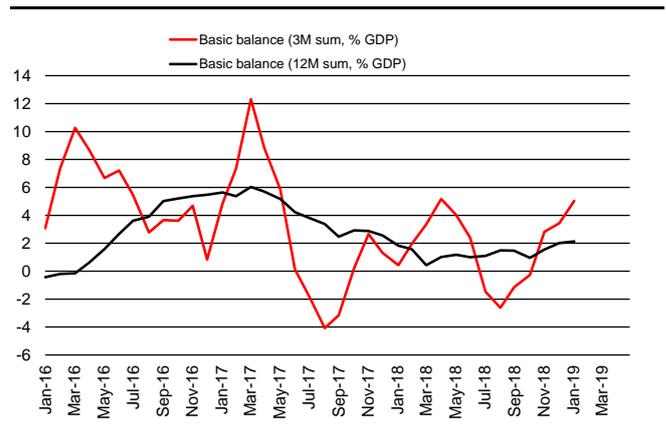


Source: Bloomberg, Haver, UniCredit Research

Potential downside surprises in inflation, if they materialize, could open the door to a significant shift in tone by the CNB. This is not our central scenario, but we do believe the risks reflect a tendency in this direction.

However, while we do believe that the CZK will come under further depreciation pressure, we expect any weakness to be relatively orderly, given Czechia's still-decent external balances. Indeed, when we look at recent basic balances (C/A + foreign direct investment) for the most recent 3M period for which monthly balance of payment data are available, flows appear to have been marginally supportive of the CZK. Hence, such flows could provide some offset.

CHART 8: STRONGER BASIC BALANCES RECENTLY COULD PROVIDE SOME OFFSET



Source: Bloomberg, Haver, UniCredit Research

Strategy: Our preference would be to position for controlled depreciation in the CZK on a 3M view, for which structures like EUR-CZK call spreads appear ideal. We are currently long EUR-CZK via a 28 June 26.10-26.70 call spread.

The tenor still covers two more central-bank meetings: 2nd May and 26th June where it is plausible that the CB could revise its relatively optimistic view of the world. We also like long USD-CZK positions on a 3M view.

Conclusion:

In this note, we consider a BEER model for the CZK's real effective exchange rate by using variables such as productivity growth relative to the eurozone, degree of openness, government debt as a percentage of GDP, net foreign assets and investment as a share of GDP.

The CZK was revealed as 2-4% overvalued, although this was less than its overvaluation peak of nearly 5-6% in 1Q18. With the CZK having oscillated historically by up to +/-6% on either side of fair value, we would suggest that, if external fundamentals turn less favorable, there will still be scope for the CZK to show further weakness. Hence, we would not view valuation as a barrier to further depreciation, if conditions warrant this.

While the CZK has held up better as a result of the more-hawkish rhetoric from the CNB, given the upside surprise in inflation, a combination of weakening global growth indicators, the risk of the CNB dialing down its optimistic view on external demand and potential downside risks to inflation could mean that the CZK will face depreciation pressure in the months ahead.

In terms of strategy, we are long EUR-CZK using options: a 28 June 26.10-26.70 call spread. The tenor covers two more CNB meetings. We also like long USD-CZK positions on a 3M view.

(The technical appendix can be found on the next page.)

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APPENDIX

For the purposes of valuing the CZK, we chose to model the trade-weighted real effective exchange rate (REER) by using a reduced-form equilibrium exchange-rate approach.

Variables used and data construction

For the dependent variable, we used the real effective exchange rate for Czechia as calculated by the Bank of International Settlements.

For the explanatory variables, we considered the following:

1. relative productivity vis-à-vis the eurozone (PROD),
2. the degree of openness of the economy (OPEN),
3. net foreign assets as a percentage of GDP (NFA),
4. the ratio of government debt to GDP (GD) and
5. investment as a share of GDP (INV)

We also experimented with other variables, including relative unit labor costs (Czechia compared with its trading partners), real interest-rate differentials, terms of trade, the trade balance (and/or current account balance), the trend in foreign direct investment and net international investment position.

However, we did not find that these variables added much to the explanatory power of our model.

All explanatory variables and the real exchange rate were expressed in logarithms for the purposes of our econometric valuation exercise.

Relative productivity (PROD): We used quarterly data from Haver on output per employed person (2010=100). We then calculated the ratio of Czechia’s productivity to eurozone productivity.

Degree of openness (OPEN): We calculated the sum of merchandise-goods exports and imports as a proportion of GDP.

Net foreign assets (NFA): We used the net-foreign-assets series derived from the quarterly international-investment-position data set from Haver, scaled as a proportion of the rolling four-quarter sum of GDP.

Government debt to GDP (GD): We used quarterly government-debt-to-GDP figures provided by Eurostat. The Bloomberg ticker is EUQDGCZ Index.

Investment as a share of GDP (INV): We used gross-fixed-capital-formation data (2010 chained prices) provided by Eurostat. We took a 4Q sum and scaled by annual GDP data. The relevant Bloomberg tickers are FCFNCZI Index and EUGNCZ Index respectively.

For our regression, we converted all variables into log form.

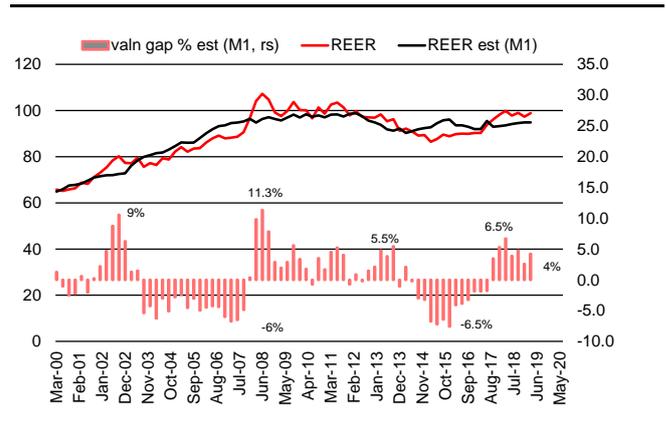
Diagnostic testing

In conducting our analysis, we found that most of the variables were non-stationary but became stationary upon differencing, i.e. they are I(1) while others are I(0). Overall, the results are conducive to applying a co-integration analysis.

For the model selection, we looked at various combinations of variables and sorted them according to the following conditions (in order of preference): **1.** the residuals of the regression are stationary (as per the methodology used by Engle and Granger²), **2.** explanatory variables are of the correct sign and statistically significant (at a 5% or 10% level) and **3.** the explanatory power of the regression was reasonably high.

The three charts below provide a snapshot of valuation signaled by the three models we homed in on (M1, M2 and M3) while tables 1,2 and 3 provide information on the model specification, diagnostic tests as well as the convergence back to equilibrium (or the error correction term).

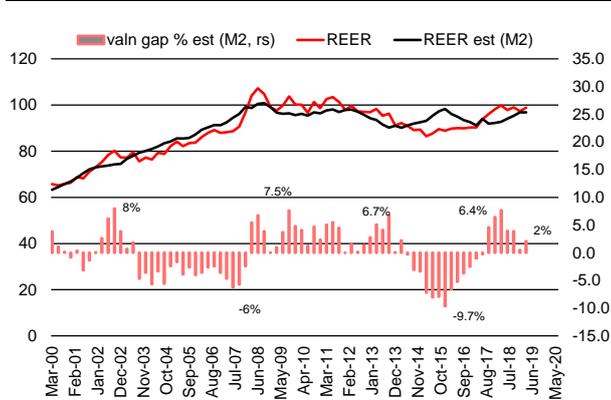
CHART 9: VALUATION BASED ON PROD, OPEN, NFA AND GD



Source: Bloomberg, Haver, UniCredit Research

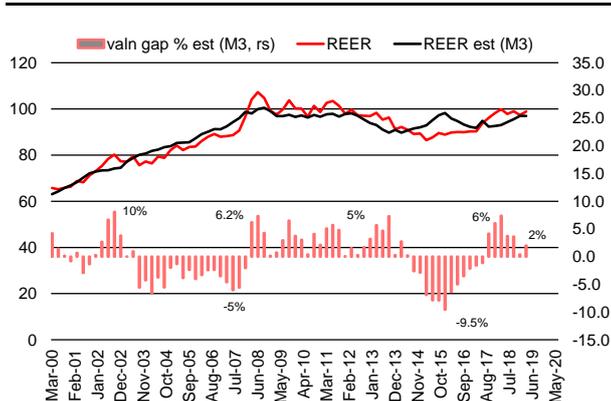
²See “Co-integration and error correction: representation, estimation and testing”, *Econometrica*, 1987.

CHART 10: VALUATION BASED ON PROD, NFA, GD AND INV



Source: Bloomberg, Haver, UniCredit Research

CHART 11: VALUATION BASED ON PROD, OPEN, NFA, GD AND INV.



Source: Bloomberg, Haver, UniCredit Research

TABLE 1: RESULTS OF REGRESSION TESTING

Model specification	M1	M2	M3
C	4.92	2.01	2.40
ln(PROD)	1.84	1.39	1.61
ln(OPEN)	-0.15		-0.12
ln(NFA)	-0.12	-0.09	-0.06
ln(GD)	0.12	0.11	0.14
ln(INV)		0.67	0.65
Mar - end valuation % (vs. model)	4.2	2.1	2.0
Post-2000 valuation extremes %)			
max	11.3	8.0	8.1
min	-7.6	-9.7	-9.6
Post-2009 valuation extremes %)			
max	6.7	7.7	7.4
min	-7.6	-9.7	-9.6

Source: UniCredit Research

TABLE 2: EXPLANATORY POWER AND DIAGNOSTICS

Model specification	M1	M2	M3
adj. R2	0.86	0.88	0.88
S.E. of regression	0.05	0.04	0.04
Residuals tests (p-values)			
Ho: residuals are I(1)	0.21	0.20	0.06
Ho: autocorrelation LM(6)	0.00	0.00	0.00
Ho: homoscedasticity	0.38	0.02	0.05
Ho: normality	0.30	0.27	0.29

Source: UniCredit Research

TABLE 3: CONVERGENCE TO EQUILIBRIUM

Model specification	M1	M2	M3
error correction term			
coefficient	-0.09	-0.15	-0.10
p-value	0.03	0.07	0.08
VECM lag length	5	1	5
Interpretation			
Valuation gap corrects? (Y/N)	Y	Y	Y
How fast does it correct? (quarters)	12	7	10

Source: UniCredit Research

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