Reply to referee report #2

Eilev Jansen and Tord Krogh, 28 November 2011

Referee #2 provides us with several constructive remarks that will benefit us in the process of revising the paper.

Firstly, the referee argues that our motivation is somewhat unclear. This is especially related to whether the CCI captures non-regulatory changes or not, and to what extent a CCI for households (which is really what we estimate) can be applicable for the whole credit market.

We absolutely agree that a CCI should capture shifts in the supply curve of credit. We also agree that our estimated trend *will* capture not only regulatory changes, but also shifts in the behavior of financial institutions, risk taking, etc. It might be that we over-emphasize the regulatory bit since these changes are more tangible—we know exactly when regulatory changes occurred. A revised paper should make sure to point out more clearly that other aspects are important too. Further, it would be an additional improvement if we make it clear that the CCI relates to households' credit conditions (rather than just doing it implicitly, as it is now), implying that it is most relevant for *e.g.* improvements of consumption functions, house price equations, etc.

Secondly, the referee points out several simplifications we make, and it is argued that these are a weakness to the paper. Let us comment on each point sequentially:

- Secured debt is assumed to be purely supply determined: This is an assumption we make in order to validate studying total and secured debt in a system, and to make it clear why we don't consider unsecured and secured debt as the system (since this would require secured debt to enter the unsecured debt equation). Cf. the last paragraph of section 3.1.

- Variables are assumed to be I(1): Indeed, this is a short-cut, since some of the variables appear to be closer to I(2). We have examined the order of integration of the data series (for the variables that are part of **y** and **x** on p.8) by a suite of different tests: the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller (1979)). The Phillips-Perron (PP) test (Phillips (1987), Phillips and Perron (1988)) as well as the Kwiatkowski, Phillips, Schmidt

and Shin (KPSS) test (Kwiatkowski et al (1992)), see Table 1. While the ADF-test and the PP test have non-stationarity as the null, the KPSS test has stationarity as the null. Optimal lag truncation for the ADF tests rely on Akaike's information criterion.

The tests reveal conflicting results. While the ADF-tests suggest that secured loans, housing wealth and (at narrow margin) liquid wealth are I(2), these results are not supported by the PP and KPSS tests which indicate they are I(1). For total loans the ADF and KPSS yield stationarity, while the PP test supports I(1). For the rest of the variables all tests suggest that they are I(1), except that the PP test suggests the income variable is stationary and the ADF test (without a deterministic trend) claims stationarity for the real interest rate.

A revised paper could possibly try to test for integration while allowing for structural breaks. Our intuition tells us that this should make the occurrence of I(2) less likely. Nevertheless, we should at the very least be less opaque about the results of our integration tests.

- Cointegration is assumed: This is assumed a priori in the estimation, and it is not tested extensively for ex post. However, the fact that the error-correction coefficients are highly significant is one piece of evidence in favor of the asserted cointegration.

- The system has little dynamics: This is done simply to keep the dimension of the system small and thus to preserve degrees of freedom.

- We impose ex ante assumptions regarding signs of dummy-coefficients: See comment below.

- Problems associated with weak statistical properties:

  i) The ADF-tests are discussed above

  ii) Non-normality: in general, excess kurtosis is less harmful to likelihood-based analyses than excess skewness. See Juselius (2006, p. 47) in the context of VAR-analysis and Davidson (2000, p.164) for asymptotic properties of the dynamic regression model. We will however look more closely at this matter and revise the results if the excess kurtosis is due to

extremely large outliers rather than smaller, but significant, outliers. With non-normal disturbances the appropriate critical values usually converge to those of the standard normal from above. In the interest of conservatism (i.e., controlling type I error) one should generally use the critical values from the t-distribution even in the absence of normality. That said, the occurrence of excess kurtosis without excess skewness suggests that the outliers in our case are located on both sides of the mean. Figure 5 provides some reassurance that the excess kurtosis may not be such a severe problem.

iii) Instability in Figure 7: The graphs do not suggests any severe mis-specification as the estimated recursive coefficients do not vary much. We should therefore drop the word "clear" in the quoted sentence, the purpose of which is to indicate a possible improvement by allowing for interaction between ST and other variables.

Regarding our "regime shift assumptions", we realize that they may confuse the reader more than they benefit the analysis, and this section of the paper should be rewritten. The reason why the assumptions are "imposed" is that we want to make sure to utilize the knowledge we have (given the investigation of regulatory changes in Krogh (2010)). However, in practice these assumptions are basically completely irrelevant: when estimated freely only one of the coefficients violate the assumptions (and is, as a result, set to zero). We trace this violation to the fact that price regulations ended one period ahead, creating a surge in inflation (and a resulting decrease in the real stock of debt), which should have been unrelated credit conditions, making this zero-restriction innocent.

In a revised version of the paper we will strongly consider to rather refer to the "regime shift assumptions" as "regime shift expectations", which we don't impose but use as guidelines to evaluate whether the trend has a reasonable shape or not. In practice this change will have no effect on our results.

References:

Davidson, J. (2000): *Econometric Theory*. Blackwell, Oxford

Dickey, D.A. and W.A. Fuller (1979): Distribution of the estimates for autoregressive time series with a unit root,. *Journal of the American Statistical Association 74,* 427-431-

Fernandez-Corugedo, E., and J. N. Muellbauer (2006): "Consumer Credit Conditions in the U.K." Working Paper 314, Bank of England, London.

Juselius, K. (2006); *The cointegrated VAR: methodology and applications*. Oxford University Press, Oxford.

Krogh, T.S.H. (2010): Credit regulations in Norway, 1970-2008, Reports 37/2010, Statistics Norway, http://www.ssb.no/english/subjects/11/01/rapp_201037_en/rapp_201037_en.pdf

Kwiatkowski, D., P.C.B. Phillips, P. Schmidt and Y. Shin (1992): Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics 54,* 159-178.

Phillips, P.C.B. (1987): Time series regression with a unit root. *Econometrica 55,* 277-301.

Phillips, P.C.B. and P. Perron (1988): Testing for a unit root in time series regression. *Biometrika 75,* 335-346.

Table 1: Tests for the order of integration[a]

	ADF		PP		KPSS		
Testing levels							
Variable	$t-ADF$	5%	$Adj.t-stat$	5%	LM	5%	Characteristics[b]
d	−3.86	−3.46	−1.22	−3.44	0.137	0.146	t
sd	−3.31	−3.46	−0.36	−3.44	0.21	0.146	t
y	−1.76	−3.46	−3.55	−3.44	0.34	0.146	t
hw	−2.37	−3.46	−1.44	−3.44	0.24	0.146	t
mw	−2.99	−3.46	−3.17	−3.44	0.10	0.146	t
lw	−1.17	−3.46	−1.42	−3.44	0.20	0.146	t
R	−2.75	−3.46	−2.83	−3.46	0.29	0.146	t
R	−3.01	−2.89					i
U	−2.45	−3.46	−2.01	−3.46	0.23	0.146	t
U	−2.67	−2.89					i
Testing first differences							
Δd	−2.15	−2.89	−9.55	−2.89	0.16	0.46	i
Δsd	−1.98	−2.89	−10.32	−2.89	0.35	0.46	i
Δy	−5.02	−2.89	−21.04	−2.89	0.35	0.46	i
Δhw	−2.65	−2.89	−6.71	−2.89	0.14	0.46	i
Δmw	−3.20	−2.89	−10.97	−2.89	0.08	0.46	i
Δlw	−2.82	−2.89	−14.93	−2.89	0.21	0.46	i
ΔR	−11.94	−2.89	−11.93	−2.89	0.18	0.46	i
ΔU	−2.95	−2.89	−16.01	−2.89	0.16	0.46	i
Testing second differences							
$\Delta^2 d$	−4.62	−2.89	−	−	−	−	i
$\Delta^2 sd$	−13.28	−2.89	−	−	−	−	i
$\Delta^2 hw$	−3.81	−2.89	−11.41	−2.89	−	−	i
$\Delta^2 lw$	−8.07	−2.89	−11.41	−2.89	−	−	i

[a] References: Augmented Dickey-Fuller (ADF) test (Dickey and Fuller (1979)), the Phillips-Perron (PP) test (Phillips (1987) and Phillips and Perron (1988)), as well as the Kwiatowski, Phillips, Schmidt, and Shin (KPSS) test (Kwiatkowski et al. (1992)) All tests are performed in EViews. We have also checked out the ADF test in PC-Give for seasonals, which are mainly relevant for disposable income. Including seasonals does not change the results.

[b] The different characteristics are: Including both trend and intercept (t) or only an intercept (i) in the test regression.