Web Appendix for:

Leverage as a Predictor for Real Activity and Volatility
(Forthcoming in: Journal of Economic Dynamics and Control)

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Overview of the Web Appendix:

Section A considers variants and extensions of forecast equations studied in the paper.

Section B reports VAR estimation results for leverage and real activity.

Section A: Variants and extensions of the baseline models

This Section presents variants and extensions of the baseline models studied in the paper. The findings below establish the robustness of the main results discussed in the paper. In particular, leverage is a significant negative predictor of future real activity; we find no support for non-linear and asymmetric effects of leverage.

Individual macro-financial controls, alternative lag structures and forecast horizons

- **Tables A.1a and A.1b** use the *individual* macro-financial controls, together with the median of YoY sectoral leverage growth rates, as predictors of future YoY real activity growth.

- **Tables A.2a and A.2b** use the 4 macro-financial factors together with sectoral leverages, as predictors of YoY real activity growth. (In Table A.2a, the relative RMSEs of different models are normalized by the RMSE of model 'F'.)

- **Tables A.3a and A.3b** use YoY changes in real activity (Y_t-Y_{t-4}) and principal components of YoY changes of macro-financial controls ($\Phi_{4,t}$) as predictors for YoY real activity growth:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-4}) + \beta_2 \Phi_{4,t} + \beta_3 \Lambda_{4,t} + \varepsilon_{t+4} \tag{A.1}$$

  where $\Lambda_{i,t}$ represents leverage indicators based on changes over i quarters. $\Phi_{i,t}$ is a vector of four factors (principal components) of i-quarter (log) changes of the set of macro-financial variables discussed in Section 3 (specifically, the quarterly differences and returns used in the construction of the factors--see right-most column in Panel (c) of Appendix to paper--are now replaced by differences and returns over s>1 quarters). Note that $\Phi_{1,t}$ and $\Lambda_{4,t}$ correspond to Φ_t and Λ_t in the main text, respectively.

- **Tables A.4a and A.4b** forecast 8-quarter ahead real activity growth, using 8-quarter leverage growth as a predictor:

$$Y_{t+8} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-1}) + \beta_2 \Phi_{1,t} + \beta_3 \Lambda_{8,t} + \varepsilon_{t+8} \tag{A.2}$$

Interaction terms between leverage and other predictors

- **Tables A.5a and A.5b** include interaction terms between real activity and leverage, as predictors:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-4}) + \beta_2 \Phi_{1,t} + \beta_3 \Lambda_{4,t} + \beta_4 \Lambda_{4,t} (Y_t - Y_{t-4}) + \varepsilon_{t+4} \tag{A.3}$$

- **Tables A.6a and A.6b** display results from augmenting the models 'F, PC-LEV' and 'F, MED-LEV' with interaction terms between leverage $\Lambda_{4,t}$ and the four macro-financial control factors $\Phi_{1,t}$:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-1}) + \beta_2 \Phi_{1,t} + \beta_3 \Lambda_{4,t} + \beta_4 \cdot (\Lambda_{4,t} \cdot \Phi_{1,t}) + \varepsilon_{t+4} \tag{A.4}$$

Non-linear transforms of leverage

- **Tables A.7a to A.7c** consider the non-linear transformations of leverage discussed in the main text (see equation (2)), for the full set of sectoral leverage measures:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-1}) + \beta_2 \Phi_{1,t} + \beta_3 \Lambda_{4,t} + \beta_4 f(\Lambda_{4,t}) + \varepsilon_{t+4} \text{ for } f(\Lambda_{4,t}) = \max(0, \Lambda_{4,t}), \text{ and } f(\Lambda_{4,t}) = (\Lambda_{4,t})^2$$

- **Table A.8** identifies the effect of leverage build-ups on future real activity by using a non-linear transformation of the deviation of leverage from a 12 quarter moving average of lagged leverage as a predictor:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-1}) + \beta_3 \Lambda_{4,t} + \beta_4 f_t(L_t) + \varepsilon_{t+4} \quad \text{(A.5)}$$

  where L_t represents the log-level of leverage, and $f_t(L_t) = \max(0, L_t - \frac{1}{12}\sum_{i=1}^{12} L_{t-i})$. A similar transformation is used by Hamilton (2010, Nonlinearities and the Macroeconomic Effects of Oil Prices, NBER WP 16186) to identify prolonged build-ups in oil prices. For comparison purposes, we also report results for $f_t(L_t) = L_t - \frac{1}{12}\sum_{i=1}^{12} L_{t-i}$.

Robustness with respect to the number of macro-financial control factors

- **Tables A.9a and A.9b** evaluate variants of the model 'F, MED-LEV' that include between 1 and 8 macro-financial control factors.

Clark-West tests of equal predictive accuracy, relative to model 'F'

- **Table A.10** provides a Clark and West (2007) MSPE-adjusted test of equal predictive accuracy of models that include the four macro-financial control factors *and* leverage as predictors, vs. model 'F'. (NB model 'F' includes the four macro-financial control factors, but no leverage information).

Individual macro-financial controls, alternative lag structures and forecast horizons (Tables A.1-A.4)

Table A.1a: RMSEs of models that use individual macro-financial control variables as predictors

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.77*	*3.90*	*0.87*	*10.16*	*19.63*	*1.91*	*4.27*	*0.95*	*10.93*	*20.96*
Random Walk	1.09	1.11	1.22	1.04	1.00	1.05	1.04	1.10	1.00	0.98
MED-LEV	0.85	0.89	0.83	0.88	0.98	0.90	0.94	0.82	0.93	1.14
MED-LEV, GDP	NA	0.89	0.79	0.88	0.97	NA	0.95	0.79	0.93	1.19
MED-LEV, net exports	0.81	0.88	0.81	0.87	0.98	0.90	0.97	0.85	0.93	1.20
MED-LEV, CPI	0.78	0.81	0.82	0.83	0.91	0.84	0.88	0.85	0.89	1.10
MED-LEV, Gov't Exp.	0.85	0.89	0.82	0.88	0.97	0.91	0.96	0.83	0.94	1.16
MED-LEV, GDP-Deflator	0.80	0.84	0.82	0.81	0.96	0.86	0.93	0.85	0.90	1.17
MED-LEV, Housing starts	0.81	0.85	0.77	0.76	0.98	0.91	0.95	0.80	0.84	1.20
MED-LEV, INDPRO	0.85	NA	0.79	0.88	0.98	0.93	NA	0.82	0.96	1.26
MED-LEV, M2	0.85	0.88	0.80	0.88	0.98	0.90	1.01	0.88	0.98	1.14
MED-LEV, Employment	0.85	0.86	0.83	0.83	0.97	0.92	0.91	0.84	0.89	1.18
MED-LEV, UNRATE	0.83	0.83	NA	0.83	0.97	0.89	0.88	NA	0.88	1.22
MED-LEV, PCE	0.80	0.88	0.77	0.86	0.97	0.87	0.97	0.81	0.96	1.17
MED-LEV, PCE durables	0.81	0.86	0.79	0.83	0.98	0.87	0.94	0.82	0.93	1.15
MED-LEV, I	0.85	0.89	0.80	NA	0.98	0.91	0.95	0.80	NA	1.21
MED-LEV, nonresidtl. Inv	0.82	0.84	0.83	0.83	0.95	0.89	0.91	0.85	0.89	1.14
MED-LEV, residential Inv	0.76	0.85	0.73	0.76	0.97	0.85	0.98	0.77	0.84	1.22
MED-LEV, term spread	0.84	0.88	0.81	0.88	0.96	0.90	0.95	0.79	0.93	1.17
MED-LEV, Gov't saving	0.85	0.89	0.82	0.88	0.97	0.90	0.95	0.82	0.95	1.18
MED-LEV, PPI	0.77	0.78	0.81	0.82	0.92	0.85	0.86	0.87	0.89	1.21
MED-LEV, oil price	0.85	0.89	0.83	0.88	0.97	0.91	0.98	0.85	0.96	1.15
MED-LEV, ISM inventories	0.85	0.89	0.83	0.88	0.97	0.89	0.96	0.83	0.94	1.15
MED-LEV, ISM new orders	0.84	0.84	0.80	0.83	0.98	0.90	0.93	0.82	0.93	1.17
MED-LEV, FF SMB	0.85	0.89	0.83	0.88	0.98	0.91	0.95	0.82	0.94	1.15
MED-LEV, FF HML	0.84	0.88	0.83	0.88	0.97	0.93	0.95	0.88	0.97	1.16
MED-LEV, FF Mom	0.84	0.84	0.81	0.85	0.94	0.92	0.94	0.83	0.95	1.19
MED-LEV, FF ST_Rev	0.82	0.86	0.78	0.84	0.97	0.90	0.98	0.82	0.94	1.13
MED-LEV, FF LT_Rev	0.85	0.89	0.83	0.88	0.97	0.92	0.95	0.86	0.95	1.14
MED-LEV, 3M T-bill	0.84	0.85	0.78	0.81	0.94	0.90	0.95	0.91	0.91	1.08
MED-LEV, 2Y T-bill	0.85	0.87	0.76	0.87	0.94	0.92	1.02	0.85	0.97	1.18
MED-LEV, 5Y T-note	0.85	0.87	0.79	0.88	0.97	0.92	0.98	0.82	0.97	1.26
MED-LEV, capacity util.	0.85	0.88	0.77	0.88	0.98	0.92	0.99	0.80	0.95	1.25

Note: The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column. **Rows 4-34 of this table show RMSE results for variants of the forecast equation (1) in the paper, in which each of the 30 macro-financial variables is used individually as a predictor, together with the median of the 8 sectoral leverages ($\Lambda_{4,t}$) and the past QoQ change of real activity ($Y_t - Y_{t-1}$). (NB: the paper only uses principal components of the 30 macro-financial variables as a predictor.)** 'In-sample RMSEs' are based on regressions as in (1) estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3). Note that in four models, the single macro-financial variable coincides with the past real activity regressor ($Y_t - Y_{t-1}$) – these models are indicated by 'NA'.

Table A.1b: Regression coefficients of leverage in models with individual macro-financial control variables

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	GDP	IP	UE	I	Rx	GDP	IP	UE	I	Rx
D-LEV	-0.61***	-0.56***	0.63***	-0.57***	-0.25	0.87	0.97	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.05}	{0.87}	{0.97}	{0.61}	{1.00}	{0.54}
MED-LEV, GDP	NA	-0.55***	0.55***	-0.54***	-0.33	NA	1.00	0.00	1.00	0.43
	NA	{0.37}	{0.58}	{0.28}	{0.06}	NA	{1.00}	{0.54}	{1.00}	{0.48}
MED-LEV, net exports	-0.52***	-0.55***	0.61***	-0.56***	-0.23	0.88	0.99	0.00	1.00	0.46
	{0.45}	{0.38}	{0.56}	{0.30}	{0.05}	{0.88}	{0.99}	{0.48}	{1.00}	{0.67}
MED-LEV, CPI	-0.62***	-0.53***	0.62***	-0.55***	-0.31	0.70	0.62	0.00	0.88	0.42
	{0.50}	{0.47}	{0.55}	{0.36}	{0.18}	{0.70}	{0.62}	{0.42}	{0.88}	{0.70}
MED-LEV, Gov't Exp.	-0.58***	-0.55***	0.62***	-0.56***	-0.23	0.86	0.99	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.06}	{0.86}	{0.99}	{0.55}	{1.00}	{0.54}
MED-LEV, GDP-Deflator	-0.64***	-0.56***	0.61***	-0.57***	-0.28	0.83	0.65	0.00	0.86	0.42
	{0.47}	{0.44}	{0.54}	{0.39}	{0.07}	{0.83}	{0.65}	{0.48}	{0.86}	{0.68}
MED-LEV, Housing starts	-0.54***	-0.47***	0.48***	-0.46***	-0.23	0.86	0.96	0.00	0.94	0.46
	{0.46}	{0.42}	{0.60}	{0.46}	{0.05}	{0.86}	{0.96}	{0.51}	{0.94}	{0.58}
MED-LEV, INDPRO	-0.59***	NA	0.55***	-0.54***	-0.30	0.88	NA	0.00	1.00	0.32
	{0.40}	NA	{0.58}	{0.28}	{0.05}	{0.88}	NA	{0.49}	{1.00}	{0.42}
MED-LEV, M2	-0.64***	-0.55***	0.61***	-0.55***	-0.24	0.87	0.97	0.00	1.00	0.46
	{0.40}	{0.37}	{0.56}	{0.28}	{0.05}	{0.87}	{0.97}	{0.67}	{1.00}	{0.57}
MED-LEV, Employment	-0.67***	-0.65***	0.62**	-0.75***	-0.42	1.00	1.00	0.00	1.00	0.33
	{0.40}	{0.40}	{0.54}	{0.35}	{0.07}	{1.00}	{1.00}	{0.86}	{1.00}	{0.54}
MED-LEV, UNRATE	-0.71***	-0.68***	NA	-0.75***	-0.41	0.88	1.00	NA	1.00	0.16
	{0.42}	{0.45}	NA	{0.36}	{0.07}	{0.88}	{1.00}	NA	{1.00}	{0.26}
MED-LEV, PCE	-0.51***	-0.51***	0.50***	-0.44***	-0.34	0.87	0.96	0.00	0.96	0.45
	{0.46}	{0.38}	{0.60}	{0.31}	{0.06}	{0.87}	{0.96}	{0.55}	{0.96}	{0.55}
MED-LEV, PCE durables	-0.56***	-0.50***	0.52***	-0.42**	-0.26	0.86	0.96	0.00	1.00	0.43
	{0.45}	{0.40}	{0.58}	{0.36}	{0.05}	{0.86}	{0.96}	{0.51}	{1.00}	{0.57}
MED-LEV, I	-0.62***	-0.56***	0.59***	NA	-0.30	0.86	1.00	0.00	NA	0.43
	{0.40}	{0.37}	{0.56}	NA	{0.05}	{0.86}	{1.00}	{0.52}	NA	{0.45}
MED-LEV, nonresidtl. Inv	-0.73***	-0.68***	0.65**	-0.73***	-0.45*	0.87	0.97	0.00	1.00	0.38
	{0.44}	{0.43}	{0.54}	{0.35}	{0.10}	{0.87}	{0.97}	{0.49}	{1.00}	{0.49}
MED-LEV, residential Inv	-0.48***	-0.46***	0.49***	-0.42***	-0.19	0.70	0.80	0.00	0.78	0.46
	{0.52}	{0.42}	{0.64}	{0.46}	{0.06}	{0.70}	{0.80}	{0.42}	{0.78}	{0.59}
MED-LEV, term spread	-0.58***	-0.56***	0.65***	-0.55***	-0.20	0.87	1.00	0.00	1.00	0.46
	{0.41}	{0.37}	{0.56}	{0.28}	{0.09}	{0.87}	{1.00}	{0.62}	{1.00}	{0.57}
MED-LEV, Gov't saving	-0.58***	-0.55***	0.61***	-0.57***	-0.20	0.90	0.96	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.06}	{0.90}	{0.96}	{0.57}	{1.00}	{0.58}
MED-LEV, PPI	-0.60***	-0.50***	0.61***	-0.53***	-0.28	0.87	0.74	0.00	1.00	0.43
	{0.51}	{0.51}	{0.56}	{0.37}	{0.15}	{0.87}	{0.74}	{0.48}	{1.00}	{0.64}
MED-LEV, oil price	-0.60***	-0.56***	0.63***	-0.57***	-0.24	0.86	0.91	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.06}	{0.86}	{0.91}	{0.51}	{1.00}	{0.54}
MED-LEV, ISM inventories	-0.60***	-0.56***	0.63***	-0.57***	-0.26	0.87	0.99	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.06}	{0.87}	{0.99}	{0.62}	{1.00}	{0.54}
MED-LEV, ISM new orders	-0.61***	-0.51***	0.56***	-0.55***	-0.26	0.87	1.00	0.00	1.00	0.43
	{0.41}	{0.43}	{0.56}	{0.36}	{0.05}	{0.87}	{1.00}	{0.59}	{1.00}	{0.54}
MED-LEV, FF SMB	-0.60***	-0.56***	0.63***	-0.58***	-0.26	0.91	0.99	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.05}	{0.91}	{0.99}	{0.58}	{1.00}	{0.55}
MED-LEV, FF HML	-0.65***	-0.57***	0.63***	-0.58***	-0.26	0.84	0.97	0.00	0.96	0.46
	{0.41}	{0.38}	{0.54}	{0.28}	{0.05}	{0.84}	{0.97}	{0.52}	{0.96}	{0.57}
MED-LEV, FF Mom	-0.56***	-0.51***	0.58***	-0.52***	-0.26	0.87	1.00	0.00	1.00	0.43
	{0.41}	{0.43}	{0.56}	{0.32}	{0.13}	{0.87}	{1.00}	{0.71}	{1.00}	{0.54}
MED-LEV, FF ST_Rev	-0.62***	-0.57***	0.62***	-0.59***	-0.27	0.87	0.94	0.00	1.00	0.43
	{0.44}	{0.41}	{0.59}	{0.34}	{0.07}	{0.87}	{0.94}	{0.58}	{1.00}	{0.54}
MED-LEV, FF LT_Rev	-0.61***	-0.55***	0.63***	-0.57***	-0.26	0.90	0.97	0.00	1.00	0.43
	{0.40}	{0.37}	{0.54}	{0.28}	{0.06}	{0.90}	{0.97}	{0.61}	{1.00}	{0.54}
MED-LEV, 3M T-bill	-0.66***	-0.62***	0.69***	-0.72***	-0.43*	0.83	0.91	0.00	0.94	0.43
	{0.41}	{0.41}	{0.59}	{0.39}	{0.13}	{0.83}	{0.91}	{0.65}	{0.94}	{0.54}
MED-LEV, 2Y T-bill	-0.61***	-0.58***	0.70***	-0.58***	-0.27	0.87	1.00	0.00	1.00	0.46
	{0.40}	{0.39}	{0.61}	{0.29}	{0.12}	{0.87}	{1.00}	{0.68}	{1.00}	{0.65}
MED-LEV, 5Y T-note	-0.60***	-0.59***	0.67***	-0.57***	-0.25	0.84	1.00	0.00	1.00	0.46
	{0.40}	{0.39}	{0.58}	{0.28}	{0.06}	{0.84}	{1.00}	{0.41}	{1.00}	{0.67}
MED-LEV, capacity util.	-0.63***	-0.53***	0.63***	-0.56***	-0.29	0.90	0.93	0.00	1.00	0.43
	{0.40}	{0.37}	{0.60}	{0.28}	{0.05}	{0.90}	{0.93}	{0.67}	{1.00}	{0.43}

Note: This Table shows regression coefficients of leverage in the models mentioned in Table A.1a. The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from regressions of each dependent variable on lagged leverage and other predictors for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistic): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations. The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significant negative and positive coefficients).

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.2a: RMSEs of <u>models that jointly use macro-financial controls and individual sectoral leverages are predictors</u>

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	1.36	1.28	1.48	1.45	1.09	1.03	1.15	1.32	1.18	0.91
Random Walk	1.49	1.42	1.81	1.50	1.09	1.09	1.20	1.46	1.18	0.89
F	*1.30*	*3.05*	*0.58*	*7.01*	*18.02*	*1.85*	*3.71*	*0.72*	*9.30*	*23.14*
F, PC-LEV	0.92	0.90	0.92	0.93	0.99	0.96	1.00	0.97	0.98	1.06
F, MED-LEV	0.90	0.88	0.88	0.89	0.97	0.93	0.98	0.96	0.94	1.08
F, MED-FoF	0.85	0.90	0.90	0.92	0.87	0.87	1.04	1.10	1.02	0.91
F, MED-MV	0.93	0.90	0.93	0.91	0.98	0.99	1.00	1.01	0.99	1.06
PC-LEV	1.21	1.18	1.30	1.35	1.08	0.99	1.18	1.20	1.18	1.02
MED-LEV	1.16	1.13	1.23	1.28	1.07	0.92	1.08	1.09	1.10	1.03
F, CB	0.94	0.90	0.91	0.96	0.95	1.02	1.04	1.01	1.04	1.02
F, INS	0.96	0.98	1.00	0.95	0.93	1.03	1.01	1.10	1.07	1.03
F, SBD	0.97	0.99	0.99	0.96	0.91	1.00	1.02	1.14	0.98	0.93
F, HH	0.98	0.98	0.98	0.99	0.98	0.94	1.02	1.03	0.97	1.21
F, BUS	0.98	1.00	0.98	1.00	0.99	1.16	1.20	1.08	1.27	1.31
F, BNK-MV	0.94	0.95	0.96	0.93	0.99	0.96	1.01	0.99	0.97	1.05
F, INS-MV	0.98	0.96	0.97	0.96	1.00	0.99	1.02	1.03	1.01	1.04
F, FIN-MV	0.93	0.84	0.88	0.88	0.98	1.03	0.99	1.06	1.04	1.05

Note: This table shows RMSEs for models listed in Column 1. It is similar to Table 1 in the main text, but in rows 10-17 <u>the macro-financial control factors and the individual sectoral leverage data are jointly used, as predictors</u>. The third row shows absolute RMSEs of the 'F' forecast model. For the other models, the Table shows **<u>relative RMSEs that are expressed relative to model 'F'.</u>**

'In-sample RMSEs' are based on regressions for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3). Estimations are based on YoY leverage growth (where included), the QoQ (log-)differences of the dependent variable, and controls based on QoQ differences (for models including the term 'F').

Columns labeled 'GDP',...,'Rx' show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.2b: Regression coefficients of leverage, in <u>models that use macro-financial controls and individual sectoral leverages are predictors</u>

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV	-0.42***	-0.49***	0.37**	-0.38**	-0.24	0.46	0.68	0.14	0.52	0.19
	{0.62}	*{0.60}*	*{0.74}*	*{0.61}*	*{0.18}*	*{0.46}*	*{0.71}*	*{0.54}*	*{0.52}*	*{0.30}*
F, MED-LEV	-0.45***	-0.51***	0.40***	-0.45***	-0.39	0.74	0.70	0.07	0.77	0.45
	{0.63}	*{0.62}*	*{0.76}*	*{0.65}*	*{0.21}*	*{0.74}*	*{0.70}*	*{0.52}*	*{0.77}*	*{0.58}*
F, MED-FoF	-0.45***	-0.39***	0.31**	-0.33***	-0.65***	0.86	0.72	0.00	0.78	0.71
	{0.67}	*{0.60}*	*{0.75}*	*{0.63}*	*{0.36}*	*{0.86}*	*{0.72}*	*{0.49}*	*{0.78}*	*{0.81}*
F, MED-MV	-0.36**	-0.42***	0.29**	-0.39***	-0.24	0.36	0.29	0.33	0.29	0.09
	{0.61}	*{0.60}*	*{0.74}*	*{0.63}*	*{0.19}*	*{0.38}*	*{0.39}*	*{0.46}*	*{0.29}*	*{0.12}*
PC-LEV	-0.53***	-0.47**	0.60**	-0.44*	-0.15	0.75	1.00	0.00	0.81	0.30
	{0.34}	*{0.31}*	*{0.48}*	*{0.19}*	*{0.02}*	*{0.75}*	*{1.00}*	*{0.52}*	*{0.81}*	*{0.42}*
MED-LEV	-0.61***	-0.56***	0.63***	-0.57***	-0.25	0.87	0.97	0.00	1.00	0.43
	{0.40}	*{0.37}*	*{0.54}*	*{0.28}*	*{0.05}*	*{0.87}*	*{0.97}*	*{0.61}*	*{1.00}*	*{0.54}*
F, CB	-0.23***	-0.33***	0.24***	-0.19**	-0.32**	0.39	0.48	0.10	0.38	0.52
	{0.60}	*{0.60}*	*{0.75}*	*{0.59}*	*{0.25}*	*{0.51}*	*{0.64}*	*{0.74}*	*{0.48}*	*{0.52}*
F, INS	-0.21**	-0.16	0.06	-0.22**	-0.39**	0.71	0.65	0.20	0.70	0.65
	{0.58}	*{0.53}*	*{0.70}*	*{0.60}*	*{0.28}*	*{0.71}*	*{0.65}*	*{0.51}*	*{0.70}*	*{0.75}*
F, SBD	-0.18**	-0.11	0.07	-0.21**	-0.46***	0.62	0.06	0.00	0.32	0.71
	{0.57}	*{0.51}*	*{0.70}*	*{0.59}*	*{0.31}*	*{0.62}*	*{0.06}*	*{0.43}*	*{0.32}*	*{0.71}*
F, HH	-0.31	-0.32**	0.25	-0.20	0.43	0.55	0.41	0.00	0.42	0.00
	{0.57}	*{0.53}*	*{0.71}*	*{0.57}*	*{0.20}*	*{0.55}*	*{0.41}*	*{0.19}*	*{0.43}*	*{0.72}*
F, BUS	-0.16*	-0.09	0.14	0.06	-0.13	0.39	0.71	0.06	0.32	0.48
	{0.56}	*{0.51}*	*{0.70}*	*{0.56}*	*{0.17}*	*{0.39}*	*{0.71}*	*{0.43}*	*{0.32}*	*{0.61}*
F, BNK-MV	-0.31**	-0.29	0.20	-0.32**	-0.17	0.62	0.26	0.00	0.42	0.01
	{0.60}	*{0.55}*	*{0.72}*	*{0.62}*	*{0.18}*	*{0.62}*	*{0.26}*	*{0.04}*	*{0.42}*	*{0.04}*
F, INS-MV	-0.19**	-0.23**	0.18**	-0.22**	-0.09	0.29	0.10	0.12	0.20	0.03
	{0.57}	*{0.54}*	*{0.71}*	*{0.59}*	*{0.17}*	*{0.30}*	*{0.33}*	*{0.17}*	*{0.22}*	*{0.06}*
F, FIN-MV	-0.33*	-0.53***	0.35***	-0.42***	-0.25	0.01	0.51	0.23	0.14	0.00
	{0.61}	*{0.65}*	*{0.76}*	*{0.65}*	*{0.19}*	*{0.01}*	*{0.51}*	*{0.33}*	*{0.14}*	*{0.19}*

Note: The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from the regressions considered in Table A.2a, for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.
The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).
The left column lists model variants as described in the main text. The results here differ from the main text in that the individual leverage models ('CB' to 'FIN-MV') were augmented by the four macro-financial control factors (indicated by the prefix 'F').
Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.3a: RMSEs of models that use <u>YoY changes of real activity and principal components of YoY changes in macro-financial control variables</u> as predictors

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.83*	*4.24*	*0.96*	*10.42*	*19.67*	*2.08*	*4.50*	*1.07*	*12.72*	*22.58*
Random Walk	1.06	1.02	1.10	1.01	1.00	0.97	0.99	0.97	0.86	0.91
F	0.54	0.63	0.56	0.61	0.84	0.84	0.82	0.71	0.73	1.12
F, PC-LEV	0.49	0.57	0.49	0.57	0.83	0.76	0.87	0.71	0.69	1.48
F, MED-LEV	0.47	0.55	0.47	0.54	0.79	0.76	0.83	0.70	0.67	1.47
F, MED-FoF	0.44	0.54	0.49	0.52	0.69	0.72	0.81	0.75	0.65	1.07
F, MED-MV	0.49	0.57	0.51	0.56	0.82	0.75	0.82	0.71	0.69	1.37
PC-LEV	0.85	0.82	0.79	0.88	0.95	0.95	0.93	0.80	0.94	1.15
MED-LEV	0.82	0.78	0.76	0.83	0.90	0.86	0.85	0.73	0.85	1.13
CB	0.98	0.95	0.97	0.98	0.97	1.02	1.00	1.01	1.01	1.05
INS	0.92	0.93	0.95	0.91	0.88	0.93	0.97	0.94	0.94	0.90
SBD	0.94	0.96	0.94	0.91	0.90	0.89	0.96	0.91	0.82	0.93
HH	0.91	0.88	0.80	0.92	1.00	0.98	0.90	0.82	0.95	1.17
BUS	0.99	0.99	0.98	1.00	0.99	1.27	1.18	1.11	1.22	1.24
BNK-MV	0.87	0.90	0.90	0.90	0.98	0.95	1.02	0.98	0.97	1.16
INS-MV	0.96	0.97	0.97	0.98	1.00	0.99	0.99	1.02	0.99	1.09
FIN-MV	0.83	0.72	0.72	0.78	0.94	0.97	0.86	0.84	0.89	1.05

Note: This table shows RMSE results for models that use <u>YoY changes in real activity and principal components of YoY changes of the 30 macro-financial controls as predictors</u> for future YoY real activity growth: $Y_{t+4} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-4}) + \beta_2\Phi_{4,t} + \beta_3\Lambda_{4,t} + \varepsilon_{t+4}$.

The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column (see the main text for detailed descriptions).

'In-sample RMSEs' are based on regression (A.1) estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3). Estimations are based on YoY leverage growth (where included), the YoY (log-)differences of the dependent variable, and controls based on YoY differences (for models including the term 'F').

Columns labeled 'GDP',...,'Rx' show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.3b: Regression coefficients of leverage, in models that use YoY changes of real activity and macro-financial control factors based on YoY changes as predictors

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV	-0.33***	-0.43***	0.39***	-0.35***	-0.33	0.74	0.72	0.03	0.57	0.75
	{0.78}	*{0.69}*	*{0.80}*	*{0.68}*	*{0.31}*	*{0.74}*	*{0.74}*	*{0.41}*	*{0.57}*	*{0.75}*
F, MED-LEV	-0.36***	-0.45***	0.42***	-0.42***	-0.66*	0.84	0.77	0.03	0.68	0.83
	{0.80}	*{0.71}*	*{0.82}*	*{0.71}*	*{0.38}*	*{0.84}*	*{0.77}*	*{0.43}*	*{0.68}*	*{0.83}*
F, MED-FoF	-0.38***	-0.40***	0.31***	-0.39***	-0.73***	0.83	0.93	0.00	0.75	0.78
	{0.83}	*{0.72}*	*{0.81}*	*{0.73}*	*{0.52}*	*{0.83}*	*{0.93}*	*{0.58}*	*{0.75}*	*{0.78}*
F, MED-MV	-0.31***	-0.36***	0.29***	-0.32***	-0.34	0.57	0.52	0.10	0.46	0.58
	{0.79}	*{0.69}*	*{0.79}*	*{0.69}*	*{0.33}*	*{0.57}*	*{0.57}*	*{0.36}*	*{0.46}*	*{0.58}*
PC-LEV	-0.66***	-0.79***	0.77***	-0.64**	-0.57	0.67	1.00	0.00	0.75	0.77
	{0.34}	*{0.36}*	*{0.48}*	*{0.24}*	*{0.10}*	*{0.67}*	*{1.00}*	*{0.80}*	*{0.75}*	*{0.77}*
MED-LEV	-0.69***	-0.80***	0.74***	-0.71***	-0.80**	0.86	0.97	0.00	0.96	0.75
	{0.40}	*{0.42}*	*{0.53}*	*{0.33}*	*{0.19}*	*{0.86}*	*{0.97}*	*{0.81}*	*{0.96}*	*{0.75}*
CB	-0.17	-0.29**	0.22***	-0.21	-0.27*	0.35	0.64	0.07	0.64	0.28
	{0.13}	*{0.13}*	*{0.23}*	*{0.06}*	*{0.07}*	*{0.45}*	*{0.72}*	*{0.86}*	*{0.68}*	*{0.33}*
INS	-0.38***	-0.37**	0.30*	-0.41**	-0.51***	0.81	0.75	0.00	0.67	0.75
	{0.25}	*{0.18}*	*{0.26}*	*{0.18}*	*{0.22}*	*{0.81}*	*{0.75}*	*{0.45}*	*{0.67}*	*{0.75}*
SBD	-0.36*	-0.30	0.37	-0.46**	-0.45***	0.36	0.17	0.04	0.26	0.64
	{0.21}	*{0.13}*	*{0.28}*	*{0.19}*	*{0.19}*	*{0.36}*	*{0.29}*	*{0.39}*	*{0.28}*	*{0.64}*
HH	-0.66**	-0.72**	0.77***	-0.58**	-0.15	0.74	0.77	0.00	0.67	0.00
	{0.26}	*{0.26}*	*{0.47}*	*{0.17}*	*{0.00}*	*{0.74}*	*{0.77}*	*{0.64}*	*{0.67}*	*{0.30}*
BUS	-0.18	-0.18	0.29	0.01	-0.17	0.32	0.13	0.22	0.12	0.55
	{0.12}	*{0.06}*	*{0.21}*	*{0.02}*	*{0.02}*	*{0.32}*	*{0.13}*	*{0.51}*	*{0.12}*	*{0.67}*
BNK-MV	-0.54**	-0.49	0.43	-0.48*	-0.28	0.62	0.39	0.00	0.71	0.19
	{0.32}	*{0.22}*	*{0.33}*	*{0.20}*	*{0.05}*	*{0.62}*	*{0.39}*	*{0.22}*	*{0.71}*	*{0.19}*
INS-MV	-0.30**	-0.30*	0.26	-0.25	-0.13	0.46	0.10	0.00	0.43	0.25
	{0.17}	*{0.11}*	*{0.23}*	*{0.07}*	*{0.01}*	*{0.46}*	*{0.10}*	*{0.00}*	*{0.43}*	*{0.25}*
FIN-MV	-0.59**	-0.75***	0.69***	-0.70***	-0.41*	0.04	0.93	0.00	0.45	0.25
	{0.38}	*{0.51}*	*{0.58}*	*{0.41}*	*{0.11}*	*{0.04}*	*{0.93}*	*{0.71}*	*{0.45}*	*{0.26}*

Note: This table considers models that use YoY changes in real activity and principal components of YoY changes of the 30 macro-financial controls as predictors (see Table A.3.a).
The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from regressions of each dependent variable on lagged leverage and other predictors for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.
The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).
The left column lists model variants based on equation (A.1), as described in Table A.3a.
Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.4a: RMSEs of models that forecast real activity at a 8-quarter horizon, using 8-quarter leverage as predictor

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.60*	*3.24*	*0.81*	*7.74*	*14.42*	*1.80*	*3.57*	*0.88*	*8.76*	*16.10*
Random Walk	1.06	1.07	1.09	1.04	1.01	1.04	1.06	1.06	1.02	0.98
F	0.71	0.86	0.70	0.84	0.93	0.82	0.96	0.76	0.83	1.03
F, PC-LEV	0.70	0.83	0.69	0.83	0.91	0.92	1.07	0.90	0.99	1.22
F, MED-LEV	0.67	0.80	0.68	0.82	0.89	0.80	0.93	0.82	0.87	1.11
F, MED-FoF	0.70	0.83	0.68	0.83	0.90	0.80	1.10	0.84	0.94	1.16
F, MED-MV	0.67	0.82	0.69	0.82	0.91	0.81	0.90	0.82	0.85	1.11
PC-LEV	0.93	0.94	0.96	0.98	0.97	1.05	1.06	1.08	1.09	1.13
MED-LEV	0.89	0.90	0.92	0.96	0.96	0.90	0.92	1.00	0.96	1.06
CB	0.98	0.99	0.99	0.97	1.00	1.06	1.03	1.09	1.07	1.07
INS	0.87	0.82	0.89	0.89	0.76	0.92	0.93	0.96	0.95	0.88
SBD	0.96	0.97	0.92	0.95	0.99	1.00	1.01	0.98	0.99	1.04
HH	1.00	1.00	1.00	1.00	0.98	1.08	1.18	1.13	1.08	1.13
BUS	1.00	1.00	0.99	1.00	0.99	1.26	1.31	1.26	1.38	1.25
BNK-MV	0.89	0.96	0.94	0.96	0.99	0.88	0.98	0.99	0.96	1.01
INS-MV	0.99	1.00	1.00	1.00	1.00	1.03	1.03	1.05	1.03	1.07
FIN-MV	0.84	0.82	0.89	0.90	0.91	0.86	0.82	0.96	0.90	1.09

Note: This Table reports RMSEs for models that forecast 8-quarter ahead real activity growth, using 8-quarter leverage growth as a predictor: $Y_{t+8} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-1}) + \beta_2\Phi_{1,t} + \beta_3\Lambda_{8,t} + \varepsilon_{t+8}$. Due to data availability, the evaluation sample for forecasts is 1996q3 to 2010q3 (shorter than the sample used in the main text). The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column (see chapter 3 in the main text).

'In-sample RMSEs' are based on regression (A.2) estimated for the sample 1996q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1996q3-2010q3). Estimations are based on leverage growth over 8 quarters (where included), the QoQ (log-)differences of the dependent variable, and controls based on QoQ differences (for models including the term 'F').

Columns labeled 'GDP',...,'Rx' show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.4b: Regression coefficients of leverage in models that forecast real activity at a 8-quarter horizon, using 8-quarter leverage growth as a predictor

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV	-0.20	-0.36	0.19	-0.10	-0.31	0.67	1.00	0.00	0.88	0.60
	{0.57}	*{0.41}*	*{0.60}*	*{0.35}*	*{0.19}*	*{0.67}*	*{1.00}*	*{0.72}*	*{0.88}*	*{0.60}*
F, MED-LEV	-0.35**	-0.49**	0.29*	-0.28	-0.43	0.74	1.00	0.00	0.91	0.65
	{0.60}	*{0.45}*	*{0.62}*	*{0.38}*	*{0.22}*	*{0.74}*	*{1.00}*	*{0.81}*	*{0.91}*	*{0.68}*
F, MED-FoF	-0.20	-0.34	0.26*	-0.15	-0.38	0.79	0.77	0.00	0.74	0.77
	{0.57}	*{0.41}*	*{0.61}*	*{0.36}*	*{0.21}*	*{0.79}*	*{0.86}*	*{0.39}*	*{0.74}*	*{0.93}*
F, MED-MV	-0.34**	-0.42**	0.21	-0.25	-0.25	0.58	0.96	0.00	0.74	0.05
	{0.60}	*{0.42}*	*{0.60}*	*{0.37}*	*{0.18}*	*{0.58}*	*{0.96}*	*{0.60}*	*{0.74}*	*{0.07}*
PC-LEV	-0.38*	-0.42**	0.34	-0.20	-0.26	1.00	1.00	0.00	0.89	0.32
	{0.23}	*{0.23}*	*{0.23}*	*{0.10}*	*{0.07}*	*{1.00}*	*{1.00}*	*{0.86}*	*{0.89}*	*{0.32}*
MED-LEV	-0.51***	-0.57***	0.45***	-0.33*	-0.33**	1.00	1.00	0.00	0.93	0.44
	{0.30}	*{0.30}*	*{0.29}*	*{0.15}*	*{0.10}*	*{1.00}*	*{1.00}*	*{1.00}*	*{0.93}*	*{0.44}*
CB	0.21	0.12	-0.13	0.24	0.03	0.16	0.63	0.00	0.47	0.33
	{0.16}	*{0.15}*	*{0.18}*	*{0.12}*	*{0.02}*	*{0.16}*	*{0.63}*	*{0.88}*	*{0.47}*	*{0.33}*
INS	-0.50***	-0.63***	0.51***	-0.49**	-0.72***	0.86	0.84	0.00	0.86	0.81
	{0.33}	*{0.42}*	*{0.34}*	*{0.26}*	*{0.43}*	*{0.86}*	*{0.84}*	*{0.40}*	*{0.86}*	*{0.81}*
SBD	-0.29*	-0.23	0.38**	-0.32**	-0.18	0.07	0.00	0.00	0.00	0.00
	{0.19}	*{0.18}*	*{0.29}*	*{0.15}*	*{0.04}*	*{0.07}*	*{0.14}*	*{0.05}*	*{0.25}*	*{0.25}*
HH	-0.10	-0.04	-0.01	0.08	0.18	0.47	0.21	0.00	0.46	0.04
	{0.12}	*{0.13}*	*{0.16}*	*{0.07}*	*{0.04}*	*{0.47}*	*{0.21}*	*{0.21}*	*{0.47}*	*{0.25}*
BUS	-0.04	-0.05	0.14	0.07	-0.17	0.49	0.19	0.18	0.12	0.63
	{0.12}	*{0.14}*	*{0.18}*	*{0.07}*	*{0.04}*	*{0.49}*	*{0.33}*	*{0.39}*	*{0.26}*	*{0.63}*
BNK-MV	-0.48**	-0.30	0.32**	-0.29*	-0.11	0.79	0.28	0.00	0.35	0.00
	{0.29}	*{0.20}*	*{0.25}*	*{0.14}*	*{0.03}*	*{0.79}*	*{0.28}*	*{0.56}*	*{0.35}*	*{0.21}*
INS-MV	-0.12	-0.04	-0.09	0.03	0.00	0.98	1.00	0.00	0.53	0.09
	{0.13}	*{0.13}*	*{0.17}*	*{0.07}*	*{0.01}*	*{0.98}*	*{1.00}*	*{0.74}*	*{0.53}*	*{0.09}*
FIN-MV	-0.57***	-0.70***	0.48***	-0.46***	-0.46**	0.91	1.00	0.00	0.98	0.63
	{0.38}	*{0.42}*	*{0.33}*	*{0.25}*	*{0.18}*	*{0.91}*	*{1.00}*	*{0.88}*	*{0.98}*	*{0.74}*

Note: This Table considers models that forecast 8-quarter ahead real activity growth, using 8-quarter leverage growth as predictors: $Y_{t+8} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-1}) + \beta_2 \Phi_{1,t} + \beta_3 \Lambda_{8,t} + \varepsilon_{t+8}$.

The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from regressions of each dependent variable on lagged leverage and other predictors for the period 1996q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.

The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).

The left column lists model variants as described in Table A.4a.

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Interactions terms between leverage and other predictors (Tables A.5-A.6)

Table A.5a: RMSEs of models that include interaction terms between leverage and real activity as predictors

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.83*	*4.24*	*0.96*	*10.42*	*19.67*	*2.08*	*4.50*	*1.07*	*12.72*	*22.58*
Random Walk	1.06	1.02	1.10	1.01	1.00	0.97	0.99	0.97	0.86	0.91
F	0.72	0.72	0.60	0.69	0.90	0.86	0.79	0.69	0.78	1.09
F, PC-LEV, realint	0.65	0.61	0.55	0.62	0.75	0.96	0.94	0.84	0.93	1.23
F, MED-LEV, realint	0.64	0.61	0.54	0.60	0.70	1.00	0.96	0.73	0.82	1.48
F, MED-FoF, realint	0.62	0.64	0.52	0.57	0.70	0.86	1.04	0.81	0.79	0.96
F, MED-MV, realint	0.66	0.64	0.56	0.62	0.75	1.19	0.94	0.95	0.99	1.09
PC-LEV, realint	0.82	0.79	0.79	0.84	0.87	1.18	1.02	0.93	1.11	1.06
MED-LEV, realint	0.79	0.77	0.76	0.80	0.83	1.07	0.90	0.80	0.96	1.25
CB, realint	0.98	0.95	0.96	0.97	0.95	1.08	1.01	1.06	0.99	1.10
INS, realint	0.90	0.92	0.93	0.87	0.87	0.99	1.34	1.30	1.26	0.99
SBD, realint	0.89	0.88	0.84	0.78	0.87	0.97	1.00	1.37	0.83	0.91
HH, realint	0.87	0.85	0.80	0.88	0.95	1.32	1.04	1.00	1.09	1.47
BUS, realint	0.93	0.92	0.95	0.92	0.94	2.50	2.08	2.75	1.97	1.96
BNK-MV, realint	0.86	0.90	0.89	0.90	0.91	1.33	1.12	1.73	1.36	1.17
INS-MV, realint	0.94	0.95	0.97	0.96	0.94	1.04	1.04	1.11	0.99	1.04
FIN-MV, realint	0.83	0.72	0.69	0.77	0.91	1.29	0.93	0.92	1.09	1.15

Note: Rows 4-17 of this Table report RMSEs for forecast models that include interaction terms between leverage and real activity as predictors (see suffix 'realint' in Column 1):

$$Y_{t+4} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-4}) + \beta_2\Phi_{1,t} + \beta_3\Lambda_{4,t} + \beta_4\Lambda_{4,t}(Y_t - Y_{t-4}) + \varepsilon_{t+4}.$$

The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column (see the main text for descriptions).

'In-sample RMSEs' are based on regressions (A.3), estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3). Estimations are based on YoY leverage growth (where included), a lag of the dependent variable based on YoY (log-)differences and controls (F) based on QoQ differences, as well as the interaction terms described in equation (A.3).

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.5b: Regression coefficients of leverage in models that include <u>interaction terms between leverage growth and real activity as predictors</u>

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV, realint	-0.21	-0.38***	0.34**	-0.35**	-0.55**	0.42	0.30	0.14	0.41	0.74
	{0.62}	*{0.65}*	*{0.75}*	*{0.63}*	*{0.44}*	*{0.52}*	*{0.30}*	*{0.17}*	*{0.41}*	*{0.74}*
F, MED-LEV, realint	-0.25	-0.40***	0.38***	-0.43***	-0.74***	0.59	0.30	0.04	0.52	0.77
	{0.64}	*{0.65}*	*{0.76}*	*{0.65}*	*{0.51}*	*{0.70}*	*{0.30}*	*{0.41}*	*{0.52}*	*{0.77}*
F, MED-FoF, realint	-0.58***	-0.47***	0.25**	-0.40***	-0.85***	0.67	0.78	0.00	0.86	0.78
	{0.66}	*{0.61}*	*{0.78}*	*{0.68}*	*{0.51}*	*{0.67}*	*{0.78}*	*{0.51}*	*{0.86}*	*{0.78}*
F, MED-MV, realint	-0.19	-0.32*	0.27**	-0.33**	-0.39**	0.26	0.03	0.30	0.19	0.67
	{0.61}	*{0.61}*	*{0.74}*	*{0.62}*	*{0.44}*	*{0.36}*	*{0.09}*	*{0.30}*	*{0.30}*	*{0.67}*
PC-LEV, realint	-0.48**	-0.76***	0.77**	-0.67**	-0.70*	0.71	0.87	0.00	0.71	0.68
	{0.40}	*{0.41}*	*{0.48}*	*{0.31}*	*{0.25}*	*{0.83}*	*{0.87}*	*{0.81}*	*{0.71}*	*{0.68}*
MED-LEV, realint	-0.53***	-0.77***	0.72***	-0.73***	-0.82***	0.75	0.99	0.00	0.87	0.74
	{0.45}	*{0.44}*	*{0.53}*	*{0.37}*	*{0.31}*	*{0.86}*	*{0.99}*	*{0.96}*	*{0.87}*	*{0.74}*
CB, realint	-0.02	-0.24**	0.22***	-0.17	-0.22	0.23	0.45	0.07	0.51	0.13
	{0.14}	*{0.14}*	*{0.24}*	*{0.07}*	*{0.10}*	*{0.35}*	*{0.52}*	*{0.93}*	*{0.57}*	*{0.25}*
INS, realint	-0.64***	-0.41**	0.25*	-0.49***	-0.53***	0.83	0.61	0.00	0.91	0.45
	{0.27}	*{0.18}*	*{0.29}*	*{0.26}*	*{0.24}*	*{0.83}*	*{0.61}*	*{0.45}*	*{0.91}*	*{0.45}*
SBD, realint	-0.50**	-0.25	0.24	-0.32**	-0.36***	0.12	0.17	0.00	0.46	0.64
	{0.29}	*{0.26}*	*{0.42}*	*{0.40}*	*{0.24}*	*{0.12}*	*{0.17}*	*{0.84}*	*{0.46}*	*{0.64}*
HH, realint	-0.53*	-0.72**	0.81**	-0.65*	-0.50	0.67	0.99	0.00	0.74	0.00
	{0.32}	*{0.31}*	*{0.48}*	*{0.24}*	*{0.10}*	*{0.80}*	*{0.99}*	*{0.75}*	*{0.74}*	*{0.30}*
BUS, realint	0.05	-0.20	0.33	-0.05	-0.27	0.16	0.12	0.23	0.16	0.39
	{0.22}	*{0.19}*	*{0.26}*	*{0.17}*	*{0.12}*	*{0.16}*	*{0.12}*	*{0.57}*	*{0.16}*	*{0.41}*
BNK-MV, realint	-0.40*	-0.46	0.40	-0.47*	-0.30	0.55	0.28	0.00	0.38	0.19
	{0.34}	*{0.23}*	*{0.35}*	*{0.21}*	*{0.17}*	*{0.65}*	*{0.28}*	*{0.61}*	*{0.42}*	*{0.19}*
INS-MV, realint	-0.08	-0.24	0.26	-0.20	-0.11	0.52	0.22	0.03	0.28	0.26
	{0.21}	*{0.13}*	*{0.23}*	*{0.10}*	*{0.13}*	*{0.65}*	*{0.22}*	*{0.49}*	*{0.39}*	*{0.26}*
FIN-MV, realint	-0.61***	-0.75***	0.59***	-0.68***	-0.46*	0.55	0.57	0.00	0.45	0.23
	{0.39}	*{0.51}*	*{0.61}*	*{0.42}*	*{0.18}*	*{0.65}*	*{0.57}*	*{0.62}*	*{0.49}*	*{0.25}*

Note: This Table report the coefficients of leverage (β_3) in the models considered in Table A.5a. Similar to Table 2 in the main text, the *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from regressions of each dependent variable on lagged leverage indicators as well as interaction terms between these and lagged real activity (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.
The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).
The left column lists model variants (as described in Table A.5a) that include an interaction term between leverage growth and the lagged dependent variable.
Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.6a: RMSEs of models with interaction terms between leverage and the four macro-financial control factors

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.77*	*3.90*	*0.87*	*10.16*	*19.63*	*1.91*	*4.27*	*0.95*	*10.93*	*20.96*
F, PC-LEV int	0.57	0.58	0.50	0.54	0.82	1.61	1.60	1.27	1.54	1.38
F, MED-LEV int	0.55	0.55	0.47	0.51	0.79	1.75	1.61	1.08	1.50	1.36

Note: Rows 2-3 of this Table reports RMSEs for models obtained by augmenting models 'F, PC-LEV' and 'F, MED-LEV' with interaction terms between leverage $\Lambda_{4,t}$ and the four macro-financial control factors $\Phi_{1,t}$:

$$Y_{t+4} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-1}) + \beta_2\Phi_{1,t} + \beta_3\Lambda_{4,t} + \beta_4 \cdot (\Lambda_{4,t} \cdot \Phi_{1,t}) + \varepsilon_{t+4}$$

The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The second and third rows show relative RMSEs of the models with interaction terms, with respect to the 'Just ΔY' model.
'In-sample RMSEs' are based on regressions of equation (A.4), estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3). Estimations are based on YoY leverage growth, the QoQ (log-)difference of the dependent variable, controls based on QoQ differences, and interaction terms as described above.
Columns labeled 'GDP',...,'Rx' show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.6b: Regression coefficients of leverage in models with interaction terms between leverage and the four macro-financial control factors

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV int	-0.35***	-0.40***	0.29***	-0.28**	-0.25	0.51	0.71	0.16	0.48	0.23
	{0.73}	*{0.73}*	*{0.83}*	*{0.73}*	*{0.34}*	*{0.57}*	*{0.72}*	*{0.51}*	*{0.48}*	*{0.33}*
F, MED-LEV int	-0.39***	-0.43***	0.34***	-0.38***	-0.36	0.77	0.64	0.07	0.74	0.43
	{0.75}	*{0.76}*	*{0.85}*	*{0.76}*	*{0.38}*	*{0.78}*	*{0.64}*	*{0.51}*	*{0.74}*	*{0.48}*

Note: The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage (β_3) in the regressions considered in rows 2-3 of Table A.6a. The sample period is 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.
The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).
The left column lists model variants as described in Table A.6a.
Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Non-linear transforms of leverage (Tables A.7-A.8)

Table A.7a: RMSEs of models that use non-linear transforms of leverage as predictors

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.77*	*3.90*	*0.87*	*10.16*	*19.63*	*1.91*	*4.27*	*0.95*	*10.93*	*20.96*
F	0.74	0.78	0.67	0.69	0.92	0.97	0.87	0.76	0.85	1.10
F, PC-LEV asym	0.68	0.71	0.59	0.64	0.90	1.02	0.93	0.78	0.93	1.25
F, MED-LEV asym	0.66	0.68	0.57	0.62	0.88	0.95	0.88	0.75	0.86	1.26
F, MED-FoF asym	0.60	0.68	0.58	0.62	0.76	0.84	0.91	0.83	0.87	1.04
F, MED-MV asym	0.68	0.70	0.61	0.63	0.90	1.05	0.91	0.75	0.95	1.30
PC-LEV asym	0.89	0.93	0.83	0.93	0.98	1.13	1.18	1.08	1.21	1.19
MED-LEV asym	0.85	0.89	0.77	0.88	0.96	0.98	1.02	0.86	1.02	1.20
CB asym	0.99	0.93	0.96	0.97	0.97	1.20	1.02	1.08	1.12	1.21
INS asym	0.93	0.94	0.92	0.90	0.90	0.97	1.03	1.02	0.95	0.98
SBD asym	0.96	0.94	0.93	0.90	0.90	1.05	0.98	1.01	0.94	1.02
HH asym	0.94	0.98	0.86	0.97	1.00	1.12	1.01	0.98	1.09	1.27
BUS asym	0.99	0.98	0.99	0.99	0.95	1.78	1.68	1.75	1.81	1.63
BNK-MV asym	0.88	0.94	0.94	0.92	0.98	1.13	1.13	1.13	1.16	1.20
INS-MV asym	0.96	0.98	0.99	0.98	1.00	1.00	1.03	1.02	1.03	1.07
FIN-MV asym	0.85	0.78	0.73	0.80	0.97	1.10	0.95	0.98	1.07	1.10
F, PC-LEV sq	0.68	0.71	0.60	0.64	0.88	1.16	1.04	0.79	1.03	1.40
F, MED-LEV sq	0.66	0.68	0.57	0.62	0.87	1.01	0.98	0.74	0.89	1.49
F, MED-FoF sq	0.61	0.69	0.58	0.62	0.78	0.86	0.93	0.84	0.90	1.09
F, MED-MV sq	0.68	0.70	0.60	0.63	0.90	1.13	0.95	0.78	1.05	1.32
PC-LEV sq	0.89	0.92	0.85	0.93	0.95	1.35	1.33	1.20	1.35	1.31
MED-LEV sq	0.85	0.89	0.79	0.88	0.93	1.08	1.14	0.91	1.08	1.40
CB sq	0.98	0.93	0.96	0.97	0.96	1.18	1.00	1.08	1.11	1.35
INS sq	0.93	0.94	0.91	0.90	0.90	0.96	1.03	1.04	0.96	0.96
SBD sq	0.96	0.94	0.92	0.89	0.90	1.11	0.99	1.02	0.95	1.05
HH sq	0.92	0.95	0.89	0.95	0.96	1.34	1.06	1.04	1.19	1.34
BUS sq	0.98	0.95	0.97	0.97	0.92	2.42	2.00	1.97	2.33	2.10
BNK-MV sq	0.87	0.94	0.94	0.92	0.96	1.51	1.42	1.47	1.42	1.48
INS-MV sq	0.95	0.98	0.99	0.98	0.99	1.00	1.03	1.02	1.03	1.07
FIN-MV sq	0.83	0.77	0.68	0.78	0.97	1.21	0.99	1.03	1.16	1.10

Note: Rows 4-30 of the Table report RMSEs for forecast models that include non-linear transformations of leverage, as predictors: $Y_{t+4} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-1}) + \beta_2\Phi_{1,t} + \beta_3\Lambda_{4,t} + \beta_4 f(\Lambda_{4,t}) + \varepsilon_{t+4}$ for $f(\Lambda_{4,t}) = \max(0, \Lambda_{4,t})$, and $f(\Lambda_{4,t}) = (\Lambda_{4,t})^2$

The suffix 'asym' denotes the inclusion of the term $max(0, \Lambda_{4,t})$. The suffix 'sq' denotes the inclusion of leverage growth squared $(\Lambda_{4,t})^2$. The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column; see Section 3 in the main text for a detailed description.

'In-sample RMSEs' are based on regressions that augment the forecast equation (2), estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3).

Table A.7b: Regression coefficients of leverage in models that use non-linear transforms of leverage as predictors

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV asym	-0.38**	-0.39*	0.11	-0.40**	-0.48	0.28	0.10	0.03	0.23	0.00
	{0.62}	*{0.60}*	*{0.76}*	*{0.61}*	*{0.20}*	*{0.28}*	*{0.12}*	*{0.04}*	*{0.23}*	*{0.07}*
F, MED-LEV asym	-0.36**	-0.29	0.10	-0.42**	-0.60*	0.23	0.10	0.12	0.33	0.09
	{0.63}	*{0.63}*	*{0.78}*	*{0.65}*	*{0.22}*	*{0.23}*	*{0.13}*	*{0.13}*	*{0.33}*	*{0.12}*
F, MED-FoF asym	-0.16	-0.06	0.03	-0.10	-0.24	0.10	0.28	0.10	0.12	0.16
	{0.70}	*{0.63}*	*{0.77}*	*{0.64}*	*{0.42}*	*{0.14}*	*{0.35}*	*{0.30}*	*{0.29}*	*{0.52}*
F, MED-MV asym	-0.28	-0.31*	0.08	-0.43**	-0.38	0.09	0.00	0.01	0.35	0.06
	{0.61}	*{0.60}*	*{0.75}*	*{0.63}*	*{0.19}*	*{0.09}*	*{0.00}*	*{0.09}*	*{0.35}*	*{0.06}*
PC-LEV asym	-0.58***	-0.53**	0.16	-0.48**	-0.54*	0.58	0.13	0.00	0.46	0.03
	{0.34}	*{0.31}*	*{0.53}*	*{0.19}*	*{0.05}*	*{0.58}*	*{0.13}*	*{0.09}*	*{0.46}*	*{0.04}*
MED-LEV asym	-0.59***	-0.44**	0.15	-0.50***	-0.61**	0.65	0.14	0.01	0.42	0.16
	{0.40}	*{0.37}*	*{0.60}*	*{0.28}*	*{0.08}*	*{0.65}*	*{0.14}*	*{0.09}*	*{0.42}*	*{0.17}*
CB asym	-0.01	-0.06	0.09	-0.03	-0.11	0.14	0.00	0.00	0.28	0.04
	{0.19}	*{0.31}*	*{0.38}*	*{0.12}*	*{0.07}*	*{0.14}*	*{0.03}*	*{0.28}*	*{0.28}*	*{0.12}*
INS asym	-0.54*	-0.53*	0.64***	-0.83***	-0.41	0.30	0.42	0.00	0.61	0.06
	{0.27}	*{0.29}*	*{0.43}*	*{0.25}*	*{0.19}*	*{0.30}*	*{0.42}*	*{0.26}*	*{0.61}*	*{0.17}*
SBD asym	-0.36*	-0.47**	0.45*	-0.64***	-0.48**	0.22	0.00	0.00	0.14	0.35
	{0.23}	*{0.28}*	*{0.41}*	*{0.25}*	*{0.19}*	*{0.22}*	*{0.00}*	*{0.00}*	*{0.14}*	*{0.42}*
HH asym	-0.79**	-0.24	-0.15	-0.35	-0.01	0.83	0.17	0.17	0.25	0.00
	{0.26}	*{0.23}*	*{0.50}*	*{0.13}*	*{0.01}*	*{0.83}*	*{0.23}*	*{0.26}*	*{0.28}*	*{0.04}*
BUS asym	-0.18	-0.38	0.34	-0.20	-0.81**	NA	NA	NA	NA	NA
	{0.18}	*{0.22}*	*{0.34}*	*{0.08}*	*{0.10}*	*NA*	*NA*	*NA*	*NA*	*NA*
BNK-MV asym	-0.69***	-0.55**	0.13	-0.68***	-0.53*	0.61	0.17	0.00	0.70	0.06
	{0.36}	*{0.28}*	*{0.40}*	*{0.21}*	*{0.04}*	*{0.61}*	*{0.17}*	*{0.17}*	*{0.70}*	*{0.06}*
INS-MV asym	-0.43**	-0.31	0.03	-0.38*	-0.16	0.30	0.00	0.04	0.10	0.07
	{0.24}	*{0.22}*	*{0.34}*	*{0.10}*	*{0.01}*	*{0.30}*	*{0.00}*	*{0.07}*	*{0.10}*	*{0.07}*
FIN-MV asym	-0.29	-0.49***	0.11	-0.44*	-0.21	0.29	0.32	0.00	0.48	0.00
	{0.40}	*{0.51}*	*{0.65}*	*{0.40}*	*{0.07}*	*{0.29}*	*{0.32}*	*{0.16}*	*{0.48}*	*{0.03}*
F, PC-LEV sq	-0.43***	-0.49***	0.35***	-0.38***	-0.27	0.54	0.71	0.14	0.62	0.22
	{0.62}	*{0.60}*	*{0.76}*	*{0.61}*	*{0.22}*	*{0.54}*	*{0.77}*	*{0.57}*	*{0.62}*	*{0.33}*
F, MED-LEV sq	-0.44***	-0.50***	0.38***	-0.45***	-0.39	0.77	0.74	0.12	0.88	0.48
	{0.63}	*{0.63}*	*{0.78}*	*{0.65}*	*{0.25}*	*{0.77}*	*{0.74}*	*{0.61}*	*{0.88}*	*{0.57}*
F, MED-FoF sq	-0.48***	-0.41***	0.32**	-0.35***	-0.71***	0.77	0.80	0.00	0.86	0.70
	{0.69}	*{0.62}*	*{0.77}*	*{0.64}*	*{0.39}*	*{0.77}*	*{0.80}*	*{0.54}*	*{0.86}*	*{0.75}*
F, MED-MV sq	-0.35**	-0.41***	0.27**	-0.39***	-0.25	0.33	0.30	0.28	0.32	0.09
	{0.61}	*{0.60}*	*{0.75}*	*{0.64}*	*{0.20}*	*{0.33}*	*{0.43}*	*{0.38}*	*{0.32}*	*{0.12}*
PC-LEV sq	-0.57***	-0.50**	0.55**	-0.46*	-0.35	0.80	0.93	0.00	0.91	0.33
	{0.35}	*{0.32}*	*{0.52}*	*{0.19}*	*{0.10}*	*{0.80}*	*{0.93}*	*{0.55}*	*{0.91}*	*{0.43}*

Table continued…

MED-LEV sq	-0.63***	-0.56***	0.59***	-0.57***	-0.39*	0.86	0.96	0.00	1.00	0.46
	{0.40}	*{0.37}*	*{0.57}*	*{0.28}*	*{0.13}*	*{0.86}*	*{0.96}*	*{0.64}*	*{1.00}*	*{0.58}*
CB sq	-0.10	-0.26***	0.20***	-0.16	-0.21*	0.19	0.65	0.07	0.54	0.33
	{0.19}	*{0.30}*	*{0.38}*	*{0.12}*	*{0.09}*	*{0.32}*	*{0.75}*	*{0.83}*	*{0.62}*	*{0.48}*
INS sq	-0.30***	-0.27**	0.21*	-0.34**	-0.46***	0.77	0.77	0.00	0.81	0.46
	{0.27}	*{0.29}*	*{0.44}*	*{0.25}*	*{0.19}*	*{0.77}*	*{0.77}*	*{0.35}*	*{0.81}*	*{0.51}*
SBD sq	-0.23	-0.18	0.23	-0.31*	-0.46***	0.43	0.09	0.00	0.29	0.67
	{0.23}	*{0.29}*	*{0.43}*	*{0.26}*	*{0.19}*	*{0.43}*	*{0.10}*	*{0.41}*	*{0.30}*	*{0.67}*
HH sq	-0.73**	-0.55*	0.55	-0.57*	-0.40	0.99	0.59	0.00	0.86	0.00
	{0.30}	*{0.27}*	*{0.47}*	*{0.16}*	*{0.08}*	*{0.99}*	*{0.59}*	*{0.33}*	*{0.86}*	*{0.36}*
BUS sq	-0.24	-0.23	0.24	-0.15	-0.45*	0.42	0.28	0.00	0.38	0.78
	{0.20}	*{0.28}*	*{0.37}*	*{0.13}*	*{0.16}*	*{0.42}*	*{0.28}*	*{0.26}*	*{0.38}*	*{0.83}*
BNK-MV sq	-0.58***	-0.46**	0.25	-0.50**	-0.38*	0.59	0.55	0.00	0.70	0.06
	{0.36}	*{0.29}*	*{0.40}*	*{0.21}*	*{0.08}*	*{0.59}*	*{0.55}*	*{0.17}*	*{0.70}*	*{0.06}*
INS-MV sq	-0.33**	-0.22*	0.12	-0.24	-0.13	0.51	0.20	0.00	0.46	0.00
	{0.24}	*{0.23}*	*{0.34}*	*{0.11}*	*{0.03}*	*{0.51}*	*{0.20}*	*{0.00}*	*{0.46}*	*{0.13}*
FIN-MV sq	-0.41**	-0.58***	0.39***	-0.50***	-0.28	0.06	0.77	0.00	0.51	0.00
	{0.43}	*{0.52}*	*{0.68}*	*{0.44}*	*{0.07}*	*{0.06}*	*{0.77}*	*{0.22}*	*{0.51}*	*{0.07}*

Note: This Table reports the coefficients of leverage (β_3) in the forecast models considered in Table A.7a.
The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.
The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).
The left column lists model variants as described in Table A.7a. The suffix 'asym' denotes the inclusion of the term $max(0, \Lambda_{4,t})$. The suffix 'sq' denotes the inclusion of leverage growth squared $(\Lambda_{4,t})^2$.
The models including non-linear transformations of non-financial business sector (BUS) leverage are perfectly collinear for some of the early rolling samples, therefore their out-of-sample results are not reported.
Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.7c: Regression coefficients of non-linear transforms of leverage

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV asym	-0.06	-0.15	0.39	0.03	0.36	0.07	0.20	0.01	0.09	0.09
	{0.62}	*{0.60}*	*{0.76}*	*{0.61}*	*{0.20}*	*{0.32}*	*{0.22}*	*{0.17}*	*{0.33}*	*{0.13}*
F, MED-LEV asym	-0.13	-0.33	0.44*	-0.05	0.33	0.06	0.36	0.00	0.07	0.33
	{0.63}	*{0.63}*	*{0.78}*	*{0.65}*	*{0.22}*	*{0.23}*	*{0.39}*	*{0.22}*	*{0.30}*	*{0.54}*
F, MED-FoF asym	-0.40	-0.44	0.37*	-0.31	-0.62**	0.52	0.36	0.00	0.54	0.57
	{0.70}	*{0.63}*	*{0.77}*	*{0.64}*	*{0.42}*	*{0.52}*	*{0.38}*	*{0.43}*	*{0.58}*	*{0.57}*
F, MED-MV asym	-0.09	-0.15	0.27	0.05	0.17	0.06	0.07	0.00	0.06	0.06
	{0.61}	*{0.60}*	*{0.75}*	*{0.63}*	*{0.19}*	*{0.12}*	*{0.07}*	*{0.06}*	*{0.22}*	*{0.16}*
PC-LEV asym	0.06	0.08	0.62*	0.04	0.42	0.09	0.19	0.04	0.13	0.14
	{0.34}	*{0.31}*	*{0.53}*	*{0.19}*	*{0.05}*	*{0.33}*	*{0.19}*	*{0.19}*	*{0.33}*	*{0.14}*
MED-LEV asym	-0.02	-0.15	0.65***	-0.09	0.42	0.09	0.28	0.00	0.14	0.36
	{0.40}	*{0.37}*	*{0.60}*	*{0.28}*	*{0.08}*	*{0.17}*	*{0.28}*	*{0.39}*	*{0.26}*	*{0.48}*
CB asym	-0.14	-0.28	0.16	-0.20	-0.16	0.19	0.45	0.16	0.29	0.22
	{0.19}	*{0.31}*	*{0.38}*	*{0.12}*	*{0.07}*	*{0.46}*	*{0.49}*	*{0.51}*	*{0.48}*	*{0.22}*
INS asym	0.25	0.27	-0.43*	0.49**	-0.05	0.01	0.00	0.22	0.00	0.29
	{0.27}	*{0.29}*	*{0.43}*	*{0.25}*	*{0.19}*	*{0.14}*	*{0.19}*	*{0.22}*	*{0.51}*	*{0.29}*
SBD asym	0.12	0.26	-0.18	0.29*	0.05	0.10	0.07	0.00	0.03	0.26
	{0.23}	*{0.28}*	*{0.41}*	*{0.25}*	*{0.19}*	*{0.10}*	*{0.07}*	*{0.30}*	*{0.03}*	*{0.26}*
HH asym	0.39	-0.06	0.88**	0.00	0.07	0.14	0.30	0.07	0.28	0.09
	{0.26}	*{0.23}*	*{0.50}*	*{0.13}*	*{0.01}*	*{0.33}*	*{0.38}*	*{0.58}*	*{0.43}*	*{0.14}*
BUS asym	0.03	0.42	-0.26	0.28	0.76*	NA	NA	NA	NA	NA
	{0.18}	*{0.22}*	*{0.34}*	*{0.08}*	*{0.10}*	*NA*	*NA*	*NA*	*NA*	*NA*
BNK-MV asym	0.23	0.24	0.20	0.30	0.41	0.03	0.06	0.14	0.00	0.00
	{0.36}	*{0.28}*	*{0.40}*	*{0.21}*	*{0.04}*	*{0.09}*	*{0.17}*	*{0.19}*	*{0.30}*	*{0.01}*
INS-MV asym	0.18	0.16	0.12	0.23	0.13	0.04	0.01	0.03	0.01	0.10
	{0.24}	*{0.22}*	*{0.34}*	*{0.10}*	*{0.01}*	*{0.19}*	*{0.01}*	*{0.09}*	*{0.06}*	*{0.17}*
FIN-MV asym	-0.32	-0.23	0.59**	-0.26	-0.10	0.01	0.03	0.00	0.00	0.00
	{0.40}	*{0.51}*	*{0.65}*	*{0.40}*	*{0.07}*	*{0.23}*	*{0.03}*	*{0.04}*	*{0.14}*	*{0.00}*
F, PC-LEV sq	0.02	-0.04	0.19	0.01	0.35	0.10	0.23	0.06	0.09	0.10
	{0.62}	*{0.60}*	*{0.76}*	*{0.61}*	*{0.22}*	*{0.35}*	*{0.28}*	*{0.26}*	*{0.35}*	*{0.22}*
F, MED-LEV sq	-0.02	-0.13	0.22*	-0.04	0.30	0.07	0.41	0.06	0.07	0.43
	{0.63}	*{0.63}*	*{0.78}*	*{0.65}*	*{0.25}*	*{0.25}*	*{0.48}*	*{0.33}*	*{0.30}*	*{0.64}*
F, MED-FoF sq	-0.16	-0.14	0.15	-0.13	-0.21*	0.23	0.20	0.00	0.29	0.57
	{0.69}	*{0.62}*	*{0.77}*	*{0.64}*	*{0.39}*	*{0.23}*	*{0.20}*	*{0.20}*	*{0.38}*	*{0.57}*
F, MED-MV sq	-0.05	-0.10	0.17*	-0.04	0.12	0.07	0.09	0.00	0.06	0.01
	{0.61}	*{0.60}*	*{0.75}*	*{0.64}*	*{0.20}*	*{0.09}*	*{0.09}*	*{0.06}*	*{0.20}*	*{0.14}*
PC-LEV sq	0.11	0.14	0.26**	0.06	0.35*	0.14	0.19	0.09	0.13	0.17
	{0.35}	*{0.32}*	*{0.52}*	*{0.19}*	*{0.10}*	*{0.26}*	*{0.19}*	*{0.29}*	*{0.23}*	*{0.19}*

Table continued…

MED-LEV sq	0.09	0.04	0.25**	0.02	0.34*	0.14	0.29	0.04	0.16	0.41
	{0.40}	*{0.37}*	*{0.57}*	*{0.28}*	*{0.13}*	*{0.25}*	*{0.29}*	*{0.28}*	*{0.26}*	*{0.54}*
CB sq	-0.11	-0.14	0.09	-0.14	-0.16	0.30	0.45	0.17	0.43	0.55
	{0.19}	*{0.30}*	*{0.38}*	*{0.12}*	*{0.09}*	*{0.58}*	*{0.49}*	*{0.57}*	*{0.62}*	*{0.62}*
INS sq	0.10	0.12	-0.24**	0.23*	-0.03	0.00	0.00	0.32	0.00	0.29
	{0.27}	*{0.29}*	*{0.44}*	*{0.25}*	*{0.19}*	*{0.09}*	*{0.16}*	*{0.32}*	*{0.45}*	*{0.29}*
SBD sq	0.06	0.19	-0.19	0.22**	-0.05	0.12	0.10	0.00	0.13	0.39
	{0.23}	*{0.29}*	*{0.43}*	*{0.26}*	*{0.19}*	*{0.12}*	*{0.10}*	*{0.38}*	*{0.13}*	*{0.39}*
HH sq	0.46*	0.46*	0.11	0.34	0.54*	0.16	0.19	0.07	0.19	0.10
	{0.30}	*{0.27}*	*{0.47}*	*{0.16}*	*{0.08}*	*{0.57}*	*{0.28}*	*{0.33}*	*{0.38}*	*{0.14}*
BUS sq	0.16	0.40*	-0.27	0.33	0.51**	0.19	0.04	0.39	0.14	0.25
	{0.20}	*{0.28}*	*{0.37}*	*{0.13}*	*{0.16}*	*{0.30}*	*{0.23}*	*{0.42}*	*{0.29}*	*{0.49}*
BNK-MV sq	0.16	0.21	0.10	0.14	0.34*	0.04	0.06	0.16	0.04	0.01
	{0.36}	*{0.29}*	*{0.40}*	*{0.21}*	*{0.08}*	*{0.20}*	*{0.20}*	*{0.20}*	*{0.29}*	*{0.09}*
INS-MV sq	0.12	0.14	0.05	0.13	0.18	0.03	0.10	0.00	0.07	0.22
	{0.24}	*{0.23}*	*{0.34}*	*{0.11}*	*{0.03}*	*{0.03}*	*{0.10}*	*{0.03}*	*{0.07}*	*{0.35}*
FIN-MV sq	-0.28**	-0.20**	0.40***	-0.29**	-0.03	0.04	0.06	0.00	0.04	0.01
	{0.43}	*{0.52}*	*{0.68}*	*{0.44}*	*{0.07}*	*{0.42}*	*{0.06}*	*{0.06}*	*{0.19}*	*{0.01}*

Note: This Table provides information on the coefficients of the non-linear transformations of leverage (β_4) in the forecast models considered in Table A.7a.

The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of the non-linear transformations of leverage, for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.

The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of coefficients for the non-linear term that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant non-linear term coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).

The left column lists model variants as described in Table A.7a. The suffix 'asym' denotes the inclusion of the term $max(0, \Lambda_{4,t})$. The suffix 'sq' denotes the inclusion of leverage growth squared $(\Lambda_{4,t})^2$.

The models including non-linear functions of non-financial business sector (BUS) leverage are perfectly collinear for some of the early rolling samples, therefore their out-of-sample results are not reported.

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.8: RMSEs for models that use a non-linear transform of the deviation of leverage from a 12 quarter moving average, as a predictor

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
Just ΔY	*1.77*	*3.90*	*0.87*	*10.16*	*19.63*	*1.91*	*4.27*	*0.95*	*10.93*	*20.96*
Random Walk	1.09	1.11	1.22	1.04	1.00	1.05	1.04	1.10	1.00	0.98
F	0.74	0.78	0.67	0.69	0.92	0.97	0.87	0.76	0.85	1.10
F, PC-LEV	0.68	0.71	0.62	0.64	0.91	0.93	0.87	0.74	0.83	1.17
F, MED-LEV	0.66	0.69	0.60	0.62	0.89	0.90	0.85	0.72	0.80	1.19
F, MED-FoF	0.62	0.70	0.61	0.63	0.80	0.84	0.90	0.83	0.87	1.00
F, MED-MV	0.68	0.71	0.63	0.63	0.90	0.96	0.87	0.76	0.85	1.17
PC-LEV	0.89	0.93	0.88	0.93	0.99	0.96	1.03	0.91	1.00	1.12
MED-LEV	0.85	0.89	0.83	0.88	0.98	0.90	0.94	0.82	0.93	1.14
CB, CBmma	0.98	0.94	0.96	0.98	0.96	1.12	1.03	1.13	1.08	1.08
INS, INSmma	0.94	0.95	0.95	0.93	0.87	1.01	1.06	1.08	1.01	0.96
SBD, SBDmma	0.95	0.96	0.94	0.91	0.90	1.03	1.00	1.02	0.97	0.96
HH, HHmma	0.92	0.96	0.87	0.91	0.98	1.06	1.01	1.06	0.99	1.33
BUS, BUSmma	0.93	0.88	0.88	0.90	0.95	1.86	1.77	1.83	2.05	2.37
BNK-MV, BNK-MVmma	0.88	0.93	0.94	0.91	0.94	1.30	1.31	1.31	1.30	1.24
INS-MV, INS-MVmma	0.94	0.97	0.98	0.95	0.99	1.04	1.04	1.03	1.00	1.20
FIN-MV, FIN-MVmma	0.83	0.78	0.70	0.81	0.96	1.05	0.99	0.95	1.07	1.22
CB, CBma	0.99	0.94	0.96	0.98	0.97	1.08	0.99	1.04	1.02	1.14
INS, INSma	0.91	0.92	0.94	0.92	0.84	0.96	0.95	1.04	0.98	0.94
SBD, SBDma	0.94	0.95	0.93	0.90	0.90	1.02	0.97	0.97	0.90	0.95
HH, HHma	0.94	0.96	0.86	0.91	0.98	1.05	1.07	0.96	0.99	1.21
BUS, BUSma	0.95	0.94	0.92	0.94	0.99	1.41	1.39	1.38	1.56	1.38
BNK-MV, BNK-MVma	0.87	0.95	0.94	0.93	0.98	1.08	1.16	1.10	1.14	1.16
INS-MV, INS-MVma	0.96	0.99	0.99	0.98	1.00	1.01	1.03	1.03	1.02	1.10
FIN-MV, FIN-MVma	0.84	0.78	0.76	0.81	0.97	1.03	0.98	0.97	1.03	1.17

Note: The first row shows absolute RMSEs of the 'Just ΔY' forecast model. The remaining rows show relative RMSEs, with respect to the 'Just ΔY' model. The model variants are listed in the first column. Rows 4-25 pertain to forecast models that include the deviation of leverage from a 12 quarter moving average of lagged leverage, as a predictor: $Y_{t+4} - Y_t = \beta_0 + \beta_1(Y_t - Y_{t-1}) + \beta_3\Lambda_{4,t} + \beta_4 f_t(L_t) + \varepsilon_{t+4}$, where L_t represents the log-level of leverage, and $f_t(L_t) = \max(0, L_t - \frac{1}{12}\sum_{i=1}^{12} L_{t-i})$ (see rows 10-17; suffix 'mma'). For comparison purposes, the Table also shows results for $f_t(L_t) = L_t - \frac{1}{12}\sum_{i=1}^{12} L_{t-i}$ (see rows 18-25; suffix 'ma').

'In-sample RMSEs' are estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3).

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Robustness with respect to the number of macro-financial control factors (Table A.9)

Table A.9a: Absolute RMSEs of models with different numbers of macro-financial controls

	In-sample RMSEs					*Out-of-sample RMSEs*				
Forecast model:	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F (1 PC)	1.73	3.90	0.75	9.95	19.62	1.96	4.53	0.81	11.02	25.23
F (2 PCs)	1.62	3.81	0.74	9.49	19.62	1.97	4.40	0.79	11.23	27.02
F (3 PCs)	1.41	3.50	0.66	8.78	18.58	1.94	4.21	0.82	11.50	25.73
F (4 PCs)	1.30	3.05	0.58	7.01	18.02	1.85	3.71	0.72	9.30	23.14
F (5 PCs)	1.30	3.05	0.58	6.99	17.66	1.88	3.84	0.72	9.20	24.35
F (6 PCs)	1.29	3.05	0.58	6.99	17.32	1.88	4.07	0.75	9.39	26.12
F (7 PCs)	1.29	3.04	0.58	6.82	17.31	2.04	4.28	0.81	10.08	28.41
F (8 PCs)	1.29	3.03	0.58	6.72	17.31	2.02	4.43	0.84	10.31	29.92
F (1 PC), MED-LEV	1.50	3.42	0.65	8.94	18.99	1.79	4.12	0.73	10.40	26.24
F (2 PCs), MED-LEV	1.44	3.40	0.65	8.72	18.95	1.89	4.25	0.74	10.66	28.20
F (3 PCs), MED-LEV	1.30	3.24	0.60	8.30	18.31	1.79	4.00	0.77	10.79	26.93
F (4 PCs), MED-LEV	1.17	2.68	0.52	6.26	17.48	1.71	3.62	0.69	8.71	24.89
F (5 PCs), MED-LEV	1.16	2.65	0.50	6.26	16.89	1.76	4.01	0.71	8.86	25.54
F (6 PCs), MED-LEV	1.15	2.64	0.50	6.26	16.62	1.78	4.17	0.72	9.12	26.88
F (7 PCs), MED-LEV	1.15	2.64	0.50	6.03	16.62	2.01	4.37	0.81	10.12	29.66
F (8 PCs), MED-LEV	1.15	2.64	0.50	6.02	16.58	1.99	4.45	0.84	10.37	31.10

Note: This table displays absolute RMSE for models with different numbers of macro-financial control factors. The model variants are listed in the first column and indicate the number of included principal components. 'F (j PCs)' is a variant of model 'F' in which j macro-financial factors (first j principal components) are used as predictors. 'F (j PCs), MED-LEV' is a variant of model 'F,MED-LEV' in which j macro-financial factors are used as predictors. (Note that model 'F (4 PCs)' corresponds to the model 'F' in the main text., while 'F (4 PCs),MED-LEV' corresponds to model 'F,MED-LEV'.)
'In-sample RMSEs' are estimated for the sample 1993q3-2010q3 (for each dependent variable). 'Out-of-sample RMSEs' are based on (pseudo) out-of-sample forecasts one year ahead, from 40-quarter rolling estimation windows (forecast evaluation period: 1993q3-2010q3).
Columns labeled 'GDP',...,'Rx' show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Table A.9b: Regression coefficients of leverage, in models with <u>different numbers of macro-financial control factors</u>

	Whole sample					*% Rolling windows with significant negative coefficients*				
Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**	**GDP**	**IP**	**UE**	**I**	**Rx**
F (1 PC), MED-LEV	-0.63***	-0.61***	0.50**	-0.59***	-0.39*	0.83	1.00	0.00	1.00	0.33
	{0.40}	*{0.38}*	*{0.62}*	*{0.28}*	*{0.07}*	*{0.83}*	*{1.00}*	*{0.52}*	*{1.00}*	*{0.36}*
F (2 PCs), MED-LEV	-0.56***	-0.58***	0.50***	-0.52***	-0.41*	0.72	0.96	0.00	1.00	0.35
	{0.45}	*{0.39}*	*{0.62}*	*{0.31}*	*{0.07}*	*{0.72}*	*{0.96}*	*{0.45}*	*{1.00}*	*{0.55}*
F (3 PCs), MED-LEV	-0.42***	-0.47***	0.40***	-0.41***	-0.27	0.77	0.77	0.12	0.88	0.42
	{0.55}	*{0.44}*	*{0.68}*	*{0.38}*	*{0.13}*	*{0.77}*	*{0.77}*	*{0.55}*	*{0.88}*	*{0.54}*
F (4 PCs), MED-LEV	-0.45***	-0.51***	0.40***	-0.45***	-0.39	0.74	0.70	0.07	0.77	0.45
	{0.63}	*{0.62}*	*{0.76}*	*{0.65}*	*{0.21}*	*{0.74}*	*{0.70}*	*{0.52}*	*{0.77}*	*{0.58}*
F (5 PCs), MED-LEV	-0.47***	-0.54***	0.44***	-0.46***	-0.46*	0.74	0.64	0.09	0.70	0.32
	{0.64}	*{0.63}*	*{0.77}*	*{0.65}*	*{0.26}*	*{0.74}*	*{0.64}*	*{0.51}*	*{0.70}*	*{0.41}*
F (6 PCs), MED-LEV	-0.48***	-0.54***	0.44***	-0.46***	-0.44*	0.70	0.67	0.09	0.68	0.32
	{0.65}	*{0.63}*	*{0.77}*	*{0.65}*	*{0.29}*	*{0.70}*	*{0.67}*	*{0.51}*	*{0.68}*	*{0.35}*
F (7 PCs), MED-LEV	-0.47***	-0.54***	0.44***	-0.47***	-0.44*	0.68	0.65	0.07	0.72	0.39
	{0.65}	*{0.63}*	*{0.77}*	*{0.67}*	*{0.29}*	*{0.68}*	*{0.65}*	*{0.49}*	*{0.72}*	*{0.45}*
F (8 PCs), MED-LEV	-0.48***	-0.54***	0.45***	-0.46***	-0.46*	0.65	0.67	0.19	0.71	0.38
	{0.65}	*{0.63}*	*{0.78}*	*{0.67}*	*{0.29}*	*{0.65}*	*{0.67}*	*{0.64}*	*{0.71}*	*{0.43}*

Note: This table displays results on coefficients of leverage in models with a varying number of macro-financial control factors. The number of included principal components is indicated in the left column (Note that model 'F (4 PCs), MED-LEV' corresponds to model 'F, MED-LEV' in the main text.)

The *Left panel* (labeled '*Whole sample*') shows standardized slope coefficients of leverage, from regressions of each dependent variable on lagged leverage and other predictors for the period 1993q3-2010q3 (for each dependent variable). Asterisks indicate significance levels (based on Newey-West HAC t-statistics): * 10%, ** 5%, *** 1%. Numbers in brackets are R^2 coefficients of corresponding regression equations.

The *Right panel* (labeled '*% Rolling windows with significant negative coefficients*') shows shares of leverage coefficients that are significantly smaller than zero at a 10% level (two-sided Newey-West HAC t-test), among the rolling 40-quarter estimation windows; numbers in brackets pertain to the share of estimation windows with significant leverage coefficients at 10% level (i.e. sum of shares for significantly negative and positive coefficients).

Columns labeled 'GDP', …,'Rx' pertain to the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return).

Clark-West test of equal predictive accuracy, relative to ‘F’ model (Table A.10)

Table A.10: P-values of Clark-West (2007) test of equal predictive accuracy, relative to model ‘F’

Forecast model	**GDP**	**IP**	**UE**	**I**	**Rx**
F, PC-LEV	0.17	0.08	0.12	0.07	0.62
F, MED-LEV	0.08	0.01	0.09	0.01	0.65
F, MED-FoF	0.01	0.19	0.73	0.23	0.04
F, MED-MV	0.28	0.19	0.27	0.15	0.80
F, CB	0.21	0.35	0.21	0.45	0.33
F, INS	0.50	0.23	0.90	0.77	0.42
F, SBD	0.05	0.71	0.93	0.14	0.04
F, HH	0.08	0.31	0.78	0.05	0.88
F, BUS	0.78	0.51	0.14	0.99	0.79
F, BNK-MV	0.13	0.20	0.18	0.04	0.74
F, INS-MV	0.31	0.56	0.60	0.46	0.77
F, FIN-MV	0.82	0.14	0.94	0.88	0.95

Note: For each model listed in the first column (see main text), and for each of the forecasted variables, the Table reports the p-value of a test of the null hypothesis that that model has the same predictive accuracy (RMSE) as model ‘F’. (Model ‘F’ is nested in each of models listed in Column 1) The MSPE-adjusted test statistic of Clark and West (2007) is used.
Columns labeled ‘GDP’,...,‘Rx’ show RMSEs for the different forecasted variables (IP: industrial production; UE: unemployment rate; I: investment; Rx: excess equity return). Out-of-sample forecasts (based on 40-quarter rolling estimation window) are used; the forecast evaluation period is 1993q3-2010q3.

Section B: VAR Results

To obtain additional insights into the dynamic interactions between real activity and leverage, we set up several vector auto-regressions (VARs) in these variables. All VARs considered here are estimated in quarterly first differences. Due to space constraints, we focus on GDP, as our measure of real activity, and on the median of sectoral leverage growth rates (in what follows, MED-LEVq refers to the sectoral median of QoQ leverage growth rates).

The estimated VAR variants are as follows: [1]

a) *VAR_small:* Includes just the QoQ growth of GDP and MED-LEVq; the lag order of the VAR is 1, as indicated by BIC lag-length selection.

b) *VAR_small_lag2:* same variables as in VAR_small, but VAR of order 2.

c) *VAR_sw2001:* The VAR of Stock and Watson (2001) (GDP growth, CPI inflation and the unemployment rate in QoQ differences) [2], augmented with MED-LEVq.

d) *VAR_as2010:* A VAR similar to the one in Adrian and Shin (2010, Figure 16), with GDP, PCE inflation, the Baa-AAA credit spread, the VIX index, the term spread (Treasury 10Y-3M), the Fed Funds rate, and MED-LEVq.

e) *VAR_all:* A VAR including all five aggregate real activity variables examined in the paper (GDP, IP, UE, I, Rx), CPI inflation, the 3 month US T-bill return and MED-LEVq.

The large number of parameters in these VARs entails out-of-sample RMSEs that are about 50% larger than those of the models in the paper. We therefore concentrate on the in-sample relationship between leverage and GDP growth, based on the sample 1993q3-2010q3.

Figure B.1 provides standardized impulse response functions (IRF) of GDP in response to a one standard deviation innovation to MED-LEVq, for all evaluated VAR variants. All IRFs are based on Cholesky decompositions that use the variable orderings in the description above. We thus assume that shocks to GDP have a contemporaneous impact on all included variables/error terms, while innovations to MED-LEVq have no contemporaneous effects on other variables. (Reverting the ordering of the variables in the Cholesky decomposition leaves the main qualitative conclusions unchanged.)

All IRFs display similar patterns in terms of magnitudes and dynamics: there is a negative effect of leverage shocks on GDP growth for the second to fourth quarter, which then gradually tapers off. Responses of MED-LEVq to an innovation to GDP growth (Figure B.2) are much less significant.

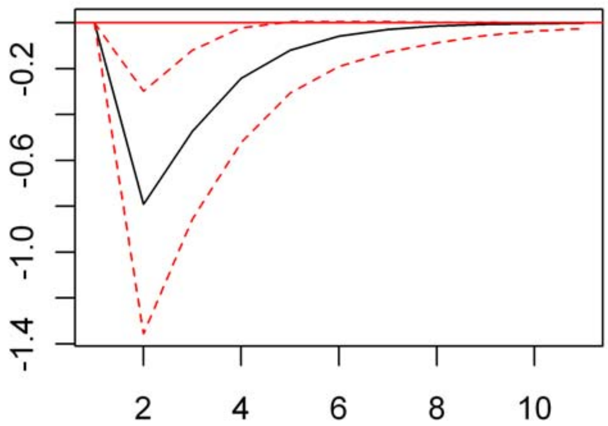
We thus conclude that leverage has predictive content for GDP growth. Moreover, leverage shocks have a negative impact on GDP growth, which recedes after more than 4 quarters.

[1] For all specifications, BIC suggests a VAR of order 1—hence, all but one VAR below are of that order.

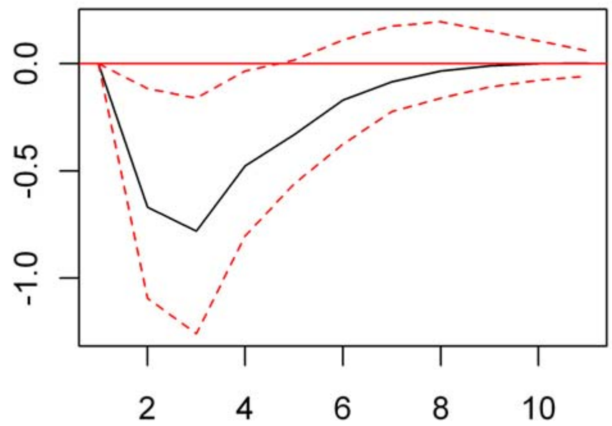
[2] Stock, M.H. and Watson M.W., 2001. Vector autoregressions. Journal of Economic Perspectives 15, 101-115.

Figure B.1: Impulse response of GDP growth in response to a 1 SD shock to MED-LEVq

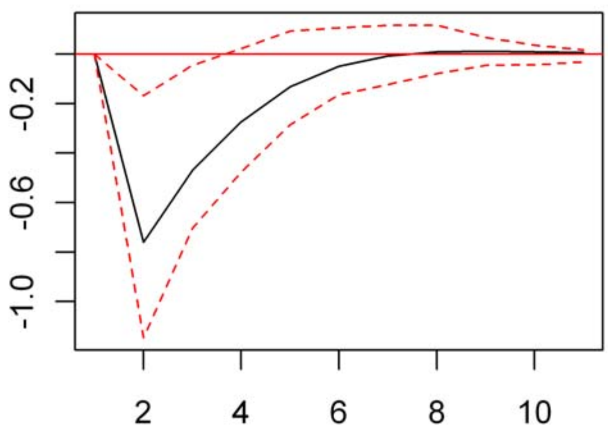
b) VAR_small



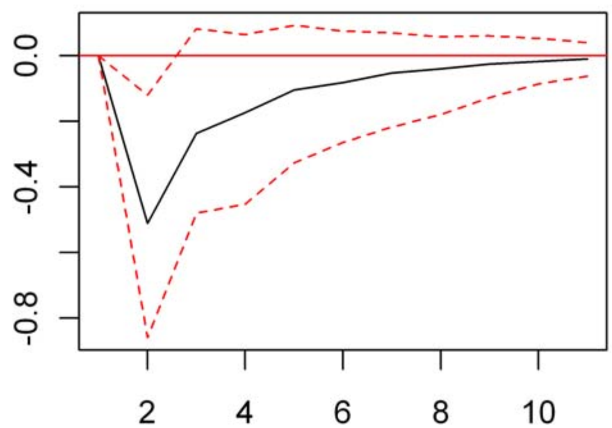
b) VAR_small_lag2



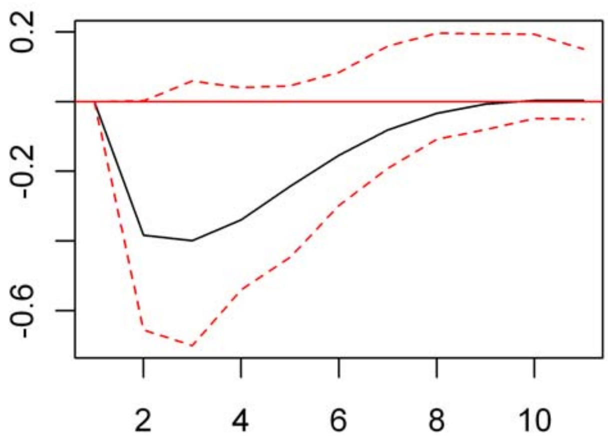
c) VAR_sw2001



d) VAR_as2010



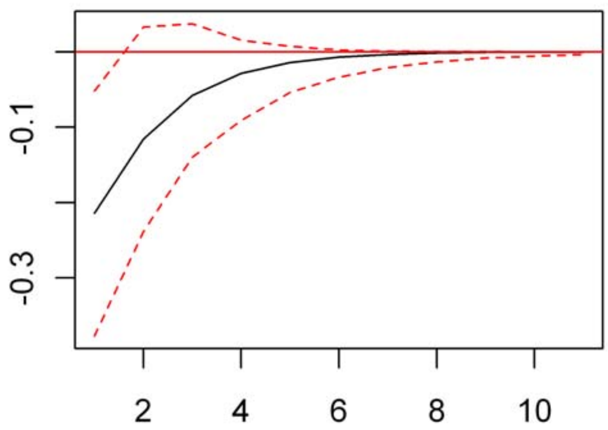
e) VAR_all



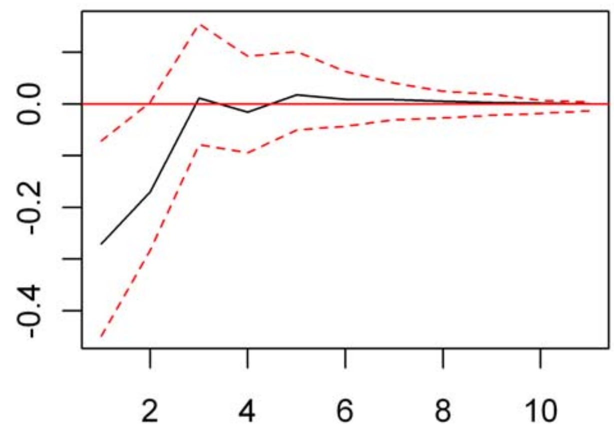
These figures show impulse response functions of quarterly GDP growth (%, annualized) in response to a positive one-standard-deviation shock to leverage (MED-LEVq), for the VARs described above. Confidence bands (± one standard deviation) are based on a bootstrap with 200 replications.

Figure B.2: Impulse response of leverage growth in response to a 1 SD shock to GDP growth

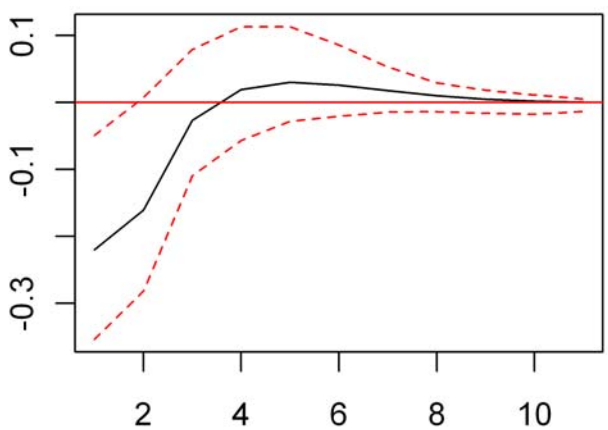
a) VAR_small



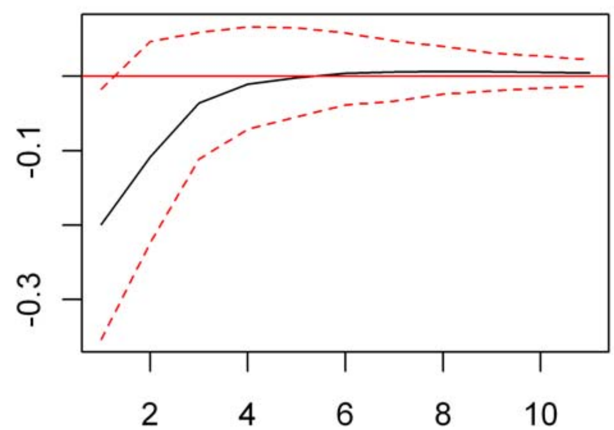
b) VAR_small_lag2



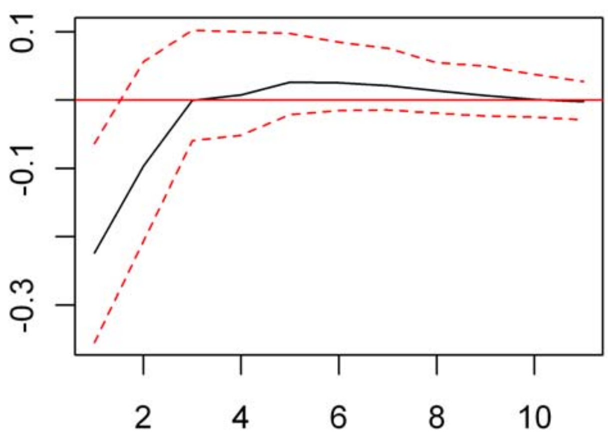
c) VAR_sw2001



d) VAR_as2010



e) VAR_all



These figures show impulse response functions of quarterly leverage growth (MED-LEVq, the cross-sectoral median of standardized quarterly leverage growth rates) in response to a positive one-standard-deviation shock to GDP growth, for the VARs described above. Confidence bands (± one standard deviation) are based on a bootstrap with 200 replications. The standard deviation of MED-LEVq in the sample is 0.63.