

Web Appendix to Modeling global financial sector stress
and credit market dislocation

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Appendix A1: treatment of missing values

An advantage of using state space methods is the convenient treatment of missing values in the dataset. Missing values can have a strong presence in the macro panel x_t and credit risk panels y_t and z_t . For example, some macroeconomic variables in x_t are not available at the beginning of the sample. Also, default data $y_{r,jt}$ is not available (missing) if there are no corresponding firms j at risk at time t , that is $k_{r,jt} = 0$. State space methods provide a natural framework to account for missing entries in the data without any adjustments to the model.

When missing values are present in the stacked data vector $y = (x'_1, y'_1, z'_1, \dots, x'_T, y'_T, z'_T)'$, we need to take care when computing the importance sample weights $w_k = p(y|f^{(k)}; \psi) / g(y|f^{(k)}; \psi)$, $f^{(k)} \sim g(f|y; \psi)$. The mode estimates of the corresponding signals $\theta = (\theta'_1, \dots, \theta'_T)'$ and factors $f = (f'_1, \dots, f'_T)'$ are available even when the respective data entries are missing. Some bookkeeping is therefore required to evaluate $p(y|f; \psi)$ and $g(\tilde{y}|f; \psi)$ at the corresponding values of f , or θ .

Missing values allow us to forecast easily. Forecasts \tilde{f}_{T+h} , for $h = 1, 2, \dots, H$, can be obtained by treating future observations y_{T+1}, \dots, y_{T+H} as missing, and by applying the estimation and signal extraction techniques as explained in the paper. We refer to Durbin and Koopman (2001, p. 92) for more details on missing values and forecasting. We use this approach when assessing credit risk deviations out of sample and to obtain filtered risk factor estimates.

Appendix A2: macro data listing and time series plots

Table 1 and Figure 1 contain a listing and time series plots, respectively, of the macro data that is used for our empirical analysis.

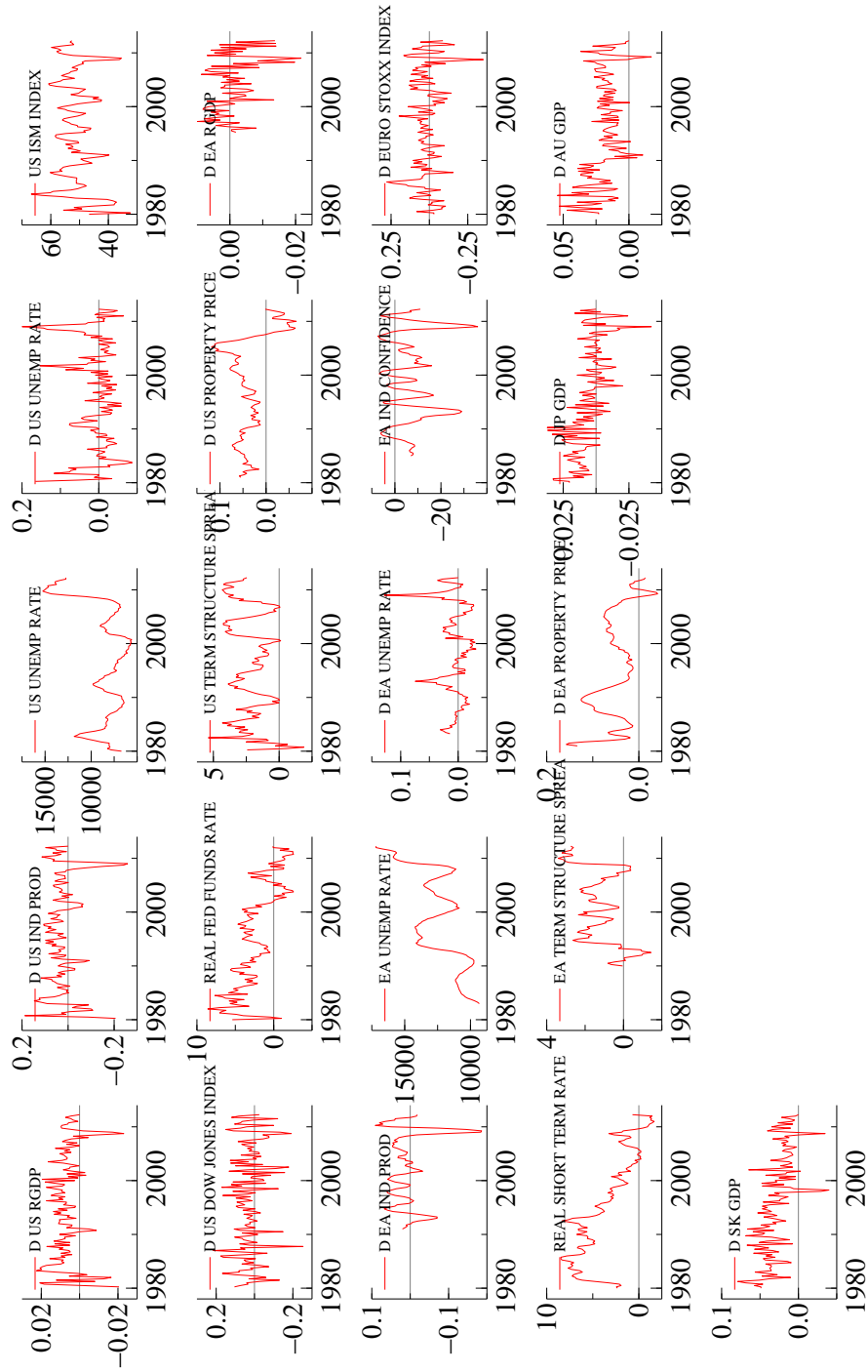
Table 1: Macro-financial time series data

We list the macroeconomic and financial market covariates that are used to construct the variables in the macroeconomic panel x_t , $t = 1, \dots, T$. The macro time series are available at a quarterly frequency, and enter the analysis as quarterly (qoq) growth rates. Datastream ID codes are given where available.

Region	Summary of time series in category	Datastream ID
(i) United States	Real GDP	USGDP...B
	Industrial production index	USIPMAN.G
	Inflation (implicit GDP price deflator)	USGDPIPE
	Dow Jones Industrials share price index	USSHRPCF
	Unemployment rate, 16 years and older	USUNPTOTO
	Treasury bond yield, 20 years	USGBOND.
	T-Bill yield, 3 months	USGBILL3
	ISM Purchasing managers index	USCNFBUSQ
	US Residential property prices	-
(ii) European countries	Euro Area (EA16) Real GDP	EKGDP...D
	Euro Area (EA16) Industrial production index	EKIPTOT.H
	Euro Area (EA16) Inflation, harmonized CPI	EMCONPRCF
	Euro Share Price Index, Datastram	EMSHRPCF
	Euro Area (EA16) Unemployment rate	EMESTUNPO
	Euro Area (EA16) Gov't bond yield, 10 years	EMGBOND
	Euro Interbank Offered Rate (Eruibor), 3 months	EMINTER3
	Euro Area (EA16) Industrial confidence indicator	EKCNFBUSQ
	Euro Area Residential propoerty prices	-
(iii) Asia-Pacific region	Japan, GDP	JP GDP CURA
	Australia, GDP	AU GDP CURA
	South Korea, GDP	KO GDP CURA

Figure 1: Macroeconomic and financial time series data

We plot quarterly growth rates of the macroeconomic and financial markets data in Table 1.

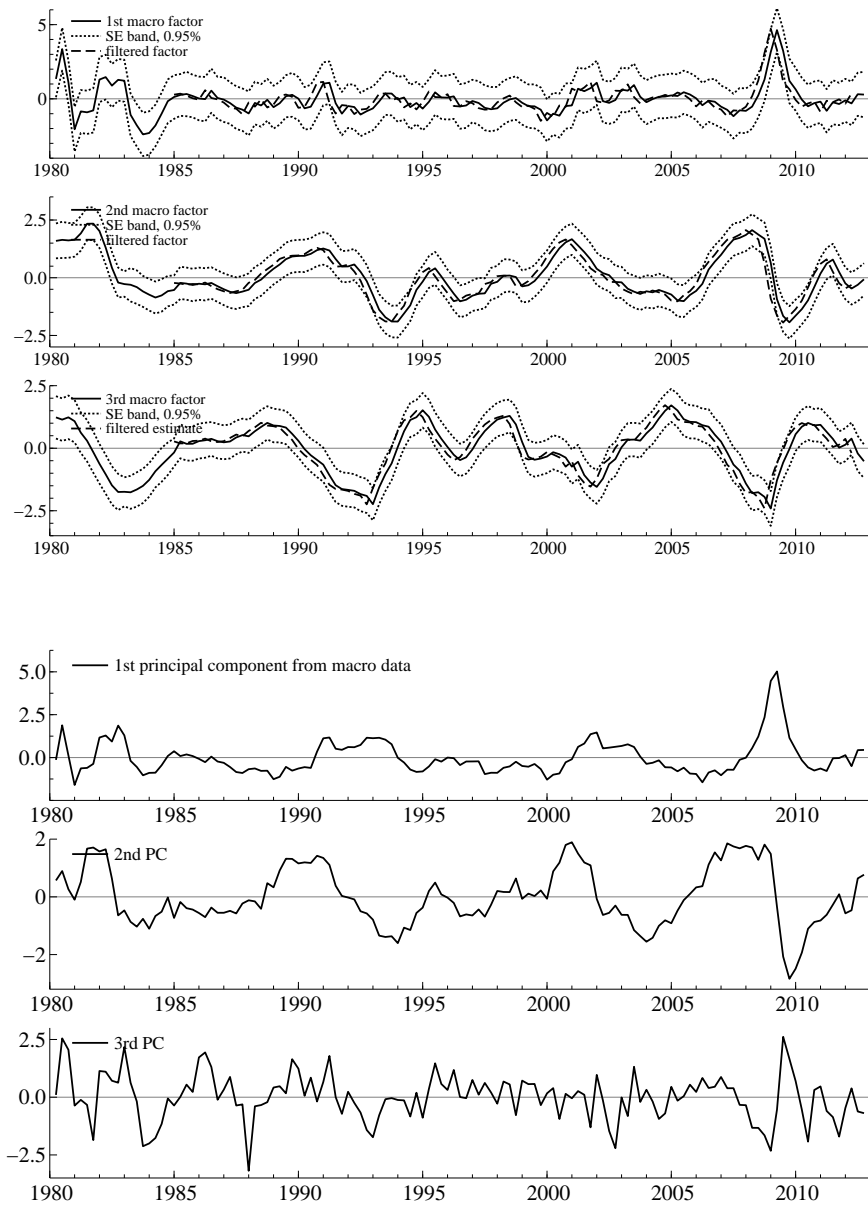


Appendix A3: macro factors

Figure 2 plots estimates of the three macro factors f_t^m . Principal component estimates for the macro data panel are reported for comparison. The factors are similar but not identical.

Figure 2: Macroeconomic factors and principal components

We plot estimates of three macro factors f_t^m . Full sample, or “smoothed”, estimates are based on all available data, while “filtered” factor estimates are based on information up to and including time t , given parameters. The bottom panel plots the first three principal components from the macro data for comparison. Factors f_t^m are common to all data in the mixed-measurement panel (default and macro data), while principal component estimates are common only to the macroeconomic and financial markets data in Table 1.



References

Durbin, J. and S. J. Koopman (2001). *Time Series Analysis by State Space Methods*. Oxford: Oxford University Press.