University of Cyprus
Economics Research Centre

RESEARCH
& INNOVATION
FOUNDATION

Forecasting the European GDP using MIDAS models: The role of Survey and Financial Indicators

Magdalini Tofini (University of Cyprus)

Elena Andreou (University of Cyprus)

14 July 2022

Forecasting GDP Growth…

Global crises: Financial crisis, COVID-19, climate, nature, uncertainty…

- Composite **Leading** Economic Indices
  - The CB Leading Economic Index for the US, the Euro Area, etc..
  - The OECD Composite Leading Indicator for OECD and non-OECD countries
  - The Cyprus Composite Leading Economic Index (CCLEI)

- Composite **Coincident** Economic Indices
  - The ADS real-time measurement for the US
  - The WEI for the US
    - Significant role of ***higher/mixed frequency*** data is recognized especially during the recent ***pandemic crisis***

Importance of High-frequency Information

Traditional models consider the <u>same</u> sampling (low) frequency

<u>Example</u>: <u>Quarterly</u> GDP growth vs <u>monthly</u> employment (EMP) and <u>weekly</u> stock prices (STOCK)

- average/sum of monthly EMP data within each quarter
- last weekly STOCK price within each quarter

<u>Simple, but</u>

- Loss of information
- Dynamics of the aggregate model ≠ dynamics in high or mixed frequency

MIxed Data Sampling (MIDAS) models

- *parsimonious specifications based on distributed lag polynomials*
- *flexibly deal with data sampled at different frequencies*
- *allow a flexible data-driven weighting scheme*
- *provide a direct forecast of the low-frequency variable*
- *yield improved inferences vis-à-vis traditional models*

MIDAS models - Literature

- **Introduced** by Ghysels, Santa-Clara, and Valkanov (2004)
- **Solution** to **equal weighting scheme** & **parameter proliferation** (Armesto, Engemann, and Owyang, 2010)
- Exhibit **good nowcasting** and **forecasting** performance of GDP (Barsoum and Stankiewicz, 2013)

Reveal the existence of bias and inefficiency

- The FLAT-LS estimator is asymptotically **biased** and **inefficient** (Andreou, Ghysels and Kourtellos, 2010)
- **Bias** of LS slope regression estimator when a flat weighting scheme is applied instead of a non-flat when the DGP is a MIDAS model (Andreou, 2016)

MOTIVATION (1) – A new empirical evidence

Estimating a MIDAS model instead of a standard Linear – LS model
→ *slope regression estimator*

- *with statistically significant* ***higher impact***
- *with statistically significant* ***forecasting gains***

low-frequency variable: ***EU*** *GDP growth*

high-frequency variables: ***EU Survey, Confidence Indicators (CIs)*** *or* ***Financial Indicators (FIs)***.

MOTIVATION (2) – The use of "soft" (survey and financial) indicators

Angelini et al. (2011)

- *bridging via factors from a large set of survey data:* ***valuable*** *for nowcasting the EA GDP.*

Bánbura and Rünstler (2011)

- *survey & financial data:* ***important information*** *for the EA GDP forecasts.*

Girardi, Gayer, and Reuter (2015)

- *survey data:* ***timeliness is not their main/only 'quality'***
- *financial data:* ***important role*** *during the period of the Great Recession (2008–09).*

Andreou, Ghysels, and Kourtellos (2013)

- *MIDAS regression models using daily financial information* ***outperform*** *quarterly forecasts of* ***U.S.*** *real GDP growth based on quarterly macroeconomic factors.*

The MIDAS Framework

The basic single high-frequency regressor **ADL-MIDAS** model for h-steps ahead (low-frequency) forecasting with high-frequency data available up to x_t^H and low-frequency lags is (Andreou, Ghysels, and Kourtellos, 2013):

$$y_{t+h}^L = \alpha_h + \sum_{i=1}^{p} \lambda_{h,i} L^i y_t^L + b_h W\left(L^{1/m}; \theta_h\right) x_t^H + \varepsilon_{t+h}^L$$

where $W\left(L^{1/m}; \theta\right) = \sum_{j=0}^{j_{max}-1} w(j;\theta) L^{j/m}$, and $W(1;\theta) = \sum_{j=0}^{j_{max}-1} w(j;\theta) = 1$.

- ***different*** *weights are attributed to each high-frequency observation*
- *ADL-MIDAS is a* ***direct forecasting tool***

The MIDAS Framework - EMIDAS

Exponential Almon lag polynomial specification:

$$w(k;\theta) = \frac{exp\left(\theta_1 k + \cdots + \theta_Q k^Q\right)}{\sum_{k=0}^{K} exp\left(\theta_1 k + \cdots + \theta_Q k^Q\right)}$$

Empirical analysis: ***Two*** *parameters functional form (Ghysels et al., 2006)*

$$y_{t+h}^{L} = \alpha_h + \sum_{i=1}^{p} \lambda_{h,i} L^i y_t^L + b_h \sum_{j=0}^{j_{max}-1} \left[\frac{exp(\theta_1 j + \theta_2 j^2)}{\sum_{k=0}^{K} exp(\theta_1 k + \theta_2 k^2)}\right] L^{j/m} x_t^H + \varepsilon_{t+h}^L$$

The MIDAS Framework - BMIDAS

Beta polynomial specification:

$$w(k;\theta_1;\theta_2) = \frac{f\left(\frac{k}{K},\theta_1;\theta_2\right)}{\sum_{k=0}^{K} f\left(\frac{k}{K},\theta_1;\theta_2\right)}$$

$$f(x,a,b) = \frac{x^{a-1}(1-x)^{b-1}\Gamma(a+b)}{\Gamma(a)\Gamma(b)} \text{ and } \Gamma(a) = \int_0^{\infty} e^{-x}x^{a-1}dx$$

$$y_{t+h}^{L} = \alpha_h + \sum_{i=1}^{p} \lambda_{h,i}\, L^i y_t^L + b_h \sum_{j=0}^{j_{max}-1} \left[\frac{z_j^{\theta_1-1}(1-z_j)^{\theta_2-1}}{\sum_{k=0}^{K} z_k^{\theta_1-1}(1-z_k)^{\theta_2-1}} + \theta_3\right] L^{j/m}\, x_t^H + \varepsilon_{t+h}^L$$

$z_i = i/K$

The MIDAS Framework - UMIDAS

Foroni, Marcellino, and Schumacher (2015): UMIDAS via OLS

Instead of estimating $b_h W\left(L^{1/m}; \theta_h\right)$ estimate the individual lags separately:

$$y_{t+h}^{L} = a_h + \sum_{i=1}^{p} \lambda_{h,i} L^i y_t^L + c_h^0 x_t^H + c_h^1 x_{t-1/m}^H + c_h^2 x_{t-2/m}^H + \cdots + c_h^{m\tilde{K}} x_{t-\tilde{K}}^H + \varepsilon_{t+h}^L$$

- Lag order: Information Criteria (AIC, BIC, or HQ)
- U-MIDAS: all parameters unconstrained → works for **small** values of m

The MIDAS Framework - PMIDAS

Polynomial Distributed Lag (PDL) or Almon lag weighting:

For each high frequency lag up to K, the regression coefficients are modeled as a q dimensional lag polynomial in the MIDAS parameters θ:

$$y_{t+h}^{L} = a_h + \sum_{i=1}^{p} \lambda_{h,i} L^i y_t^L + \sum_{k=0}^{K} x_{t-k/m}^{H}{}' \left(\sum_{j=0}^{q} k^j \theta_j \right) + \varepsilon_{t+h}^{L}$$

where q is the Almon polynomial order.

Importantly, the number of coefficients to be estimated depends on the **polynomial order** and **not** the **number of high frequency lags**.

Empirical Analysis

Implement an in-sample and out-of-sample analysis using the MIDAS models when the low frequency variable is ***quarterly GDP*** *in the* ***European Union (EU)*** *and* ***monthly CIs*** *and* ***FIs*** *are used as predictors.*

Main objectives:

- *Reveal:* ***statistically significant higher impact*** *of the estimated slope coefficient when a MIDAS model is estimated instead of a Linear-LS model.*
- *Reveal:* ***forecasting gains*** *of MIDAS models vis-à-vis Linear LS models as well as vis-à-vis traditional benchmark models (AR(p) and RW).*

In-sample Empirical Analysis:

The role of Survey Confidence Indicators (CIs)

Table 1: In-sample estimation results of the **MIDAS** regression models when low-frequency variable is quarterly **EU GDP** and high-frequency predictors are monthly **Confidence Indicators (CIs)** vis-à-vis the **common-frequency Linear-LS models**.

	BMIDAS			EMIDAS		
	$\widehat{\boldsymbol{\beta}}_{GDP}$	$\widehat{\boldsymbol{\beta}}_{CI}$	**BIC**	$\widehat{\boldsymbol{\beta}}_{GDP}$	$\widehat{\boldsymbol{\beta}}_{CI}$	**BIC**
EUCONS	0.439***	**0.221*** **	**0.033**	0.519***	0.177***	**0.031**
EUESI	0.507***	0.139***	0.078	0.453***	**0.185*** **	0.056
EUINDU	**0.580*** **	0.075	0.131	0.477***	0.139***	0.129
	PMIDAS (d=3)			**UMIDAS**		
EUCONS	0.429***	**0.221*** **	**-0.009**	0.519***	0.177***	**-0.062**
EUESI	0.499***	0.147***	0.029	0.453***	**0.185*** **	-0.038
EUINDU	**0.580*** **	0.075**	0.085	0.477***	0.139***	0.035
	LINEAR					
EUCONS	**0.540*** **	0.099***	0.119			
EUESI	0.406***	**0.158*** **	**0.038**			
EUINDU	0.392***	0.132***	0.057			

$\widehat{\boldsymbol{\beta}}$: *summations of lags based on the BIC criterion and serial correlation tests*
, **, **: *significance at 10%, 5%, 1% (two-sided p-values)*

The valuable Consumption Survey Indicator

IC and slope coefficient size → EUCONS has the **greatest** impact on EU GDP providing the **best-fitted** models among all CIs.

- **Matsusaka and Sbordone (1995)**: *Consumer sentiment adds **significant** information in forecasting GDP.*
- **Batchelor and Dua (1998)**: *GDP forecasts during the 1991 recession could have been **improved** if forecasters took consumption confidence into account.*
- **Christiansen, Eriksen, and Møller (2014)**: *Consumption CI is not only a **strong predictor** of future recessions on its own, but combining it with classical recession predictors provides even **stronger recession predictions**.*
- **Jongrim and Inhwan (2021)**: *Global consumer confidence cycle has played a **key role** in global business cycle **fluctuations.***

Table 2: In-sample estimation results of the **MIDAS** regression models when low-frequency variable is quarterly **EU GDP** and high-frequency predictors are monthly **Consumption** Survey Indicators.

	BMIDAS			EMIDAS		
	$\widehat{\beta}_{GDP}$	$\widehat{\beta}_{CI}$	BIC	$\widehat{\beta}_{GDP}$	$\widehat{\beta}_{CI}$	BIC
EUCONS	0.439***	0.221***	**0.033**	0.519***	0.177***	**0.031**
EUCONS_q1	**0.532*** **	0.240***	0.097	0.536***	0.237***	0.052
EUCONS_q2	0.471***	0.367***	0.142	0.488***	**0.295*** **	0.114
EUCONS_q4	0.480***	0.164***	0.119	0.527***	0.152***	0.098
EUCONS_q9	0.499***	**0.390** **	0.227	**0.584*** **	0.071***	0.223
	PMIDAS (d=3)			**UMIDAS**		
EUCONS	0.429***	0.221***	**-0.009**	0.519***	0.177***	**-0.062**
EUCONS_q1	**0.533*** **	0.236	0.049	0.519***	**0.257*** **	0.129
EUCONS_q2	0.518***	0.230***	0.104	0.557***	0.141***	0.068
EUCONS_q4	0.467***	0.164***	0.081	0.527***	0.152***	0.004
EUCONS_q9	0.489***	**0.442**	0.213	**0.584*** **	0.071***	0.130
	LINEAR					
EUCONS	0.540***	0.099***	0.119			
EUCONS_q1	0.524***	**0.122*** **	**0.062**			
EUCONS_q2	**0.578*** **	0.070**	0.168			
EUCONS_q4	0.549***	0.085***	0.135			
EUCONS_q9	0.567***	0.078***	0.144			

$\widehat{\beta}$: *summations of lags based on the BIC criterion and serial correlation tests*
*****, ******, *******: *significance at 10%, 5%, 1% (two-sided p-values)*

Out-of-sample Empirical Analysis:

The forecasting performance of Confidence Indicators (CIs)

Out-of-sample Empirical Analysis: The forecasting performance of CIs

Training sample: 1995Q1-2007Q4

Evaluation sample: 2008Q1-2019Q4

Predictive models: $LINEAR$, $BMIDAS$, $EMIDAS$, $PMIDAS$, $UMIDAS$

Benchmark models: $AR(p)$ and RW

The ratio of RMSFEs for each Confidence Indicator (CI) used in a model is computed as:

$$r_i = \frac{RMSFE_{predictive\ model,CI_i}}{RMSFE_{benchmark\ model}}$$

$r_i < 1$ → *forecasting models* ***beat*** *the benchmark models*

Table 3: Out-of-sample estimation results of quarterly EU GDP models: The Linear-LS regression model with common-frequency variables versus the alternative MIDAS models with higher-frequency monthly **sentiment** predictors.

Ratios of RMSFEs when the Benchmark model is the *RW*					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
EUCONS	0.9048	**0.8108**	**0.8457**	**0.8075**	**0.8467**
EUESI	**0.8492**	0.8897	0.8792	0.8969	0.8792
EUINDU	0.8644	0.9164	0.9108	0.9164	0.9132

Ratios of RMSFEs when the Benchmark model is the *AR*(*p*)					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
EUCONS	0.9136	**0.8187**	**0.8540**	**0.8154**	**0.8550**
EUESI	**0.8575**	0.8984	0.8878	0.9057	0.8878
EUINDU	0.8728	0.9254	0.9198	0.9254	0.9221

Table 4: Out-of-sample estimation results of quarterly EU GDP models: The Linear-LS regression model with common-frequency variables versus the alternative MIDAS models with higher-frequency monthly **consumption sentiment** predictors.

Ratios of RMSFEs when the Benchmark model is the *RW*					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
EUCONS	**0.9048**	**0.8108**	**0.8457**	**0.8075**	**0.8467**
EUCONS_q1	0.9155	0.9064	0.9107	0.8974	0.9444
EUCONS_q2	0.9427	0.9482	0.9169	0.9249	0.9196
EUCONS_q4	0.9171	0.8552	0.8887	0.8522	0.8919
EUCONS_q9	0.9230	0.8756	0.9332	0.8753	0.9332

Ratios of RMSFEs when the Benchmark model is the *AR*(*p*)					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
EUCONS	**0.9136**	**0.8187**	**0.8540**	**0.8154**	**0.8550**
EUCONS_q1	0.9245	0.9153	0.9196	0.9062	0.9537
EUCONS_q2	0.9520	0.9575	0.9259	0.9339	0.9286
EUCONS_q4	0.9261	0.8636	0.8974	0.8606	0.9006
EUCONS_q9	0.9320	0.8842	0.9423	0.8839	0.9423

CONCLUSIONS – Empirical Analysis with Confidence Indicators

- **MIDAS models reveal that EUCONS**:
  1. has the **greatest impact** on EU GDP growth,
  2. provides the **best-fitted model**, and
  3. brings the **best out-of-sample predictor**.

*Barsky and Sims (2012): *surprise movements in consumption confidence are **prognostic** of long-lasting movements in macroeconomic variables*

- **MIDAS models reveal**:
  1. **statistically significant different estimated slope coefficients**, and
  2. **forecasting gains** against LINEAR-LS and traditional benchmark models.

In-sample Empirical Analysis:

The role of Financial Indicators (FIs)

Table 5: In-sample estimation results of the MIDAS regression models when low-frequency variable is quarterly EU GDP and high-frequency predictors are monthly **Financial Indicators (FIs)** vis-à-vis the **common-frequency Linear-LS models**.

	BMIDAS			EMIDAS		
	$\widehat{\boldsymbol{\beta}}_{GDP}$	$\widehat{\boldsymbol{\beta}}_{FI}$	**BIC**	$\widehat{\boldsymbol{\beta}}_{GDP}$	$\widehat{\boldsymbol{\beta}}_{FI}$	**BIC**
EURIBOR6	0.991***	-0.231***	**0.121**	0.855***	-0.151***	**0.088**
EURIBOR3	**0.994*** **	**-0.237*** **	0.136	**0.991*** **	**-0.195*** **	0.110
EURIBOR12	0.802***	-0.154***	0.160	0.815***	-0.137***	0.117
	PMIDAS (d=3)			**UMIDAS**		
EURIBOR6	**0.864*** **	**-0.144** **	**0.085**	**0.808*** **	**-0.131*** **	**0.074**
EURIBOR3	0.846***	**-0.144***	0.109	0.802***	-0.127***	0.089
EURIBOR12	0.809***	-0.132**	0.115	0.765***	-0.114***	0.092
	LINEAR					
EURIBOR6	0.896***	-0.133***	**0.154**			
EURIBOR3	**0.914*** **	**-0.139*** **	0.161			
EURIBOR12	0.848***	-0.116***	0.162			

$\widehat{\boldsymbol{\beta}}$: *summations of lags based on the BIC criterion and serial correlation tests*

, **, **: *significance at 10%, 5%, 1% (two-sided p-values)*

Out-of-sample Empirical Analysis:

The forecasting performance of Financial Indicators (FIs)

Table 6: Out-of-sample estimation results of quarterly EU GDP models: The Linear-LS regression model with common-frequency variables versus the alternative MIDAS models with higher-frequency monthly **financial** and **sentiment predictors/combinations**.

Ratios of RMSFEs when the Benchmark model is the *RW*					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
Stocks	**0.8485**	**0.8301**	**0.8312**	**0.8535**	**0.9013**
Euribor rates	0.9561	0.9483	0.9647	0.9657	0.9603
Commodity prices	0.9514	0.9571	0.9731	0.9607	0.9808
Sentiments	0.8492	**0.8108**	0.8457	**0.8075**	**0.8467**

Ratios of RMSFEs when the Benchmark model is the *AR*(*p*)					
	LINEAR	**BMIDAS**	**EMIDAS**	**PMIDAS**	**UMIDAS**
Stocks	**0.8568**	**0.8383**	**0.8393**	**0.8619**	**0.9101**
Euribor rates	0.9655	0.9575	0.9741	0.9752	0.9697
Commodity prices	0.9607	0.9665	0.9827	0.9701	0.9904
Sentiments	0.8575	**0.8187**	0.8540	**0.8154**	**0.8550**

*In the table are presented the "best" out-of-sample **predictors/combinations** for each model based on forecast evaluation analysis.*

Important "Soft" Leading Indicators

Consumption Confidence Indicator – most common sentiment predictor

- The Conference Board (CB) Leading Economic Index for Germany and the UK
- The OECD Composite Leading Indicator for France
- The Euro Area Wide Leading Indicator (ALI) (Bondt and Hahn (2014))
- The CLI for German business cycle (Tkacova, Gavurova, Behun (2017))

The only* sentiment component that asks about expectations over the **next 12 months*

Stock Price Index – most common financial predictor

- The Conference Board (CB) Leading Economic Index for the US, the Euro Area, France, and Germany
- The Euro Area Wide Leading Indicator (ALI) (Bondt and Hahn (2014))
- The CLI for German business cycle (Tkacova, Gavurova, Behun (2017))

CONCLUSIONS

- ***Statistically significant different estimated slope coefficients***: problem regardless if the high frequency variable is a CI or a FI.

- MIDAS models reveal that the **Consumption CI**
  1. has the **greatest impact** on EU GDP growth,
  2. provides the **best-fitted model**, and
  3. brings the **best out-of-sample predictor**.

- MIDAS models in general provide:
  1. the highest gains in terms of MSFE vis-a-vis the benchmarks, and thus
  2. the highest gains in terms of MSFE vis-a-vis the Linear-LS model

*when the **financial predictors** are **Stocks** and **Euribor rates**, as well as when predictors are **Sentiment** indicators (in terms of best predictors/combinations).*

- *The majority of **MIDAS** models are in favor of the **Sentiment predictors**, whereas the **LINEAR-LS** model is in favor of the **Financial Stock predictors**.*

Thank you!

Appendix

Table: Variable Description (acronyms, definition, source, frequency, transformations) over the sample period 1995Q1-2019Q4.

Variable/Acronym	Definition & Data Source	Frequency & Transformation
EUGDP	GDP growth in the EU (Eurostat)	Quarterly growth rate
Confidence Indicators (CIs): European Commission		
EUESI	Economic Sentiment Indicator in the EU	Monthly and Quarterly Δ
EUINDU	Industry Confidence Indicator in the EU	
EUSERV	Services Confidence Indicator in the EU	
EUCONS	Consumption Confidence Indicator in the EU	
EURETS	Retail Confidence Indicator in the EU	
EUBUILD	Construction Confidence Indicator in the EU	

Confidence Indicators' (CIs) questions: European Commission		
EUINDU_q2	Assessment of order-book levels	Monthly and Quarterly Δ
EUINDU_q4	Assessment of stocks of finished products	
EUINDU_q5	Production expectations for the months ahead	
EUSERV_q1	Business situation development over the past 3 months	
EUSERV_q2	Evolution of the demand over the past 3 months	
EUSERV_q3	Expectation of the demand over the next 3 months	
EUCONS_q1	Financial situation over last 12 months	
EUCONS_q2	Financial situation over next 12 months	
EUCONS_q4	General economic situation over next 12 months	
EUCONS_q9	Major purchases over next 12 months	
EURETS_q1	Business activity (sales) development over the past 3 months	
EURETS_q2	Volume of stock currently hold	
EURETS_q4	Business activity expectations over the next 3 months	
EUBUILD_q3	Evolution of your current overall order books	
EUBUILD_q4	Employment expectations over the next 3 months	

40%	**EUINDU [(Q2 - Q4 + Q5) / 3]**	**Correl**
	Q2: Assessment of order-book levels	(94%)
	Q4: Assessment of stocks of finished products	(-92%)
	Q5: Production expectations for the **months ahead**	(92%)
30%	**EUSERV [(Q1 + Q2 + Q3) / 3]**	**Correl**
	Q1: Business situation development over the past 3 months	(92%)
	Q2: Evolution of the demand over the past 3 months	(77%)
	Q3: Expectation of the demand over the **next 3 months**	(83%)
20%	**EUCONS [(Q1 + Q2 + Q4 + Q9) / 4]**	**Correl**
	Q1: Financial situation over last 12 months	(71%)
	Q2: Financial situation over **next 12 months**	(92%)
	Q4: General economic situation over **next 12 months**	(94%)
	Q9: Major purchases over **next 12 months**	(49%)
5%	**EURETS [(Q1 - Q2 + Q4) / 3]**	**Correl**
	Q1: Business activity (sales) development over the past 3 months	(90%)
	Q2: Volume of stock currently hold	(-65%)
	Q4: Business activity expectations over the **next 3 months**	(88%)
5%	**EUBUILD [(Q3 + Q4) / 2]**	**Correl**
	Q3: Evolution of your current overall order books	(89%)
ESI weight	**Q4**: Employment expectations over the **next 3 months**	(91%)

Financial Indicators (FIs)		
EASTOXX50	Euro area (changing composition), Euro, Dow Jones Euro Stoxx 50 Price Index (European Central Bank)	Monthly and Quarterly log-return
EASTOXX	Euro area (changing composition), Euro, Dow Jones Euro Stoxx Price Index (European Central Bank)	
GEGBY10Y	Germany 10-year Government Benchmark Bond Yield (DataStream)	Weekly, Monthly, and Quarterly Δ
EURIBOR3	Europe 3-month EURIBOR (European Central Bank)	Monthly and Quarterly Δ
EURIBOR6	Europe 6-month EURIBOR (European Central Bank)	
EURIBOR12	Europe 12-month EURIBOR (European Central Bank)	
BRENTOILEUR	Brent Crude Oil (€)-Commodity Prices (Global Financial Data)	Weekly, Monthly, and Quarterly log-return
WTEXASOILEUR	West Texas Intermediate Oil Price (€/Barrel)-Commodity Prices (Global Financial Data)	
OILFUTUREUR	Crude Oil Futures (€)-Futures Contracts (Global Financial Data)	
GOLDEUR	Gold Bullion Price-New York (€/Ounce)-Commodity Price (Global Financial Data)	
SILVEREUR	Silver Cash Price (€/Ounce)-Commodity Prices (Global Financial Data)	
CORNOILEUR	Corn Oil Price, Wet Mill, Chicago (Cents/Pound) (€)-Commodity Prices (Global Financial Data)	Monthly and Quarterly log-return
WHEATEUR	Wheat #2 Cash Price (€/Bushel)-Commodity Prices (Global Financial Data)	