### PROGRAM

**Monday, May 16**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>8:30 a.m. – 9:00 a.m.</td>
<td>Administrative Briefing</td>
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<td>9:00 a.m. – 9:30 a.m.</td>
<td><strong>Opening Session</strong>&lt;br&gt;Mr. Norbert Funke, Director, JVI; and&lt;br&gt;Mr. Charis Christofides, Senior Economist, European and Middle Eastern (EM) Division, IMF Institute for Capacity Development (ICD)</td>
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<tr>
<td>9:30 a.m. – 10:30 a.m.</td>
<td><strong>Initial Quiz</strong></td>
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<td>10:30 a.m. – 12:00 p.m.</td>
<td><strong>Introductory Lecture: Overview of the Macroeconomic Forecasting course</strong>&lt;br&gt;Mr. Sam Ouliaris, Deputy Division Chief, EM Division, ICD&lt;br&gt;• A short introduction to the design of the course, its main elements, and objectives&lt;br&gt;• Structure of the course, role of participants and counselors&lt;br&gt;• Philosophy of forecasting, caveats, and related issues</td>
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<td>12:00 p.m. – 12:30 p.m.</td>
<td><strong>Group photo</strong></td>
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<td>2:00 p.m. – 3:30 p.m.</td>
<td><strong>Unit 1</strong>&lt;br&gt;Stationary VARs, structural VARs and their application I: short-run restrictions&lt;br&gt;Mr. Sam Ouliaris&lt;br&gt;• Introduction to SVAR: identification problem&lt;br&gt;• Choleski decomposition and short-run SVAR restrictions&lt;br&gt;• Impulse responses</td>
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<td>4:00 p.m. – 5:30 p.m.</td>
<td><strong>W1</strong>&lt;br&gt;• Evaluating effect of monetary policy shocks in “Choleski-ordered” SVARs, SVARs with the “institutionally-implied” short-run restrictions</td>
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1 Coffee breaks are held from 11:00 a.m. – 11:30 a.m. and from 4:00 p.m. – 4:30 p.m. Lunch breaks are from 12:30 p.m. – 2:00 p.m. (Unless otherwise indicated).
### Tuesday, May 17

**Unit 2**  
Modeling of non-stationary variables, forecasting with VECMs  
*Mr. Mikhail Pranovich*, Economist, Joint Vienna Institute (JVI)

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| 9:00 a.m. – 12:30 p.m. | L–2  | • Testing variables for integration  
                           • Testing for co-integration and estimating VECMs               |
| 2:00 p.m. – 5:30 p.m.  | W–2  | • Estimating long-run macroeconomic equilibrium relationships. Forecasting with VECMs |

### Wednesday, May 18

**Unit 3**  
Structural VARs and their application for policy analysis II: long-run and other restrictions  
*Mr. Sam Ouliaris*

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<td>9:00 a.m. – 10:30 a.m.</td>
<td>L–3</td>
<td>• Identifying structural VARs using long-run restrictions</td>
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<td>10:30 a.m. – 12:30 p.m.</td>
<td>W–3</td>
<td>• Other restrictions</td>
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**Unit 4**  
State-Space Models and the Kalman Filter  
*Mr. Charis Christofides*

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<td>2:00 p.m. – 5:30 p.m.</td>
<td>L–4</td>
<td>• State-space representation</td>
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<td>• The Kalman filter</td>
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<td>• Maximum likelihood estimation and Kalman smoothing</td>
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### Thursday, May 19

**Unit 4 (cont’d)**  
State-Space Models and the Kalman Filter  
*Mr. Charis Christofides*

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| 9:00 a.m. – 12:30 p.m.  | W–4  | • Application of state-space models: estimating business condition index, forecasting the yield curve, estimating equilibrium interest rate  
                           • Output gap estimation (e.g., HP filter, multivariate filter) |

**Unit 5**  
Factor Models and Factor-Augmented Vars (FAVARs)  
*Mr. Sam Ouliaris*

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| 2:00 p.m. – 5:30 p.m.  | L–5, W–5 | • Basics of factor models  
                           • Small and large scale; selection of number of factors  
                           • Estimation, forecasting with FAVAR  
                           • Extensions  
                           • Unbalanced datasets; I(1) variables; nonlinearities |
### Friday, May 20

**Unit 5** [Factor Models and Factor-Augmented Vars (FAVARs)]

- **Mr. Sam Ouliaris**
- **9:00 a.m. – 12:30 p.m.** L–6, W–6
- Estimating FAVARs on several macro-financial datasets (monthly industrial production; quarterly GDP growth; monthly inflation). Examples from both industrial and emerging economies.

**Unit 6** [Conditional forecasting with VARs in small open economies]

- **Mr. Charis Christofides**
- **2:00 p.m. – 3:30 p.m.** L–7
- Conditional forecasting using VARs
- Incorporating external forecasts and scenario analysis
- **4:00 p.m. – 5:30 p.m.** W–7
- Conditional forecasting and scenario analysis with a VAR model for a small open economy

### Monday, May 23

**Unit 7** [Bayesian Models and Bayesian VARs (BVARs)]

- **Mr. Mikhail Pranovich**
- **9:00 a.m. – 12:30 p.m.** L–8
- Introduction to Bayesian econometrics, estimation of linear regression models
- Activity: exercise on Bayesian estimation of moments of normal distribution
- Estimating BVARs with analytical Minnesota and DSGE-VAR priors
- Review of empirical results on BVARs forecasting performance
- **2:00 p.m. – 5:30 p.m.** W–8
- Estimating BVARs with Minnesota, Normal-Wishart priors and DSGE-VAR priors. Forecasting macroeconomic variables with BVARs

### Tuesday, May 24

**Unit 8** [Forecast Combinations]

- **Mr. Mikhail Pranovich**
- **9:00 p.m. – 10:30 a.m.** L–9
- Motivation for combining forecasts
- Implementation issues
- Methods to assign weights
- **10:30 a.m. – 12:30 p.m.** W–9
- Application of combination techniques to forecasting of macroeconomic variables

**Unit 9** [Univariate and multivariate models of volatility and their application]

- **Mr. Charis Christofides**
- **2:00 p.m. – 5:30 p.m.** L–10
- Estimating univariate volatility models (ARCH, GARCH) and their descendants (TARCH, EGARCH)
- Estimating multivariate volatility models
- Background for the workshop: Value-at-Risk analysis
**Wednesday, May 25**

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| 9:00 a.m. – 10:30 a.m. | W-10    | **Unit 9** (cont’d) Univariate and multivariate models of volatility and their application  
*Mr. Charis Christofides*  
- Estimation of univariate and multivariate GARCH models.  
- Forecasting with GARCH models, application of MVGARCH to Value-at-Risk analysis  
- Volatility impact on first moment prediction |
| 10:30 a.m. – 5:30 p.m. | O-1     | **Unit 10** Final Project: application of models for policy analysis and forecasting in selected countries  
*All Counselors*  
- Projects: Participants will be provided (and encouraged to bring their own) datasets for a number of selected countries from the region and apply models taught in the course to forecast inflation or another key macro variable (single equation, factor, Kalman Filter, combination, etc.) |

**Thursday, May 26**

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| 9:00 a.m. – 5:30 p.m. | O-1     | **Unit 10** (cont’d) Final Project: application of models for policy analysis and forecasting in selected countries  
*All Counselors*  
- Projects: Participants will be provided (and encouraged to bring their own) datasets for a number of selected countries from the region and apply models taught in the course to forecast inflation or another key macro variable (single equation, factor, Kalman Filter, combination, etc.). |

**Friday, May 27**

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| 9:30 a.m. – 11:30 a.m. | O-2     | **Unit 10** (final) Final Project: application of models for policy analysis and forecasting in selected countries  
*All Counselors*  
- Project presentations: groups present and discuss results of their projects in a plenary session |
| 11:30 a.m. – 1:00 p.m. |         | **Final Test and Course Evaluation** |

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