FAA
Office of Aviation Policy and Plans (APO-100)

FAA U.S. Passenger Airline Forecasts, Fiscal Years 2020-2040

Methodology and Data Sources

March 24, 2020
Version 1.1

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Background

The Federal Aviation Administration (FAA) Aerospace Forecast Report, henceforth referred to as the Report, is produced annually by the FAA's Forecast and Performance Analysis Branch of the Office of Aviation Policy and Plans (APO-100). The Report covers the following subject areas:

- U.S. airlines (passenger and cargo)
- General aviation
- U.S. commercial aircraft fleet
- Unmanned aircraft systems
- Commercial space transportation, and
- FAA operations at towers, Terminal Radar Approach Control and En-Route facilities

From this point onward, this document will only discuss the traffic and passenger forecasts developed for U.S. passenger airlines.

The Report details operations and passengers, over a twenty year period, for U.S. airlines flying domestically and internationally. These forecasts are used by the agency in its planning and decision-making processes. In addition, these forecasts are used extensively throughout the aviation and transportation communities as the industry plans for the future.

The forecasts can be found at this website: Link to Aviation Aerospace Forecast

In reading and using the information contained in the forecasts, it is important to recognize that forecasting is not an exact science. Forecast accuracy is largely dependent on underlying economic and political assumptions. While this always introduces some degree of uncertainty in the short-term, the long run average trends generally tend to be stable and accurate.

It should also be noted that the forecasts reflect *unconstrained demand*; that is, it is assumed that airports, air traffic control, and the airlines will increase supply as demand warrants.

Lastly, the forecasts represent only flights that enter or depart from the United States (U.S.) and do not include Unmanned Aerial Systems (UASs)[1] nor low earth orbit flights.

[1] Also known in the popular press as "drones."

Purpose of this document

The purpose of this document is to standardize the process, requirements, data sources and analyst judgment required to develop the national and international forecasts as well as provide a reference for anyone who uses them in their own analyses.

Updates to this document will be made on an on-going, as needed basis. Policy decisions, software updates, and data availability may necessitate changes. Any questions or comments should be directed to the individuals listed in the Acknowledgements section.

Document revision history

Revision No.	Author	Purpose	Date
1.0	Roger Schaufele	First draft	21 March 2017
1.1	Jonathan Corning	Update	24 March 2020

Acknowledgements

This document was prepared by the FAA Forecast and Performance Analysis Branch of the Office of Aviation Policy and Plans under the direction of Roger Schaufele, Manager. The following individuals were responsible for individual subject areas:

Oversight
Roger Schaufele, Manager
202-267-3306
Roger.Schaufele@FAA.gov

Domestic and International forecasts
Jonathan Corning, Economist
202-267-8388
Jonathan.Corning@FAA.gov

Domestic forecast methodology

Forecast Years

The Report is published annually by the FAA and includes historical data and forecast data for a 20 year horizon. Historical and forecast data presented include:

- Economic assumptions
- Available seat miles (ASMs)
- Revenue passenger miles (RPMs)
- Load factor (LF)
- Passenger miles flown
- Nominal and real passenger yield[2]
- Enplaned passengers
- Average seats per aircraft mile
- Average passenger trip length (PTL)
- Forecast accuracy[3]
- Alternative (optimistic and pessimistic) scenarios

Data in the Report are presented on a U.S. Government fiscal year basis (October through September). All model inputs are converted from calendar year to fiscal year when required.

Assumptions

The Report assumes an unconstrained demand driven forecast for aviation services based upon national economic conditions as well as conditions within the aviation industry. It is "unconstrained" in the sense that over the long term, it is assumed that the aviation industry will expand (or contract) as necessary to meet demand. That said, it should be noted that some airports do function under constrained conditions (e.g., slot caps at LaGuardia airport) and that weather and unforeseen events like September 11, 2001 impact demand and the ability of the system to satisfy demand requirements in real time. These real world "constraints" are inherent in the historical data that the statistical models use to forecast the outputs bulleted above; therefore, they do influence the model's "unconstrained" forecast.

Domestic Forecast Methodology

Historical data used to supply inputs into the forecast models were obtained from U.S. Department of Transportation's Bureau of Transportation Statistics. Additional information about the input data can be found in Appendix B.

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[2] Yield includes the following taxes and fees: FAA ad valorem tax, segment fee and Transportation Security Administration (TSA) security fee.

[3] The forecast accuracy section evaluates system totals, that is, the total of domestic and international forecast variables.

For statistical modeling, APO uses SAS software.[4] To develop its short term (one year out) domestic and international forecasts of key traffic measures, the FAA uses a simplified version of the Unobserved Components Model (UCM)[5] called the Basic Structural Model (BSM). The model is used to forecast enplaned passengers (PAX), RPMs and LF. The UCM model is a convenient way to additively decompose a time series into components: the trend, the seasons, the cycles, the autoregressive term, regressive terms involving lagged dependent variables, regressive terms on independent variable and the so-called irregular movements. The BSM output is then used to inform, with analyst judgement, the short-term forecast.

The BSM is formally described by the equation

$$y_t = \mu_t + \gamma_t + \varepsilon_t \text{ where } \quad \mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t \text{ with } \beta_t = \beta_{t-1} + \xi_t$$

where $\eta_t \sim \text{niid}(0,\sigma_\eta^2)$ and $\xi_t \sim \text{niid}(0,\sigma_\xi^2)$.

The equation defining μ_t is called the level of the trend and the equation defining β_t is called the (eventually stochastic) slope of the trend, the notation "niid" standing for normally independently and identically distributed. It is also assumed that η_t and ξ_t are independent of each other.

There are models for four separate entities: Domestic, Atlantic, Latin, and Pacific, corresponding to the U.S. Department of Transportation entity definitions used in Form 41 reporting. Overall a total of twelve sets of coefficients are developed, three sets of coefficients (one for the PAX model, one for the RPM model, and one for the LF model) for each of the four entities. Forecasts for ASMs and PTL for each entity are calculated using the forecasted values of RPMs and LF for ASMs and RPMs along with PAX for PTL. Forecasts for passenger yields are based on entity specific historic month over month variation applied to the latest actual monthly data for each entity as reported in the Airlines 4 America monthly yield report.

For the remaining years, APO employs a three-stage, least squares (3SLS) regression analysis of a system of equations. The rationale behind choosing 3SLS over ordinary least squares (OLS) is that the errors of the different equations are correlated and 3SLS model provides a way to produce estimates that are more consistent and asymptotically efficient.[6]

For the 3SLS model, the following variables were used:

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[4] The modeling software used is SAS v9.3, copyrighted by SAS Institute Inc., Cary, NC USA.

[5] For further information, please see SAS/ETS 13.2 User's Guide: The UCM Procedure, page 2304, Link to SAS.

[6] For more detailed information about the 3SLS model, please refer to SYSLIN procedure documentation at Link to SAS, SAS Institute Inc.

Endogenous variables[7]:

- Log of mainline carrier RPMs
- Log of mainline carrier passenger yield
- Log of regional carrier load factor
- Log of mainline carrier load factor
- Log of mainline carrier real cost per available seat mile (ASM)
- Log of mainline carrier stage length

Instrumental variables[8]:

- Log of personal consumption expenditure per capita
- Civilian unemployment rate
- Post September 11, 2001 dummy variable (fiscal year 2002 onwards)
- Mainline carrier's share of domestic passenger market
- Regional carrier average passenger trip length
- Log of mainline carrier average passenger trip length
- A time variable (i.e., 1/(year – 1986))
- Log of refiners acquisition cost (i.e., weighted average price of crude received in refinery)

The following relationships were then determined, and using the resultant coefficients, the dependent variables were forecast into the future.[9] This procedure was done separately using mainline and regional carrier data to produce two sets of predicted variables.

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[7] Endogenous variables are variables determined by the system. Endogenous variables can also appear on the right-hand side of equations. Source: SAS Institute Inc. website, http://support.sas.com/documentation/cdl/en/etsug/60372/HTML/default/viewer.htm#etsug_syslin_sect004.htm, dated April 8, 2016.

[8] Instrumental variables are predetermined variables used in obtaining values for the current period endogenous variables by a first-stage regression. The use of instrumental variables characterizes estimation methods such as two-stage least squares and three-stage least squares. Instrumental variables estimation methods substitutes these first-stage predicted values for endogenous variables when they appear as regressors in model equations. Source: SAS website, Link to SAS, dated 2014.

[9] The SIMLIN procedure was used to generate predicted values for the dependent variables using the coefficients that were produced by the SYSLIN procedure. For more detailed information, please refer to SIMLIN procedure documentation at http://support.sas.com/documentation/cdl/en/etsug/60372/HTML/default/viewer.htm#etsug_simlin_sect001.htm, SAS Institute Inc.

Dependent variable	Independent variables
Log of mainline carrier RPMs	• Log of real PCE per capita • Unemployment rate • Log of mainline carrier passenger yield[10] • Post September 11, 2001 dummy variable
Log of mainline carrier real yield	• Log of mainline carrier passenger trip length • Log of mainline carrier real cost per ASM
Log of mainline carrier stage length	• Log of real refiners acquisition cost • Log of mainline carrier passenger trip length
Log of mainline carrier cost per ASM	• Log of mainline carrier stage length • Log of real refiners acquisition cost
Log of regional load factor	• Time variable (i.e., 1/(year-1986)) • Post September 11, 2001 dummy variable • Lagged log of regional load factor
Log of mainline carrier load factor	• Time variable (i.e., 1/(year-1986)) • Post September 11, 2001 dummy variable • Lagged log of mainline carrier load factor

These variables and the structure of the linear equations were chosen after much beta testing of different economic variables and model structures; this model produced the best fit and accurately reflected the analysts' knowledge of the aviation industry. It will be subject to change in the future as the aviation industry restructures itself or if major disruptions to the economy occur. The output from the statistical model is shown in Appendix C of this document.

For the Report, the growth rates of the statistical model's predicted variables were used rather than the actual predicted values. The growth rates were spliced on to fiscal year 2020 estimates which were estimated separately via the BSM model described earlier.

These forecast values were then used to generate the following forecast variables for mainline and regional carriers:

Forecast variable	Formula[11]
Load factor	RPMs / ASMs
Carrier departures	Miles flown / stage length

[10] The term yield, in all of the domestic models detailed in this report, includes the following taxes and fees: ad valorem taxes, segment fee and TSA security fee.

[11] For ease of reading, multiplicative factors used to convert numbers to millions, thousands, etc. as needed have been eliminated.

Carrier miles flown	Previous year value * growth rate of ASMs[12]
Carrier stage length	Trip length / Trip vs stage length ratio
Seats per aircraft mile	ASMs / miles flown
Mainline carrier passenger revenue	Nominal passenger yield * RPMs
Mainline carrier nominal passenger yield	Real passenger yield * consumer price index
Mainline carrier real passenger yield	Previous year * statistical model's predicted real yield mainline carrier growth rate
Regional carrier passenger revenue	Previous year * (mainline real yield growth rate * regional RPM growth rate)
Regional nominal passenger yield	Passenger revenue / RPMs
Regional carrier real passenger yield	Passenger revenue / consumer price index
Trip length versus stage length ratio	Annual growth rate of .05% was applied per analyst judgment

The mainline and regional carrier variables are then summed to produce domestic totals; these numbers are reproduced in the various tables of Appendix C of the Report.

Alternative Scenarios

Optimistic and pessimistic scenarios were also created for the domestic forecast. All of the model inputs, sources, and calculations are identical to the baseline forecast (described above) except for the economic data from IHS Markit.[13] Rather, data from IHS Markit's 10-year and 30-year optimistic and pessimistic forecasts from their November 2019 Baseline U.S. Economic Outlook were used. Inputs from these alternative scenarios were used to create a "high" and a "low" traffic, capacity, and yield forecast.

U.S. Airlines International Forecast

[12] This growth rate was adjusted slightly by the analyst based on an understanding of industry trends.

[13] IHS Markit is a large, independent private consulting firm with a division devoted to economic analysis and forecasting. More information about the company can be found at Info from ihs.com.

This forecast focuses solely on U.S. airlines flying into or out of the U.S. and relies upon Form 41[14] data provided by BTS and IHS Markit. As is the case with the domestic forecast, it is a 20 year forecast based on the federal government's fiscal year.

Forecast Years

The Report includes historical data and forecast data for a 20 year horizon. Historical and forecast data presented include:

- Economic assumptions
- Available seat miles (ASMs)
- Revenue passenger miles (RPMs)
- Load factor
- Nominal and real passenger yield[15]
- Passengers
- Alternative (optimistic and pessimistic) scenarios

Data in the Report are presented on a U.S. Government fiscal year basis (October through September).
Form 41 Forecast Methodology

Historical data used to supply inputs into the forecast models were obtained from U.S. Department of Transportation's Bureau of Transportation Statistics. Additional information about the input data can be found in Appendix B.

The statistical model[16] used for the Form 41 based international forecast employs a general linear regression model for three regions: Atlantic[17], Latin[18] and Pacific[19]. The dependent variable is RPMs for each model.

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[14] "The Form 41 Financial Reports contain financial information on large certificated U.S. air carriers. Financial information includes balance sheet, cash flow, employment, income statement, fuel cost and consumption, aircraft operating expenses, and operating expenses. This data is collected by the Office of Airline Information of the Bureau of Transportation Statistics. [Schedule P-1.2] provides quarterly profit and loss statements for carriers with annual operating revenues of $20 million or more. The data include operating revenues, operating expenses, depreciation and amortization, operating profit, income tax, and net income." Data Profile: Air Carrier Statistics (Form 41 Traffic) for U.S. Carriers, BTS website, Info from BTS=.

[15] For the international forecasts, real and nominal yield excludes taxes and fees due to airline reporting requirements on Form 41.

[16] The modeling software used is SAS v9.3, copyrighted by SAS Institute Inc., Cary, NC USA.

[17] The Atlantic region includes Western and Central Europe, the Balkans, Commonwealth of Independent states, the Middle East, and Africa.

[18] The Latin region includes Latin America and the Caribbean.

[19] The Pacific region includes the Asia-Pacific region.

The independent variables for each model are shown below; additional information about them can be found in Appendix B.

Model	Independent Variable	Description
Atlantic region	US25For75	Ratio of indexed U.S. GDP to indexed Atlantic region GDP
	Tension	Gulf wars dummy variable; applied to 1991 and 2003
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Latin region	LatinGDPIx50	Ratio of indexed U.S. GDP to indexed Latin region GDP
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Pacific region	TotalPacAsiaGDP	Sum of U.S., Japan and Pacific region (excluding Japan) GDP
	SARS	Severe acute respiratory syndrome dummy variable; applied to 2003
	GFC2	Global financial crisis dummy variable; applied to 2008-2010
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036

These variables and the structure of the regression models were chosen after much testing of different economic variables and model structures; these models produced the best fit and accurately reflected the analysts' knowledge of the aviation industry. They will be subject to change in the future as the aviation industry restructures itself or if major disruptions to the world economies occur. The output from the regional models is shown in Appendix C of this document.

The region specific models' predicted annual growth rates for the dependent variable, RPMs, is then applied to the last historical year of data; in this case, 2016. The final results are three forecasts of RPMs, one for each region.

To develop a forecast of passengers by region, the model's forecast regional RPMs, described in the preceding paragraph, are divided by an estimated annual trip length of the respective region. The latter is determined by an APO analyst looking at regional historical data and applying knowledge of the aviation industry. It should be noted that, globally, trip length is increasing at a decreasing rate since there is a natural limit to how far people are willing–or need–to fly on a single trip.

These forecast values were then used to generate the following forecast variables for mainline and regional carriers for each of the three regions:

Forecast variable	Formula[20]
Nominal passenger revenue	RPMs * Nominal yield
Nominal yield	Nominal passenger revenue / RPMs
Real yield	Nominal yield / CPI index
Seats per aircraft	Forecast based on analyst judgment of historical trends and knowledge of the industry
Miles flown	ASMs / Seats per aircraft
Trip length	RPMs / Passengers
Mainline trip vs stage length	Forecast based on analyst judgment of historical trends and knowledge of the industry
Mainline carrier stage length (miles)	Total aircraft miles flown for all three regions / Mainline trip vs stage length estimate
Mainline carrier departures	Total miles flown for all three regions / Mainline stage length
Regional carrier international departures	Forecast based on analyst judgment of historical trends and knowledge of the industry
Total carrier departures	Mainline + regional carrier departures for all three regions
Load factor	RPMs / ASMs

Most of these variables are reproduced in the various tables of Appendix C of the Report.

Alternative Scenarios

Optimistic and pessimistic scenarios were also created for the international F41 forecast. All of the model inputs, sources, and calculations are identical to the baseline forecast (described above) except for the economic data from IHS Markit. Rather, for U.S. GDP forecasts, data from IHS Markit's 30-year optimistic and pessimistic forecasts from their November 2019 Baseline U.S. Economic Outlook were used. Since IHS Markit does not produce optimistic and pessimistic forecasts for their world GDP components table, a set of ratios were derived using Markit's baseline, optimistic, and pessimistic 30-year macro scenarios for Major Trading Partners GDP and Minor Trading Partners GDP. Inputs from these alternative scenarios were used to create a "high" and a "low" traffic, capacity, and yield forecast.

U.S. and Foreign Flag International Forecast

This passengers-only forecast includes U.S. and foreign flag carriers flying into or out of the U.S. and relies upon passenger data provided by the U.S. Customs and Border Protection (CBP) agency[21] and GDP and exchange rate data provided by IHS Markit.

[20] For ease of reading, multiplicative factors used to convert numbers to millions, thousands, etc. as needed have been eliminated.

[21] Customs and border protection data is processed and released by the Department of Commerce.

Forecast Years

The Report includes historical data and forecast data for a 20 year horizon. Data in the Report are presented on a U.S. Government calendar year basis. CBP Forecast Methodology

Historical data used to supply inputs into the forecast models were obtained from CBP. Additional information about the input data can be found in Appendix B.

The statistical model[22] used for the CBP based international forecast employs a general linear regression model for multiple independent countries. These countries were chosen because they form the majority of the passengers traveling between the U.S. and foreign destinations. The dependent variable is passengers for all of the models.

The independent variables for each model are shown below; additional information about them can be found in Appendix B. These models were chosen based on goodness of fit and the analyst's knowledge of the aviation market within the country under review.

As is the case with the domestic forecast, this forecast is unconstrained as well.

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[22] The modeling software used is SAS v9.3, copyrighted by SAS Institute Inc., Cary, NC USA.

Model	Independent Variable	Description
Atlantic Region		
France	GDP5	Ratio of indexed U.S.GDP vs indexed France GDP
	Yield	Forecast based on analyst judgment of historical trends and knowledge of the industry
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Germany	LGDP5	Log(ratio of indexed U.S. GDP vs indexed Germany GDP)
	LExch	Log(exchange rate of euro vs U.S. dollar)
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Ireland	LGDP6	Log(ratio of indexed U.S. GDP vs indexed Ireland GDP)
	LExch	Log(exchange rate of euro vs U.S. dollar)
	Yield	Forecast based on analyst judgment of historical trends and knowledge of the industry
	TravelTax	Ireland Air Travel Tax dummy variable
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Italy	GDP7	Log(ratio of indexed U.S. GDP vs indexed Germany GDP)
	PanAm	Pan American bankruptcy dummy variable; applied to 1991
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	IraqWar	Iraq War dummy variable; applied to 2003
	Millennium	2001 dummy variable
Netherlands	GDP5	Ratio of indexed U.S. GDP vs indexed Netherlands GDP
	11-Sep	September 11, 2001 dummy variable; applied to 2001
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Spain	GDP1	Ratio of indexed U.S. GDP vs indexed Spain GDP

United Kingdom	GDP9	Ratio of indexed U.S. GDP vs indexed UK GDP
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	GFC	Global financial crisis dummy variable; applied to 2008-2036
Other European countries	GDP3	Log(ratio of indexed U.S. GDP vs indexed other European countries GDP)
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	11-Sep	September 11, 2001 dummy variable; applied to 2001
Latin America Region		
Bahamas	Yield	Forecast based on analyst judgment of historical trends and knowledge of the industry
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	11-Sep	September 11, 2001 dummy variable; applied to 2001
Brazil	GDP4	Log(ratio of indexed U.S. GDP vs indexed Brazil GDP)
	11-Sep	September 11, 2001 dummy variable; applied to 2001
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Dominican Republic	GDP5	Log(ratio of indexed U.S. GDP vs indexed Dominican Republic GDP)
Jamaica	GDP5	Log(ratio of indexed U.S. GDP vs indexed Jamaica GDP)
Mexico	LGDP6	Log(ratio of indexed U.S. GDP vs indexed Mexico GDP)
Other Latin America countries	GDP3	Log(ratio of indexed U.S. GDP vs indexed other Latin American countries GDP)
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036

Pacific Region		
China	GDP5	Ratio of indexed U.S. GDP vs indexed China GDP
	Exch	Exchange rate of Renminbi vs U.S. dollar
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
Hong Kong	GDP3	Ratio of indexed U.S. GDP vs indexed Hong Kong GDP
	SARS	SARS epidemic dummy variable; applied to 2003
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
India	GDP5	Ratio of indexed U.S. GDP vs India indexed GDP
	NonStopServ	Start of non-stop service from U.S. to India dummy variable; applied to 2006-2036
Japan	LGDP2	Log(ratio of indexed U.S. GDP vs indexed Japan GDP)
	LNFlatYield	Log of real yield held constant from 2015 onwards
	11-Sep	September 11, 2001 dummy variable; applied to 2001
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
South Korea	LGDP2	Log(ratio of indexed U.S. GDP vs indexed South Korea GDP)
	11-Sep	September 11, 2001 dummy variable; applied to 2001
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	FinanCrisis	Financial crisis dummy variable; applied 1998-1999
	NWPaxData	
Taiwan	GDP5	Ratio of indexed U.S. GDP vs indexed Taiwan GDP
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036
	GFC	Global financial crisis dummy variable; applied to 2008-2036
Other Pacific	GDP3	Ratio of indexed U.S. GDP vs indexed other Pacific countries GDP
	GFC	Global financial crisis dummy variable; applied to 2008-2036

Transborder (via Canada)	LGDP7	Log(ratio of indexed U.S. GDP vs indexed Canada GDP)
	11-Sep	September 11, 2001 dummy variable; applied to 2001
	Post911	Post September 11, 2001 dummy variable; applied to 2002-2036

The passenger forecasts for the individual countries are not reported publicly; rather, only the annual totals for all countries combined are discussed in the text of the Report. The data are not represented in the tables in the appendices. Alternative forecasts for the CBP forecast are not done.

APPENDIX A: Glossary of terms

Acronym	Description
3SLS	Three stage least square statistical model
APO	FAA Office of Aviation Policy and Plans
ASMs	Available seat miles
BSM	Basic structural model
CBP	U.S. Customs and Border Protection Agency
CY	Calendar year
F41 or Form 41	Form 41 Financial Reports from the U.S. Bureau of Transportation Statistics
FAA	Federal Aviation Administration
FY	Federal government fiscal year (October – September)
GDP	Gross domestic product
OLS	Ordinary least squares model
PAX	Passenger
PCE	Personal consumption expenditure
PTL	Passenger trip length
RAC	Refiners acquisition cost
RPMs	Revenue passenger miles
SAS	Statistical Analysis Software (a software suite developed by SAS Institute)
SARS	Severe acute respiratory syndrome

APPENDIX B: Data inputs and sources

Data inputs and sources for the baseline domestic forecast

Economic Variables (all data are converted to fiscal year by APO)

Model Label	Description	Notes	Model input	Source
CPI	Consumer price index, all-urban, Source: BLS, Units: - 1982-84=1.00 seasonally adjusted	Index is used to calculate real prices, such as yield	Indirectly	IHS Markit, Mnemonic: • Baseline: CPI.Q.FMS • Optimistic: CPI.Q.FMBA2 • Pessimistic: CPI.Q.FMBA1
UNRATE	Civilian unemployment rate Source: BLS Units: - percent		Yes	IHS Markit, Mnemonic: • Baseline: RUC.Q.FMS • Optimistic: RUC.Q.FMBA2 • Pessimistic: RUC.Q.FMBA1
PCE	Real Consumer Spending - Total personal consumption expenditures, Source: BEA, Units: Billion 2009 dollars annual rate.	Variables are used to calculate personal consumption expenditure per capita	Indirectly	IHS Markit, Mnemonic: • Baseline: CONSR.Q.FMS • Optimistic: CONSR.Q.FMBA2 • Pessimistic: CONSR.Q.FMBA1
POP	Total population, including armed forces overseas Source: Census Units: millions-end of period		Indirectly	IHS Markit, Mnemonic: • Baseline: NP.Q.FMS • Optimistic: NP.Q.FMBA2 • Pessimistic: NP.Q.FMBA1

Model Label	Description	Notes	Model input	Source
Log of PCEPC	Personal consumption expenditure per capita. APO-100 transforms data into natural log for model.	Is calculated by APO (PCE / Total population including armed forces overseas)	Yes	APO
RAC	Refiners Acquisition Cost. Weighted average price of crude received in refinery inventories Source: DOE Units: dollars per barrel- not seasonally adjusted		Yes	IHS Markit, Mnemonic: • Baseline: POILRAP.Q.FMS • Optimistic: POILRAP.Q.FMBA2 • Pessimistic.: POILRAP.Q.FMBA1

Aviation Variables (all data are converted to fiscal year by APO)

Model Label	Description	Notes	Model input	Source
Year	Calendar year		Indirectly	Bureau of Transportation Statistics, TranStats, *Form T1: U.S. Air Carrier Traffic And Capacity Summary by Service Class*[23]
Month	Month of year			
UniqueCarrierName	Unique Carrier Name. When the same name has been used by multiple carriers, a numeric suffix is used for earlier users, for example, Air Caribbean, Air Caribbean (1).	Each carrier is categorized as being either a network, regional, low fare or "other" carrier. All carriers are known "mainline" carriers with the exception of regionals.		
UniqueCarrier	Unique Carrier Code. When the same code has been used by multiple carriers, a numeric suffix is used for earlier users, for example, PA, PA(1), PA(2). Use this field for analysis across a range of years.			

[23] "The Air Carrier Statistics database, also known as the T-100 data bank, contains domestic and international airline market and segment data. Certificated U.S. air carriers report monthly air carrier traffic information using Form T-100. The data is collected by the Office of Airline Information, Bureau of Transportation Statistics, Research and Innovative Technology Administration. The tables in this database provide domestic market, domestic segment, international market, international segment, combined table for domestic and international market, combined table for domestic and international segment data by certificated U.S. air carriers. Large certificated carriers hold Certificates of Public Convenience and Necessity issued by the U.S. Department of Transportation authorizing the performance of air transportation with annual operating revenues of $20 million or more." Data Profile: Air Carrier Statistics (Form 41 Traffic) for U.S. Carriers, BTS website, Info from BTS.

Model Label	Description	Notes	Model input	Source
CarrierRegion	Carrier's operation region. Carriers report data by operation region (Atlantic, Latin, Pacific, System, International, and Domestic)	For the domestic forecasts, Region = Domestic		
T320_ASM	Available seat miles	Summed by airline category	Yes	
T140_RPM	Revenue passenger miles			
T110_RPax	Revenue passengers enplaned			
T410_RMilesFlown	Revenue aircraft miles flown	Is used to calculate stage length	Indirectly	
T510_RDPerformed	Revenue aircraft departures performed			
MainPTL ComPTL	Mainline carrier passenger trip length Regional carrier passenger trip length	Historical data is calculated (RPMs/Passengers); future years is an exogenous variable decided by APO. These data are calculated separately for mainline and regional carriers.	Yes	
MainPaxShr	Mainline carrier's share of passenger market (versus the regional carriers)	Historical data is calculated; futures years is an exogenous variable decided by APO	Yes	
MainStage	Average stage length for mainline carriers	Historical data is calculated (T410_RMilesFlown/ T510_RDPerformed) by APO	Yes	
TotalEnpl	Total passengers (mainline and regional)		Yes	
MainLF ComLF	Mainline and regional load factors	Is calculated by APO (RPMs/ASMs)	Yes	

Model Label	Description	Notes	Model input	Source
Log of MainYld2	Average of mainline passenger yield transformed via natural log	Is calculated by APO [log(passenger revenue[24] / mainline RPMs)]	Yes	
MainCASM	Average mainline cost per available seat mile	Is calculated by APO (mainline operating expenses / mainline ASMs)	Yes	
SvcClass	Type of service provided (scheduled, non-scheduled, etc.).	F designation was used for the domestic forecasts; that is, scheduled passenger/cargo service, can include freight or mail in the belly	Indirectly	
LFOpex NetOpex	Low fare and Network carriers' operating expenses	Is used to calculate mainline operating expenses	Indirectly	Bureau of Transportation Statistics, TranStats, Form 41, *Schedule P-1.2:* Air Carrier Financial[25]
LFPrev NetPrev	Low fare and Network carriers' passenger revenue	Is used to calculate mainline passenger yield	Indirectly	
Post911	Post 9/11 dummy variable	Applied fiscal years 2002-2036 by APO	Yes	APO
Time	Time variable = 1/(year – 1986)	Used to dampen demand in the future as the aviation market reaches maturity	Yes	

[24] Includes the following taxes: FAA ad valorem tax, segment fee and TSA security fee.

[25] "The Form 41 Financial Reports contain financial information on large certificated U.S. air carriers. Financial information includes balance sheet, cash flow, employment, income statement, fuel cost and consumption, aircraft operating expenses, and operating expenses. This data is collected by the Office of Airline Information of the Bureau of Transportation Statistics. [Schedule P-1.2] provides quarterly profit and loss statements for carriers with annual operating revenues of $20 million or more. The data include operating revenues, operating expenses, depreciation and amortization, operating profit, income tax, and net income." Data Profile: Air Carrier Statistics (Form 41 Traffic) for U.S. Carriers, BTS website, From BTS.

Data inputs and sources for the Form 41 baseline international forecast Info from BTS

Economic Variables (all data are converted to fiscal year by APO)

Model label	Description	Notes	Model input	Source
CPI	Consumer price index, all-urban, Source: BLS, Units: - 1982-84=1.00 seasonally adjusted	Index is used to calculate real prices, such as yield	Indirectly	IHS Markit, Mnemonic: • Baseline: CPI.Q.FMS • Optimistic: CPI.Q.FMBA2 • Pessimistic: CPI.Q.FMBA1
GDP	Real annual GDP history and forecast estimates by country	A ratio of U.S. GDP to region specific GDP was developed for each of the region specific models (Atlantic, Latin and Pacific) by APO.	Indirectly	IHS Markit, GDP Components, Interim forecast, monthly, sheet GDPR$A

Aviation Variables (all data are converted to fiscal year by APO)

Model label	Description	Notes	Model input	Source
Passengers	Mainline carrier passengers	International regional carrier passengers are grouped with the Latin region's mainline carrier passengers	Indirectly	Bureau of Transportation Statistics, TranStats, *Form T1: U.S. Air Carrier Traffic And Capacity Summary by Service Class*[26]
Trip length	Average passenger trip length (PTL) in miles by region	Historical data is calculated via RPMs/Passengers by region. PTL is used to estimate regional passenger forecasts (RPMs / PTL) by APO.	Indirectly	
Load Factor	Average regional load factor	Historical data is calculated via RPMs / ASMs. Forecast load factor is estimated by the APO analyst based on knowledge of the aviation industry. Forecast load factor is used to forecast ASMs.	Indirectly	APO

[26] "The Air Carrier Statistics database, also known as the T-100 data bank, contains domestic and international airline market and segment data. Certificated U.S. air carriers report monthly air carrier traffic information using Form T-100. The data is collected by the Office of Airline Information, Bureau of Transportation Statistics, Research and Innovative Technology Administration. The tables in this database provide domestic market, domestic segment, international market, international segment, combined table for domestic and international market, combined table for domestic and international segment data by certificated U.S. air carriers. Large certificated carriers hold Certificates of Public Convenience and Necessity issued by the U.S. Department of Transportation authorizing the performance of air transportation with annual operating revenues of $20 million or more." Data Profile: Air Carrier Statistics (Form 41 Traffic) for U.S. Carriers, BTS website, From BTS.

SARS	Severe acute respiratory syndrome (SARS) dummy variable used in the Pacific region model	Applied fiscal year 2003 by APO	Yes	APO
GFC2	Global financial crisis dummy variable used in the Pacific region model	Applied fiscal years 2008-2010	Yes	APO
Post911	Post 9/11 dummy variable used in the Atlantic, Pacific, and Latin region models	Applied fiscal years 2002-2036 by APO	Yes	APO
Tension	Gulf wars dummy variable used in the Atlantic region model	Applied fiscal years 1991 and 2003	Yes	APO

APPENDIX C: Model outputs

Baseline Domestic Model Output

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	MAINLINERPM
Dependent Variable	lmainrpm
Label	Log(Mainline RPMs)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1.279476	0.319869	662.93	<.0001
Error	27	0.013028	0.000483		
Corrected Total	31	1.294658			

Root MSE	0.02197	**R-Square**	0.98992
Dependent Mean	13.01908	**Adj R-Sq**	0.98843
Coeff Var	0.16872		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	-1.31489	1.315122	-1.00	0.3263	Intercept
lpcepc	1	1.375380	0.147548	9.32	<.0001	Log(PCE per capita)
UNRATE	1	-0.01376	0.003567	-3.86	0.0006	Unemployment Rate
lrmainyld2	1	-0.18281	0.157792	-1.16	0.2568	Log(Mainline Loaded Real Yield)
POST911	1	-0.16834	0.025728	-6.54	<.0001	Post 9/11 dummy

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	MAINLINEYLD
Dependent Variable	lrmainyld2
Label	Log(Mainline Loaded Real Yield)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1.182897	0.591449	322.11	<.0001
Error	29	0.053249	0.001836		
Corrected Total	31	1.238024			

Root MSE	0.04285	**R-Square**	0.95692
Dependent Mean	-1.59202	**Adj R-Sq**	0.95395
Coeff Var	-2.69158		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	12.70306	0.600376	21.16	<.0001	Intercept
lmainptl	1	-1.97510	0.077860	-25.37	<.0001	Log(Mailine Pax Trip Length)
lrmaincasm	1	0.447061	0.125713	3.56	0.0013	Log(Mainline Real CASM)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	MAINLINESTAGE
Dependent Variable	lmainstage
Label	Log(Mainline Stage)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.785229	0.392614	814.08	<.0001
Error	29	0.013986	0.000482		
Corrected Total	31	0.799215			

Root MSE	0.02196	**R-Square**	0.9825
Dependent Mean	6.67048	**Adj R-Sq**	0.98129
Coeff Var	0.32923		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	-5.37995	0.412070	-13.06	<.0001	Intercept
lrealrac	1	-0.04923	0.013086	-3.76	0.0008	log(Refiners Real Cost)
lmainptl	1	1.793085	0.066151	27.11	<.0001	Log(Mailine Pax Trip Length)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	MAINUNITCOST
Dependent Variable	lrmaincasm
Label	Log(Mainline Real CASM)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.114309	0.057155	102.47	<.0001
Error	29	0.016175	0.000558		
Corrected Total	31	0.131883			

Root MSE	0.02362	**R-Square**	0.87604
Dependent Mean	-1.81321	**Adj R-Sq**	0.86749
Coeff Var	-1.30251		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.261575	0.227391	1.15	0.2594	Intercept
lmainstage	1	-0.41499	0.039068	-10.62	<.0001	Log(Mainline Stage)
lrealrac	1	0.178367	0.012460	14.32	<.0001	log(Refiners Real Cost)

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	COMMUTERLF
Dependent Variable	lcomlf
Label	Log(Commuter Load Factor)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1.302372	0.434124	983.48	<.0001
Error	28	0.012360	0.000441		
Corrected Total	31	1.314732			

Root MSE	0.02101	**R-Square**	0.9906
Dependent Mean	4.15103	**Adj R-Sq**	0.98959
Coeff Var	0.50614		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.676408	0.192340	3.52	0.0015	Intercept
time3	1	-0.11773	0.053224	-2.21	0.0353	Inverse of Time
POST911	1	0.047363	0.017672	2.68	0.0122	Post 9/11 dummy
lglcomlf	1	0.836767	0.047922	17.46	<.0001	Lag-log of Commuter Load Factor

The SYSLIN Procedure
Two-Stage Least Squares Estimation

Model	MAINLINELF
Dependent Variable	lmainlf
Label	Log(Mainline Load Factor)

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	0.466540	0.155513	696.17	<.0001
Error	28	0.006255	0.000223		
Corrected Total	31	0.472795			

Root MSE	0.01495	**R-Square**	0.98677
Dependent Mean	4.30117	**Adj R-Sq**	0.98535
Coeff Var	0.34749		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.621285	0.199966	3.11	0.0043	Intercept
time3	1	-0.09885	0.037779	-2.62	0.0142	Inverse of Time
POST911	1	0.020464	0.010333	1.98	0.0576	Post 9/11 dummy
lglmainlf	1	0.857127	0.047212	18.15	<.0001	Lag-log of Mainline Load Factor

The SYSLIN Procedure
Three-Stage Least Squares Estimation

Cross Model Covariance

	MAINLINERP	MAINLINEYL	MAINLINEST	MAINUNITCO	COMMUTERLF	MAINLINELF
MAINLINERP	0.000483	0.000029	0.000130	-0.000185	0.000089	0.000099
MAINLINEYL	0.000029	0.001836	-0.000053	0.000145	0.000080	-0.000055
MAINLINEST	0.000130	-0.000053	0.000482	-0.000153	0.000052	0.000045
MAINUNITCO	-0.000185	0.000145	-0.000153	0.000558	-0.000042	-0.000101
COMMUTERLF	0.000089	0.000080	0.000052	-0.000042	0.000441	0.000202
MAINLINELF	0.000099	-0.000055	0.000045	-0.000101	0.000202	0.000223

Cross Model Correlation

	MAINLINERP	MAINLINEYL	MAINLINEST	MAINUNITCO	COMMUTERLF	MAINLINELF
MAINLINERP	1.00000	0.03052	0.26979	-0.35572	0.19345	0.30198
MAINLINEYL	0.03052	1.00000	-0.05646	0.14314	0.08892	-0.08602
MAINLINEST	0.26979	-0.05646	1.00000	-0.29561	0.11305	0.13803
MAINUNITCO	-0.35572	0.14314	-0.29561	1.00000	-0.08380	-0.28473
COMMUTERLF	0.19345	0.08892	0.11305	-0.08380	1.00000	0.64371
MAINLINELF	0.30198	-0.08602	0.13803	-0.28473	0.64371	1.00000

Cross Model Inverse Correlation

	MAINLINERP	MAINLINEYL	MAINLINEST	MAINUNITCO	COMMUTERLF	MAINLINELF
MAINLINERP	1.25794	-0.11793	-0.21204	0.32703	-0.01572	-0.25752
MAINLINEYL	-0.11793	1.06744	0.04717	-0.13303	-0.24253	0.23916
MAINLINEST	-0.21204	0.04717	1.14171	0.26132	-0.10353	0.05155
MAINUNITCO	0.32703	-0.13303	0.26132	1.29567	-0.19760	0.34984
COMMUTERLF	-0.01572	-0.24253	-0.10353	-0.19760	1.80512	-1.22007
MAINLINELF	-0.25752	0.23916	0.05155	0.34984	-1.22007	1.97620

Cross Model Inverse Covariance						
	MAINLINERP	MAINLINEYL	MAINLINEST	MAINUNITCO	COMMUTERLF	MAINLINELF
MAINLINERP	2607.11	-125.288	-439.57	630.39	-34.06	-784.39
MAINLINEYL	-125.29	581.344	50.12	-131.45	-269.39	373.43
MAINLINEST	-439.57	50.122	2367.31	503.85	-224.38	157.06
MAINUNITCO	630.39	-131.452	503.85	2322.94	-398.23	991.10
COMMUTERLF	-34.06	-269.391	-224.38	-398.23	4089.41	-3885.40
MAINLINELF	-784.39	373.427	157.06	991.10	-3885.40	8846.69

The SYSLIN Procedure
Three-Stage Least Squares Estimation

Model	MAINLINERP
Dependent Variable	lmainrpm
Label	Log(Mainline RPMs)

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	-1.79563	1.198139	-1.50	0.1456	Intercept
lpcepc	1	1.439365	0.134376	10.71	<.0001	Log(PCE per capita)
UNRATE	1	-0.01192	0.003251	-3.67	0.0011	Unemployment Rate
lrmainyld2	1	-0.05205	0.144121	-0.36	0.7208	Log(Mainline Loaded Real Yield)
POST911	1	-0.13856	0.023653	-5.86	<.0001	Post 9/11 dummy

Durbin-Watson	0.888247
Number of Observations	32
First-Order Autocorrelation	0.515213

The SYSLIN Procedure

Three-Stage Least Squares Estimation

Model	MAINLINEYL
Dependent Variable	lrmainyld2
Label	Log(Mainline Loaded Real Yield)

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	12.75938	0.598365	21.32	<.0001	Intercept
lmainptl	1	-1.97648	0.077833	-25.39	<.0001	Log(Mailine Pax Trip Length)
lrmaincasm	1	0.472929	0.123594	3.83	0.0006	Log(Mainline Real CASM)

Durbin-Watson	0.760097
Number of Observations	32
First-Order Autocorrelation	0.617561

The SYSLIN Procedure

Three-Stage Least Squares Estimation

Model	MAINLINEST
Dependent Variable	lmainstage
Label	Log(Mainline Stage)

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	-5.24748	0.406001	-12.92	<.0001	Intercept
lrealrac	1	-0.04372	0.012724	-3.44	0.0018	log(Refiners Real Cost)
lmainptl	1	1.770544	0.065046	27.22	<.0001	Log(Mailine Pax Trip Length)

Durbin-Watson	0.572227
Number of Observations	32
First-Order Autocorrelation	0.643269

The SYSLIN Procedure

Three-Stage Least Squares Estimation

Model	MAINUNITCO
Dependent Variable	lrmaincasm
Label	Log(Mainline Real CASM)

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.157095	0.220991	0.71	0.4828	Intercept
lmainstage	1	-0.39599	0.037598	-10.53	<.0001	Log(Mainline Stage)
lrealrac	1	0.172655	0.011622	14.86	<.0001	log(Refiners Real Cost)

Durbin-Watson	1.647994
Number of Observations	32
First-Order Autocorrelation	0.175949

The SYSLIN Procedure

Three-Stage Least Squares Estimation

Model	COMMUTERLF
Dependent Variable	lcomlf
Label	Log(Commuter Load Factor)

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.757752	0.184939	4.10	0.0003	Intercept
time3	1	-0.10053	0.052081	-1.93	0.0638	Inverse of Time
POST911	1	0.058760	0.017135	3.43	0.0019	Post 9/11 dummy
lglcomlf	1	0.815139	0.046079	17.69	<.0001	Lag-log of Commuter Load Factor

Durbin-Watson	1.758872
Number of Observations	32
First-Order Autocorrelation	0.115148

The SYSLIN Procedure

Three-Stage Least Squares Estimation

Model	MAINLINELF
Dependent Variable	lmainlf
Label	Log(Mainline Load Factor)

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variable Label
Intercept	1	0.621176	0.185900	3.34	0.0024	Intercept
time3	1	-0.07194	0.035758	-2.01	0.0539	Inverse of Time
POST911	1	0.024228	0.009755	2.48	0.0193	Post 9/11 dummy
lglmainlf	1	0.856053	0.043894	19.50	<.0001	Lag-log of Mainline Load Factor

Durbin-Watson	2.300558
Number of Observations	32
First-Order Autocorrelation	-0.15362

The SIMLIN Procedure

Inverse Coefficient Matrix for Endogenous Variables

Variable	lmainrpm	lrmainyld2	lmainstage	lrmaincasm	lcomlf	lmainlf
lmainrpm	1.0000	-0.0520	0.009747	-0.0246	0	0
lrmainyld2	0	1.0000	-0.1873	0.4729	0	0
lcomlf	0	0	0	0	1.0000	0
lmainlf	0	0	0	0	0	1.0000
lrmaincasm	0	0	-0.3960	1.0000	0	0
lmainstage	0	0	1.0000	0	0	0

Reduced Form for Lagged Endogenous Variables

Variable	lglmainlf	lglcomlf
lmainrpm	0	0
lrmainyld2	0	0
lcomlf	0	0.8151
lmainlf	0.8561	0
lrmaincasm	0	0
lmainstage	0	0

Reduced Form for Exogenous Variables

Variable	lpcepc	UNRATE	POST911	lmainptl	lrealrac	time3	MAINPAXSHR	Intercept
lmainrpm	1.4394	-0.0119	-0.1386	0.1201	-0.004676	0	0	-2.5147
lrmainyld2	0	0	0	-2.3081	0.0898	0	0	13.8164
lcomlf	0	0	0.0588	0	0	-0.1005	0	0.7578
lmainlf	0	0	0.0242	0	0	-0.0719	0	0.6212
lrmaincasm	0	0	0	-0.7011	0.1900	0	0	2.2351
lmainstage	0	0	0	1.7705	-0.0437	0	0	-5.2475

Fit Statistics								
Variable	N	Mean Error	Mean Pct Error	Mean Abs Error	Mean Abs Pct Error	RMS Error	RMS Pct Error	Label
lmainrpm	32	0	-0.000509	0.0167	0.12830	0.0225	0.1736	Log(Mainline RPMs)
lrmainyld2	32	0	-0.0852	0.0357	2.26133	0.0441	2.7536	Log(Mainline Loaded Real Yield)
lcomlf	32	0.001081	0.0107	0.0254	0.62668	0.0324	0.8064	Log(Commuter Load Factor)
lmainlf	32	0.0000782	-0.003200	0.0134	0.31663	0.0175	0.4180	Log(Mainline Load Factor)
lrmaincasm	32	0	-0.0248	0.0200	1.10404	0.0264	1.4471	Log(Mainline Real CASM)
lmainstage	32	0	-0.001128	0.0174	0.26321	0.0210	0.3202	Log(Mainline Stage)

Baseline International (Form 41) Model Output

Pacific Region

RPM Forecast, Pacific

The REG Procedure
Model: MODEL1
Dependent Variable: rpm

Number of Observations Read	51
Number of Observations Used	30
Number of Observations with Missing Values	21

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2007916178	401583236	85.96	<.0001
Error	24	112119222	4671634		
Corrected Total	29	2120035399			

Root MSE	2161.39636	**R-Square**	0.9471
Dependent Mean	59988	**Adj R-Sq**	0.9361
Coeff Var	3.60302		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	
Intercept	Intercept	**1**	17711	2580.27064	6.86	<.0001	
gdpi_pu2		**1**	575.89197	39.44951	14.6	<.0001	
sars	sars	**1**	-7015.41676	2396.22084	-2.93		0.0074
gfc2	gfc2	**1**	-2963.33451	1411.96218	-2.1		0.0465
nwdata	nwdata	**1**	-4912.20012	1566.95553	-3.13		0.0045
post911	post911	**1**	-13208	1949.75241	-6.77	<.0001	

RPM Forecast, Pacific

The REG Procedure
Model: MODEL1
Dependent Variable: rpm

Durbin-Watson D	1.488
Number of Observations	30
1st Order Autocorrelation	0.12

Atlantic Region

RPM Forecast, Atlantic

The AUTOREG Procedure

Dependent Variable	rpm

RPM Forecast, Atlantic

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	1011764751	**DFE**	26
MSE	38914029	**Root MSE**	6238
SBC	618.754038	**AIC**	613.149248
MAE	4530.97623	**AICC**	614.749248
MAPE	4.96689162	**HQC**	614.942269
		Total R-Square	0.9235

Durbin-Watson Statistics

Order	DW
1	0.6539
2	1.0722

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-12473	10442	-1.19	0.2431	
gdpi_a2	1	1130	141.3972	7.99	<.0001	
middleeast	1	-12544	4884	-2.57	0.0163	middleeast
post911	1	-362.1853	4839	-0.07	0.9409	post911

Estimates of Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	33725492	1	|********************|
1	22105230	0.655446	|************* |

Preliminary MSE	19236713

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.655446	0.151048	-4.34

RPM Forecast, Atlantic

The AUTOREG Procedure

Yule-Walker Estimates

SSE	378929527	**DFE**	25
MSE	15157181	**Root MSE**	3893
SBC	593.253635	**AIC**	586.247648
MAE	2799.64935	**AICC**	588.747648
MAPE	3.15269388	**HQC**	588.488923
		Transformed Regression R-Square	0.8592
		Total R-Square	0.9713

Durbin-Watson Statistics

Order	DW
1	0.8691
2	1.4622

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-30893	10995	-2.81	0.0095	
gdpi_a2	1	1392	136.5186	10.19	<.0001	
middleeast	1	-6579	2316	-2.84	0.0088	middleeast
post911	1	-10425	4127	-2.53	0.0183	post911

Latin Region

RPM Forecast, Latin

The AUTOREG Procedure

Dependent Variable	rpm

RPM Forecast, Latin

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	500985581	**DFE**	26
MSE	19268676	**Root MSE**	4390
SBC	597.667816	**AIC**	592.063027
MAE	3092.11653	**AICC**	593.663027
MAPE	7.64826937	**HQC**	593.856047
		Total R-Square	0.9715

Durbin-Watson Statistics

Order	DW
1	0.302
2	0.7279

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-36759	10804	-3.4	0.0022	
gdpi_lu9	1	1565	103.177	15.16	<.0001	
post911	1	-10546	3436	-3.07	0.005	post911
yld	1	-3087	1058	-2.92	0.0072	

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	16699519	1	|********************|
1	11247990	0.673552	|************* |

Preliminary MSE	9123416

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.673552	0.147828	-4.56

RPM Forecast, Latin

The AUTOREG Procedure

Yule-Walker Estimates

SSE	163061402	**DFE**	25
MSE	6522456	**Root MSE**	2554
SBC	568.000035	**AIC**	560.994048
MAE	1864.95451	**AICC**	563.494048
MAPE	4.27222649	**HQC**	563.235323
		Transformed Regression R-Square	0.9413
		Total R-Square	0.9907

Durbin-Watson Statistics

Order	DW
1	0.6008
2	0.6837

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-43565	9096	-4.79	<.0001	
gdpi_lu9	1	1441	96.1538	14.98	<.0001	
post911	1	-5416	2792	-1.94	0.0638	post911
yld	1	-1948	786.4259	-2.48	0.0204	

Baseline International (Customs and Border Protection) Model Output

France

Final 2020 model - France

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	5.88E+13	1.96E+13	247.77	<.0001
Error	26	2.06E+12	79143480490		
Corrected Total	29	6.09E+13			

Root MSE	281325	**R-Square**	0.9662
Dependent Mean	5670133	**Adj R-Sq**	0.9623
Coeff Var	4.96152		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	-2760496	864312	-3.19	0.0037
gdp5	gdp5	**1**	11625827	680021	17.1	<.0001
post911	post911	**1**	-1189189	214526	-5.54	<.0001
yld	yld	**1**	-106923	42149	-2.54	0.0175

Final 2020 model - France

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Durbin-Watson D	1.09
Number of Observations	30
1st Order Autocorrelation	0.292

Germany

Final 2020 model - Germany

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2.0302	0.40604	204.07	<.0001
Error	24	0.04775	0.00199		
Corrected Total	29	2.07795			

Root MSE	0.04461	**R-Square**	0.977
Dependent Mean	15.8816	**Adj R-Sq**	0.9722
Coeff Var	0.28086		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	16.95099	0.30478	55.62	<.0001
lexr	lexr	**1**	-0.52732	0.10141	-5.2	<.0001
lgdp2	lgdp2	**1**	2.2271	0.13272	16.78	<.0001
lyld	lyld	**1**	-0.36556	0.11449	-3.19	0.0039
post911	post911	**1**	-0.13478	0.04246	-3.17	0.0041
11-Sep	11-Sep	**1**	-0.09304	0.05604	-1.66	0.1099

Final 2020 model - Germany

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	1.756
Number of Observations	30
1st Order Autocorrelation	0.092

Ireland

Final 2020 model - Ireland

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	6.08036	1.01339	319.26	<.0001
Error	23	0.07301	0.00317		
Corrected Total	29	6.15337			

Root MSE	0.05634	**R-Square**	0.9881
Dependent Mean	14.37464	**Adj R-Sq**	0.985
Coeff Var	0.39194		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	16.28891	0.36444	44.7	<.0001
gulfwar	gulfwar	**1**	-0.14786	0.06219	-2.38	0.0261
lexr	lexr	**1**	-0.55345	0.13155	-4.21	0.0003
lgdp4	lgdp4	**1**	1.5247	0.0682	22.36	<.0001
lyld	lyld	**1**	-0.59031	0.13633	-4.33	0.0002
post911	post911	**1**	-0.35835	0.06172	-5.81	<.0001
traveltax_ie	traveltax_ie	**1**	-0.16074	0.03167	-5.08	<.0001

Final 2020 model - Ireland

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	1.902
Number of Observations	30
1st Order Autocorrelation	0.037

Italy

Final 2020 model - Italy

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	1.22E+12	**DFE**	24
MSE	5.09E+10	**Root MSE**	225567
SBC	838.431409	**AIC**	830.024225
MAE	140372.133	**AICC**	833.676399
MAPE	5.34275433	**HQC**	832.713755
		Total R-Square	0.9215

Durbin-Watson Statistics

Order	DW
1	0.6968
2	1.2393

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-2232337	393604	-5.67	<.0001	
gdp9	1	5823751	533258	10.92	<.0001	gdp9
gulfwar	1	14464	242836	0.06	0.953	gulfwar
iraqwar	1	-247520	243537	-1.02	0.3196	iraqwar
millenium	1	139642	246360	0.57	0.5761	millenium
post911	1	-816871	189363	-4.31	0.0002	post911

Estimates of Autocorrelations

Lag	Covariance	Correlation	- 1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	4.07E+10	1	|********************|
1	1.83E+10	0.450403	|********* |

Preliminary MSE	3.25E+10

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.450403	0.186167	-2.42

Final 2020 model - Italy

The AUTOREG Procedure

Yule-Walker Estimates

SSE	7.62E+11	**DFE**	23
MSE	3.31E+10	**Root MSE**	182018
SBC	827.912084	**AIC**	818.103702
MAE	112274.497	**AICC**	823.194612
MAPE	4.29038301	**HQC**	821.241488
		Transformed Regression R-Square	0.8897
		Total R-Square	0.951

Durbin-Watson Statistics

Order	DW
1	0.5812
2	1.1957

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-2123427	414462	-5.12	<.0001	
gdp9	1	5640301	538612	10.47	<.0001	gdp9
gulfwar	1	-124483	168827	-0.74	0.4684	gulfwar
iraqwar	1	-262306	167974	-1.56	0.132	iraqwar
millenium	1	385347	168543	2.29	0.0318	millenium
post911	1	-688794	182272	-3.78	0.001	post911

Netherlands

Final 2020 model - Netherlands

The AUTOREG Procedure

Dependent Variable	pax
	pax

Final 2020 model - Netherlands

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	2.95E+12	**DFE**	26
MSE	1.13E+11	**Root MSE**	336583
SBC	858.044049	**AIC**	852.439259
MAE	266458.755	**AICC**	854.039259
MAPE	7.92891338	**HQC**	854.232279
		Total R-Square	0.9185

Durbin-Watson Statistics

Order	DW
1	0.6275
2	1.2219

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-3535168	543858	-6.5	<.0001	
gdp6	1	9338160	752958	12.4	<.0001	gdp6
post911	1	-1408613	268959	-5.24	<.0001	post911
11-Sep	1	-582820	371196	-1.57	0.1285	11-Sep

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	9.82E+10	1	|********************|
1	6.06E+10	0.617383	|************ |

Preliminary MSE	6.08E+10

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.617383	0.157332	-3.92

Final 2020 model - Netherlands

The AUTOREG Procedure

Yule-Walker Estimates

SSE	1.51E+12	**DFE**	25
MSE	6.02E+10	**Root MSE**	245424
SBC	841.797154	**AIC**	834.791167
MAE	177384.419	**AICC**	837.291167
MAPE	4.97889976	**HQC**	837.032443
		Transformed Regression R-Square	0.8505
		Total R-Square	0.9583

Durbin-Watson Statistics

Order	DW
1	1.3459
2	1.9481

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-3577891	699625	-5.11	<.0001	
gdp6	1	9236792	919996	10.04	<.0001	gdp6
post911	1	-1197840	322995	-3.71	0.001	post911
11-Sep	1	-760964	265548	-2.87	0.0083	11-Sep

Spain

Final 2020 model - Spain

The AUTOREG Procedure

Dependent Variable	pax
	pax

Final 2020 model - Spain

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	1.07E+13	**DFE**	28
MSE	3.81E+11	**Root MSE**	617254
SBC	889.851117	**AIC**	887.048722
MAE	459643.535	**AICC**	887.493166
MAPE	22.9839571	**HQC**	887.945232
		Total R-Square	0.6709

Durbin-Watson Statistics

Order	DW
1	0.1371
2	0.4018

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-2544722	629196	-4.04	0.0004	
gdp1	1	5334184	706017	7.56	<.0001	gdp1

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	3.56E+11	1 |	|********************|
1	2.84E+11	0.797615 |	|********** |

Preliminary MSE	1.29E+11

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.797615	0.11608	-6.87

Final 2020 model - Spain

The AUTOREG Procedure

Yule-Walker Estimates

SSE	1.97E+12	**DFE**	27
MSE	7.30E+10	**Root MSE**	270206
SBC	843.60656	**AIC**	839.402968
MAE	191998.473	**AICC**	840.326045
MAPE	9.82255762	**HQC**	840.747733
		Transformed Regression R-Square	0.5441
		Total R-Square	0.9392

Durbin-Watson Statistics

Order	DW
1	0.5294
2	0.7642

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-2873822	941908	-3.05	0.0051	
gdp1	1	5949686	1048077	5.68	<.0001	gdp1

United Kingdom

Final 2020 model - United Kingdom

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	2.63E+14	8.77E+13	113.46	<.0001
Error	26	2.01E+13	7.73E+11		
Corrected Total	29	2.83E+14			

Root MSE	879237	**R-Square**	0.929
Dependent Mean	16210264	**Adj R-Sq**	0.9208
Coeff Var	5.42395		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	-6350964	1523829	-4.17	0.0003
gdp9	gdp9	**1**	28285449	2106037	13.43	<.0001
post911	post911	**1**	-3482506	647338	-5.38	<.0001
gfc	gfc	**1**	-2450979	533305	-4.6	<.0001

Final 2020 model - United Kingdom

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Durbin-Watson D	1.376
Number of Observations	30
1st Order Autocorrelation	0.298

Other European Countries

Final 2020 model - Other Atlantic

The AUTOREG Procedure

Dependent Variable	pax
	pax

Final 2020 model - Other Atlantic

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	7.44E+13	**DFE**	27
MSE	2.75E+12	**Root MSE**	1659552
SBC	951.502572	**AIC**	947.29898
MAE	1313768.67	**AICC**	948.222057
MAPE	13.3184278	**HQC**	948.643745
		Total R-Square	0.9366

Durbin-Watson Statistics

Order	DW
1	0.8207
2	1.4498

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-20578950	1819830	-11.31	<.0001	
gdp1	1	43752265	2757488	15.87	<.0001	gdp1
post911	1	-8712872	1194182	-7.3	<.0001	post911

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	2.48E+12	1	|********************|
1	1.42E+12	0.572337	|********** |

Preliminary MSE	1.67E+12

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.572337	0.160819	-3.56

Final 2020 model - Other Atlantic

The AUTOREG Procedure

Yule-Walker Estimates

SSE	3.57E+13	**DFE**	26
MSE	1.37E+12	**Root MSE**	1171941
SBC	933.295257	**AIC**	927.690467
MAE	926497.24	**AICC**	929.290467
MAPE	9.38666041	**HQC**	929.483488
		Transformed Regression R-Square	0.8775
		Total R-Square	0.9695

Durbin-Watson Statistics

Order	DW
1	0.8906
2	1.1135

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-16819754	2264729	-7.43	<.0001	
gdp1	1	36859374	3104817	11.87	<.0001	gdp1
post911	1	-4933138	1208912	-4.08	0.0004	post911

Bahamas

Final 2020 model - The Bahamas

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.0945	0.04725	7.82	0.0021
Error	27	0.16314	0.00604		
Corrected Total	29	0.25765			

Root MSE	0.07773	**R-Square**	0.3668
Dependent Mean	14.77174	**Adj R-Sq**	0.3199
Coeff Var	0.52622		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	14.80563	0.0167	886.66	<.0001
lgdp9	lgdp9	**1**	0.23439	0.06881	3.41	0.0021
swineflu	swineflu	**1**	-0.18175	0.07935	-2.29	0.03

Final 2020 model - The Bahamas

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	0.686
Number of Observations	30
1st Order Autocorrelation	0.372

Brazil

Final 2020 model - Brazil

The AUTOREG Procedure

Dependent Variable	pax
	pax

Final 2020 model - Brazil

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	3.03E+12	**DFE**	26
MSE	1.17E+11	**Root MSE**	341440
SBC	858.903701	**AIC**	853.298911
MAE	247793.981	**AICC**	854.898911
MAPE	8.78594752	**HQC**	855.091932
		Total R-Square	0.9384

Durbin-Watson Statistics

Order	DW
1	0.5736
2	1.3644

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-4143841	406853	-10.19	<.0001	
gdp1	1	9797122	632834	15.48	<.0001	gdp1
post911	1	-1705144	250712	-6.8	<.0001	post911
11-Sep	1	-741102	362053	-2.05	0.0509	11-Sep

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	1.01E+11	1	|********************|
1	7.12E+10	0.704623	|********** |

Preliminary MSE	5.09E+10

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.704623	0.141916	-4.97

Final 2020 model - Brazil

The AUTOREG Procedure

Yule-Walker Estimates

SSE	1.29E+12	**DFE**	25
MSE	5.15E+10	**Root MSE**	227009
SBC	837.323564	**AIC**	830.317577
MAE	167027.286	**AICC**	832.817577
MAPE	5.96742741	**HQC**	832.558852
		Transformed Regression R-Square	0.8328
		Total R-Square	0.9738

Durbin-Watson Statistics

Order	DW
1	1.2773
2	1.973

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-3488228	605972	-5.76	<.0001	
gdp1	1	8571344	856816	10	<.0001	gdp1
post911	1	-1088460	309986	-3.51	0.0017	post911
11-Sep	1	-514614	238778	-2.16	0.041	11-Sep

Dominican Republic

Final 2020 model - Dominican Republic

The AUTOREG Procedure

Dependent Variable	lpax
	lpax

Final 2020 model - Dominican Republic

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	0.26359891	**DFE**	28
MSE	0.00941	**Root MSE**	0.09703
SBC	-50.097013	**AIC**	-52.899408
MAE	0.08116707	**AICC**	-52.454963
MAPE	0.53952229	**HQC**	-52.002898
		Total R-Square	0.9603

Durbin-Watson Statistics

Order	DW
1	0.3093
2	0.6835

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	15.3343	0.0208	736.07	<.0001	
lgdp5	1	1.4315	0.055	26.03	<.0001	lgdp5

Estimates of Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.00879	1	|********************|
1	0.00691	0.786807	|********** |

Preliminary MSE	0.00335

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.786807	0.11878	-6.62

Final 2020 model - Dominican Republic

The AUTOREG Procedure

Yule-Walker Estimates

SSE	0.07959923	**DFE**	27
MSE	0.00295	**Root MSE**	0.0543
SBC	-81.653417	**AIC**	-85.857009
MAE	0.04055936	**AICC**	-84.933933
MAPE	0.27161139	**HQC**	-84.512244
		Transformed Regression R-Square	0.8697
		Total R-Square	0.988

Durbin-Watson Statistics

Order	DW
1	1.5566
2	1.7389

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	15.3452	0.0464	330.42	<.0001	
lgdp5	1	1.3757	0.1025	13.42	<.0001	lgdp5

Jamaica

Final 2020 model - Jamaica

The AUTOREG Procedure

Dependent Variable	lpax
	lpax

Final 2020 model - Jamaica

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	0.21497692	**DFE**	28
MSE	0.00768	**Root MSE**	0.08762
SBC	-56.213953	**AIC**	-59.016347
MAE	0.06704195	**AICC**	-58.571903
MAPE	0.45249612	**HQC**	-58.119837
		Total R-Square	0.8928

Durbin-Watson Statistics

Order	DW
1	0.3302
2	0.5576

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	14.893	0.0179	832.94	<.0001	
lgdp6	1	1.6401	0.1074	15.27	<.0001	lgdp6

Estimates of Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.00717	1	|********************|
1	0.00499	0.697003	|********** |

Preliminary MSE	0.00368

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.697003	0.138	-5.05

Final 2020 model - Jamaica

The AUTOREG Procedure

Yule-Walker Estimates

SSE	0.07985118	**DFE**	27
MSE	0.00296	**Root MSE**	0.05438
SBC	-81.85857	**AIC**	-86.062162
MAE	0.04095289	**AICC**	-85.139085
MAPE	0.27763329	**HQC**	-84.717396
		Transformed Regression R-Square	0.7654
		Total R-Square	0.9602

Durbin-Watson Statistics

Order	DW
1	1.5125
2	1.3769

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	14.912	0.0333	447.79	<.0001	
lgdp6	1	1.5917	0.1696	9.39	<.0001	lgdp6

Mexico

Final 2020 model - Mexico

The AUTOREG Procedure

Dependent Variable	lpax
	lpax

Final 2020 model - Mexico

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	0.3625093	**DFE**	28
MSE	0.01295	**Root MSE**	0.11378
SBC	-40.538369	**AIC**	-43.340764
MAE	0.09430567	**AICC**	-42.896319
MAPE	0.56736662	**HQC**	-42.444253
		Total R-Square	0.9223

Durbin-Watson Statistics

Order	DW
1	0.139
2	0.3716

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	16.7485	0.0238	704.39	<.0001	
lgdp8	1	1.7851	0.0979	18.23	<.0001	lgdp8

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.0121	1 |	|********************|
1	0.0107	0.885728 |	|****************** |

Preliminary MSE	0.0026

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.885728	0.089336	-9.91

Final 2020 model - Mexico

The AUTOREG Procedure

Yule-Walker Estimates

SSE	0.05085463	**DFE**	27
MSE	0.00188	**Root MSE**	0.0434
SBC	-94.524677	**AIC**	-98.728269
MAE	0.03346793	**AICC**	-97.805192
MAPE	0.20273523	**HQC**	-97.383504
		Transformed Regression R-Square	0.8202
		Total R-Square	0.9891

Durbin-Watson Statistics

Order	DW
1	1.0269
2	1.732

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	16.8045	0.0604	278.05	<.0001	
lgdp8	1	1.8895	0.1703	11.1	<.0001	lgdp8

Other Latin American Countries

Final 2020 model - Other Latin

The AUTOREG Procedure

Dependent Variable	lpax
	lpax

Final 2020 model - Other Latin

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	0.13614547	**DFE**	27
MSE	0.00504	**Root MSE**	0.07101
SBC	-66.516958	**AIC**	-70.72055
MAE	0.05431958	**AICC**	-69.797473
MAPE	0.32333733	**HQC**	-69.375785
		Total R-Square	0.966

Durbin-Watson Statistics

Order	DW
1	0.4044
2	0.6936

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	17.168	0.0486	353.01	<.0001	
lgdp7	1	2.0001	0.1175	17.03	<.0001	lgdp7
post911	1	-0.1934	0.0525	-3.68	0.001	post911

Estimates of Autocorrelations

Lag	Covariance	Correlation	-1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.00454	1 |	|********************|
1	0.00331	0.730079 |	|************** |

Preliminary MSE	0.00212

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.730079	0.134018	-5.45

Final 2020 model - Other Latin

The AUTOREG Procedure

Yule-Walker Estimates

SSE	0.04086985	**DFE**	26
MSE	0.00157	**Root MSE**	0.03965
SBC	-98.454237	**AIC**	-104.05903
MAE	0.02792224	**AICC**	-102.45903
MAPE	0.16666296	**HQC**	-102.26601
		Transformed Regression R-Square	0.922
		Total R-Square	0.9898

Durbin-Watson Statistics

Order	DW
1	1.3929
2	1.1484

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	17.082	0.0448	381.63	<.0001	
lgdp7	1	1.791	0.1165	15.37	<.0001	lgdp7
post911	1	-0.0774	0.0415	-1.87	0.0733	post911

China

Final 2020 model - China

The AUTOREG Procedure

Dependent Variable	pax pax

Final 2020 model - China

The AUTOREG Procedure

Ordinary Least Squares Estimates			
SSE	4.55E+12	**DFE**	25
MSE	1.82E+11	**Root MSE**	426523
SBC	874.477994	**AIC**	867.472007
MAE	320717.317	**AICC**	869.972007
MAPE	59.3052296	**HQC**	869.713283
		Total R-Square	0.9798

Durbin-Watson Statistics	
Order	**DW**
1	1.1644
2	1.721

Parameter Estimates						
Variable	**DF**	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**	**Variable Label**
Intercept	1	-1824047	629022	-2.9	0.0077	
exr	1	-285935	85630	-3.34	0.0026	exr
gdp4	1	9705683	502193	19.33	<.0001	gdp4
gfc	1	-1517674	380305	-3.99	0.0005	gfc
post911	1	-1546778	255749	-6.05	<.0001	post911

Estimates of Autocorrelations			
Lag	**Covariance**	**Correlation**	**- 1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1**
0	1.52E+11	1 |	|********************|
1	6.24E+10	0.411373 |	|******** |

Preliminary MSE	1.26E+11

Estimates of Autoregressive Parameters			
Lag	**Coefficient**	**Standard Error**	**t Value**
1	-0.411373	0.186052	-2.21

Final 2020 model - China

The AUTOREG Procedure

Yule-Walker Estimates			
SSE	3.28E+12	**DFE**	24
MSE	1.37E+11	**Root MSE**	369494
SBC	868.227931	**AIC**	859.820747
MAE	268202.461	**AICC**	863.472921
MAPE	53.9766317	**HQC**	862.510277
		Transformed Regression R-Square	0.964
		Total R-Square	0.9854

Durbin-Watson Statistics	
Order	**DW**
1	1.309
2	1.3635

Parameter Estimates						
Variable	**DF**	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**	**Variable Label**
Intercept	1	-2044331	727926	-2.81	0.0097	
exr	1	-210099	96962	-2.17	0.0404	exr
gdp4	1	8770534	563111	15.58	<.0001	gdp4
gfc	1	-944477	401818	-2.35	0.0273	gfc
post911	1	-1190181	310261	-3.84	0.0008	post911

Hong Kong

Final 2020 model - Hong Kong

The AUTOREG Procedure

Dependent Variable	pax
	pax

Final 2020 model - Hong Kong

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	6.29E+11	**DFE**	26
MSE	2.42E+10	**Root MSE**	155501
SBC	811.712481	**AIC**	806.107691
MAE	124990.874	**AICC**	807.707691
MAPE	7.48083232	**HQC**	807.900711
		Total R-Square	0.9741

Durbin-Watson Statistics

Order	DW
1	0.8959
2	1.3013

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-1763587	156736	-11.25	<.0001	
gdp3	1	4672716	241776	19.33	<.0001	gdp3
sars	1	-251505	172656	-1.46	0.1572	sars
post911	1	-510101	114885	-4.44	0.0001	post911

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	2.10E+10	1	|********************|
1	1.09E+10	0.519522	|********** |

Preliminary MSE	1.53E+10

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.519522	0.170891	-3.04

Final 2020 model - Hong Kong

The AUTOREG Procedure

Yule-Walker Estimates

SSE	4.00E+11	**DFE**	25
MSE	1.60E+10	**Root MSE**	126551
SBC	801.891328	**AIC**	794.885341
MAE	88755.8439	**AICC**	797.385341
MAPE	5.06957155	**HQC**	797.126616
		Transformed Regression R-Square	0.9459
		Total R-Square	0.9835

Durbin-Watson Statistics

Order	DW
1	1.593
2	1.8142

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	-1588232	198829	-7.99	<.0001	
gdp3	1	4354267	280944	15.5	<.0001	gdp3
sars	1	-367482	113839	-3.23	0.0035	sars
post911	1	-323500	124182	-2.61	0.0152	post911

India

Final 2020 model - India

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4.53E+12	2.27E+12	321.81	<.0001
Error	27	1.90E+11	7039152721		
Corrected Total	29	4.72E+12			

Root MSE	83900	**R-Square**	0.9597
Dependent Mean	530069	**Adj R-Sq**	0.9568
Coeff Var	15.82807		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	-318711	69580	-4.58	<.0001
gdp6	gdp6	**1**	781227	103288	7.56	<.0001
nostopserv_in	nostopserv_in	**1**	365930	58610	6.24	<.0001

Final 2020 model - India

The REG Procedure
Model: MODEL1
Dependent Variable: pax pax

Durbin-Watson D	1.533
Number of Observations	30
1st Order Autocorrelation	0.225

Japan

Final 2020 model - Japan

The AUTOREG Procedure

Dependent Variable	lpax lpax

Final 2020 model - Japan

The AUTOREG Procedure

Ordinary Least Squares Estimates			
SSE	0.10758824	**DFE**	24
MSE	0.00448	**Root MSE**	0.06695
SBC	-63.375743	**AIC**	-71.782927
MAE	0.04898811	**AICC**	-68.130753
MAPE	0.30145741	**HQC**	-69.093396
		Total R-Square	0.7184

Durbin-Watson Statistics	
Order	**DW**
1	0.9254
2	1.4416

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	17.5839	0.2523	69.69	<.0001	
lgdp3	1	1.6482	0.2271	7.26	<.0001	lgdp3
lyld	1	-0.3359	0.0762	-4.41	0.0002	lyld
post911	1	-0.3427	0.0553	-6.2	<.0001	post911
11-Sep	1	-0.192	0.0774	-2.48	0.0205	11-Sep
tsunami	1	0.000563	0.0713	0.01	0.9938	tsunami

Estimates of Autocorrelations

Lag	Covariance	Correlation	- 1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.00359	1 |	|********************|
1	0.00182	0.506785 |	|********** |

Preliminary MSE	0.00267

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.506785	0.179755	-2.82

Final 2020 model - Japan

The AUTOREG Procedure

Yule-Walker Estimates			
SSE	0.07314323	**DFE**	23
MSE	0.00318	**Root MSE**	0.05639
SBC	-71.254468	**AIC**	-81.06285
MAE	0.04193438	**AICC**	-75.971941
MAPE	0.2581326	**HQC**	-77.925065
		Transformed Regression R-Square	0.6071
		Total R-Square	0.8085

Durbin-Watson Statistics	
Order	**DW**
1	1.568
2	1.7515

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	17.3586	0.3569	48.64	<.0001	
lgdp3	1	1.5567	0.2827	5.51	<.0001	lgdp3
lyld	1	-0.2705	0.1086	-2.49	0.0204	lyld
post911	1	-0.3131	0.0699	-4.48	0.0002	post911
11-Sep	1	-0.2117	0.0633	-3.34	0.0028	11-Sep
tsunami	1	-0.0478	0.0532	-0.9	0.3779	tsunami

South Korea

Final 2020 model - South Korea

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5.75024	1.43756	94.62	<.0001
Error	25	0.37983	0.01519		
Corrected Total	29	6.13007			

Root MSE	0.12326	**R-Square**	0.938
Dependent Mean	14.99493	**Adj R-Sq**	0.9281
Coeff Var	0.82202		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	16.0125	0.10729	149.25	<.0001
afc	afc	**1**	-0.3767	0.10046	-3.75	0.0009
lgdp3	lgdp3	**1**	2.103	0.14919	14.1	<.0001
post911	post911	**1**	-0.77864	0.11161	-6.98	<.0001
11-Sep	11-Sep	**1**	-0.63077	0.13925	-4.53	0.0001

Final 2020 model - South Korea

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	0.978
Number of Observations	30
1st Order Autocorrelation	0.477

Taiwan

Final 2020 model - Taiwan

The AUTOREG Procedure

Dependent Variable	lpax
	lpax

Final 2020 model - Taiwan

The AUTOREG Procedure

Ordinary Least Squares Estimates

SSE	1.34203091	**DFE**	28
MSE	0.04793	**Root MSE**	0.21893
SBC	-1.2716925	**AIC**	-4.0740873
MAE	0.1733073	**AICC**	-3.6296428
MAPE	1.21211173	**HQC**	-3.1775771
		Total R-Square	0.6281

Durbin-Watson Statistics

Order	DW
1	0.2566
2	0.6921

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	14.6368	0.0482	303.58	<.0001	
lgdp6	1	1.0135	0.1474	6.88	<.0001	lgdp6

Estimates of Autocorrelations

Lag	Covariance	Correlation	1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1
0	0.0447	1 |	|********************|
1	0.0342	0.763406 |	|************** |

Preliminary MSE	0.0187

Estimates of Autoregressive Parameters

Lag	Coefficient	Standard Error	t Value
1	-0.763406	0.124307	-6.14

Final 2020 model - Taiwan

The AUTOREG Procedure

Yule-Walker Estimates

SSE	0.35777457	**DFE**	27
MSE	0.01325	**Root MSE**	0.11511
SBC	-36.657422	**AIC**	-40.861014
MAE	0.08470909	**AICC**	-39.937937
MAPE	0.59262126	**HQC**	-39.516248
		Transformed Regression R-Square	0.5447
		Total R-Square	0.9009

Durbin-Watson Statistics

Order	DW
1	1.1297
2	1.0473

Parameter Estimates

Variable	DF	Estimate	Standard Error	t Value	Approx Pr > |t|	Variable Label
Intercept	1	14.6681	0.0932	157.37	<.0001	
lgdp6	1	1.3754	0.242	5.68	<.0001	lgdp6

Rest of Asia Pacific

Final 2020 model - Other Pacific

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1.2776	0.42587	129.88	<.0001
Error	26	0.08525	0.00328		
Corrected Total	29	1.36285			

Root MSE	0.05726	**R-Square**	0.9374
Dependent Mean	15.33472	**Adj R-Sq**	0.9302
Coeff Var	0.37341		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	15.71276	0.04796	327.66	<.0001
gfc	gfc	**1**	-0.17337	0.03846	-4.51	0.0001
lgdp5	lgdp5	**1**	1.20143	0.09618	12.49	<.0001
post911	post911	**1**	-0.17131	0.04179	-4.1	0.0004

Final 2020 model - Other Pacific

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	1.328
Number of Observations	30
1st Order Autocorrelation	0.216

Canada

Final 2020 model - Canada

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Number of Observations Read	61
Number of Observations Used	30
Number of Observations with Missing Values	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1.90063	0.63354	449.23	<.0001
Error	26	0.03667	0.00141		
Corrected Total	29	1.9373			

Root MSE	0.03755	**R-Square**	0.9811
Dependent Mean	16.813	**Adj R-Sq**	0.9789
Coeff Var	0.22336		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	**1**	17.23159	0.02918	590.44	<.0001
lgdp1	lgdp1	**1**	1.78756	0.07281	24.55	<.0001
post911	post911	**1**	-0.31767	0.03228	-9.84	<.0001
11-Sep	11-Sep	**1**	-0.16427	0.04192	-3.92	0.0006

Final 2020 model - Canada

The REG Procedure
Model: MODEL1
Dependent Variable: lpax lpax

Durbin-Watson D	1.504
Number of Observations	30
1st Order Autocorrelation	0.209