Modeling of the number of passengers in air transport on a specific route

Jeremy KITAIGORODSKI,
Luc FISCHER

IENAC 10T

May 11, 2012

Outline

1. Question of interest
2. Database
3. Data description
4. Econometrics analysis
5. Concluding comments

Question of interest

Parameters to modelize the number of passengers in air transport on a given route?

Context:
Route :Marseille- London (all airports)
Period: from 1990 to 2011

Dependent and explanatory variables

Dependent variable : N, number of passengers on the route Marseille - London
Explanatory variables :

- N_{tot}: Total number of passengers
- M_{tot}: Total number of movements
- A: Number of airlines on the route
- Dest : Number of destination served in the UK
- P : Oil barrel price in $US

Database

Year	Pax on the route	Pax total	Movements total	Airlines	destinations in UK	Barrel price in US$
1990	101479	4982824	111243	1	4	23,65
1991	94145	4449898	106323	1	3	19,97
1992	103996	4705679	108761	1	3	19,31
1993	149252	4780251	101245	1	6	17
1994	160278	4831369	100267	1	9	15,82
1995	159185	5106617	113597	1	7	17,04
1996	166491	5401394	116342	1	6	20,65
1997	167753	5473556	121004	1	3	19,11
1998	199112	5669511	118906	1	11	12,78
1999	209528	6016825	123131	1	9	17,92
2000	255256	6458429	134093	1	7	28,52
2001	277932	5932032	125616	1	12	14,44
2002	272149	5457443	119672	1	6	24,95
2003	239705	5364763	111611	2	9	28,89
2004	330882	5756038	116353	2	14	38,24
2005	287920	5859480	115112	2	9	54,41
2006	307625	6115943	114934	3	17	65,14
2007	384369	6962773	120615	3	18	72,45
2008	357540	6965933	121208	3	19	96,99
2009	396473	7290119	122666	3	15	61,48
2010	372111	7522167	122087	3	22	79,44
2011	412143	7363068	119686	3	13	111,22

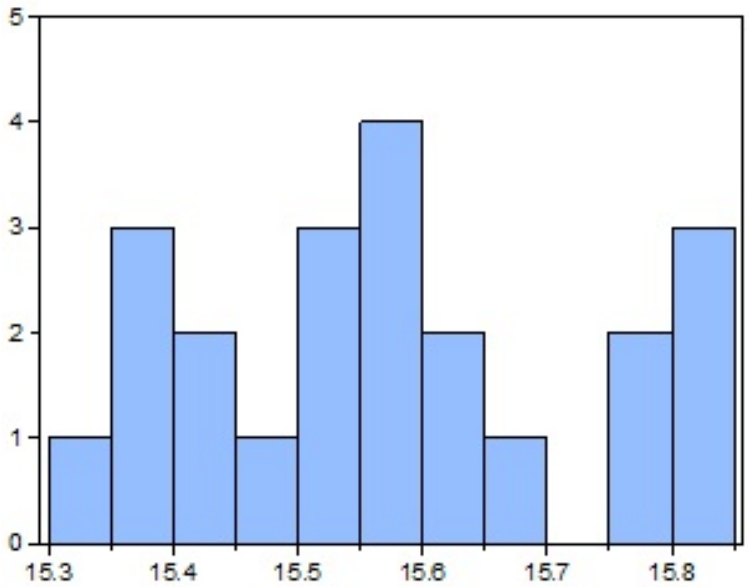
Easyjet's entrance

Ryanair's entrance

Figure : Our data

N_{tot}

- Total number of passengers for the year in Marseille airport (N_{tot})

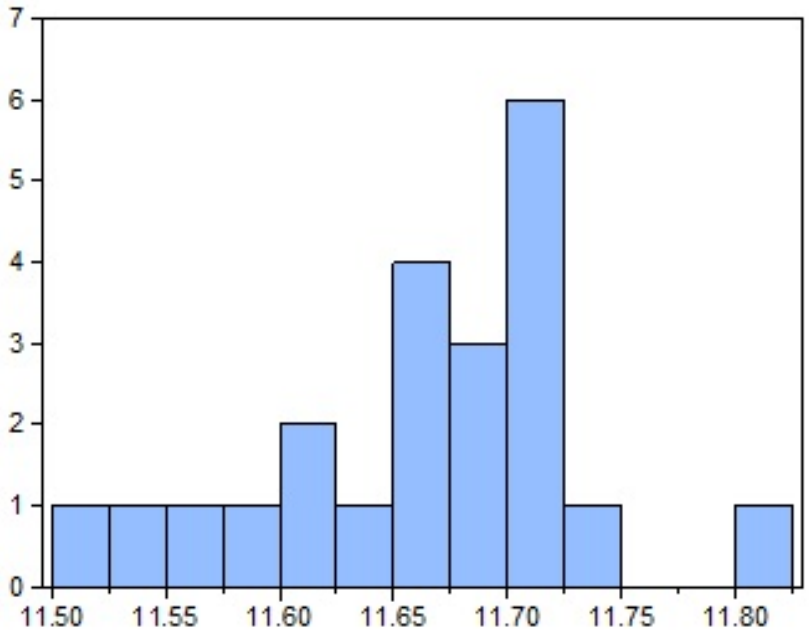


Series: LOGNTOT	
Sample 1990 2011	
Observations 22	
Mean	15.56862
Median	15.55819
Maximum	15.83336
Minimum	15.30839
Std. Dev.	0.154669
Skewness	0.211729
Kurtosis	2.040100
Jarque-Bera	1.008997
Probability	0.603808

Figure : $\log N_{tot}$ diagram

M_{tot}

- Total number of movements for the year in Marseille airport (M_{tot})



Series: LOGMTOT	
Sample 1990 2011	
Observations 22	
Mean	11.66398
Median	11.67524
Maximum	11.80629
Minimum	11.51559
Std. Dev.	0.068877
Skewness	-0.463253
Kurtosis	3.158819
Jarque-Bera	0.810000
Probability	0.666977

Figure : $\log M_{tot}$ diagram

A

- Number of airlines serving MRS-LND route (A)

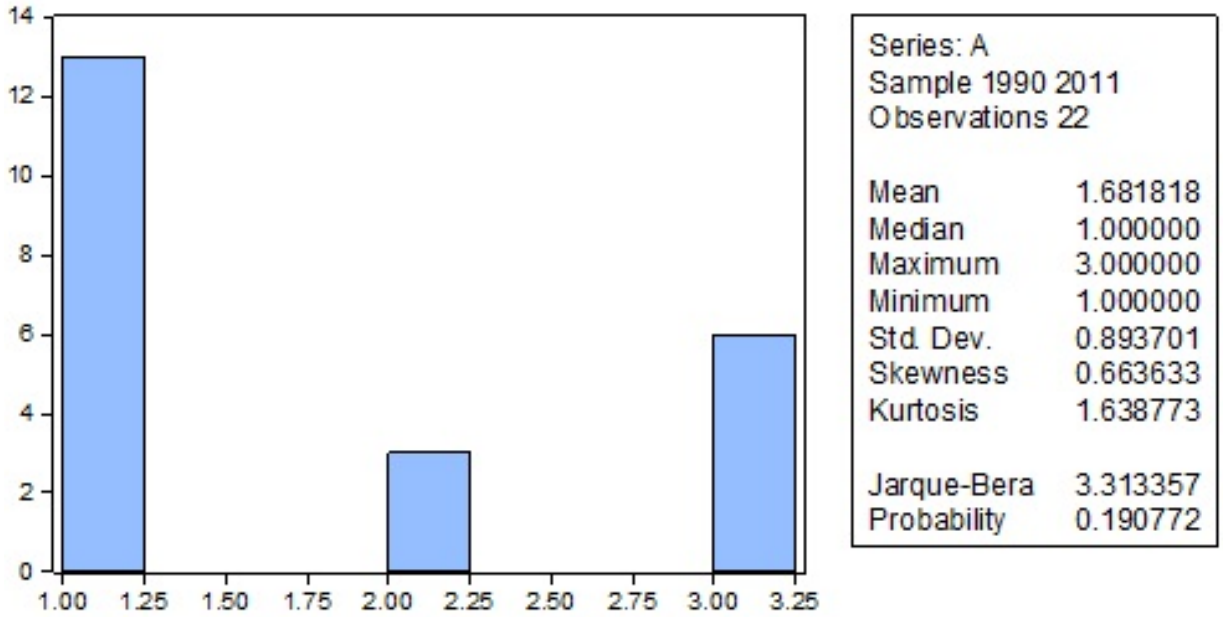
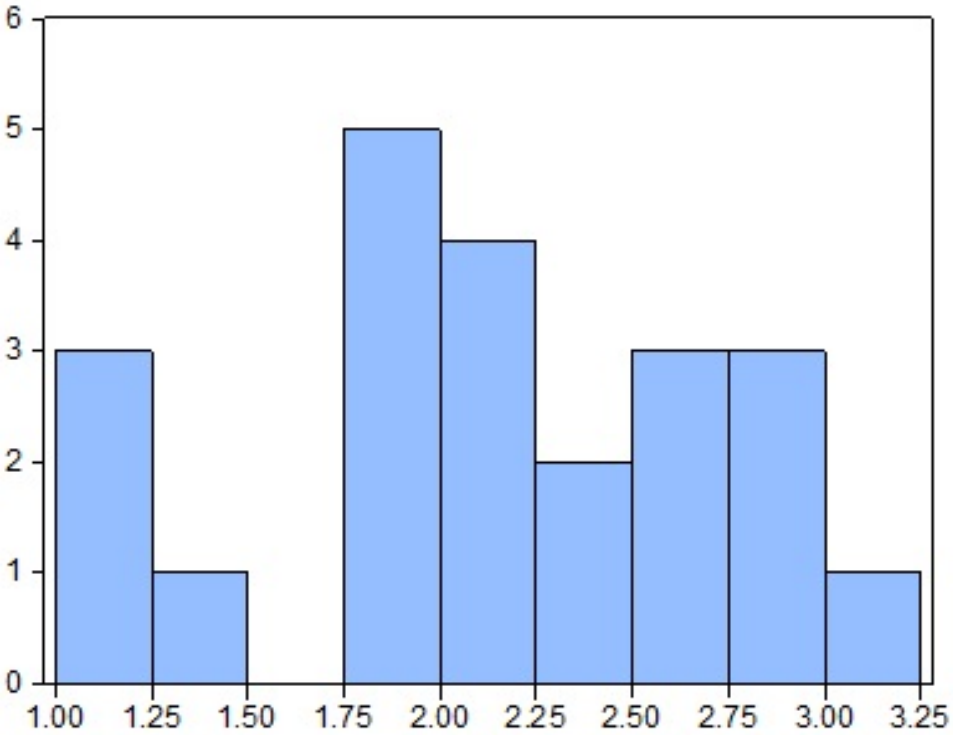


Figure : A diagram

Dest

- Number of destinations in the UK (Dest)



Series: LOGDEST	
Sample 1990 2011	
Observations 22	
Mean	2.149639
Median	2.197225
Maximum	3.091042
Minimum	1.098612
Std. Dev.	0.609635
Skewness	-0.344970
Kurtosis	2.151703
Jarque-Bera	1.095989
Probability	0.578108

Figure : logDest diagram

P

- Oil barrel price in $US (P)

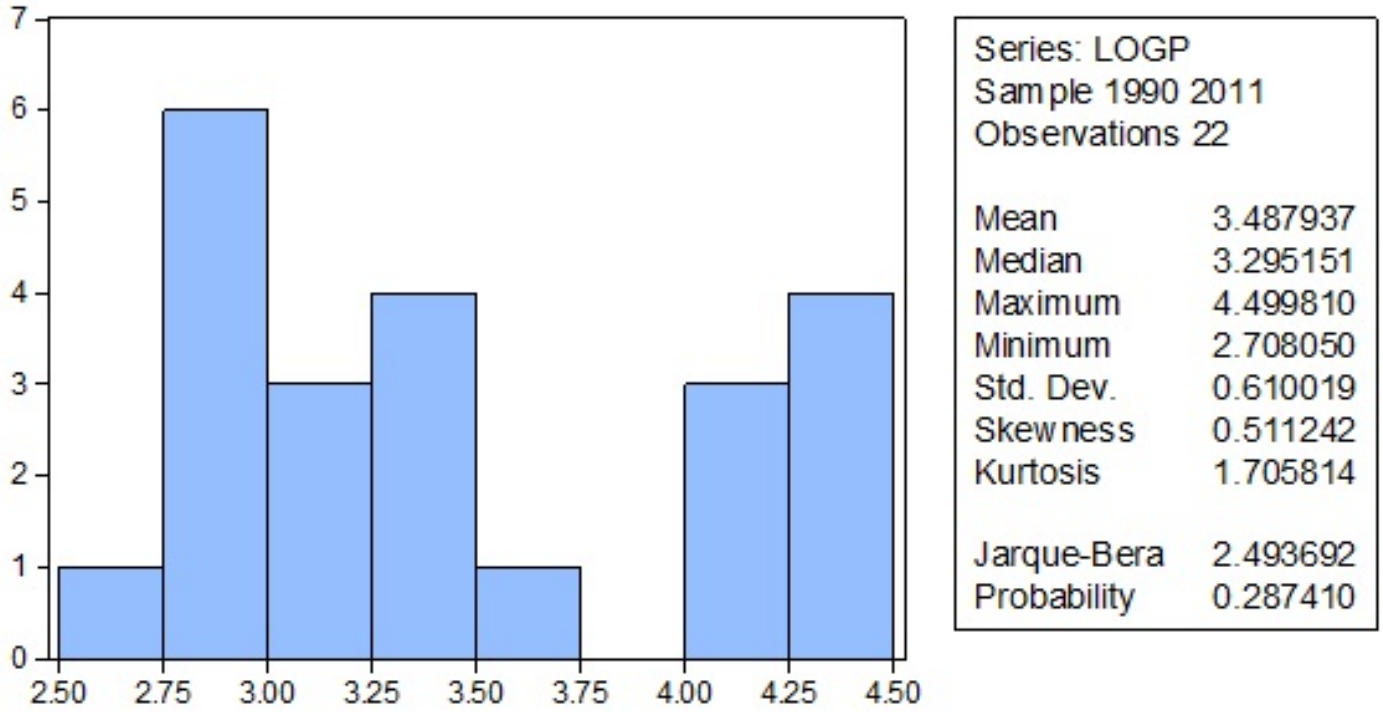


Figure : logP diagram

Econometrics analysis

First model:
Linear model in all parameters:

$$lnNi = a_0 + a_1 * ln(N_{tot}, i) + a_2 * ln(M_{tot}, i) + a_3 * ln(Ai) + a_4 * ln(Dest, i) + a_5 * ln(Pi) + u_i$$

i= 1990,1991,. . . ,2011

Test 01

Dependent Variable: LOGN
Method: Least Squares
Date: 05/08/12 Time: 09:12
Sample: 1990 2011
Included observations: 22

	Coefficient	Std. Error	t-Statistic	Prob.
C	-15.20125	7.701971	-1.973683	0.0659
LOGNTOT	0.400878	0.944294	0.424526	0.6768
LOGMTOT	1.742525	1.241648	1.403396	0.1796
LOGA	0.199839	0.284316	0.702874	0.4922
LOGDEST	0.347711	0.126066	2.758158	0.0140
LOGP	0.036651	0.210581	0.174047	0.8640

R-squared	0.890078	Mean dependent var	12.31869
Adjusted R-squared	0.855727	S.D. dependent var	0.459715
S.E. of regression	0.174615	Akaike info criterion	-0.425469
Sum squared resid	0.487845	Schwarz criterion	-0.127912
Log likelihood	10.68016	Hannan-Quinn criter.	-0.355374
F-statistic	25.91150	Durbin-Watson stat	1.377523
Prob(F-statistic)	0.000000		

Figure : Results for the first test

$\Rightarrow \log N_{tot}$ and logP seem not to be relevant

Linear regression

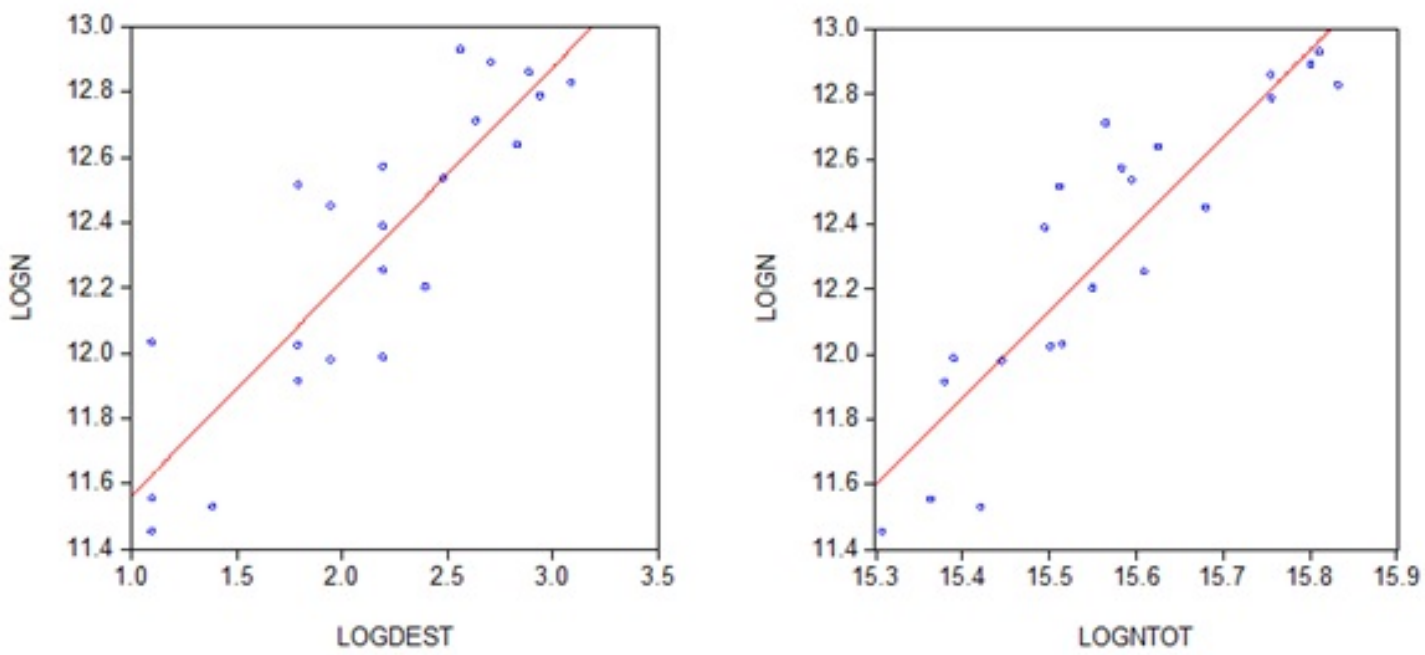


Figure : Linear Regression: logN(logN_{tot}) and logN(logDest)

Test 02

Dependent Variable: LOGN
Method: Least Squares
Date: 05/08/12 Time: 15:14
Sample: 1990 2011
Included observations: 22

	Coefficient	Std. Error	t-Statistic	Prob.
C	-14.43414	6.033756	-2.392231	0.0272
LOGNTOT	1.674396	0.398545	4.201274	0.0005
LOGDEST	0.318568	0.101114	3.150589	0.0053

R-squared	0.873774	Mean dependent var	12.31869
Adjusted R-squared	0.860487	S.D. dependent var	0.459715
S.E. of regression	0.171710	Akaike info criterion	-0.559895
Sum squared resid	0.560203	Schwarz criterion	-0.411116
Log likelihood	9.158841	Hannan-Quinn criter.	-0.524847
F-statistic	65.76177	Durbin-Watson stat	1.084355
Prob(F-statistic)	0.000000		

Figure : Results for the second test

Wald test

Wald Test:
Equation: EQ01

Test Statistic	Value	df	Probability
F-statistic	3.895425	(1, 16)	0.0659
Chi-square	3.895425	1	0.0484

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	-15.20125	7.701971

Restrictions are linear in coefficients.

Figure : Wald test for N_{tot} coefficient

Residues

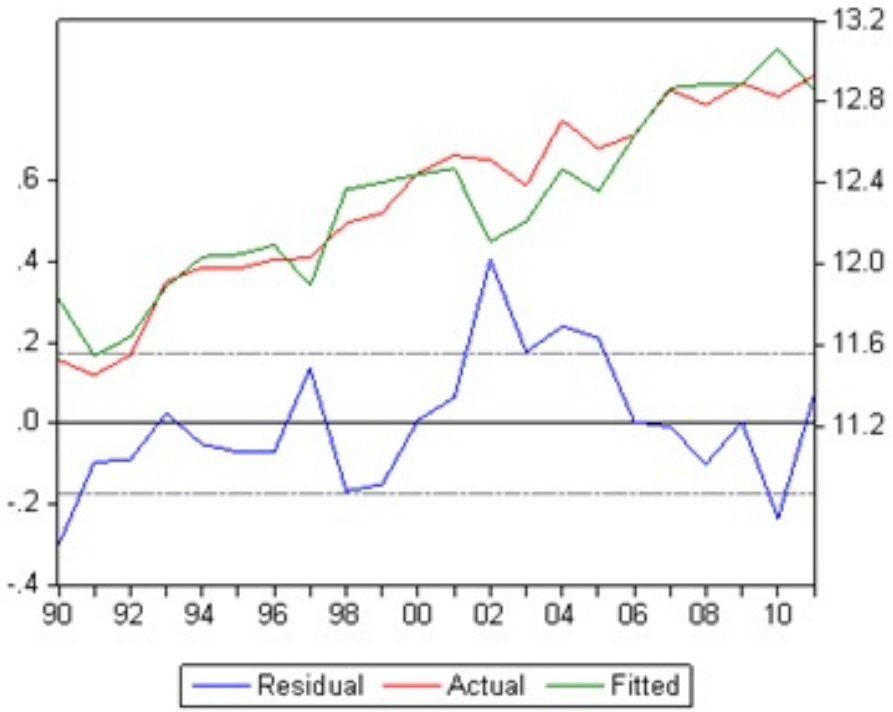


Figure : Residues Graph

Heteroscedasticity Test

H_0: homoscedasticity, H_1: heteroscedasticity

Heteroskedasticity Test: White

F-statistic	0.598592	Prob. F(5,16)	0.7017
Obs*R-squared	3.466818	Prob. Chi-Square(5)	0.6284
Scaled explained SS	2.878056	Prob. Chi-Square(5)	0.7188

Figure : Heteroscedasticity Test

High probability $\Rightarrow$ Do not reject H_0

Concluding comments

The final model :

$$logN = -14,43 + 1,67 * logN_{tot} + 0,32 * logDest$$

- Airfare price evolution
- Number of observations
- Time series data
- Another approach