

## Task 1: Is there evidence of discrimination in mortgage lending? (50%).

You are given a dataset called **Wldrg\_Mortgage\_App**, with 1989 observations on approvals and rejections of mortgage applications in a US urban area. Description of all variables is given below.

1. occ	occupancy	32. apr	appraised value
2. loanamt	loan amt in thousands	33. prop	type of property
3. action	type of action taken	34. inss	PMI sought
4. msa	msa number of property	35. inson	PMI approved
5. suffolk	=1 if property in Suffolk County	36. gift	gift as down payment
6. race	race of applicant	37. cosign	is there a cosigner
7. gender	gender of applicant	38. unver	unverifiable info
8. appinc	applicant income, \$1000s	39. review	number of times reviewed
9. typur	type of purchaser of loan	40. netw	net worth
10. unit	number of units in property	41. unem	unemployment rate by industry
11. married	=1 if applicant married	42. min30	=1 if minority pop. > 30%
12. dep	number of dependents	43. bd	=1 if boarded-up val > MSA med
13. emp	years employed in line of work	44. mi	=1 if tract inc > MSA median
14. yjob	years at this job	45. old	=1 if applic age > MSA median
15. self	self-employment dummy	46. vr	=1 if tract vac rte > MSA med
16. atotinc	total monthly income	47. sch	=1 if > 12 years schooling
17. cototinc	coapp total monthly income	48. black	=1 if applicant black
18. hexp	propose housing expense	49. hispan	=1 if applicant Hispanic
19. price	purchase price	50. male	=1 if applicant male
20. other	other financing, \$1000s	51. reject	=1 if action == 3
21. liq	liquid assets	52. approve	=1 if action == 1 or 2
22. rep	no. of credit reports	53. mortno	no mortgage history
23. gdlin	credit history meets guidelines	54. mortperf	no late mort. payments
24. lines	no. of credit lines on reports	55. mortlat1	one or two late payments
25. mortg	credit history on mortgage paym	56. mortlat2	> 2 late payments
26. cons	credit history on consumer stuf	57. chist	=0 if accnts deliq. >= 60 days
27. pubrec	=1 if filed bankruptcy	58. multi	=1 if two or more units
28. hrat	housing exp, % total income	59. loanprc	amt/price
29. obrat	other oblgs, % total income	60. thick	=1 if rep > 2
30. fixadj	fixed or adjustable rate?	61. white	=1 if applicant white
31. term	term of loan in months	62. obwhite	obrat*awhite

Wooldridge data sets: <http://fmwww.bc.edu/ec-p/data/wooldridge/datasets.list.html>

Please carry out the following tasks.

1. Use a non-linear estimators such as Probit or Logit (or both) to estimate a baseline model in which the probability of rejection depends only on racial and demographic characteristics of the applicant. Carry out post-estimation evaluation and interpret your findings. **(10 marks)**
2. Add to model (1) above a range of credit risk indicators associated with the **applicant**, re-estimate and run post-estimation tests as above. Interpret your findings and compare with those in (1) above. **(15 marks)**.
3. Add to model (2) above a range of credit risk indicators associated with the **property**, re-estimate and run post-estimation tests as above. Interpret your findings and compare with those in (1) and (2) above. **(15 marks)**.
4. Conclude by identifying the 'best' model and interpreting your findings in the light of relevant literature **(10 marks)**.

Relevant works to start with and relevant Stata routines:

Hunter, W. C., & Walker, M. B. (1996). The cultural affinity hypothesis and mortgage lending decisions. *The Journal of Real Estate Finance and Economics*, 13(1), 57-70. Available [here](#).

Robinson, J. K. (2002). Race, gender, and familial status: discrimination in one US mortgage lending market. *Feminist Economics*, 8(2), 63-85. Available [here](#) .

Kau, J. B., Keenan, D. C., & Munneke, H. J. (2012). Racial discrimination and mortgage lending. *The Journal of Real Estate Finance and Economics*, 45(2), 289-304. Available [here](#) .

Probit/Logit model specification test (linktest). See Stata documentation available [here](#).

Model performance: area under receivers operating characteristics (ROC) curve. See Stata documentation available [here](#) .

## Task 2: Testing for weak-form market efficiency and volatility (50%)

You are given the dataset *Wldrg\_NYSE*, which contains 691 weekly time-series observations on New York Stock Exchange (NYSE) stock price and returns.

Obs: 691

1. price	NYSE stock price index
2. return	$100 \cdot (p - p(-1)) / p(-1)$
3. return_1	lagged return
4. t	time trend: 1 to 691
5. price_1	price(-1)
6. price_2	price(-2)
7. cprice	price - price_1
8. cprice_1	cprice(-1)

Source: Wooldridge data sets at <http://fmwww.bc.edu/ec-p/data/wooldridge/datasets.list.html>

Drawing on the relevant theoretical and empirical literature:

1. Test for weak-form market efficiency, using four methods: serial correlation, runs, variance ratio, and unit root. **(15 marks)**
2. Comment on strengths and weaknesses of the efficient market hypothesis and the method used **(10 marks)**
3. Estimate return volatility using different ARCH and GARCH models. **(15 marks)**
4. Conclude by interpreting your findings and commenting on the strengths and weaknesses of the theory and the method used **(10 marks)**

Two relevant work to kick off with:

Degutis, A., & Novickyte, L. (2014). The efficient market hypothesis: A critical review of literature and methodology. *Ekonomika*, 93(2), 7. Available [here](#)

Pilbeam, K., & Langeland, K. N. (2015). Forecasting exchange rate volatility: GARCH models versus implied volatility forecasts. *International Economics and Economic Policy*, 12(1), 127-142. Available [here](#)

## **NOTE on producing regression output tables**

Use *esttab* to produce output tables as word files.

This is how:

Estimate model1

Type: estimates store model1 (or any meaningful name you choose)

Estimate model2

Type: estimates store model2 (or any meaningful name you choose)

Finally:

```
esttab model1 model 2 using Drive:\folder\file_name.rtf, ///  
cells(b(star fmt(3)) se(par fmt(3))) starlevels(* 0.10 ** 0.05 *** 0.01) ///  
stats (N k df_m ll aic bic) varwidth(15) modelwidth(10)
```

Notes:

- The /// are used to break long lines in the DO file. There must be a space before and after each ///
- The width can be adjusted if necessary
- The fmt(3) specifies the decimal place. 3 decimal places are OK.

The output will be stored as rtf file in the directory you specify.