Mohamed Khidher University

Faculty of economics, Commercial and Management Sciences
Department of commerce

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Exercise series N°03

Exercise 1: choose the correct answer for the following questions

1. **What is the primary difference between a probit model and a logit model?**
   a) The probit model uses the logistic function, while the logit model uses the normal cumulative distribution function (CDF).
   b) The probit model assumes a normal distribution of errors, whereas the logit model assumes a logistic distribution of errors.
   c) The probit model is used for linear regression, while the logit model is used for classification.
   d) There is no fundamental difference between the two models.
2. **In a probit model, what type of function links the independent variables to the probability of an event occurring?**
   a) Linear function
   b) Logarithmic function
   c) Normal cumulative distribution function (CDF)
   d) Exponential function
3. **Which of the following is an assumption of the probit model?**
   a) The error terms follow a standard normal distribution.
   b) The dependent variable must be continuous.
   c) The independent variables must be normally distributed.
   d) The dependent variable must have more than two categories.
4. **If the estimated coefficient in a probit model is positive, what does it imply?**
   a) The probability of the event occurring decreases.
   b) The probability of the event occurring increases.
   c) The variable is not significant.
   d) The direction of the effect cannot be determined.

5. **If a probit model is estimated as follows:** $P(Y=1/X)=\Phi(0.5+1.5X)$

   What is the probability of Y=1 when X=1?
   a) 0.9772
   b) 0.5000
   c) 0.0228
   d) 0.7500

6. **Which of the following is a common issue when interpreting probit model coefficients?**
   a) The coefficients directly represent the change in probability.
   b) The coefficients do not have a direct probabilistic interpretation.
   c) The coefficients can be interpreted in the same way as those in a linear regression model.
   d) The coefficients are always positive.
7. **Which test is commonly used to assess the overall goodness-of-fit of a probit model?**
   a) Durbin-Watson test
   b) Wald test
   c) Hosmer-Lemeshow test
   d) McFadden's R^2
8. **Which of the following distributions does the probit model assume for the error term?**
   a) Standard normal distribution
   b) Exponential distribution
   c) Logistic distribution
   d) Poisson distribution
9. **You estimate a probit model and find the following output:** Intercept: -1.2 وCoefficient on X: 2.4

What is the probability of Y=1 when X=1.0?
a) 0.8849
b) 0.1151
c) 0.5000
d) 0.7500

10. **A probit model estimates $P(Y=1|X)=\Phi(2.3X-1.1)$. If X=0.8, what is the probability of Y=1?**
    a) 0.7704
    b) 0.2296
    c) 0.5000

11. **In a probit model, a coefficient of** -0.7 **for an independent variable means:**
    a) The probability decreases, but the change depends on the standard normal distribution.
    b) The probability decreases by exactly 0.7 for every unit increase in the variable.
    c) The probability decreases by 70%.
    d) The probability is always negative.

12. **If $\beta3=-0.4\beta3=-0.4$ and X3X3 increases from 1 to 2, what happens to the probability of the event occurring?**
    a) It increases
    b) It decreases
    c) It stays the same
    d) It becomes exactly 0.5000

13. A researcher estimates a probit model with the following equation:

$Z=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3$

where: $\beta_0=-0.8$, $\beta_1=1.2$, $\beta_2=0.5$, $\beta_3=-0.4$

If $X_1=2$, $X_2=3$, and $X_3=1$, what is the predicted **Z-score** and the probability of event occurring?

a) z-score is 2.1, the probability id 0.9821

b) z-score is 1.8, the probability id 0.9641

c) z-score is 2.1, the probability id 0.9820

d) z-score is 1.8, the probability id 0.9821

Exercise 2

A bank wants to predict whether a loan applicant will default on their loan based on: **Credit Score (X1)** and **Loan Amount (X2)**

Credit Score (X1)	Loan Amount	Default
600	30	1
650	25	1
700	15	**1**
750	10	0
720	12	0
680	20	1
710	18	**1**
640	28	1
670	22	1
730	14	**1**
690	19	**1**
620	27	1
740	13	**0**
660	24	1
780	9	0
630	26	1
760	11	**1**
725	17	0
605	31	1
675	23	1
745	12	**1**
695	21	0
715	16	0
655	29	1
785	8	**1**
610	32	1
770	10	0

725	18	0
640	30	1
720	14	0

1. Write the Probit model equation to predict the probability of loan default ;
2. Estimate the parameters, interpret the results;
3. If a borrower has a **Credit Score of 650** and a **Loan Amount of $25,000$**, what is the predicted Z-score
4. Predict Default for a New Applicant, who has: **Credit Score =800, Loan Amount = $15,000$**
5. If an applicant **increases** their loan amount from **$10,000$ to $20,000$**, and the coefficient for Loan what happens to the predicted Z-score?
6. If a **Credit Score = 750** and a **Loan Amount = $10,000$**, what is the predicted **Z-score** and probability of default? (Use $\Phi(-0.3) =$ **0.3821**)