Sub LagrangeMultiplierTest()

Dim ws As Worksheet

Dim lastRow As Long

Dim i As Long, col As Long

Dim residuals() As Double

Dim laggedResiduals() As Double

Dim n As Long

Dim sumXY As Double, sumX2 As Double, sumY2 As Double

Dim R2 As Double, LM As Double

Dim columnsToTest As Variant

Dim criticalValue As Double

Dim resultCol As Long

' ÔíÊ ÝÚÇá Ñæ ÇäÊÎÇÈ ˜ä

Set ws = ActiveSheet

' ÊÚÑíÝ ÓÊæäåÇ (A ÈÑÇí u¡ B ÈÑÇí t¡ C ÈÑÇí s¡ D ÈÑÇí r)

columnsToTest = Array("U", "T", "S", "R")

' ãÞÏÇÑ ÈÍÑÇäí ÈÑÇí ÓØÍ 5% æ df=1

criticalValue = 3.841

' ÓÊæä ÔÑæÚ ÈÑÇí ËÈÊ äÊÇíÌ (E=5)

resultCol = 5 ' ÓÊæä E

' ÍáÞå ÈÑÇí åÑ ÓÊæä

For col = LBound(columnsToTest) To UBound(columnsToTest)

' íÏÇ ˜ÑÏä ÂÎÑíä ÑÏíÝ ÏÇÏååÇ ÏÑ ÓÊæä ÝÚáí

lastRow = ws.Cells(ws.Rows.Count, columnsToTest(col)).End(xlUp).Row

If lastRow < 3 Then

MsgBox "ÏÇÏå ˜ÇÝí äíÓÊ ÏÑ ÓÊæä " & columnsToTest(col), vbExclamation

Exit Sub

End If

n = lastRow - 1

' ÂÑÇíååÇ Ñæ ÇäÏÇÒå ÈÏå

ReDim residuals(2 To lastRow)

ReDim laggedResiduals(2 To lastRow)

' ãÍÇÓÈå ÈÇÞíãÇäÏååÇ

For i = 2 To lastRow

If IsNumeric(ws.Cells(i, columnsToTest(col)).Value) And Not IsEmpty(ws.Cells(i, columnsToTest(col)).Value) Then

residuals(i) = ws.Cells(i, columnsToTest(col)).Value - Application.WorksheetFunction.Average(ws.Range(columnsToTest(col) & "2:" & columnsToTest(col) & lastRow))

Else

residuals(i) = 0

End If

Next i

' ãÍÇÓÈå lagged residuals

For i = 3 To lastRow

laggedResiduals(i) = residuals(i - 1)

Next i

' ÑÑÓíæä ÈÇÞíãÇäÏååÇ

sumXY = 0

sumX2 = 0

sumY2 = 0

For i = 3 To lastRow

sumXY = sumXY + residuals(i) \* laggedResiduals(i)

sumX2 = sumX2 + laggedResiduals(i) \* laggedResiduals(i)

sumY2 = sumY2 + residuals(i) \* residuals(i)

Next i

' ãÍÇÓÈå R^2 æ LM

If sumX2 <> 0 And sumY2 <> 0 Then

R2 = (sumXY \* sumXY) / (sumX2 \* sumY2)

LM = n \* R2

Else

LM = 0

End If

' ËÈÊ äÊÇíÌ Êæí ÔíÊ

ws.Cells(1, resultCol).Value = "LM for " & columnsToTest(col) ' ÚäæÇä

ws.Cells(2, resultCol).Value = Round(LM, 4) ' ãÞÏÇÑ LM

If LM > criticalValue Then

ws.Cells(3, resultCol).Value = "ÎæÏåãÈÓÊí æÌæÏ ÏÇÑå (LM > " & criticalValue & ")"

Else

ws.Cells(3, resultCol).Value = "ÎæÏåãÈÓÊí äíÓÊ (LM ? " & criticalValue & ")"

End If

' ÓÊæä ÈÚÏí ÈÑÇí äÊíÌå ÈÚÏí

resultCol = resultCol + 1

Next col

' íÇã ÇÊãÇã

MsgBox "ÂÒãæä ÈÑÇí åãå ÓÊæäåÇ ÇäÌÇã ÔÏ. äÊÇíÌ ÏÑ ÓÊæäåÇí E Èå ÈÚÏ ËÈÊ ÔÏåÇäÏ.", vbInformation

End Sub