In this assignment, we work on paper that analyzes the factors affecting the growth rate of manufacturing sector in the United States. The paper and the data sets we use (PS08-Kliesen2013) are on ELMS.
Kliesen, Kevin L., and John A. Tatom. 2013. "U.S. Manufacturing and the Importance of International Trade: It's Not What You Think" Federal Reserve Bank of St. Louis Review. 95(1), 27-49.

The assignment has two parts. In part 1, you have to read the paper and answer the questions.
In part 2, you should use Stata. You need to write a do file that contains all the codes, and then generate the log file.
(In part 2, copy and paste the results from Stata. Use the font Lucida Console to keep the format of Stata results.)
You must upload this file (**HW3.doc**) with answers as well as **the log file** on ELMS.

Part 1:

Read the paper and answer the following questions:

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Read the paper and answer the following questions:

a. What are the main questions the paper asks?

The study primarily explores the dynamics of the U.S. manufacturing sector, focusing on the period following the 2008-09 recession. Key questions addressed in the study include the reasons behind the decline in manufacturing employment despite the sector's impressive comeback, the role of manufacturing productivity growth in output and employment, the impact of manufacturing-led economic growth on services and employment, the historical context of deindustrialization, and the influence of globalization, outsourcing, and offshoring on manufacturing trends

b. What is the dependent variable in these regressions? What are the explanatory variables? What are the control variables?

The explanatory variables in the regression in page 40 were variables like Foreign GDP, unemployment rate, real imports, real exports, etc, while the dependent variable was the log change of US manufacturing output.

c. What is the main finding of the paper. Where in the paper can you find evidence for the main finding. How do the authors justify their findings?

The main finding of the paper suggests that imports play a critical and positive role in boosting manufacturing output in the United States, more so than exports. The paper argues that the importance of imports to domestic manufacturing performance cannot be overstated, with goods imports constituting more than 100 percent of manufacturing value added and accounting for over half of the gross output and sales of domestically produced products. The authors challenge the idea that limiting imports would boost manufacturing growth and justify their findings by emphasizing the significant contribution of imports to the overall health and productivity of the U.S. manufacturing sector.

Part 2:

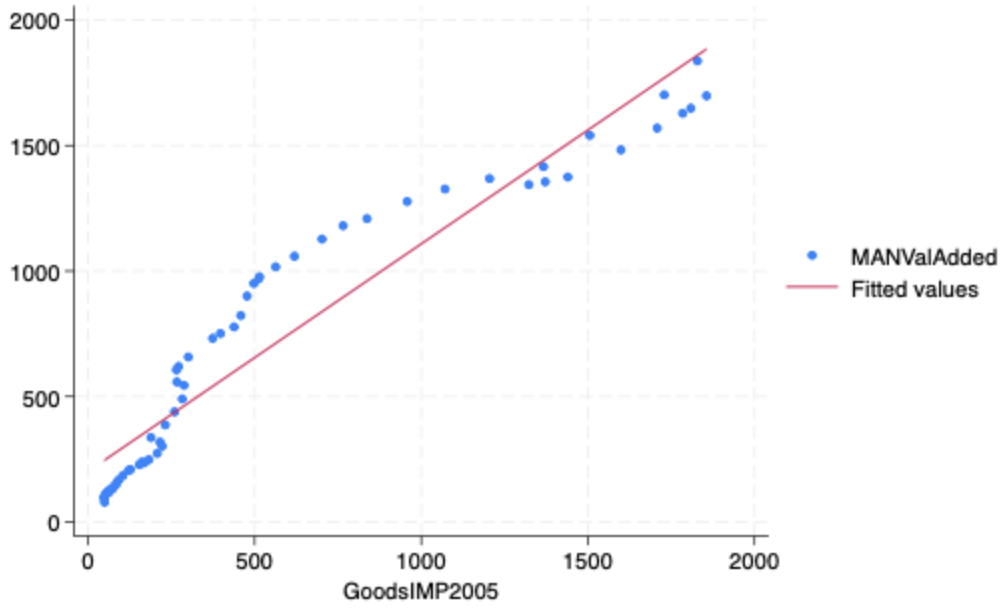
The variables and their description are as follows:

Annual data (PS08-Kleiser2013)	
Year	Year
ExptoChina	Nominal values of U.S. export to China
ExotoWorld	Nominal value of total U.S. export
MANValAdded	Manufacturing value added. Nominal value.
MANPriceIndex	Manufacturing price index (2005=100)
GDPPriceIndex	GDP price index (2005=100)
GoodsExp2005	U.S. export of goods, billion dollars, real (2005 chained price index)
GoodsImp2005	U.S. import of goods, billion dollars, real (2005 chained price index)
USGDPReal	U.S. real GDP
MANRealInd	U.S. Manufacturing production, indexed (2005=100)
DollarNom	Nominal value of dollar (trade-weighted)
DollarReal	Real value of dollar (trade-weighted)
OilNom	Nominal oil price (Refiners' acquisitions price)
FuelReal	Real price of fuel
EquiptSoft	Equipment and software fixed private investment
ExpReal	Real goods export
ImpReal	Real goods import

1. The data we use in this part is annual data. Use the following commands to define the variable as annual data:

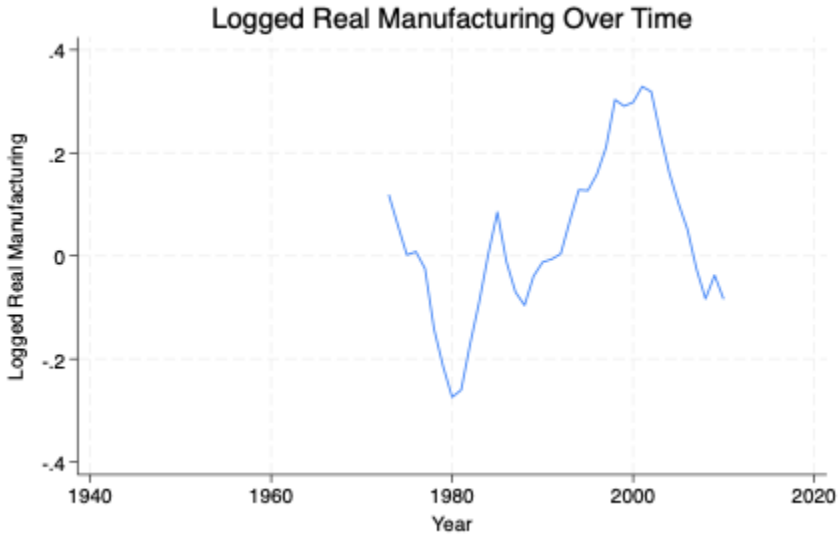
tsset year

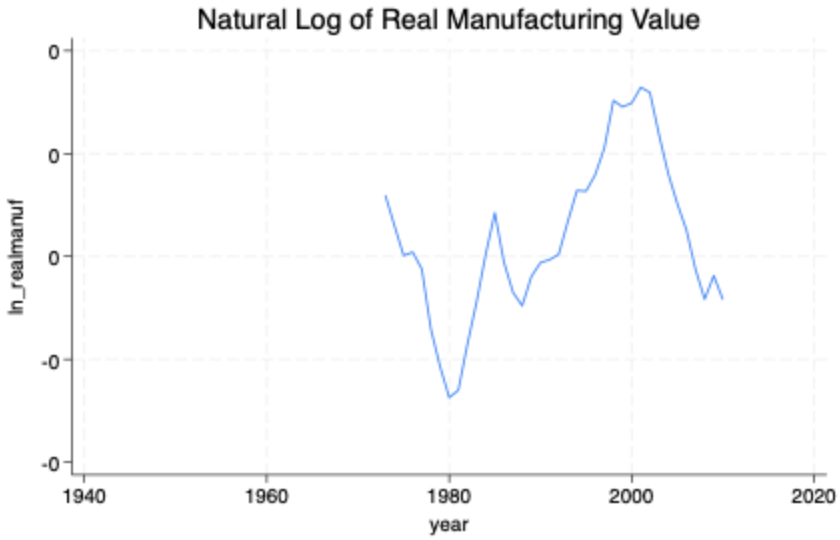
Then draw a graph of manufacturing production (MANValAdded) over time.



Calculate the real manufacturing by dividing the nominal values by the price index (). Draw the graph of real manufacturing over time.

Calculate the natural log of real manufacturing value added. Draw the graph over time.





Copy and paste the graphs below and compare them.

Then discuss the possibility of non-stationarity in the data.

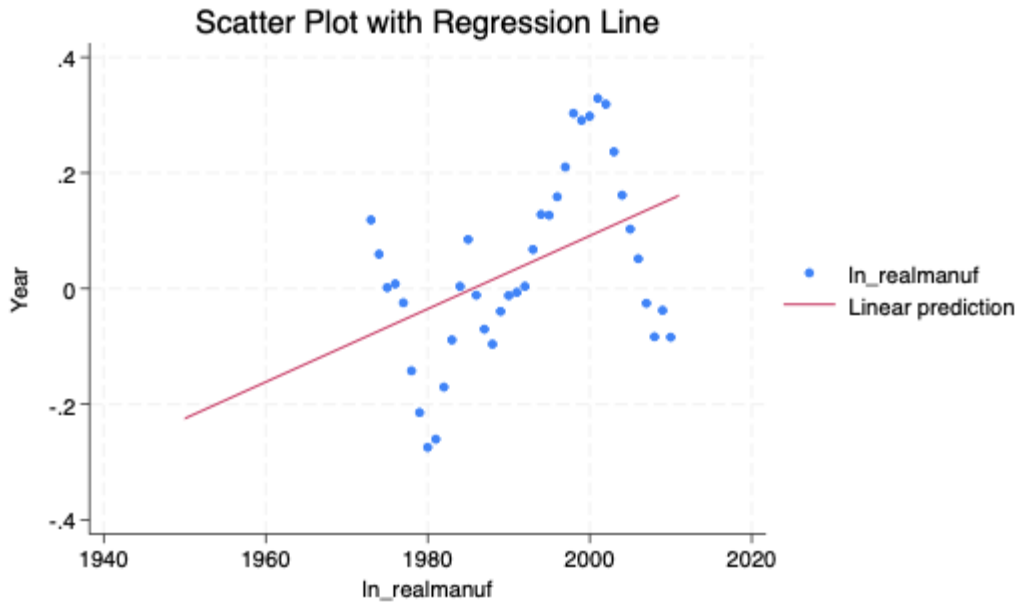
2. Design and run a regression that discovers the existence of a linear time trend in the log data. Copy and paste the results below and explain.

. regress ln_realmanuf year

```
      Source |       SS           df       MS      Number of obs   =        38
-------------+----------------------------------   F(1, 36)        =      8.82
       Model |   .18231212         1   .18231212   Prob > F        =    0.0053
    Residual |  .744542228        36  .020681729   R-squared       =    0.1967
-------------+----------------------------------   Adj R-squared   =    0.1744
       Total |  .926854348        37  .025050118   Root MSE        =    .14381

------------------------------------------------------------------------------
ln_realmanuf | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        year |   .0063165   .0021274     2.97   0.005     .0020018    .0106311
       _cons |  -12.54165   4.236878    -2.96   0.005    -21.13444   -3.948863
------------------------------------------------------------------------------
```

Calculate the predicted values and the residuals. Draw the data and the fitted line in one graph and the residual in another graph. Copy and paste the graphs below.



3. The residual from the above regression is the "detrended data" we would like to work on to build a model (you can call it y and rename it to y if you like). Run an AR(1) model on y (run a regression of y on the first lag of y. The first lag of y in Stata is shown by L1.y).
Copy and paste the regression results below. Interpret the results. Is the past a significant factor is explain the data?

. regress lMANRRes L1.lMANRRes

```
      Source |       SS           df       MS      Number of obs   =        37
-------------+----------------------------------   F(1, 35)        =    161.11
       Model |   .57854604         1   .57854604   Prob > F        =    0.0000
    Residual |  .125682007        35  .003590914   R-squared       =    0.8215
-------------+----------------------------------   Adj R-squared   =    0.8164
       Total |  .704228047        36   .01956189   Root MSE        =    .05992

------------------------------------------------------------------------------
   lMANRRes | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
------------+-----------------------------------------------------------------
   lMANRRes |
      L1. |   .9181984   .0723386    12.69   0.000     .7713432    1.065054
          |
      _cons |  -.0112683   .0098625    -1.14   0.261    -.0312902    .0087536
------------------------------------------------------------------------------
```

This indicates that the autoregressive coefficient for the AR(1) model, represented by the variable L1.lMANRRes is highly significant. The coefficient is 0.9182, with a standard error of 0.0723, resulting in a t-statistic of 12.69 and a p-value of 0.000, which suggests strong evidence against the null hypothesis of no autoregressive effect. It also signifies a positive correlation with lMANRRes, Therefore, the past values of the detrended variable are indeed

a significant factor in explaining the current data, and the autoregressive term is an important contributor to the model's predictive power.

4. Run a model with the first and second lag (L2.y). Run another model with the first, and second and third lag (L3.y). Compare these two models with the model in the previous question. How many lags seems appropriate? Explain. Copy and paste the regression results below (you may create a table containing the three models and use it.)

```
 regress L1.lMANRRes L2.lMANRRes

      Source |       SS           df       MS      Number of obs   =        37
-------------+----------------------------------   F(1, 35)        =    161.11
       Model |   .57854604         1   .57854604   Prob > F        =    0.0000
    Residual |  .125682007        35  .003590914   R-squared       =    0.8215
-------------+----------------------------------   Adj R-squared   =    0.8164
       Total |  .704228047        36   .01956189   Root MSE        =    .05992

------------------------------------------------------------------------------
 L.lMANRRes | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   lMANRRes |
        L2. |   .9181984   .0723386    12.69   0.000     .7713432    1.065054
            |
      _cons |  -.0112683   .0098625    -1.14   0.261    -.0312902    .0087536
------------------------------------------------------------------------------


. regress L1.lMANRRes L2.lMANRRes L3.lMANRRes

      Source |       SS           df       MS      Number of obs   =        36
-------------+----------------------------------   F(2, 33)        =    124.74
       Model |  .604691053         2  .302345527   Prob > F        =    0.0000
    Residual |  .079986367        33  .002423829   R-squared       =    0.8832
-------------+----------------------------------   Adj R-squared   =    0.8761
       Total |   .68467742        35  .019562212   Root MSE        =    .04923

------------------------------------------------------------------------------
 L.lMANRRes | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   lMANRRes |
        L2. |   1.471089   .1408426    10.44   0.000     1.184543    1.757636
        L3. |  -.6009411   .1408555    -4.27   0.000    -.8875137   -.3143684
            |
      _cons |  -.0037523   .0083447    -0.45   0.656    -.0207297    .0132251
------------------------------------------------------------------------------
```

It is most likely better to have as little lags as possible.

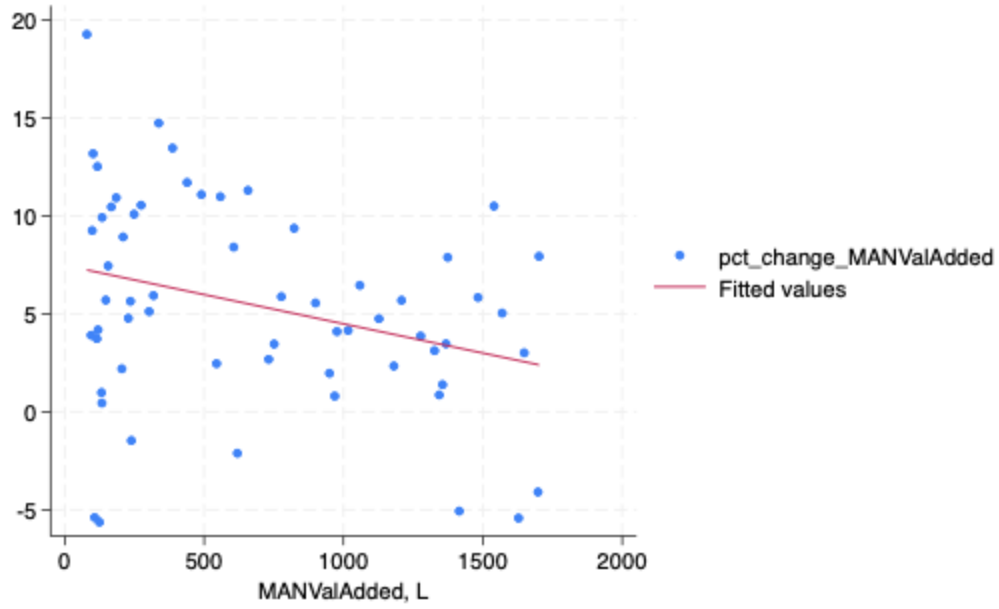
5. We like to draw the ACF and PACF of the data. Use the command corrgram with the name of your variable (y). Copy and paste the results below.
Explain the ACF and PACF and compare them with Figures 11.6 and 11.7 in the lecture notes. Is there any evidence for AR model? How many lags is appropriate? Explain.

corrgram lMANRRes

LAG	AC	PAC	Q	Prob>Q	-1 0 1 [Autocorrelation]	-1 0 1 [Partial autocor]
1	0.8446	0.9182	29.303	0.0000	|------	|-------
2	0.6256	-0.6009	45.828	0.0000	|-----	----|
3	0.3744	0.0041	51.915	0.0000	|--	|
4	0.1316	-0.2007	52.69	0.0000	|-	-|
5	-0.0767	-0.1804	52.961	0.0000	|	-|
6	-0.2156	-0.0052	55.168	0.0000	-|	|
7	-0.2810	-0.0376	59.039	0.0000	--|	|
8	-0.2839	-0.2345	63.121	0.0000	--|	-|
9	-0.2688	-0.2996	66.907	0.0000	--|	--|
10	-0.2645	0.1188	70.706	0.0000	--|	|
11	-0.2472	0.2022	74.147	0.0000	-|	|-
12	-0.2363	-0.4804	77.41	0.0000	-|	---|
13	-0.2370	-0.1000	80.826	0.0000	-|	|
14	-0.2423	-0.2364	84.544	0.0000	-|	-|
15	-0.2238	-0.0695	87.853	0.0000	-|	|
16	-0.1885	-0.2045	90.307	0.0000	-|	-|
17	-0.1661	-0.0677	92.305	0.0000	-|	|

The ACF shows a strong positive correlation at lag 1 (AC = 0.8446), which gradually decreases for subsequent lags but remains statistically significant up to lag 17. The PACF also reveals a sharp drop after lag 1, indicating that most of the autocorrelation at higher lags can be explained by the intervening lags. In this case, an AR(1) model may be reasonable due to the sharp decline in autocorrelation after lag 1.

6. Find the annual growth rate of manufacturing real value index (MANRealInd), real import, and real export (ExpReal and ImpReal). [Use the formula: (new-old)*100/old, where old is the first lag of the variable.]
Run a regression of manufacturing growth rate on export growth rate. Draw the scatter graph and fitted line. Copy and paste the graph below. It should look like Figure 10 in the paper.
Explain if export growth is an important factor for manufacturing growth. Do the results support the theory the authors suggest?



.
. regress pct_change_MANValAdded

Source	SS	df	MS	Number of obs	=	61
Model	0	0	.	Prob > F	=	.
Residual	1655.0783	60	27.5846383	R-squared	=	0.0000
Total	1655.0783	60	27.5846383	Adj R-squared	=	0.0000
				Root MSE	=	5.2521

pct_change~d	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
_cons	5.414168	.6724635	8.05	0.000	4.069041	6.759295

7. Run a regression of manufacturing growth rate on import growth rate. Draw the scatter graph and fitted line. Copy and paste the graph below. It should look like Figure 13 in the paper.
Explain if import growth is an important factor for manufacturing growth. Do the results support the theory the authors suggest?

regress MANValAdded GoodsIMP2005

Source	SS	df	MS	Number of obs	=	62
Model	17104650.9	1	17104650.9	Prob > F	=	0.0000

```
    Residual |  1694564.51        60  28242.7419   R-squared       =    0.9099
-------------+----------------------------------   Adj R-squared   =    0.9084
       Total |  18799215.4        61  308183.859   Root MSE        =    168.06

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 MANValAdded | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
GoodsIMP2005 |   .9064459   .0368331    24.61   0.000     .8327687     .980123
       _cons |   201.5836   29.6742     6.79   0.000     142.2263    260.9408
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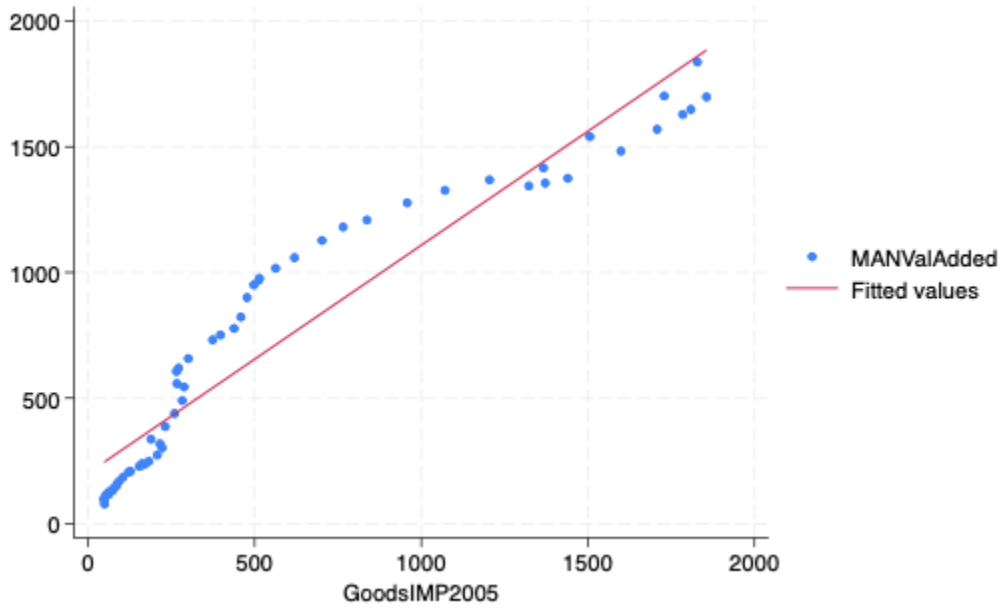

Overall, the results suggest a strong positive relationship between Goods Imports in 2005 and Manufacturing Value Added, supporting the notion that the two variables are closely associated. Meaning, imports always result in positives for the economy as imports is an important factor for manufacturing growth.