Project Report

ANALYSIS OF EFFECTS OF CHANGE IN TECH PULSE INDEX IN ECONOMIC CONDITIONS OF SILICON VALLEY

Course: Economic Data Analysis using STATA (ECO5435)

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Contents

Executive Summary and Key Findings

This report examines dynamics of High technology industries and its effect on economy of Silicon Valley, California, which includes overall employment rate, change in housing prices and consumer sentiment in geographical area of interest. Silicon Valley's economy closely tied to tech industries growth which has effect on employment creation, more median income, better economic condition.

Additionally, this report examines technology industry trends as they relate to the recessions and explains more on 2000's recession. Recessions had a negative impact on components of technology industries, negative growth in job creation in computer and electronic manufacturing. The tech bubble burst is a worst phase of American tech industries in early 2000s which badly affected the economy around Silicon Valley. The report examines growth in high technology and information industries and its innovations, and how it has helped in reducing overall unemployment rate, improving the overall economic conditions.

Key Findings include:

1. Tech Industry downfall in early 2000's recession and 2008's great recession caused loss of thousands of jobs. There is a statistically significant relationship between the Tech Pulse Index and unemployment rate in Silicon Valley.
2. Economic conditions in Silicon Valley and change in high-technology industry are correlated, and the regression values are statistically significant.
3. Technology industry growth change has statistically significant association with home prices in Silicon Valley.
4. Consumer sentiment in Silicon Valley has hit its bottom during the dotcom bust and during great economic depression of 2008.
5. Technology industry is growing at steady rate after the recovery from 2008 recession. The overall private investment in tech industry has grown near double after 2010.
6. Unemployment rate in Silicon Valley was highest during 2000s recession.
7. Technology Industry growth is negative in the latest quarter i.e., Q1, 2020.
8. There is slump in economic condition, employment number and Tech Pulse Index after January 2020 amid national wide lockdown of cities.

Introduction

US economy has the longest sustained expansion in the world. The high-tech information Technology industry share in 20 trillion dollars US economy is huge and its contribution is more than 6% according to data from US Bureau of Economic Analysis (BEA). Growth of high-tech companies over the year effected all sectors including and not limited to Manufacturing, Agriculture, Finance, insurance and real estate and government. It has helped in transformation of every industry, improved living standards and more international trade. For the growth of these high-tech companies, a work environment with spirit of cooperation, professional network is needed and one of such places is Silicon Valley. Silicon Valley is technology headquarters of more than 30 businesses in the Fortune 1000, and thousands of startup companies. With $128,308 per capita in annual gross domestic product, Silicon Valley residents out-produce almost every nation on the planet. The increasing GDP per capita indicates economic development and here in this research project we will address the how change in Tech Pulse Index of IT sector correlates to economic conditions and peoples' life in Silicon Valley.

Why it is important?

The displacement effect theories suggest that response to period of crisis significantly influence fluctuations in public policies and economic relieve packages. Macroeconomic indicators such as consumer sentiments, unemployment rate and industrial indicator indices are separate elements of economy yet highly relevant to each other. The Tech Pulse Index is an index of activities track in U.S. information technology sector. It summarizes the health of this sector and help us understand the variation in investments in IT goods, consumption of personal computers and software, employment in IT sector, as well as industrial production and shipments. From this index study we can have more information on effect on unemployment rate, economic condition, house price variation, consumer sentiment. Keeping track of these macroeconomic indicators and studying them are important and thus developing a regression model will help us to find relationship between these variables. This research project will helps in identifying the effects of the variation in tech industry in past and developing a good predictive model will help government to look into tech industry crisis in advance to take measures to avoid any severe effect on people especially around Silicon Valley where most IT industries and startup companies are set up. One of such important factors which may affect people is unemployment rate. When a country slips into recession the government – working through Federal Reserve- works to reduce unemployment by boosting economic growth through expansionary monetary policy. Hence our project will analyze tech industry effect on unemployment, consumer sentiment, housing prices and overall economic conditions which in turn helps government to make relevant policies in favor of country and its population if it is done properly.

Research Questions

In this project we will look into answer following questions:

1. Does tech industry downfall have any effects on unemployment rate over the years in Silicon Valley?
2. How economic condition in Silicon Valley depends on tech industry?
3. How much tech industry growth have effect on housing prices in Silicon Valley?
4. How much consumer sentiment related to variation in tech industry growth?

Data and Methods

In our research we use linear regression and correlation techniques determine how significantly variables related to economic conditions in Silicon Valley depends on change in activities of information technology industries. The reason behind using linear regression method is that it is simple, easy and if statistically found significant, we can then develop better prediction methods with reduced errors. The Tech sector's importance to the U.S. economy makes it necessary to understand changes in high-tech activities on a timely manner. However, these activities are very difficult to track as it is a very broad and diffuse entity in which different economic indicators can provide conflicting signals about the direction of activity. In recent years, for example, investments in information technology, software development has an increasing trend despite a continued shrinkage in high-tech employment. The reason for this explained in later part.

Since we are interested in analyzing US Tech Pulse Index and its effect on economic condition in Silicon Valley, we use the statistical data available from Federal Reserve Economic Data. The first type of data variables used in our models consists of industry activity indicators for California State which we assume essentially gives data of Silicon Valley. Second, macroeconomic indicators like Home Price Index, GDP for California, Investments in Private IT sector and Unemployment number for state of California. Macroeconomic indicators describe characteristics of the California State economy over time. Industrial activity indicator we are interested in is Tech Pulse Index. Most of the data are available on quarterly basis which are as recent as March 2020. The description of each variable is given below.

The Tech Pulse Index [SFTPGR12M159SFRBSF] is a coincidence index of activity in the U.S. information technology sector. The index interpreted as the health of the tech sector. The indicators help to compute the index include investment in IT goods, consumption of personal computers and software, employment in the IT sector, industrial production of the technology

sector, and shipments by the technology sector. The descriptive statistic values of Tech Pulse are shown in Table 1. There are 120 quarterly data available for Tech Pulse Index with mean of 73.07. It is seasonally adjusted, taken moving average and set 100 on Jan 2000. Standard deviation is recorded as 22.86. The change in Tech Pulse Index is shown in Figure 1.

Home Price Index [SFXRSA]: This index gives the variation in house prices over the years in Silicon Valley. This index is constructed from year 1987. In most countries including U.S., housing is considered as an investment for retirement. Hence, tracking housing prices over the year will help us to understand the economic condition and people sentiment during recession. The descriptive statistics values of Home price index are given in Table 1. There are 120 quarterly data are available for our study from 1990. Index has a mean of 144.2. It is seasonally adjusted, taken moving average and set to 100 on Jan 2000. Standard deviation is recorded as 63.70. Figure 2 shows us variation in Home Price Index over the years.

Unemployment Rate in California [CAUR] data provides us information on unemployment in California state from 1971 to January 2020. Unemployment data is crucial for government policies and also gives us an idea about current economic situation. In our analysis we look at variation in unemployment rate in California State and compare with unemployment rate change due to change in growth of technology industry. We assume this data is relatable to Silicon Valley. We are curious about the effect of recessions on tech industry and unemployment rate together. The descriptive statistics values of Unemployment Rate in California are given in Table 1. For our study we use 120 quarterly data are available from 1990. Index has a mean of 7.10. Standard deviation in unemployment rate is recorded as 2.20 in California. Unemployment rate is picturized in Figure 3 for your reference.

Economic Conditions Index for San Francisco [SFCAGRIDX] shows economic stability Silicon Valley. This index measures average economic growth in the Silicon Valley area and recorded from 1990 recorded on monthly basis. It is computed using a dynamic factor model that includes 12 variables measuring various aspects of economic activity in the California metropolitan areas. The index is calibrated to Gross Metropolitan Product (GMP) growth and variance to allow for comparison across metro areas in United States. The descriptive statistics values of Economic Conditions Index for California are given in Table 1. For our study we use 120 moving average quarterly data from 1990. Index has a mean of 2.76. Standard deviation is recorded as 2.94 for California. Figure 5 Shows change in economic conditions over the years from 1990.

Surveys of Consumers, University of Michigan[Consumer Sentiment Index], data contains consumer sentiment variation from 1966 to 2019. The University of Michigan Consumer Sentiment Index is a consumer confidence index published monthly by the University of Michigan. The index is normalized to have a value of 100 in December 1966. This index helps to assess near-time consumer attitudes on the business climate, personal finance, and spending. We are interested in effect of technology industry downfall during recession and its effect on consumer sentiment. The descriptive statistics values of consumer sentiment Index for are given in Table 1. For our study we use 120 moving average quarterly data from 1990. Index has a mean of 87.38. Standard deviation is recorded as 12.18. The index is normalized to have a value of 100 in December 1966. Figure 5 shows the Consumer Sentiment Index over the years.

Unemployed Persons in Silicon Valley [LAUMT064194000000004] is data on unemployed person through household survey. Unemployed persons are all persons who had no employment during the reference week, were available for work, except for temporary illness, and had made specific efforts to find employment some time during the 4 week-period ending with the reference week. Persons who were waiting to be recalled to a job from which they had been laid off need not have been looking for work to be classified as unemployed. This data will help us to identify unemployment rate change in tech industry and the overall unemployment rate in California. The descriptive statistics values of Unemployed Persons number are given in Table 1. For our study we use 120 moving average quarterly data from 1990. Index has a mean of 52526. Standard deviation is recorded as 20679.86.

Real Gross Private Domestic Investment (GPDIC1) is data on private domestic investments in technology over the years. This helps us to understand relation between investments made over the decade and technology industry over the years. The descriptive statistics are shown in Table 1. The data has many missing values and voids in the entry so we will consider only 75 quarterly data for our study. From the table, we can see that mean of this data set is 415.65 billion with standard deviation of 189.79 billion US dollars. The Figure 6 shows us the constant increase in investment past recession.

Results, Trends and Interpretations Analysis

Tech-Pulse Index provides a fair account of sector's development over past 2 decades. First examination of index reveals between 1995 and Q1 of 2000, the tech industry enjoyed a massive

growth of 320% shown in figure 1. The growth was due to adoption of internet and shift towards information age. In 1993, Mosaic and subsequent web browsers gave computer users access to the World Wide Web also known as www. Between 1990 to 2000 ownership of computers and users with internet access were increased massively in US. This helped in revolutionizing tech industry but high speculations about valuations of these internet-based companies led to increased blind investments without proper caution and finally to dotcom bust in 2002. Many companies filed for bankruptcy and laid off thousands of employees. Then the recovery was slow with a but yet significant till 2008 with 48% growth. The great recession of 2008 came late to Silicon Valley, but according to New York Times columnist Laurie J. Flynn, the region was bracing a tough year. Index shows drop in Tech activity from Q3 2008 to Q1 2009 hits a low of 67 Index point which was decrease of 27% from the peak of Q1 2008. From the study of the reasons for recession effect in Silicon Valley, it was found that lack of enthusiasm in venture capital investments due to global slow-down in economy led cash crunch companies to bankruptcy and employment loss.

Next, when we analyzed variation in tech pulse and unemployment rate, unemployment rate in California were highest in year 2002 and year 2008 when overall unemployment rate in US is also at its peak. The comparison can be seen in Figure 8. The close examination of Tech Pulse Index levels from Q1 1990 to Q1 2020 suggests that the indexes accurately captures the variation in unemployment rate. Our regression model shown in Table 2 and correlation Table 3, provides evidence of strong correlation between change in Tech Pulse Indices and unemployment rate. The R-square value is 25.39% which has statistical importance. Hence for every unit increase in change in Tech Pulse Index, unemployment decreases by 0.56 units when adjusted for all other variables. Starting of year 1990, the dot-com companies were growing aggressively and were hiring employees at a record rate which is clearly visible in the unemployment trend shown in Figure 3. From 1995, the unemployment rate was decreasing and reached its bottom to 4.75% in Q4 2000. But in Q2 of 2001, the signs of recession started, many of the tech companies which were spending shortage of cash were trying to cut employees force to cut cost. From Figure 8, it is clear that change in unemployment rate was highest when the Tech Pulse Index reached its low. Unemployment rate took almost 4 years to decrease to 5% from the 2002 recession. This trend of loss of jobs were repeated in the time of great recession of 2008. The early indicators of the unemployment were due to amid global slowdown but later even after the economy was back in track, it was observed that tech companies were not hiring more employees. The reason was tech companies were adopting technologies and new development and adoptions in

software industries like artificial intelligence, automation of work helped companies to optimize their work force. From 2012, tech industry had a steady state, unemployment rate is declining.

Our examination of Tech Pulse Index and Private domestic investment in software industry suggests that after 1990, there is increasing trend in investments and it is nearly quadrupled over 3 decades. But to be true, all investments made doesn't bring good returns. Looking at the Figure 1 we can observe that tech industry growth rate doesn't have a linear fit. Referring to Figure 7, tech Industry activity was at peak at year 2000-2001, just before the tech bubble bust in 2002. Then as we thought tech industry was gaining momentum, the industry growth was again hindered by great recession of 2008. After the recovery from 2008's great recession, we can observe a growth in tech industry. The index crossed its base set point=100 in 2019 showing a recovery from the recession's affect.

Economic Condition Index shown in Figure 4 gives a realistic picture on economic situation and can act as an indicator of upcoming recessions. We can observe the variation from 1990 to 2020, which clearly indicates sharp drop in economic condition year before recession of 2000s and the great recession of 2008. Figure 9 shows a correlation between Tech Pulse Index and Economic condition. Our regression model shown in Table 4 and correlation shown Table 5 re-confirms this and correlation value is 55% which is high. From our regression model, we can see that more than 30% variation in change in economic condition is explained by Tech Pulse Index. Early signs of recession can be seen by looking at the decreasing economic condition index. Hence for every unit increase in change in Tech Pulse Index, the economic condition index increases by 0.42 units when adjusted for all other variables.

The decreasing economic condition is also evident by the decreasing Home Price Index in California which is clearly shown by Figure 10. Buying a House is considered as a valuable investment around the world. The decrease in the home price index shows less people are buying houses or economic conditions of people are not in good shape. Slowdown in housing market is generally shows a depressed economy. 48% decrease in home price index was highest in Q1 2009, shows a great economic depression. Our regression model and correlation table shown in Table 6 and Table 7 explains nearly 47% of all the changes in Home Price Index by change in Economic condition Index and Tech Pulse Index. The correlation table shows there is more than 50% association between the variables. This is significant explanation for our research. This gives us a prediction model that for every unit increase in change in Tech Pulse Index, the home price index will increase by 0.42 units when adjusted for all other variables.

Lastly, we studied the association between Consumer Sentiment Index and Tech Pulse Index. Even though the consumer sentiment hits bottom during recessions, there is no clear association between consumer sentiment in Silicon Valley and Tech Pulse Index. This is confirmed by the very small R-square value of 0.019. We assume this disassociation mainly because of factors like Consumer sentiment Index conducted on national level and thus necessarily not an indication of consumer sentiment in Silicon Valley and also the survey is not specific to tech Industry people. From the Figure 11, we can see that decline in consumer sentiment was not very significant during dotcom bust but the consumer sentiment was lowest at the great recession of 2008 before the tech industry index was declined to its lowest.

Conclusion

The data from last decade suggest that the current health of the sector is very good till last quarter of 2019 but taking massive downturn in growth of information and high-tech industries. Good news is for now it is nowhere near as severe as 2002 recession or the great recession of 2008, first was triggered by the dotcom bust and second due to global slowdown. But since the January 2020, global economy is taking a huge hit due to Covid-19. The recovery from the great recession of 2008 may get washed off amid this situation. The unemployment rate was record low till 4th quarter of 2019 in California but more than 30% of Americans filled for Unemployment benefits in April 2020. Looking at the current situation around the world, we predict a sluggish growth in technology industry and hence increased unemployment rate and downsized economic condition. But we also believe once the pandemic comes under control, technology industry will be the first to show early recovery.

Appendix 1

Figure 1 Tech Pulse Index

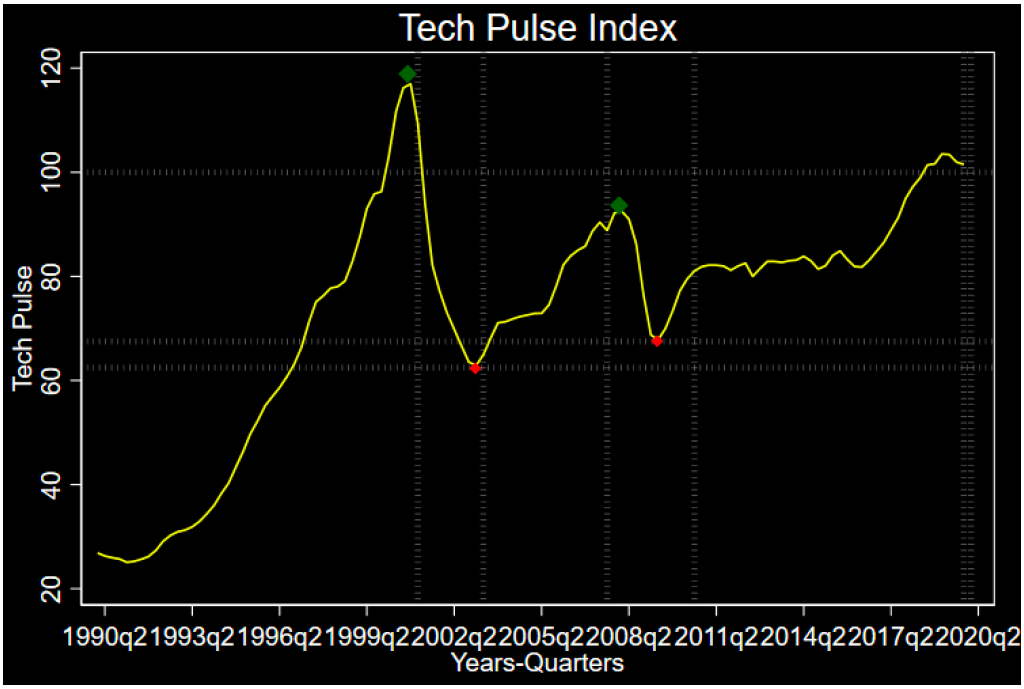

Figure 1.1 Tech Pulse Index variation

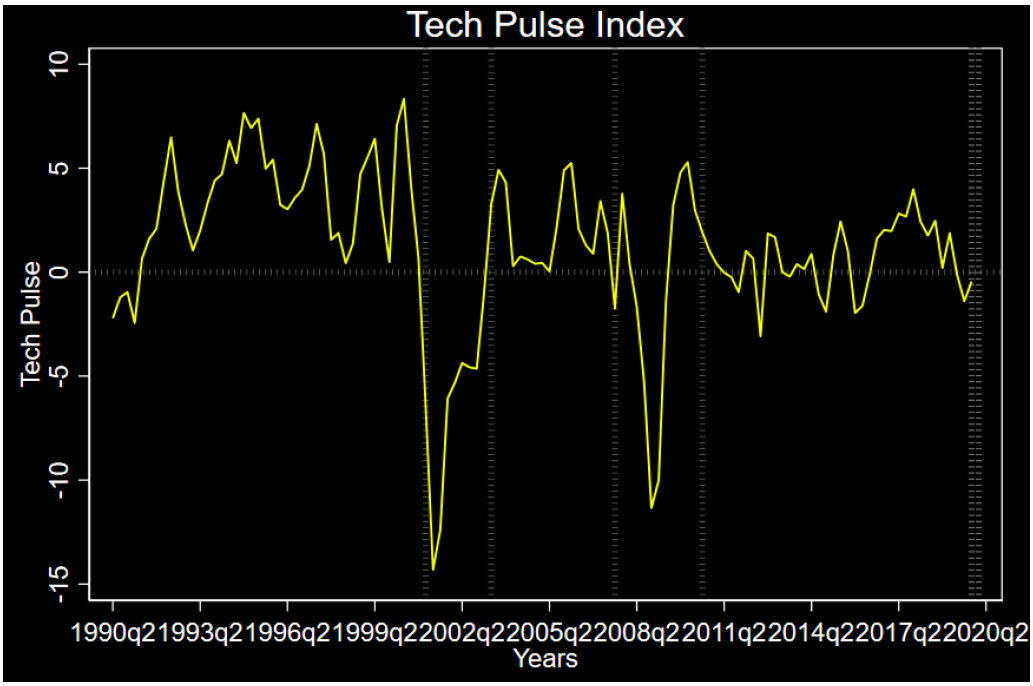

Figure 2 Home Price Index Variation

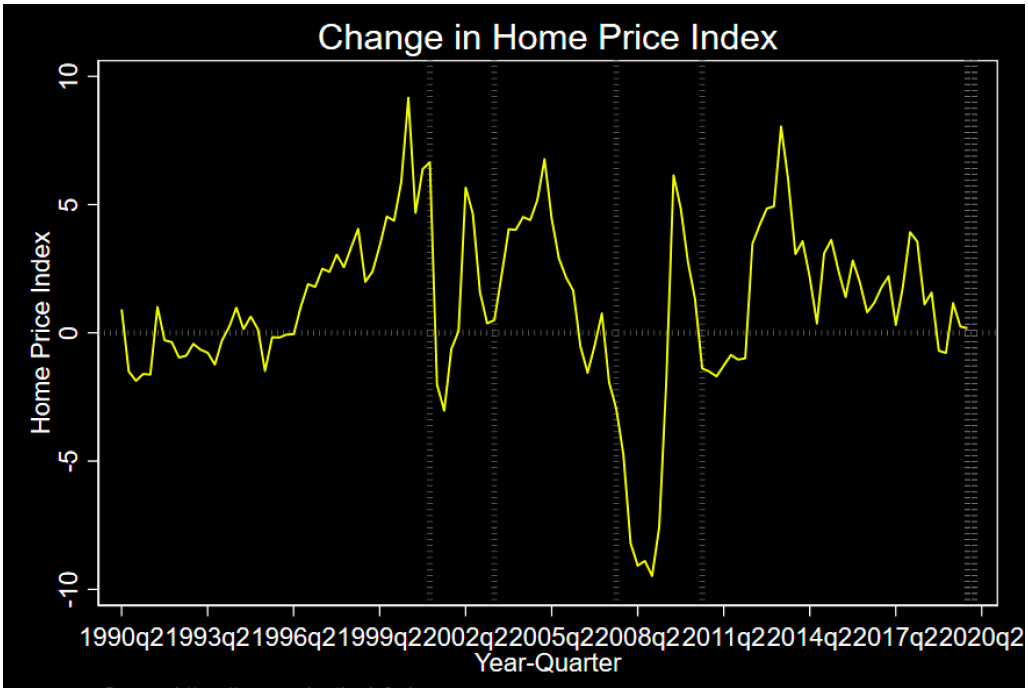

Figure 3 Unemployment Rate in California

Figure 4 Variation in Economic Condition Index

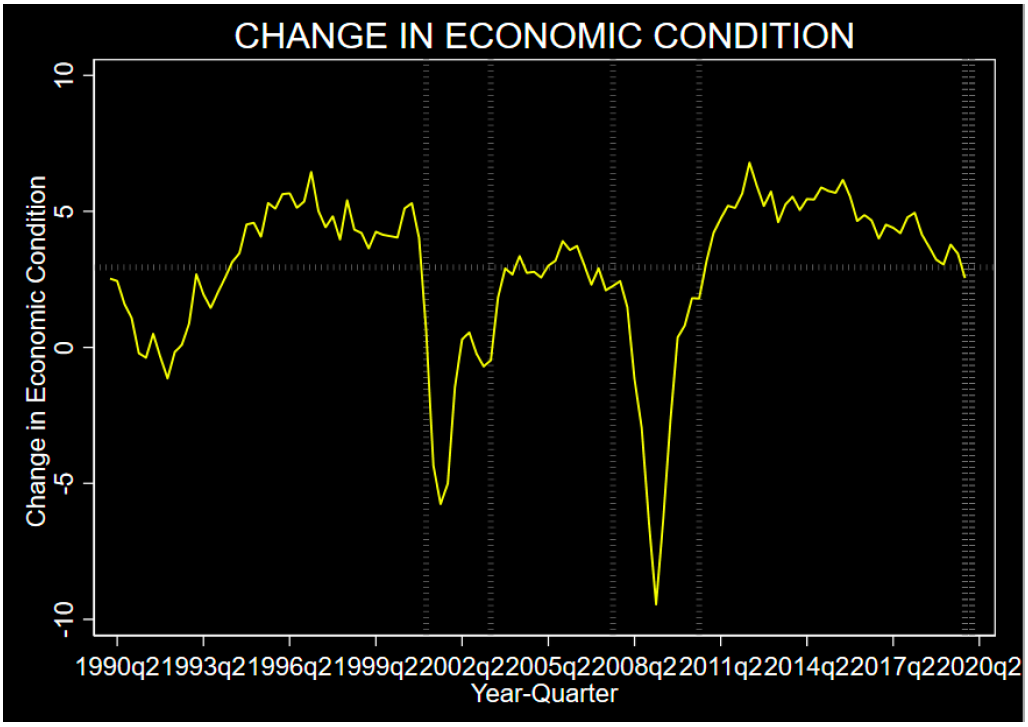

Figure 5 University of Michigan Consumer sentiment Index

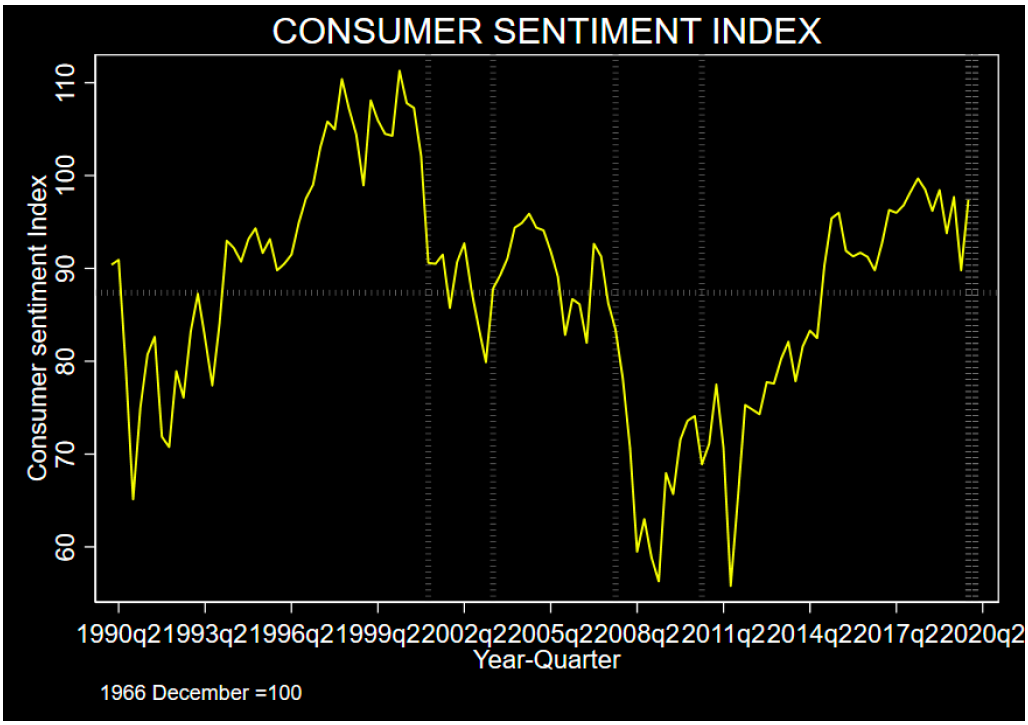

Figure 6 Investment in Software Industries from 1990 to 2020

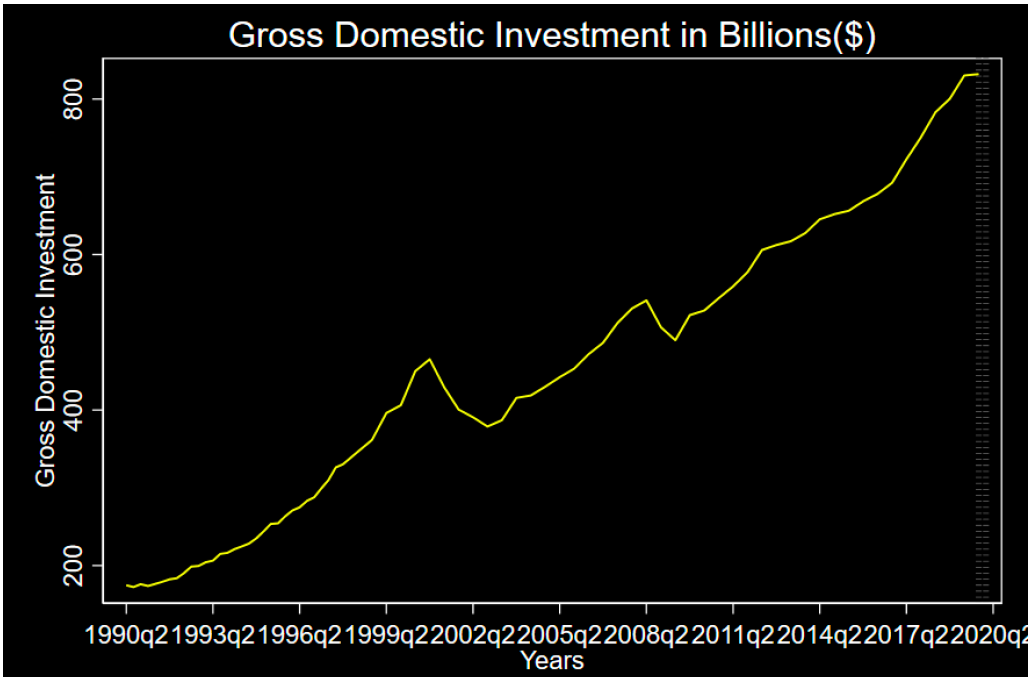

Figure 7 Investment trend with Tech Pulse Index

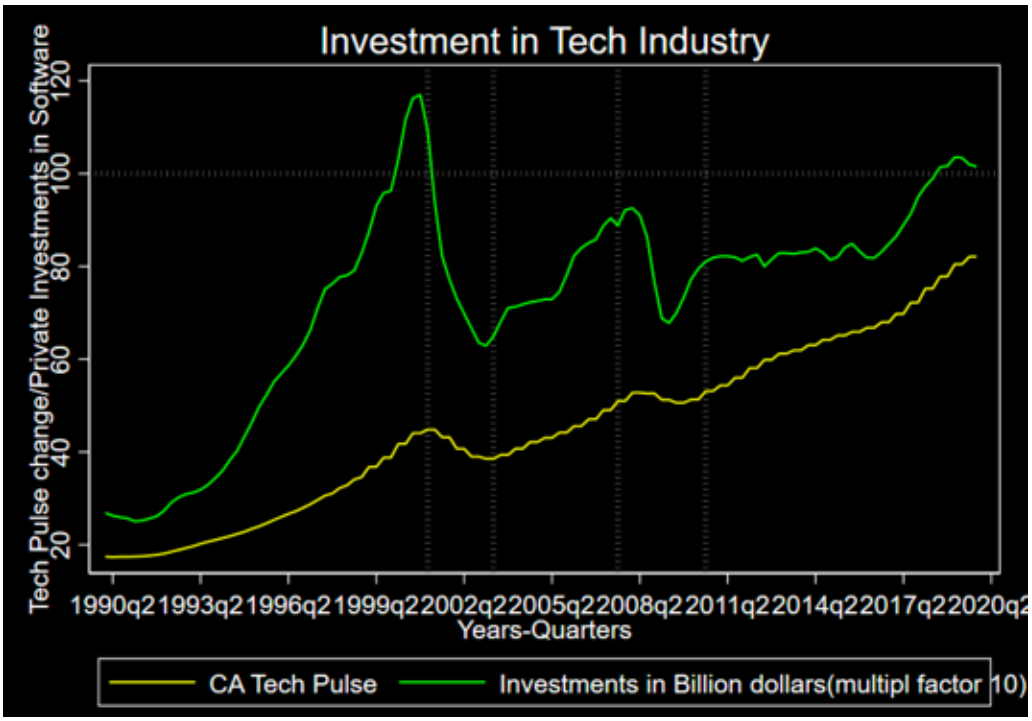

Figure 8: Unemployment rate and variation in Tech Pulse Index.

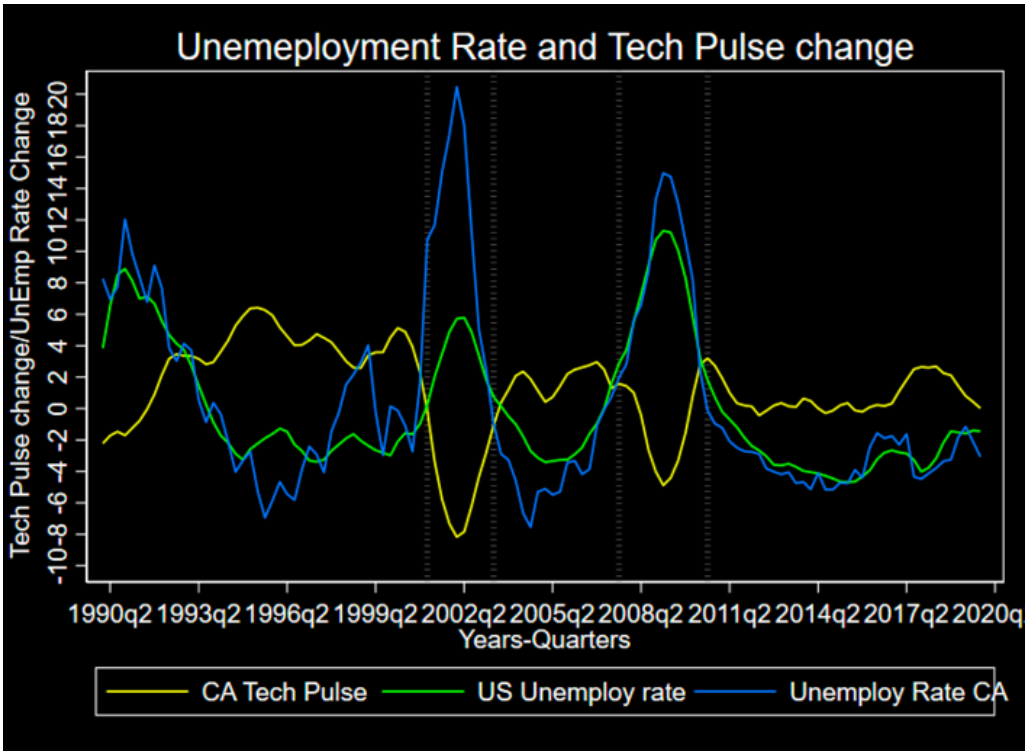

Figure 9 Economic Condition and Change in Tech Pulse Index

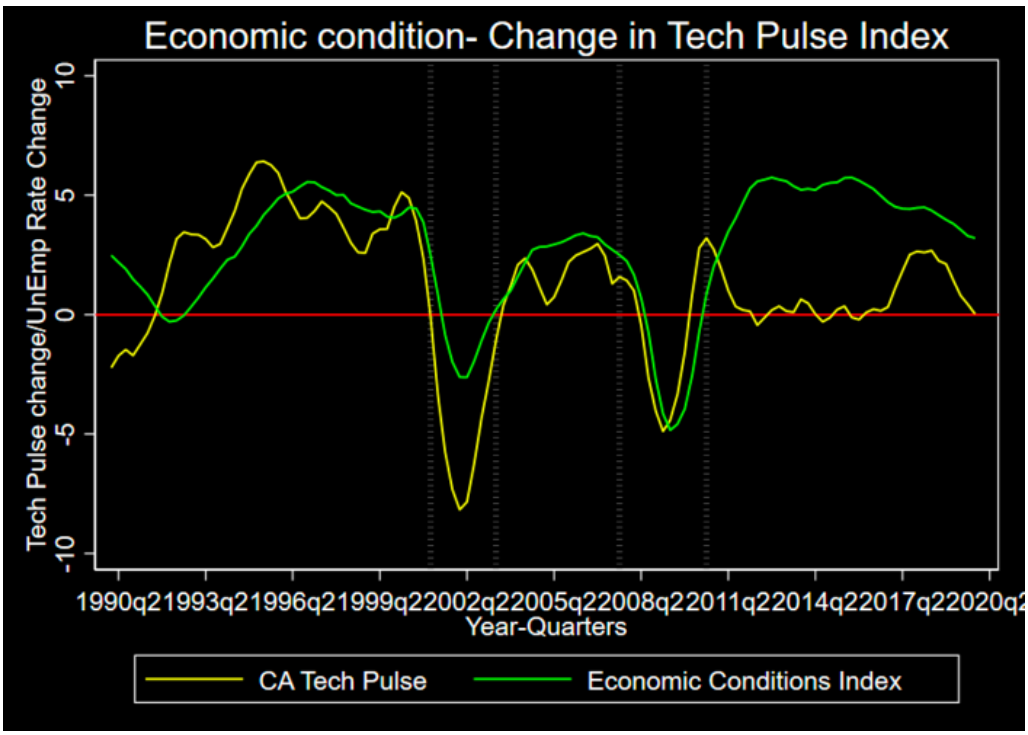

Figure 10 Home Price Index Variation with Tech Pulse Index, Economic condition

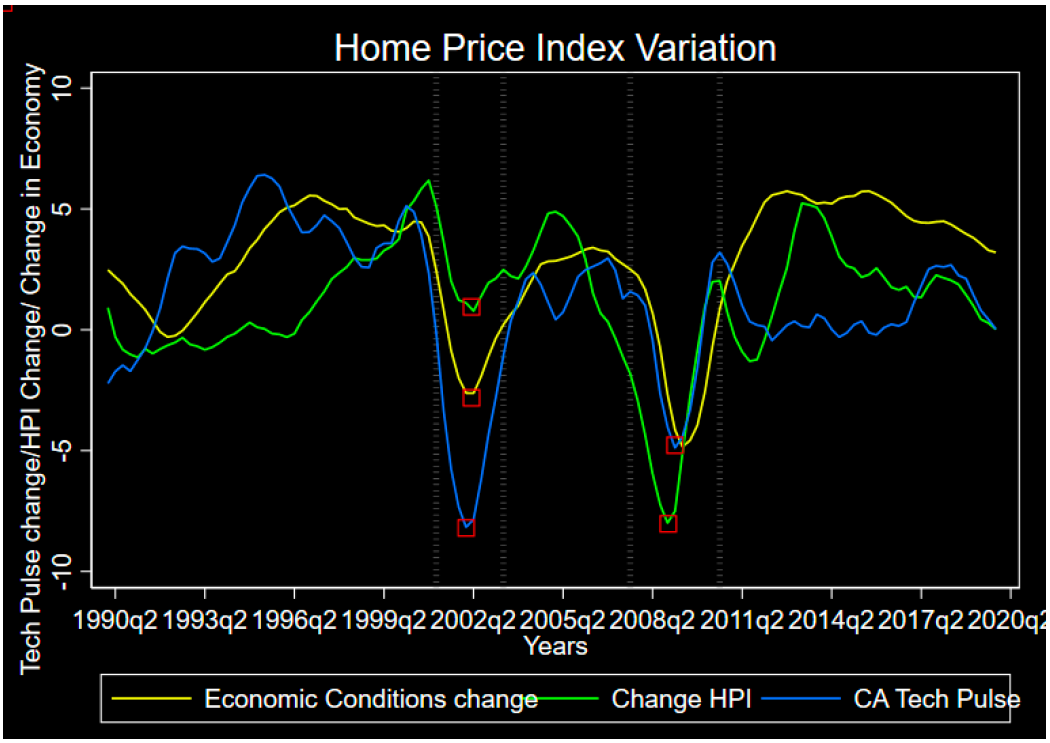

Figure 11 Consumer Confidence Index (UM) -Tech Pulse Index

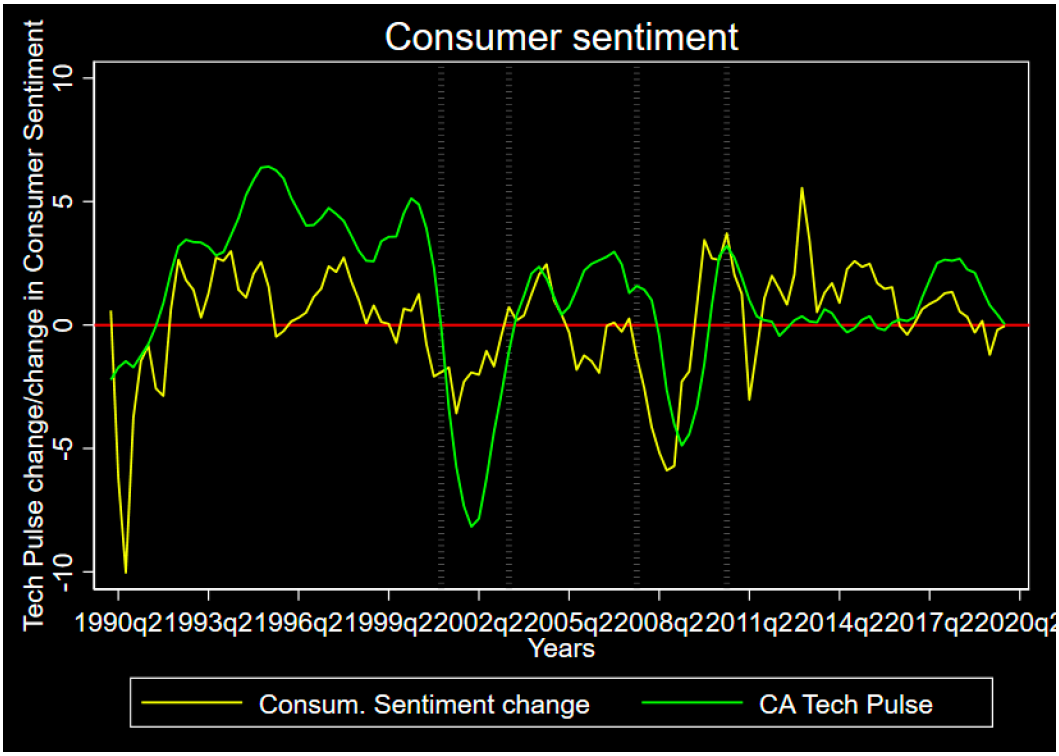

Table 1 Descriptive Statistics of all the variables includes minimum value, maximum value, mean, median and standard deviation.

```
*Description of data
tabstat TechPulse UnempRate COMPInd CPI EcoCond UMCS HPI UnempNo Invest, stats(min max mean median sd)
```

stats	TechPu~e	UnempR~e	COMPInd	CPI	EcoCond	UMCS	HPI	UnempNo	Invest
min	25.0855	3.9	4.407131	129.6	-9.45	55.8	66.70913	25453	172.364
max	116.9894	12.25	12.73783	297.725	6.79	111.3	267.8346	104994	832.176
mean	73.07649	7.1075	7.748449	204.1491	2.765819	87.38375	144.2286	52526.39	415.6755
p50	80.53825	6.616667	7.482017	200.55	3.521667	90.45	135.3008	47492.5	400.761
sd	22.86413	2.228229	2.35269	46.65277	2.944063	12.18248	63.70508	20679.86	189.7976

Table 2: Regression of change in Tech Pulse Index and Unemployment Rate

```
. regress change_UnempRate change_TechPulse
```

Source	SS	df	MS		
Model	614.320946	1	614.320946	Prob > F	0.0000
Residual	2012.1126	117	17.1975436	R-squared	0.2339
				Adj R-squared	0.2274
Total	2626.43354	118	22.2579114	Root MSE	4.147

Number of obs	=	119			
F(1, 117)	=	35.72			
Prob > F	=	0.0000			
R-squared	=	0.2339			
Adj R-squared	=	0.2274			
Root MSE	=	4.147			

change_UnempRate	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
change_TechPulse	-.5855148	.0979656	-5.98	0.000	-.7795305	-.3914991
_cons	.5675419	.3979226	1.43	0.156	-.220523	1.355607

Table 3 Correlation table for Unemployment Rate and Tech Pulse Index variation

```
. pwcorr TechPulse UnempRate change_TechPulse change_UnempRate change_UnempNo, sig star(5)
```

	TechPu~e	UnempR~e	chang~se	chang~te	change~o
TechPulse	1.0000				
UnempRate	-0.3755*	1.0000			
	0.0000				
change_Tec~e	-0.1485	0.0419	1.0000		
	0.1071	0.6512			
change_Une~e	-0.2570*	0.1353	-0.4836*	1.0000	
	0.0048	0.1423	0.0000		
change_Une~o	-0.0746	0.0039	-0.4908*	0.6050*	1.0000
	0.4199	0.9664	0.0000	0.0000	

Table 4 Regression for Economic Condition in California and Change in Tech Pulse Index

```
. regress EcoCond change_TechPulse
```

Source	SS	df	MS	Number of obs	=	119
				F(1, 117)	=	52.20
Model	318.178286	1	318.178286	Prob > F	=	0.0000
Residual	713.198753	117	6.09571584	R-squared	=	0.3085
				Adj R-squared	=	0.3026
Total	1031.37704	118	8.74048338	Root MSE	=	2.469

EcoCond	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
change_TechPulse	.4213815	.0583247	7.22	0.000	.3058725	.5368905
_cons	2.262048	.236907	9.55	0.000	1.792866	2.73123

Table 5 Correlation Table for Economic Condition in California and Change in Tech Pulse Index

```
. pwcorr EcoCond change_TechPulse , sig star(3)
```

	EcoCond	chang~se
EcoCond	1.0000	
change_Tec~e	0.5554*	1.0000
	0.0000	

Table 6 Regression for HPI and Tech Pulse Index change.

```
. regress ma_EcoCond4 ma_change_HPI10 ma_change_TechPulse3
```

Source	SS	df	MS	Number of obs	=	120
				F(2, 117)	=	52.99
Model	374.49442	2	187.24721	Prob > F	=	0.0000
Residual	413.439991	117	3.53367513	R-squared	=	0.4753
				Adj R-squared	=	0.4663
Total	787.93441	119	6.62129757	Root MSE	=	1.8798

ma_EcoCond4	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ma_change_HPI10	.3976292	.0676459	5.88	0.000	.2636601	.5315983
ma_change_TechPulse3	.4204914	.0601998	6.98	0.000	.3012688	.539714
_cons	1.820675	.1943829	9.37	0.000	1.43571	2.20564

Table 7 Correlation table for HPI and Tech Pulse Index change

```
. pwcorr ma_EcoCond4 ma_change_HPI10 ma_change_TechPulse3, sig star(3)
```

	ma_Eco~4	ma_ch~10	ma_cha~3
ma_EcoCond4	1.0000		
ma_change~10	0.5064*	1.0000	
	0.0000		
ma_change_~3	0.5660*	0.2157*	1.0000
	0.0000	0.0180	

Table 8 Regression for Consumer Sentiment Index and Tech Pulse Index

```
. regress change_UMCS change_TechPulse
```

Source	SS	df	MS		
Model	98.0780324	1	98.0780324	Prob > F	0.1343
Residual	5046.7884	117	43.1349436	R-squared	0.0191
Total	5144.86643	118	43.600563	Adj R-squared	0.0107
				Root MSE	6.5677

Number of obs	=	119
F(1, 117)	=	2.27

change_UMCS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
change_TechPulse	.2339516	.1551511	1.51	0.134	-.073317	.5412202
_cons	-.0006141	.6302024	-0.00	0.999	-1.248697	1.247469

APPENDIX 2

```
*Economic Data Analysis*
*Final Project*
*Gawtam*
*Analysis of Tech Pulse Index and its effect on People in Silicon Valley

cd "//Client/H$/Documents/EDAUS/ECONOMIC DATA ANALYSIS USING STATA"

cls
clear all

set fredkey 31a0f64cc1305b80770ef935fc4992cf

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SMU06409003133400001SA LAUMT064194000000004 A679RC1Q027SBEA GDPC1 CARGSP
CADATAWWWNGSP, clear

*San Francisco Tech Pulse (SFTPINDM114SFRBSF)
*House price Index: SFXRSA
*Unemployment rate: CAUR
*Consumer Price Index for All Urban Consumers:CUURA422SA0
*Economic Conditions Index for San Francisco-Oakland-Hayward, CA (MSA) (SFCAGRIDX)
*University of Michigan: Consumer Sentiment (UMCSENT)
*All Employees: Durable Goods: Computer and Electronic Product Manufacturing in
Sacramento--Roseville--Arden-Arcade, CA (MSA) (SMU06409003133400001SA)
*Unemployed Persons in San Jose-Sunnyvale-Santa Clara, CA (MSA)
(LAUMT064194000000004)
*Real Gross Private Domestic Investment in information processing equipment and software
(A679RC1Q027SBEA)
*Real Gross Domestic Product (GDPC1)
*Gross Domestic Product by Industry: Private Industries: Information: Data Processing,
Internet Publishing, and Other Information Services for California (CADATAWWWNGSP)
*Real Total Gross Domestic Product for California (CARGSP)

*Data Cleaning
```

```
keep if SFTPINDM114SFRBSF != .
keep if SFXRSA !=.
keep if SFCAGRIDX !=.
keep if CUURA422SA0!=.


label var SFTPINDM114SFRBSF "CA Tech Pulse"
label var CAUR "Unemployment rate"
label var CUURA422SA0 "Consumer Price Index"
label var SFCAGRIDX "Economic Conditions Index"
label var UMCSENT "UM Consumer Sentiment"
label var SFXRSA "House Price Index"
label var SMU06409003133400001SA "Employee no-Computer/Ele Product"
label var LAUMT064194000000004 "Unemployment number"
label var A679RC1Q027SBEA "Investment in Billions"

ren SFTPINDM114SFRBSF TechPulse
ren CAUR UnempRate
ren SMU06409003133400001SA COMPInd
ren CUURA422SA0 CPI
ren SFCAGRIDX EcoCond
ren UMCSENT UMCS
ren SFXRSA HPI
ren LAUMT064194000000004 UnempNo
ren A679RC1Q027SBEA Invest

*TechPulse UnempRate COMPInd CPI EcoCond UMCS HPI UnempNo Invest
gen dqq= qofd(daten)
sort dqq
collapse TechPulse UnempRate COMPInd CPI EcoCond UMCS HPI UnempNo Invest, by(dqq)

format dqq %tq
tsset dqq

save project.dta, replace
```

```
gen change_TechPulse=(D1.TechPulse/L1.TechPulse)*100
gen change_UnempRate=(D1.UnempRate/L1.UnempRate)*100
gen change_COMPInd=(D1.COMPInd/L1.COMPInd)*100
gen change_CPI=(D1.CPI/L1.CPI)*100
gen change_EcoCond=(D1.EcoCond/L1.EcoCond)*100
gen change_UMCS=(D1.UMCS/L1.UMCS)*100
gen change_UnempNo=(D1.UnempNo/L1.UnempNo)*100
gen change_HPI=(D1.HPI/L1.HPI)*100
gen Invest_2=Invest/10

*Dot com burst happened on Oct, 2002= 2002 Q4
di tq(1996q1)
di tq(2002q4)
di tq(2008q3)
di tq(2020q1)


*Description of data
tabstat TechPulse UnempRate COMPInd CPI EcoCond UMCS HPI UnempNo Invest, stats(n min max mean median sd)

*Individual graphs
line TechPulse dqq, title("Tech Pulse Index")xlabel(121(12)241) xtitle("Years-Quarters")ytitle("Tech Pulse") note("Source:https://research.stlouisfed.org") xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(100 62.48 67.5, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))

line Invest dqq,xlabel(121(12)240) xtitle("Years")ytitle("Gross Domestic Investment") title("Gross Domestic Investment in Billions($)") note("Source:https://fred.stlouisfed.org") xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))
```

```
line change_HPI dqq, title("Change in Home Price Index")xlabel(121(12)241) xtitle("Year-Quarter")ytitle("Home Price Index") note("Source:https://research.stlouisfed.org")xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(0, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))

line UnempRate dqq, title("Unemployment Rate")xlabel(121(12)241) xtitle("Year-Quarter")ytitle("Unemployment Rate ") note("Source:https://research.stlouisfed.org")xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(7, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))

line EcoCond dqq, title("CHANGE IN ECONOMIC CONDITION")xlabel(121(12)241) xtitle("Year-Quarter")ytitle("Change in Economic Condition ")xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(2.94, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))

line UMCS dqq, title("CONSUMER SENTIMENT INDEX")xlabel(121(12)241) xtitle("Year-Quarter")ytitle("Consumer sentiment Index") note("1966 December =100")xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(87.38, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))

*Tech Pulse Index
line change_TechPulse dqq, title("Tech Pulse Index")xlabel(121(12)241) xtitle("Years")ytitle("Tech Pulse") note("Source:https://research.stlouisfed.org")xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick)
```

```
lpattern(dot) lcolor(gray)) yline(0, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(239 240, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray))


*Tech Industry and Private investments
tssmooth ma ma_change_TechPulse= change_TechPulse, window(4,1,1)
tssmooth ma ma_Invest_2=Invest_2, window(4,1,1)
line ma_Invest_2 dqq || line TechPulse dqq, xlabel(121(12)240) xtitle("Years-Quarters") ylabel() ytitle("Tech Pulse change/Private Investments in Software") legend(label (1 "CA Tech Pulse") label(2 "Investments in Billion dollars(multipl factor 10)") col(2))title("Investment in Tech Industry") xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(100, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray))

*Association between TechPulse, Unemployment number and Unemployment Rate
tssmooth ma ma_change_UnempRate= change_UnempRate, window(4,1,1)
tssmooth ma ma_change_UnempNo= change_UnempNo, window(4,1,1)

line ma_change_TechPulse dqq|| line ma_change_UnempRate dqq || line ma_change_UnempNo dqq, xlabel(121(12)240) xtitle("Years-Quarters") ylabel(-10(2)20) ytitle("Tech Pulse change/UnEmp Rate Change") legend(label (1 "CA Tech Pulse") label(2 "US Unemploy rate") label(3 "Unemploy Rate CA") col(3)) title("Unemeployment Rate and Tech Pulse change") xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(100, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray))

scatter ma_change_TechPulse ma_change_UnempRate ma_change_UnempNo dqq, xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(192 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xtitle("Year") ytitle("Log CA TechPulse / Log Unemployment rate")legend(label (1 "CA Tech Pulse") label(2 "Unemployment rate") label(3 "Unemploy Rate CA") col(3))

regress change_UnempRate change_TechPulse
regress UnempRate TechPulse
```

```
pwcorr TechPulse UnempRate change_TechPulse change_UnempRate change_UnempNo, sig star(5)

*Association between change TechPulse and Economic Conditions
tssmooth ma ma_EcoCond= EcoCond, window(4,1,1)

line ma_change_TechPulse dqq|| line ma_EcoCond dqq, xlabel(121(12)240) xtitle("Year-Quarters") ylabel() title("Economic condition- Change in Tech Pulse Index") ytitle("Tech Pulse change/UnEmp Rate Change") legend(label (1 "CA Tech Pulse") label(2 "Economic Conditions Index") col(3)) xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) yline(0)

scatter ma_change_TechPulse ma_EcoCond dqq, xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(192 202, lstyle(p2area) lwidth(thick) lpattern(dot) lcolor(gray)) xtitle("Year-Quarters") ytitle("Log CA TechPulse / Economic condition change")legend(label (1 "Log CA Tech Pulse") label(2 "Economic Conditions change") col(3))

regress EcoCond change_TechPulse
pwcorr EcoCond change_TechPulse , sig star(3)

*Relation between Economic condition, Housing price Index and TechPulse Index
tssmooth ma ma_EcoCond4= EcoCond, window(4,1,1)
tssmooth ma ma_change_HPI10= change_HPI, window(4,1,1)
tssmooth ma ma_change_TechPulse3= change_TechPulse, window(4,1,1)

line ma_EcoCond4 dqq || line ma_change_HPI10 dqq || line ma_change_TechPulse3 dqq,xlabel(121(12)240) xtitle("Years") ylabel() ytitle("Tech Pulse change/HPI Change/ Change in Economy") legend(label (1 "Economic Conditions change") label(2 "Change HPI") label(3 "CA Tech Pulse") col(3)) xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(major_grid) lwidth(thick) lpattern(dot) lcolor(gray)) title("Home Price Index Variation")

regress ma_EcoCond4 ma_change_HPI10 ma_change_TechPulse3
pwcorr ma_EcoCond4 ma_change_HPI10 ma_change_TechPulse3, sig star(3)
```

```
regress EcoCond change_HPI change_TechPulse
pwcorr EcoCond change_HPI change_TechPulse, sig star(3)

*Association between Consumer confidence, TechPulse Index
tssmooth ma ma_change_UMCS8= change_UMCS, window(5,1,1)

line ma_change_UMCS8 dqq ||line ma_change_TechPulse dqq,xlabel(121(12)240) xtitle("Years") ylabel() ytitle("Tech Pulse change/change in Consumer Sentiment") legend(label (1 "Consum. Sentiment change") label(2 "CA Tech Pulse") col(3)) xline(164 173, lstyle(p1area) lwidth(thick) lpattern(dot) lcolor(gray)) xline(190 202, lstyle(major_grid) lwidth(thick) lpattern(dot) lcolor(gray)) title("Consumer sentiment") yline(0)

regress change_UMCS change_TechPulse
pwcorr change_UMCS change_TechPulse, sig star(1)


*End of file*
```

Reference:

[1] “Taking the Pulse of the Tech Sector: A Coincident Index of High-Tech Activity” by Bart Hobijn, Kevin J. Stiroh, and Alexis Antoniades.
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[3] https://www2.deloitte.com/us/en/insights/economy/spotlight/economics-insights-analysis-07-2019.html
[4] https://www.theguardian.com/technology/2019/apr/30/silicon-valley-wealth-second-richest-country-world-earth
[5] https://www.frbsf.org/economic-research/indicators-data/tech-pulse
[6] https://fred.stlouisfed.org
[7] Causality Testing for U.S. Public Expenditure, Economic Uncertainty, and Other Indicators by Emilia Suggs.