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Oil Price Changes and Unemployment Rate in the U.S. and Chile

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Abstract

There is a recurring question in theoretical, empirical and policy work is what the effects of higher oil prices are on the country's macroeconomic aggregates. Empirical evidence in support of the view that fluctuation in the economy due to the interaction of macroeconomic variables is caused by oil price was based on inappropriate econometric models. These studies do not capture the composition of the price of oil that is affected by the exogenous oil shocks and has an indirect or direct impact on the macroeconomic aggregates. In this study, we decompose the change in oil prices into three structural shocks. We then study the response of unemployment to the shocks in the U.S. and Chile. U.S. and Chile are the countries that import crude oil until recently when the U.S. has started exporting oil and aims to be "Energy Independence" while the demand for oil in Chile has increased exponentially leading to a dramatic increase in crude oil import. We, therefore, explore potential mechanisms: Response of unemployment rate across gender to the exogenous oil shocks. The paper proposes a Structural Vector Auto Regression (VAR)[1] model that documents the response of unemployment rate to the exogenous oil. Our results suggest that the unemployment rate across gender responses differently to the three oil shocks in the U.S. and Chile.

Keywords: Real Oil prices, oil price shock, unemployment, vector autoregression, oil demand and oil supply shock, the precautionary demand shock

[1]. In the rest of the paper, I use the abbreviation of Vector Auto Regression as VAR

1. Introduction

Oil is the lifeblood of all the nations. Oil has become the world's most important source of energy since the mid-1950s when the Middle East began to realize its power. Since then, demand for oil has been increasingly industrialized and urbanized. In addition to the demand for oil, fears of oil supply disruption show distinct jumps in the oil prices. The upward jump in oil prices affects the economy on a micro and macro level.

At the 'Macro' level, oil prices directly affect the prices of goods made with petroleum products and indirectly affect the costs such as transportation, manufacturing, and heating which is passed to the consumers. Various channels in the economic literature majorly study and present the demand and supply-side affected by the changes in oil prices. One channel state that raising oil prices increases the money demand and if the policymakers cannot compensate for the increasing demand with higher money supply then the interest rates increase inevitably. As a result, higher interest rates will hinder investment and output growth. The income-transfer channel focuses upon the transmission of income and wealth from countries importing oil to countries exporting oil in the case of an increase in oil prices. Higher oil prices unavoidably tend to reduce the purchasing power of economic units that must import oil (Pierce et al.1974). Another channel emphasizes the classic supply side effect which arose due to the increase in oil prices. According to this channel, an upswing in the price of oil which is a basic factor in the production side raises the production costs impeding productivity and output growth. Then, the slowdown in productivity increases the unemployment rate (Brown and Yucel, 2002 p194). Another vein of the channel explains the oil price shocks resulting in the reallocation of specialized labor and capital from adversely affected sectors to positively affected sectors. Higher oil prices, therefore, results in a recessionary effect and dampen the expansionary effect of lower oil prices (oil-importing countries). Following the theoretical ideology on the displacement of sectors because of changes in the oil price, Hamilton (1988) builds a model for an economy with multiple sectors where the shift of specialized labor and capital between sectors occurs at a high cost leading to increased unemployment. For example, if there is an increase in the relative oil price then there will be a downswing in labor demand in the automobile industry and will simultaneously have an upswing in labor demand on the oil field.

But these two situations will be unable to offset each other due to many factors like skill sets, location, the expectation for the situation to improve, and many more.

Few works of literature lay weight on monetary policy to explain the asymmetric effect of oil price on economic activity which means that negative oil price shocks tend to affect the economic growth lesser than what positive shock would do (Ozge Kocaaslan 2018). Brown and Yücel (2002) also indicate that petroleum product prices and adjustment costs have also been associated with the asymmetric reaction to a change in the price of oil.

Killian (2008) has stated that in the past an increase in major energy prices has often been followed by severe economic dislocations, suggesting a causal link from higher energy prices to recessions, higher unemployment, and possibly inflation. It has been a greater interest to the researchers and economists from around the world to dig and explore new explanatory relation between oil price and unemployment. The literature has focused on three complementary mechanisms by which unemployment may be directly affected by oil price changes. There is a lack of statistical evidence against the hypothesis in the responses of the U.S. unemployment rate. The paper finds statistical evidence that complementary mechanisms affect unemployment across gender differently.

Killian (2009) distinguished three shocks from the endogenous components of the real price of crude oil; shocks to the current physical availability of crude oil (oil supply shocks), shocks to the current demand for crude oil driven by fluctuations in the global business cycle (aggregate demand shocks); and shocks driven by shifts in the precautionary demand for oil (precautionary demand shocks). I quantify their historical contribution to the real price of oil. This paper, therefore, aims to study the variance in the unemployment rate across gender in the U.S. economy due to changes in the underlying shifts of the endogenous components of the oil price which is affected by the exogenous oil shocks by proposing a structural Vector Auto Regression Model (VAR) studying the dataset (1990-2019). This paper finds that the three exogenous shocks affect the unemployment rate across gender adversely in the US and Chile. In the last section, there are concluding remarks.

2. Literature Review

a. Oil price and Unemployment

Changes in the oil price have often been used as a major "scalar response" or "predictor" by different economists to estimate, forecast, or analyze the effect on various macroeconomic variables in different economies at various stages of development. On one hand, Gisser and Goodwin(1986); Aguiar-Conraria and Wen (2007) and many others have provided empirical evidence that oil prices were a significant determinant of the economic activity and on the other, there are economists like Lutz Killian (2009); Lutz and Logan (2011); Ozge Kocaaslan (2018); Baumeister and Peersman (2008); Cavallo and Wu (2006) and many others argued that oil prices generally do not completely affect the macroeconomic aggregates of the countries' economy. Lutz Killian (2009) proposed a structural decomposition of the real price of crude oil to understand the different drivers that eventually drive the prices in different directions, Baumeister and Peersman (2008), in a Bayesian VAR framework, use sign restrictions to disentangle supply from demand oil price shocks, and Cavallo and Wu (2006) construct an oil shocks measure based on news exogenous to the economy. Though there are common works of literature that have examined and evaluated the relation between the macroeconomic aggregates and changes in the price of oil, the findings have not been well defined as it has few drawbacks.

Bureau of Labor Statistics (BLS) defines unemployment as "People who are jobless, looking for a job, and available for work are unemployed". Unemployment is a central object of study in macroeconomics, yet it remains poorly understood. There has been a wide disagreement on whether unemployment is mostly voluntary or involuntary, and whether business cycles mostly reflect movements in equilibrium unemployment or fluctuation around a relatively stable equilibrium (Carruth et al. 1998). However, the unemployment rate is a useful measure to track phases of economic cycles, as trends in unemployment are closely linked to economic performances and its variations. The patterns of unemployment can reveal periods of recession and the subsequent sign of recovery. There is a negative impact on the long-run economic growth when the rates of unemployment are high and steady as unemployment wastes resources, generates redistributive pressures and distortions, increases poverty, limits labor

mobility, and promotes social unrest and conflict. Therefore, when designing and setting monetary policies, the central banks of most economies use the unemployment rate to determine the health of the economy. It is not just limited to the central banks, investors also use the current unemployment rate to look at which sectors are losing jobs faster, determining the future flow of investment.

The changes in the oil price affect the production and demand side of the economy which shows an effect on the labor. There are few pieces of research where the studies extensively focused on the oil supply shock on global crude oil production and changes in the prices of oil affecting the macro picture of a country's economy focusing mainly on the stock market, exchange rate, investment, and unemployment (Chen, 2006; Basher et al. 2011). Hamilton (1983) conducted a pioneer study of finding a higher correlation between higher oil prices and the future level of unemployment. The findings were supported by Mork (1989) who further studied the persistence of the correlation and concluded that the results become more convincing with the correction for price controls using unemployment data. A further study by Uri (1996), Karaki (2018), David and Haltiwanger (2001) found that the price of oil relative to the price of labor will result in a sectoral shift that gave rise to the unemployment gap (Albanesi, 2018).

Several studies using several different approaches have addressed the question of whether there is any measurable relationship between changes in crude oil prices and unemployment. Economists, till 1982 failed to provide explanatory empirical support for concluding that crude oil prices affected the unemployment rate. Identification of the nature and extent of the impacts of fluctuations in the price of crude oil on employment and the rate of the unemployment rate are of significant concern due to the inherent instability in crude oil prices over the past two decades. Uri (1996) in his paper proved that based on ordinary least squares estimation with correction for first-order serial correlation, the price of oil relative to the price of labor will result in a sectoral shift. Unexpected oil price increases may also operate through costly reallocation of labor and capital across sectors (Davis and Haltiwanger, 2001). Karaki (2018) studied the contribution of structural oil price shocks on state-level unemployment during the shale boom period. He found that among oil supply shocks, aggregate demand shocks, oil specific demand shocks, and the unobserved shock in unemployment,

aggregate demand shocks contributed the most to explaining the changes in state unemployment rates for both oil-producing and oil-importing states.

An unexpected increase in the real price of oil, resources may relocate from industries that use energy intensively in consumption (e.g., motor vehicles) or production (e.g., chemicals), to industries that rely less on energy. Yet, this reallocation process is costly due to the mismatch between the desired and actual distribution of capital and labor. Hence, costly sectoral reallocation would amplify the effect of an unexpected energy price change beyond the share of energy expenditure in GDP, leading to an increase in involuntary unemployment. Hamilton (1998) argued that as oil prices increase and workers get laid off, these workers will tend to wait until conditions in the sector where they work improve rather than decide to relocate to other industries. Thus, the presence of frictions in the reallocation of resources implies that higher oil prices may amplify recessions and mitigate expansions.

b. Unemployment in the U.S. and Chile

Unemployment trend in the U.S.

Albanesi (2018) defines the gender unemployment gap as the differences between male and female unemployment rates. From the 1950s to the late 1980s, women's labor force proportion increased from 30 percent to around 45 percent in the US. Between 1970 and 1980, the female proportion of the unemployed did not exhibit a higher trend and therefore, the unemployment gap virtually disappeared but the pattern changes during the recession with the male unemployment rising more than female unemployment. The gender differences persist across industries in most of the economies but the labor force shares of women have increased in the U.S. and by the early 2000s nearly half of the US labor force participants were women. This can be backed by a transition in the composition of industry and occupation and their role in explaining overall unemployment patterns. From 1982, the unemployment rate of the female is lower than the male unemployment rate. Before 1980, there was a big gap between the unemployment rate but after the recession in 1990, we observed a steady decline in female unemployment than male. But after 2008 till 2012, the unemployment rate has increased in both the genders, male pattern higher than female. Researchers like Groshen and Potter (2003) argue that the industrial shifts

leading to change in the unemployment pattern across gender are partly responsible for the failure of employment to grow robustly following the 2001 Recession. Some researchers like Wolff (2005) argued that since 1960, due to the increase in computer use (technological shock), there has been an upward trend in the unemployment rate.

BLS has classified industries into 10 divisions[2] and can be broadly categorized into goods-producing industries, service-providing industries, and government. In general, goods-producing industries, such as construction and manufacturing, employ mostly male workers while most female workers work in the service-providing industries and government (Albanesi, 2018). Employment in service-providing industries accounts for 43.2 percent of the women's labor force but only 24.8 percent for the men's labor force. The composition of goods-producing industries observed 1.3 percent of women participation and 11.1 percent of men participation in the construction industry, 6.6 percent of women and 14.4 percent of men in the manufacturing industry, and 3.0 percent of women and 7.8 percent of men in transportation and communication industry. While the participation of women labor force in government is higher than men It has been studied that during the recession, job losses were particularly high in the goods-producing industries while jobs in service-providing industries grew, resulting in the unemployment gap and timing of job losses and gains experienced by women and men (Hartmann and English, 2010).

Historically, US recessions have been preceded by sharp spikes in oil prices like a shot up nearly 135 percent between July and October 1990, oil prices doubled between 1999 and 2000 and shot up more than 96% between 2007 and 2008. This briefly explains an indirect relationship between the unemployment rate and oil price. Theoretically, an increase in the oil price leads to an increase in the prices of final goods as the industrial production declines and purchasing power declines due to costly goods and steady income with lesser saving(Romer and Romer, 1989). Due to the drying up of demand, the economy experiences a shift in the fiscal and monetary policies reflecting a changing pattern in the macroeconomic aggregates like unemployment. Empirically, Michaelidas (2013), Killian, and Vigfusso (2014) have proved the relationship between the unemployment rate

[2] U.S. Bureau of Labor Statistics: Industry classification Overview (https://www.bls.gov/ces/naics/home.htm)

affected by changes in the oil price through changes in the composition of industries resulting due to recession.

Lee and Ni (2002) find that the oil price shocks mostly to reduce the supply of oil-intensive industries while they mostly reduce the demand of many other industries, especially the automobile industry. The increased operating cost of durable goods and heightened uncertainty are major reasons for oil price shocks to induce recessions. Killian (2009) has further explained the cumulative effect of oil shocks on the price of oil. Alderman (1995) shows international incidents such as the Arab-Israel War in October 1973, the Iranian revolution in October 1978, and Iran-Iraq War in 1980-81 caused a temporary oil supply disruption. Though there was an oil supply disruption, oil supply shock served only to amplify some of the short-run dynamics of the price of oil. For most industries in the U.S., the global demand shocks act mainly as positive demand shocks, and the oil-specific demand shocks act mainly as negative supply shocks. The oil supply shocks act mainly as negative supply shocks for oil-intensive industries and act mainly as negative demand shocks for less oil-intensive industries, as Lee and Ni (2002) found for exogenous oil price shocks. Due to the events of the war, there was uncertainty about future oil supply shortfalls which is represented by the precautionary demand. During such events, oil market-specific demand shock is responsible for the fairly sharply defined increase and decrease of price oil and aggregate demand causes long swings in the price of oil. Due to the rapid shifts in the shocks, the US economy experienced recessions after both oil price shocks. Industrial Production declined by about 17% from March 1973–75, and by more than 5% from October 1978 to July 1980. Among all industries, the automobile industry suffered the largest decline-its output plunged by more than 30% during both oil crises. Oil price shocks may cause resource shifting across service industries and manufacturing industries that need to be examined which defines the unemployment rate across gender.

Unemployment trend in Chile

Chile is a highly urbanized country. Chile has transited from being one of the most regulated and least productive economies in the world during the 1960s to becoming one of the most dynamic emerging economies during

the 1990s[3]. This has coincided with the implementation of economic policies based on the opening of the economy to trade and capital flows, the state's withdrawal from investment decisions, legal stability, and respect for property rights enshrined in the constitution, a strong commitment to macroeconomic equilibrium and deregulation of labor markets (Ffrench-Davis, Leiva, & Madrid, 1992). Chile has experienced three episodes of serious recession (1973-1975, 1980-1981, and 1998-1999) where the unemployment rate increased by 50 percent or more and average unemployment duration lengthened noticeably (Naudon, 2018). This has caused large decreases in labor market earnings and decreases in family well-being. In 1975, the Chilean economy suffered from a sharp increase in the international price of oil with the ensuing deterioration in terms of trade. As a result, Chile suffered a major recession categorized by an increase in unemployment. The fast recovery after the 1980-81 recession, was seen in the construction and industry where the average rate of employment growth was 20 percent and 11 percent per year, respectively.

In the 1990s, the trend of high unemployment in Chile began to change and by late 1993, the unemployment rate decreased to 4.9% and recorded the lowest to that of the rest of Latin America. This was observed when real wages had increased significantly. Chile emphasizes on an economic model that designs and plans to develop employment-intensive industries. Recently, Chile has experienced a plunge in the unemployment rate. According to the 2019 report, the unemployment rate is 7.43% with 6.3% female unemployment and 7.4% male unemployment. The plunge was observed because Chile has been flagged as an economy with a "dual labor market" referring the economy offers temporary contracts as a proportion to the permanent contracts. Along these lines, Silva and Vazquez-Grenno (2013) found that the unemployment variability is driven by movements to and from temporary jobs.

In Chile, the economic growth over the past fifty years has been characterized by the ongoing reallocation of production across over time, with the increasing share of the tertiary sector relative to the primary and secondary sectors. According to INE data, the employment share of the

[3] According to Gallego and Loayza (2002), Chile's economic growth rate in 1985-2002 was among the four highest in the world. Moreover, according to the same source, the change in the growth rate per capita between 1985 and 2002 was actually the highest in the world

primary sector nationwide has remained stable at roughly 10% since 2008, while the secondary sector accounts for roughly 11% of employment since 2008, and the remaining lion share accounted for by the tertiary sector.

Chile had strategically made the education gap closer to both men and women but there are sharp disparities between women and men in the area of economic participation and opportunity (Haussman, Tyson and Zahidi, 2010). Chile's intense labor laws like paying for childcare if the women employment is 20 or more and no firing for two years after pregnancy surrounding women have been the main cause behind the obstacles of female unemployment and pushing them to enter the informal sector. In the 1980s, export agriculture and forestry had shown an increase in the women's participation in Chile's central valley and southern central zone. In 1992, the labor participation rate for men was estimated at 76 percent and that for women at 32 percent with 4.4 percent of the unemployment rate. By late 1993, Chile's economy experienced an unexpected boom in the size of the labor force, mainly from women seeking employment, which increased the unemployment rate to 4.9 percent.

The information regarding the distribution of unemployment rate across gender sector-wise was difficult to obtain for Chile even though the sector-wise unemployment rate of the U.S. was easily available. By doing thorough research, I can conclude that the majority of female employees are involved in the informal sector of the Chilean economy.

c. Oil import and export of the U.S. and Chile

Till the early 2000s, the United States was struggling under declining domestic oil production that led to an increase in the import of oil. But in 2000, new technology allowed companies to draw oil and gas from shale deposits which were economical as the cost of extraction would be impractical. Over the past decade, the U.S. has begun producing more oil, decreasing the reliance on imports. Not importing oil or greater production of oil is a net positive for the United States. As a result, new jobs have been created in the U.S., but oil exploration and extraction are expensive and highly capital-intensive. That also means that oil prices impact the domestic oil sector more directly, with jobs and profits linked to the price of oil. Due to Energy independence, a drop-in oil price can be an issue for economic instability. Previously, when the price of oil dropped, it lowered the price of

the import and reduced cost for the manufacturing and transport sectors but now low oil prices harm U.S. oil companies and domestic oil industry workers that are laid off. As consumers of oil, however, lower prices still benefit most consumers with cheaper gasoline and travel as well as lower prices of many manufactured goods. Though changes in the oil price do not completely throw off the US economy by hook it common for oil prices to increase the impact of economic shocks.

It is interesting to note that Chile is an oil-import dependent country whereas the U.S. is a major oil and exporting country. Chile majorly imports oil from the US, the Eurozone, and Japan. The low oil prices from the U.S. will benefit Chile though it may hurt the domestic oil producers. According to the finding of Pedersen (2011), the spread of shock to energy prices towards other prices is almost four times higher in economies emerging like Chile than advanced like the U.S. Chile has a stabilization fund to decrease the volatility of fuel prices. As per 2019, the total oil import in Chile is 45% (due to environmental sanctions on state-owned company ENAP and its subsidiaries) whereas the total net oil import of the U.S. is 11 % and domestic production is 86%.

3. VAR Model

It is important to understand the composition of oil prices which is the consequence of the normal functioning of the oil market(endogenous) so to interpret the effect of changes in the oil price on the macroeconomic aggregates. It should be noted that the endogenous variable is different from the shocks. We composite the model for the shocks, but it does not imply that each variable is a shock. The shocks affect the composition of oil prices which affects the macroeconomic aggregates.

So, Killian (2009) proposed the three-variable Vector Auto Regression (VAR) model based on monthly data to identify underlying shocks in the oil market. Vector Auto Regression Model (VAR) is proposed as it captures the record to predict for 16 months how the unemployment rate would respond to decomposed variables of oil price change affected by the oil supply shock, aggregate demand shock, and oil market-specific demand shock. In Time Series econometrics, we studied the response of one variable to another variable over time (time horizon), for this we cannot look into the coefficient to understand the effect. We use the Moving Average representation of the VAR Model. Based on the parameter, we calculate the response function. VAR model is interpreted by looking at the

impulse response function that traces out the change in forecast of the dependent variable in the VAR in response to "shocks". The impulse response is necessary for this study as it includes all the endogenous variables and gives us pieces of information. VAR models are used as structural shocks are identified by restricting the sign of the responses of selected macroeconomic aggregates to these shocks. In the VAR model, there is an error band which is the area of the response of the macroeconomic aggregates to the shocks of the economic mechanism.

The structural VAR representation is

$$A_0 z_t = \alpha + \sum_{i=1}^{24} A_i z_{t-i} + \varepsilon_t,$$

where $z_t = (\Delta prod_t, index\_killian_t, roil_t)$ and $\Delta prod_t$ is the percent change in global crude oil production (oil supply), $index\_killian_t$ is the index of real economic activity (aggregate demand) and $roil_t$ is the real price of oil (precautionary demand) and ε_t refers to the vector of serially and mutually uncorrelated innovations. We have 4 variables in the vector z_t. Therefore, A matrix is assumed to be lower triangle following the identification proposed in Killian (2009).

Oil shocks are designed as unexpected innovations to endogenous variables of oil price. There is a wide literature on the interaction of these endogenous variables and the shocks.

The oil supply shocks are designed as unexpected innovations to global oil production and it is assumed that it does not respond to the demand for oil within the same month as the oil producers set production based on expected trend growth in demand and it is difficult for the oil-producing countries to adjust the production cost and to forecast the state of the crude oil market.

Aggregate demand shocks are defined as innovations to global real economic activity that is not captured and explained based on crude oil supply shocks.

Oil-specific demand shocks reflect changes in the demand for oil as opposed to changes in the demand for all industrial commodities, and fluctuations in precautionary demand for oil which are driven by the uncertain shortfalls in the future oil supply. Other structural shocks could affect the oil-specific demand shocks but there are reasons that the oil-specific demand shocks effectively represent exogenous shifts in the precautionary demand. Killian used the oil future market data to prove that there is a high correlation between shock-induced movements in the real price and independent measures of the precautionary demand component of the real oil price.

The face of a negative shock in the oil supply, oil production contracts (negative sign), increases its price (positive sign) and its impact on world activity is (weakly) negative in the extent to which production costs increase.

The face of a positive shock in the oil supply, oil production expands (positive sign), decrease in the oil price (negative sign) and its impact on world activity is positive in the extend to which the production costs decrease. The decrease in the production cost will theoretically decrease the unemployment rate due to higher demand for products.

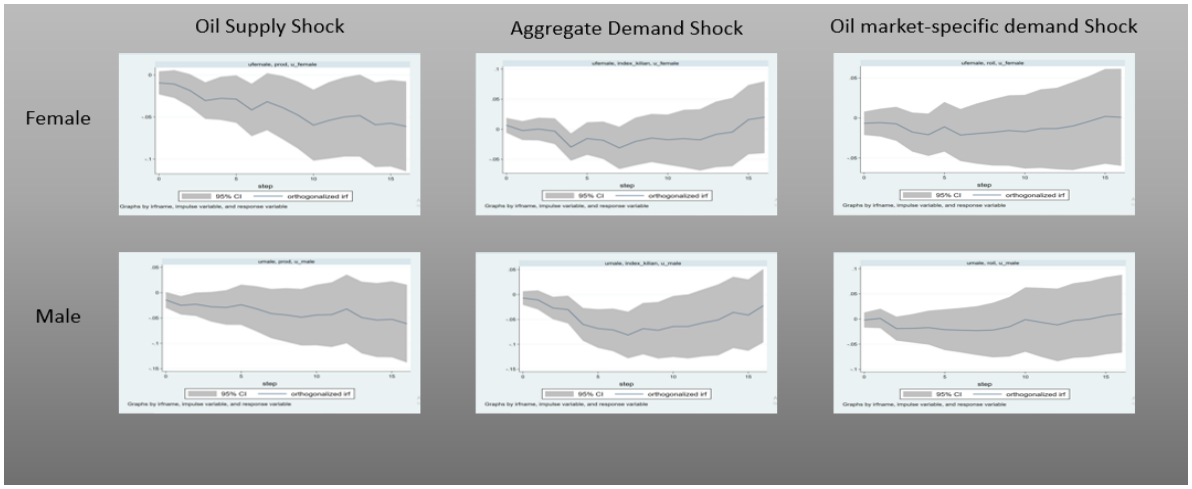
4. Data & Results

There are three observable variables: Crude oil production, aggregate demand, and the real price of oil. Monthly data from 1990:1 through 2019:12 have been obtained from the Bureau Labor of Statistics (BLS), U.S. Energy Information Administration (EIA) and OECD Data for Oil_production to measure the crude oil production; Index_killian to measure aggregate demand; CPI and oil price to measure the real price of oil. The price, quantity, and the index is about the global oil market. It is not a market for any specific country. It is the market for the global economy.

The following figures show the responses of global oil production, real economic activity, and the real price of oil to one-standard deviation structural innovations.

In the figures, there is an error band which is the shaded area.

1. *The response of the Unemployment rate to the oil shocks in the U.S.*



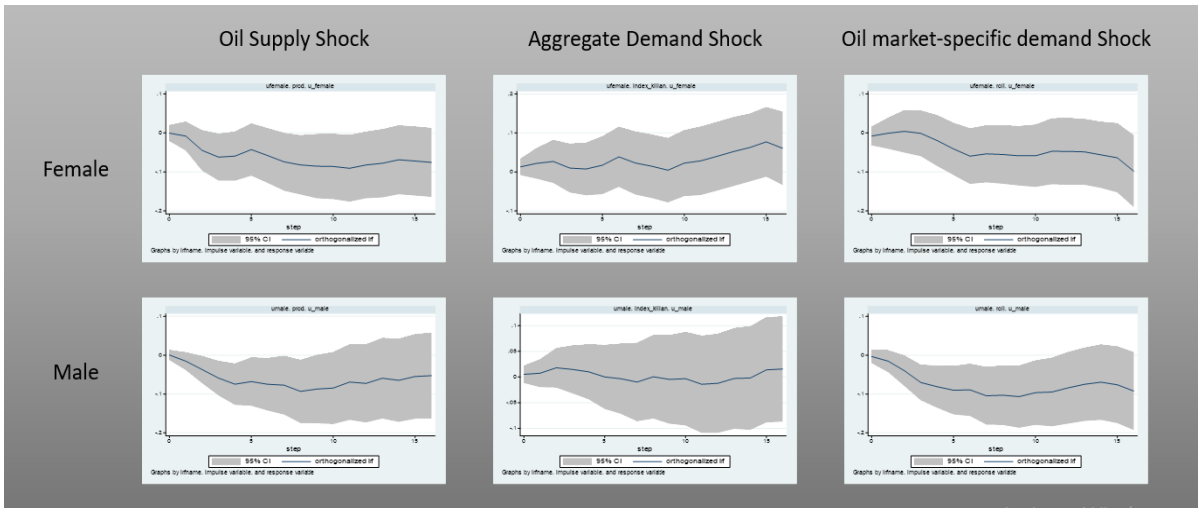
The first column explains the response of female and male unemployment rate to the oil supply shock in the U.S. The top left (1st row and 1st column), from the 2nd month 0 touches the top line of the shaded area which means that unanticipated oil supply disruption significantly lowers the unemployment rate. It implies that there is a positive supply shock that will decrease the oil price leading to the low cost of production and solving the problem of unemployment rate in the female population. There is a 95% confidence interval that the points in the shaded area include the response of unemployment in females in the U.S. to supply shock. Therefore, from the 2nd month, unemployment rate response negative to the oil supply shock & becomes statistically significant in the long run. It can be explained that the oil supply disruptions in one region tend to trigger endogenous expansion of crude oil production elsewhere in the world which helps offset the initial production shortfall. The bottom left (2nd row and 1st column), unlike how unemployment in females responded to an oil supply shock, unemployment in males has nearly no response to an oil supply shock. Theoretically, supply disruption causes a small and transitory increase in the real price of oil within the first few years which is evident in the figure that the unemployment in male response positively for a very short time and then disappears and remains insignificant.

The middle column is the response of female and male unemployment rates to the aggregate demand shock. The impact of an aggregate demand shock on the unemployment rate in the female is temporary and short-lived. It causes a small temporary push to the real economic activity that is partially statistically significant. The aggregate demand from the global business cycle does not largely affect the reduction of unemployment in the female. Whereas, strong aggregate demand shock solves the problem of the unemployment rate for males. From the 3rd month till the 9th month, the aggregate demand shock has a positive effect on the unemployment rate of males. Unlike for females, the unemployment rate for males negatively responded to a positive aggregate demand shock. An increase in aggregate demand for all industrial commodities causes a delayed but sustained increase in the real price of oil. Because of the aggregate demand shock, there is a shift in the demand curve, decreasing the prices of goods & increasing production. Over time, the stimulus wears out & the adverse effect of the higher commodity prices triggered by this shock dominates,

making the effects of the positive aggregate demand shock recessionary with a delay.

The last column explains the response of female and male unemployment rates to the oil market-specific demand shock. There is no response of unemployment in females and males to a precautionary demand shock. If the prediction would have been made before 1990, then the oil market-specific demand shock would have affected the unemployment rate but as the US has the access to the inventory holdings of oil, oil market-specific demand globally does not have an effect on the unemployment rate in the U.S.

2. *The response of the Unemployment rate to the oil shocks in Chile*



The first column explains the response of female and male unemployment rates to the oil supply shock in Chile. There is no response of the female unemployment rate to the oil supply shock as crude oil supply is assumed not to respond to innovation to the demand for oil within the same month but there is a small response in the 8th month. For the unemployment rate in males, there is a positive oil supply shock, but it is temporary and short-lived.

The middle column is the response of female and male unemployment rates to the aggregate demand shock in Chile. There is no significant response to female unemployment to the shock. The same pattern is seen for male unemployment. Demand for all industrial goods has an insignificant effect on the unemployment rate on both genders.

The last column explains the response of female and male unemployment rates to the oil market-specific demand shock in Chile. For the female unemployment, there is no response to the shock & that the unemployment rate keeps on increasing over 16 months except on 6^{th} & 16^{th} month. For the male unemployment rate, from 3^{rd} month to 9^{th} month the response is negative to the shock then it increases insignificantly. The spike in the import of oil due to environmental sanctions could be on the reason. As the oil inventory is held by other countries, a precautionary demand in those countries will affect the import of oil which will affect the oil shock.

5. Conclusion

The results have shown that the unemployment rate of male and female responds negatively to different shocks differently in the U.S. and Chile. In the U.S., by early 2000 nearly half of the US labor participants were women and with the highest number in the service sector and government while male participation is higher in the goods-producing industries affecting the reallocation of labor. In Chile, women's labor participation is high in the informal sector. The Chilean economy has more contractual and temporary jobs which paint the true unemployment rate as the definition of the unemployment rate is ambiguous. We find that precautionary demand shock does not affect the U.S unemployment rate whereas it affects Chile's unemployment rate. Oil supply shock affects both the economies female unemployment rate. Aggregate demand has an effect on the male unemployment rate in the U.S. The results that we got explains shock causing the resource shifting across the service sector and manufacturing industries. Our analysis sheds light on the real price of oil which is explained based on the demand for oil (Domestic inventory holdings). A further study can be done by taking the 2020 unemployment rate of the U.S. which is interesting due to the COVID-19 affecting the labor market and simultaneously affecting the oil price. Possible future work could include assessing the influence of the future shocks identified in our model on Policy in the U.S. and Chile. We can also look into the mechanism on why precautionary demand shock affect Chile and not the U.S. and the paper suggests that policymakers should consider oil price when designing labor insurance or unemployment insurance

References

Aguiar-Conraria, L. and Wen, Y., 2007. Understanding the large negative impact of oil shocks. *Journal of Money, Credit and Banking*, *39*(4), pp.925-944

Albanesi, S. and Şahin, A., 2018. The gender unemployment gap. *Review of Economic Dynamics*, *30*, pp.47-67

Adelman, M.A., 1995. *The genie out of the bottle: World oil since 1970*. MIT Press

Baumeister, C. and Peersman, G., 2013. Time-varying effects of oil supply shocks on the US economy. *American Economic Journal: Macroeconomics*, *5*(4), pp.1-28

Brown, S.P. and Yücel, M.K., 2002. Energy prices and aggregate economic activity: an interpretative survey. *The Quarterly Review of Economics and Finance*, *42*(2), pp.193-208.

Carruth, A.A., Hooker, M.A. and Oswald, A.J., 1998. Unemployment equilibria and input prices: Theory and evidence from the United States. *Review of economics and Statistics*, *80*(4), pp.621-628

Gisser, M. and Goodwin, T.H., 1986. Crude oil and the macroeconomy: Tests of some popular notions: Note. *Journal of Money, Credit and Banking*, *18*(1), pp.95-103.

Groshen, E.L. and Potter, S., 2003. Has structural change contributed to a jobless recovery?. *Current Issues in Economics and Finance*, *9*(8)

Hamilton, J.D., 1988. A neoclassical model of unemployment and the business cycle. J.Political Econ. 96, 593–617

Hartmann, H.I., English, A. and Hayes, J., 2010. *Women and men's employment and unemployment in the Great Recession*. Institute for Women's Policy Research

Hausmann, R., 2009. The global gender gap report 2009. World Economic Forum.

Herrera, A.M., Karaki, M.B. and Rangaraju, S.K., 2019. Oil price shocks and US economic activity. *Energy policy*, *129*, pp.89-99

Karaki, M.B., 2018. Oil prices and state unemployment rates. *The Energy Journal*, *39*(3).

Kilian, L., 2009. Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. *American Economic Review*, *99*(3), pp.1053-69.

Kilian, L. and Lewis, L.T., 2011. Does the Fed respond to oil price shocks?. *The Economic Journal*, *121*(555), pp.1047-1072.

Kilian, L. and Vigfusson, R.J., 2017. The role of oil price shocks in causing US recessions. *Journal of Money, Credit and Banking*, *49*(8), pp.1747-1776

Kocaaslan, O.K., 2019. Oil price uncertainty and unemployment. *Energy Economics*, *81*, pp.577-583

Lee, K. and Ni, S., 2002. On the dynamic effects of oil price shocks: a study using industry level data. *Journal of Monetary economics*, *49*(4), pp.823-852

Michaelides, M. and Mueser, P.R., 2013. The role of industry and occupation in recent US unemployment differentials by gender, race, and ethnicity. *Eastern Economic Journal*, *39*(3), pp.358-386

Naudon, A. and Pérez, A., 2018. Unemployment dynamics in Chile: 1960-2015. *Economía chilena, vol. 21, no. 1*.

Pierce, J.L., Enzler, J.J., Fand, D.I. and Gordon, R.J., 1974. The effects of external inflationary shocks. *Brookings Papers on Economic Activity*, *1974*(1), pp.13-61.

Romer, C.D. and Romer, D.H., 1989. Does monetary policy matter? A new test in the spirit of Friedman and Schwartz. *NBER macroeconomics annual*, *4*, pp.121-170

Silva, J. and J. Vázquez-Grenno (2013). "The Ins and Outs of Unemployment in a Two-Tier Labor Market." Labour Economics 24: 161–9.

Uri, N.D., 1996. Crude oil price volatility and unemployment in the United States. *Energy*, *21*(1), pp.29-38

Wolff, E.N., 2005. Computerization and rising unemployment Duration. *Eastern Economic Journal*, *31*(4), pp.507-536