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Prescription Opioids, Labor Supply, and the U.S. Economy

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Abstract: The purpose of this paper is to explore the impact of prescription opioids on the overall labor force participation rate. Using county-level data for the states hardest hit by opioid overdose deaths in the year 2015, this paper empirically explores the effect of the opioid prescription rate on the aggregate labor force participation rate in the United States. It is critical to understand why America's labor force is shrinking because declining labor force participation coupled with demographic aging poses a major challenge for future U.S. economic growth. The year 2015, defined by the lowest labor force participation rate in nearly 40 years and the steep rise in the quantity of opioids prescribed, provides a unique opportunity to study the labor market impact of prescription opioids. To the best of my knowledge, no previous studies have used cross-section data for the year 2015 to analyze the relationship. A regression model is then developed that accounts for clustering. Appropriate tests and allowances are made for clustered data. The paper also computes the impact of declining labor force participation on U.S. economic growth for the 2000-2015 period. Results indicate that the effect of the opioid prescription rate on the overall labor force participation rate is negative and statistically significant. Furthermore, this analysis reveals that declining labor force participation significantly weakened the U.S. economy over the 2000-2015 period.

Keywords: Labor force participation, prescription opioids, opioid overdose, economic growth, clustered data.

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1. Introduction

Over 16 million people in the world and over 2 million people in the United States suffer from Opioid Use Disorder (OUD) – a disorder that is characterized by the chronic use of opioid despite its adverse consequences (Dydyk *et al*. 2024). While the opioid use disorder is rising throughout the world, it has changed into an epidemic in the United States. This epidemic began with increased prescribing of opioids in the 1990s, which led to growing overdose deaths. Over 480 thousand lives have been lost

due to the opioid crisis since 2000. The current opioid crisis, largely caused by inapt prescribing practices, marketing and abuse of oral prescription opioids for severe and chronic noncancer pain, worsened during the COVID-19 pandemic. The puzzling fact about this crisis in the United States is that despite a steady and significant fall in opioid prescribing, opioid overdose deaths have been rising at a continuous pace. Specifically, while there has been a 38 percent decline in opioid prescribing in the past decade, there has been a 300 percent rise in opioid overdose deaths (Kharasch *et al*. 2022). This phenomenon can be partially explained by the fact that although the number of prescriptions per 100 persons has been decreasing, the quantity of opioids in morphine mg equivalents (MME) prescribed per person has been rising (Kharasch *et al*. 2022).

In 2015, the total cost of the opioid epidemic was USD 504 billion dollars, according to the Council of Economic Advisers. Calculating the economic costs of opioid epidemic is far from being straight forward because of the extensive direct and indirect costs. For example, the Boston Fed has divided opioid epidemic's direct costs into three main categories – criminal justice costs, treatment costs, and health complications costs[1]. Two most important indirect costs include loss of current and future productivity, according to the St. Louis Fed[2]. While the loss of human life and adverse health effects are striking, there is still considerable debate on the labor market effects of opioid crisis. Previous studies on the relationship between prescription opioids and labor market outcomes have found mixed results. However, a 2023 Brookings report states, "There is strong evidence that the opioid epidemic has reduced labor force participation in the United States[3]." Moreover, while the United States has been experiencing a declining labor force participation rate (LFPR) since 2000, it fell from a peak of 67.3 percent in early 2000 to a near forty-year low of 62.4 percent in 2015 when the quantity of opioid prescribed increased significantly.

It is important to explore the determinants of labor force participation because declining labor force participation coupled with demographic aging poses a major challenge for future US economic growth. Note that half of the gains in participation rates driven by post-World War II baby boom and more women entering into the labor force during the 1960 – 2000 period were reversed. Additionally, the fact that the United States has been experiencing a steady decline in the prime-age male participation rate and at the same time a stagnant prime-age female participation rate has adverse implications for future national economic growth and standards of living as prime-age workers tend to be at their most productive years. Also, multiple waves of the COVID-19 pandemic have inflicted havoc on the US labor market. In 2021, over 47 million employees in the United States quit their jobs voluntarily – a phenomenon

called the "Great Resignation," which continued in 2022. A 2022 Monthly Labor Review article, published by the Bureau of Labor Statistics, states, "Over the last year, the rate of job quitting in the United States has reached highs not seen since the start of the U.S. Bureau of Labor Statistics job Openings and Labor Turnover Survey program in December 2000." Besides, the phenomenon of "Great Resignation," cannot be explained fully by the labor market tightness, according to the article. While the labor market has recovered, the participation rate at 62.5 percent in January 2024, reported by the BLS, is still below the pre-pandemic rate at 63.3 percent in January 2020. Hornstein *et al*. (2023) states, "Analyzing how participation evolved for various groups of the population suggests that more than two-thirds of this decline has been due to persistent "trend" factors…. Estimates project that trend factors – driven largely by population aging – could push labor participation down an additional percentage point over the next decade."

Van Zandweghe (2012) finds that 1.1 percentage points of the decline in labor force participation between 2007 and 2011 were due to trend factors while 0.8 percentage point of the decline was due to cyclical factors. Aaronson *et al*. (2014), Fernald *et al*. (2017) find that the decline in labor force participation is largely explained by persistent trends. Aaronson *et al*. (2012) conclude that half of the decline in labor force participation for the 1999-2011 period is due to demographic factors. Fernald *et al*. (2017) have argued that if non-demographic changes in LFPR were mostly explained by cyclical factors then the labor force participation rate should have returned to a normal or close to normal range by mid-2016 when cyclical components practically disappeared. Krueger (2017) finds that the demographic change factor is responsible for most of the decline – between half and two-thirds of the decline in labor force participation between 1997 and 2017. Previous studies thus mainly conclude that trend factors cannot completely explain the decline in labor force participation. Moreover, research shows that health factors have played a key role in the decline.

Krueger (2017) finds that the number of deaths from opioid overdoses quadrupled from 1999 to 2015. He observes that health conditions linked to pain prevent 40 percent of prime-age men from working and almost two-thirds of the men who take pain medication take prescription medications. A Blue Cross Blue Shield report discloses that in 2015, more than 20 percent of individuals insured by Blue Cross Blue Shield have taken prescription opioids[4]. Doctor and Menchine (2017) find that annual opioid dispensing in the United States is adequate for one-month supply of painkillers for everyone in the United States. Also, research finds that opioid therapy is not an effective therapy. Frieden and Hourly (2017) report, "1 in every 550 patients who started on opioid therapy died from an opioid-related cause, with the median fatality

occurring within 2.6 years of the initial prescription." Therefore, exploring the labor market impact of prescription opioids is vital for understanding the decline in the U.S. labor force participation rate.

Harris *et al.* (2020) conclude based on their findings that any positive labor market effects from opioids' beneficial use are offset by their adverse labor market effects. Using a combination of county-level data and individual prescriber data from Medicare Part D for 10 U.S. states from 2010 to 2015, the authors find a strong negative effect of per capita opioid prescriptions on labor force participation rates, employment-to-population ratios, and unemployment rates. Specifically, their results show that a 10 percent rise in prescription opioids contributes to a 0.53 percentage point drop in labor force participation. Aliprantis *et al.* (2019) show a negative association between the availability of opioid prescriptions and labor force participation. Nevertheless, Perez-Arce, and Prados (2021) have found a lack of studies on the relationship between health issues and labor force participation. Also, there is not much research related to labor market effects of health issues related to the recent opioid crisis.

The purpose of this paper is to examine the factors contributing to downward trends in labor force participation with a particular focus on the labor market impact of the access to prescription opioids using county-level cross-section data of the top 10 states with opioid overdose deaths for the year 2015. The states included in this study are the states that are ranked by the Centers for Disease Control and Prevention (CDC) as the top ten states with opioid deaths in 2015[5]. These states are Kentucky, Massachusetts, New Hampshire, New Mexico, Ohio, Pennsylvania, Rhode Island, Tennessee, Utah, and West Virginia. The reasons for selecting the year 2015 are twofold: a) in 2015, the labor force participation rate fell to a near forty-year low, and b) the quantity of opioids prescribed rose steeply. According to the CDC, the quantity of opioids in MME prescribed per person was approximately three times higher in 2015 than it was in 1999 and 63.1 percent of drug overdoses involved an opioid[6]. Furthermore, approximately half of opioid-related deaths involved prescription opioids.

The year 2015, defined by the lowest labor force participation rate in nearly 40 years and the steep rise in the quantity of opioids prescribed, thus provides a unique opportunity to study the labor market impact of prescription opioids. Hence, this study selects the year 2015 to empirically estimate the effect of the opioid prescription rate on the aggregate labor force participation rate using the county-level data for the states hardest hit by opioid deaths. To the best of my knowledge, using cross-section data, no previous studies have chosen the year 2015 for analyzing the relationship. A regression model is then developed that accounts for clustering at the state level. This

paper also intends to compute the impact of declining labor force participation rates on U.S. economic growth for the 2000-2015 period.

2. The Model

Following Krueger (2017), this study specifies the following regression equation to estimate the effect of the opioid prescription rate on the labor force participation rate.

$$l_{ij} = \beta_0 + \beta_1\, opioid_{ij} + \beta_2\, edu\_level_{ij} + \beta_3 Gr(prime_{ij}) + \beta_4 female\_wkids_{ij} + D_j + \varepsilon_{ij}, \quad (1)$$

where l_{ij} is the labor force participation rate of people aged 16 years and older in the i^{th} county in the j^{th} state. The primary variable of interest in this study is $opioid_{ij}$, the opioid prescription rate in the i^{th} county in the j^{th} state, measured by the number of opioid prescriptions per 100 people. The variable edu_level_{ij} is the education level of the i^{th} county in the j^{th} state, measured by the proportion of 25-and-older population with a bachelor's degree and higher. Boheim *et al.* (2023) find that in the United States, the average labor force participation rate for individuals with tertiary education is 23.3 percentage points higher than the participation rate for individuals with less than high school education. This difference across the OECD is 24 percentage points. Note that human capital theory suggests a positive association between human capital and labor force participation. Researchers (e.g., Mincer 1974, Katz and Murphy 1992, Goldin, and Katz 2009, Oreopoulos and Petronijevic 2013) show that empirically, there is a strong positive relationship between education and wages. Moreover, there are other non-pecuniary benefits accompanying human capital, such as improved employability, higher job satisfaction, safer workplace, and the likelihood of having health insurance through employers, which are likely to influence labor force participation positively (Laplagne *et al.* 2007, Oreopoulos and Petronijevis 2013). However, this rise in the labor force participation rate for workers with tertiary education is partially offset by the decline in labor force participation of young workers between the ages of 16 and 24 because of an increase in school enrollment. In the past two decades, young people have demonstrated the most significant fall in labor force participation because of the substantial rise in the returns to education since early 1980s (Krueger 2017). Therefore, the effect of the rise in the education level of workers aged 25 years and older on the aggregate labor force participation rate will depend on the strength of these two opposing effects.

$Gr(prime_{ij})$ is the growth rate of prime-age workers, individuals in the age range of 25 to 54, in the i^{th} county in the j^{th} state. Labor force participation for prime-age workers is supposed to be high as people in this age group are typically done with schooling but are not yet close to retirement age. Therefore, the growth of prime-age

workers in a county is expected to have a positive effect on the aggregate labor force participation rate. The variable $female\_wkids_{ij}$ measures the proportion of women with kids under the age of 6 at home in the i^{th} county in the j^{th} state. A 2018 Congressional Budget office (CBO) report states, "Having children under the age of 5 at home is related to the labor force participation of women but not men and varies with marital status. Married women with young children are less likely to work than married women without young children, whereas unmarried women with young children are more likely to work than unmarried women without children." Therefore, the estimated sign of this variable will depend on a county's proportion of unmarried women with young children. A set of state dummy variables, captured by D_j, is included in equation (1) to account for heterogeneity across states. ε_{ij} is the stochastic error term.

This paper uses county-level cross-section data that are grouped into 10 states. Data are clustered at the state level because model errors for counties may be correlated within a state or cluster. It is assumed that errors are uncorrelated across states or clusters. Studies that fail to control this within-cluster error correlation may produce misleadingly small standard errors and significant coefficient estimates. Cameron and Miller (2015) states, "It is not unusual to have applications where standard errors that control for within-cluster correlation are several times larger than default standard errors that ignore such correlation." Most widely used method of addressing the problem of clustered errors is to first estimate the regression model with no or limited control for within-cluster error correlation and then obtain "cluster-robust" standard errors after estimating the model and this study does so here. Although this method proposed by White (1984), Liang and Zeger (1986), and Arellano (1987) is suggested for the sample with large number of clusters, Cameron, and Miller (2015) states that it is not uncommon for the number of clusters to be small. Also, there is no precise definition of "few" clusters. Note that the statistical software, STATA, used in this study, rescales the residual when the number of clusters is small.

2.1. Data Sources

The Census Bureau's American Community Survey is the data source for the county-level data for *l*, the labor force participation rate, *edu_level*, education level, *Gr(prime)*, the growth rate of prime-age workers, and *female_wkids*, the proportion of women with kids under the age of 6 at home. Data on the variable *opioid*, the opioid prescription rate, are sourced from the Centers for Disease Control and Prevention. The data source for Y, real GDP of the U.S., is the Bureau of Economic Analysis. Data on L, the quantity of labor in the U.S., and WA, working-age population in the U.S., are sourced from the Current Population Survey. The data source for the variable N, total

population in the U.S., is the World Bank. Table 1 reports the summary statistics of the variables used to estimate equation (1).

Table 1: Summary Statistics

Variables	*Mean*	*Standard Deviation*
l	56.87	8.05
Opioid	96.32	43.71
Edu_level	17.33	8.31
Gr(prime)	-1.11	1.54
Female_wkids	6.88	2.90

Number of Observations 508

3. Estimation Results

Equation (1) is estimated by ordinary least squares (OLS). As stated earlier, post-estimation, this study obtains cluster-robust standard errors to control for within-cluster correlation. The coefficient estimates, with z values in parentheses, are

$$\underset{}{l_{ij}} = \underset{(19.90)^{**}}{43.65} - \underset{(-2.17)^{**}}{0.03 opioid_{ij}} + \underset{(11.37)^{**}}{0.52 edu\_level_{ij}} + \underset{(0.77)}{0.32 Gr(prime_{ij})} + \underset{(4.30)^{**}}{1.65\ female\_wkids_{ij}}$$

**Significant at the 5% level; All state dummy variables are negative and significant.

The coefficient on *opioid*, the opioid prescription rate, is negative and significant at the 5 percent level, indicating that labor force participation rate is lower in a county with higher opioid prescription rate. There might be a possibility of reverse causality or simultaneity between the labor force participation rate and the opioid prescription rate. The reverse causality begins with the relationship between the unemployment rate and the opioid prescription rate. Research shows that an increase in unemployment rate leads to an increase in opioid related deaths. Studies also show that a rise in the unemployment rate may result in a decrease in the labor force participation rate. Therefore, there might be a bi-directional relationship between the opioid prescription rate and the labor force participation rate through its association with the unemployment rate, which may cause the relationship to be spurious. Aliprantis *et al.* (2019) investigate this potential reverse causality by examining the relationship between labor market outcomes and opioid misuse just before and after the onset of the Great Recession, a period of significantly weak labor demand. Their findings show no notable increase in the rate of opioid misuse after the onset of the Great Recession. Harris *et al.* (2020) have addressed the problem of reverse causality by using instrumental variables. They have found that the negative influences of per capita opioid prescriptions on labor force participation, unemployment rates and employment-to-population ratios are most noticeable in the

counties with stronger labor markets. Research also contends that there might be no relationship between labor force participation and the unemployment rate. Thus, the estimation results of equation (1) in this paper are not likely to be driven by the role of reverse causality or simultaneity between the labor force participation rate and the opioid prescription rate.

The coefficient on *edu_level*, the proportion of 25-and-older population with a bachelor's degree and higher, is positive and significant at the 5 percent level, indicating that an increase in the level of education increases employability, which in turn increases labor force participation. Previous studies have found education's positive effect on labor force participation. The coefficient on *Gr(prime)*, the growth rate of prime-age population, has the expected positive sign but not significant. The coefficient on *female_wkids*, the proportion of women with kids under the age of 6 at home, is positive and significant at the 5 percent level, which is consistent with the CBO's findings. All state fixed effects are negative and significant.

4. The Impact of Declining Labor Force Participation on the National Economy

Following Marone (2016) and Bloom *et al.* (2010), this study computes the effect of falling labor force participation on economic growth in the United States for the 2000-2015 period. Obeying their method, this paper first divides economic growth into three components: a) the growth of real GDP per worker, b) the growth of the labor force participation rate, and c) the growth of the share of working-age population aged 16 years and over. The three components of economic growth are derived using the following identity that shows the association among the level of real GDP per capita, real GDP per worker, labor force participation rate, and the share of working-age population.

$$Y/N = (Y/L) * (L/WA) * (WA/N) \quad (2)$$

where Y, L, and N are real GDP, the quantity of labor, and the total population, respectively. The variable WA measures the working-age population aged 16 years and over. Y/N, Y/L, and L/WA are real GDP per capita, real GDP per worker, labor productivity, and the proportion of working-age population that is in the labor force, labor force participation rate, respectively. WA/N is the share of working-age population aged 16 years and over in the total population.

Converting equation (2) into natural logs and differentiating with respect to time yields,

$$Gr(Y/N) = Gr(Y/L) + Gr(L/WA) + Gr(WA/N) \quad (3)$$

Equation (3) shows that the growth rate of real GDP per capita, *Gr(Y/N)*, is the sum of the growth rate of labor productivity, *Gr(Y/L)*, the growth rate of the labor force participation rate, *Gr(L/WA)*, and the growth rate of working-age share, *Gr(WA/N)*. Note that this paper assumes that an increase in real GDP per worker is caused by an increase in labor productivity. Using time-series data for the 2000-2015 period, this study computes the three components of economic growth to measure the contribution of each component to economic growth. Table 2 shows that between 2000 and 2015, the U.S. economy grew at an average of 1.19 percent per year.

Table 2: Sources of Growth in Real GDP Per Capita, 2000-2015

Average Annual Growth

Real GDP Per Capita Growth, Gr(Y/N)	1.19
Breakdown of Real GDP Per Capita Growth	
Growth in Labor Productivity, Gr(Y/L)	1.27
Growth in Labor Force Participation Rate, Gr(L/WA)	-0.39
Growth in Working-Age Share, Gr(WA/N)	0.31

The decomposition of growth suggests that over this period, the growth rate of labor productivity was the largest driver of economic growth, contributing 107 percent or 1.27 percentage points of total growth in real GDP per capita on average. Note that since the 1970s, the rate of productivity growth has been slowing. The growth rate of the working-age share contributed 26 percent or 0.31 percentage point of total growth in real GDP per capita on average over this period. However, the average growth rate of labor force participation rate fell, which resulted in a negative contribution of 33 percent or -0.39 percentage point of total growth in real GDP per capita on average. Note that the negative contribution of the growth rate of the labor force participation rate more than offset the positive contribution of the growth rate of the working-age share, thereby leading to a less than 2 percent average growth rate for real GDP per capita over this period.

5. Summary and Conclusions

A growing labor force is one of the major drivers of economic growth and future prosperity of a nation. The findings of this paper show that between 2000 and 2015, falling growth in the labor force participation rate was responsible for a decrease of 33 percent of total growth in real GDP per capita, which averaged less than 2 percent over this period. Nevertheless, the U.S. economy between 2000 and 2015 grew on average solely because of labor productivity growth and growth in working-age share. The Congressional Budget Office projects that over the 2017-2027 period, real GDP will

grow at an average of less than 2 percent, mostly because of the slower growth of the labor force. However, explaining why the U.S. economy is experiencing falling labor force participation can be strikingly complex. Krause and Sawhill (2017) state, "There is still a lot that we don't know about America's declining labor force participation rate."

Although previous research concludes that structural factors (e.g., aging of population) are basically responsible for the decline, the structural factors fail to explain the falling participation rate entirely. This paper thus attempts to explore whether the rise in opioid prescriptions has played a role in the decline of labor force participation rate. Using county-level data for the top 10 states hardest hit by opioid overdose deaths in 2015, this paper shows a negative and statistically significant effect of the opioid prescription rate on the aggregate labor force participation rate. Additionally, the results show that the effect of growth of prime-age workers on the aggregate labor force participation rate is positive but not significant, indicating a declining labor force participation rate among the group of workers who are supposed to be most productive. Furthermore, evidence shows that declines have been relatively steep for prime-age workers with high school degree or less. This study also finds that counties with a higher proportion of people with a bachelor's degree or higher have a higher aggregate labor force participation rate. Evidence shows that lack of education or skills is one of the factors responsible for downward trends in labor force participation of prime-age workers.

Notably, previous research has produced mixed results. Also, research on the labor market outcomes of prescription opioids is still limited. This study is thus another attempt to elucidate why America's labor force is shrinking and particularly to explore the link between prescription opioids and labor force participation. This analysis does not suggest significantly restricting the availability of prescription opioids because restricting legitimate use(s) of prescription opioids may prevent individuals from returning to work. Rather, this study underscores that the easy access to prescription opioids as well as the illegitimate use of opioids can have adverse effects on labor force participation, which in turn will weaken overall economic growth.

This analysis can be extended by addressing other relevant and intriguing questions. For example, one question this study has not fully addressed due to data constraints is how to fully affirm the direction of causality between the labor force participation rate and the opioid prescription rate. It would be interesting if future research could identify the sources of exogeneous variability in prescription rates or develop a simultaneous equation model to address the possible simultaneity bias between the labor force participation rate and the opioid prescription rate. Another valuable extension of this

analysis would be to examine the relationship between labor force exit rates and opioid prescription rates.

Notes

1. See https://www.bostonfed.org/publications/new-england-public-policy-center-policy-report/2018/the-fiscal-impact-of-the-opioid-epidemic-in-the-new-england-states.aspx.
2. See https://www.stlouisfed.org/open-vault/2019/september/economic-costs-opioid-epidemic.
3. See https://www.brookings.edu/articles/the-economic-impact-of-the-opioid-epidemic/
4. See https://www.bcbs.com/sites/default/files/file-attachments/health-of-america-report/BCBS-HealthOfAmericaReport-Opioids.pdf.
5. See https://www.cdc.gov/nchs/pressroom/sosmap/drug_poisoning_mortality/drug_poisoning.htm.
6. See https://www.cdc.gov/mmwr/volumes/66/wr/mm6626a4.htm#:~:text=The%20amount%20of%20opioids%20prescribed%20in%20the%20United%20States%20began,Europe%20in%202015%20(14).

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