What has been the impact of Covid-19 on economic inactivity rates? An Analysis of local authority areas in England and Wales by gender.

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Abstract

This paper uses a linear random effects model to analyse the impact of Covid-19 on economic inactivity rates across local authority areas in England and Wales, focusing on whether the impact differs by gender. This study uses panel data across England and Wales from March 2020 and throughout 2021, alongside a number of control variables including education, age and industrial composition. After analysing the data, this study finds that the Covid-19 pandemic had a statistically significant positive impact on economic inactivity rates, for both men and women. However, the impact was larger for women, implying that for a 10 percent increase in Covid case rates in an area, economic inactivity is predicted to rise by 1.02 percentage points for women, and 0.65 percentage points for men. This paper explores the economic theory of the neoclassical model of labour-leisure choice to analyse how the trade-off between work and leisure has been influenced by the pandemic.

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1. Introduction

This research paper seeks to primarily analyse the impact of the Covid-19 pandemic on economic inactivity rates across local authority areas in England and Wales, and to ascertain if this impact differs by gender. In March 2020 the world was hit by a global pandemic, resulting in approximately 763 million cases of Covid worldwide (World Health Organisation, 2023). The UK implemented its first lockdown on 23rd March 2020 and had additional lockdowns as the pandemic continued. The subsequent lockdowns varied nationwide, dependent on Covid case intensity, indicating the importance of analysing the impacts across local authorities. Lockdown, amongst other measures to control the spread of the virus, drove the UK economy into a technical recession, after two consecutive quarters of negative Gross Domestic Product (GDP), in Q2 2020 when GDP experienced a record-breaking fall of 20.4 percent (ONS, 2020).

The measures to control the virus triggered a sudden fall in demand, for both consumption and investment, alongside a drop in the supply of goods and services during the early stages of the pandemic. The supply shock was driven by social distancing requirements forcing businesses, in particular retail and other high-risk sectors, to close, consequently reducing the demand for restaurants and similar amenities (del Rio-Chanona, et al., 2020). The closure of these businesses was further impacted by job losses and uncertainty.

To combat this the UK government introduced their flagship policy to reduce unemployment in the labour market, the Coronavirus Job Retention Scheme (CJRS). This was implemented on 20th April 2020 with the aim of keeping individuals employed by paying 80 percent of their wages initially (Francis-Devine & Ferguson, 2021). This is likely to be a key reason why during the pandemic, there has been a greater rise in economic inactivity opposed to unemployment, contrasting the Global Financial Crisis (GFC) of 2008, where there was a greater increase in unemployment (Verick, et al., 2022).

Research in the US found that flows from employment into non-participation more than doubled during the pandemic, with significant gender gaps (Albanesi & Kim, 2021). Therefore, this research focuses on economic inactivity, as opposed to unemployment, as during the pandemic flows into inactivity have been larger (ONS, 2023). Moreover, this research aims to establish if this impact varies significantly by gender, as minimal evidence currently exists for England and Wales.

To understand the implications of a rise in economic inactivity, it is important to differentiate between the definitions of those in the labour supply, which includes people in employment, the unemployed and the economically inactive. Employment is a measure of individuals over the age of 16 who have paid work, including employees and self-employment (ONS, 2020). The

unemployed comprises of people without a job that have been actively seeking work within the last four weeks and are able to start within the next two weeks.

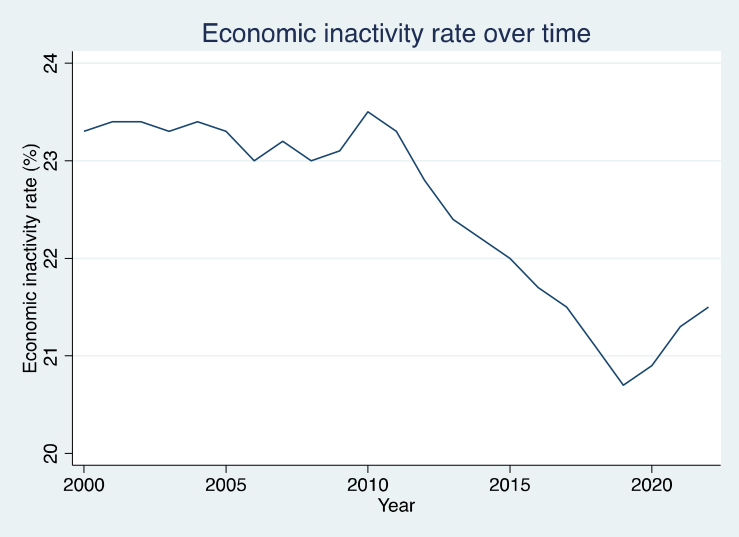

Figure 1: Economic inactivity rate over time (ONS,

Whereas the economic inactivity rate is defined as people without a job who have not been seeking work or are unable to start work in the next two weeks. This began to increase in Q2 2020, contrasting trends since records began in 1971, highlighted in Figure 1 (ONS, 2023). This may be partly due to the fact that looking after the family or home, which increased dramatically during the pandemic due to school closures and shielding relatives, is classed as economic inactivity, rather than unemployment. Despite signs of recovery in unemployment and the average age of exiting the labour market in Q2 2022, economic inactivity and employment continue to be negatively affected by the influence of the pandemic (Department for Work and Pensions, 2022).

A rise in the economic inactivity rate could have significant implications for the UK economy, presenting through a loss in GDP, as a result of a reduced labour supply which implies less people are contributing to overall output (Dotsey, et al., 2017). These factors could have substantial negative implications for the UK's long-term growth prospects, as a significant rise in inactivity will cause lower income tax revenues for the government, whilst also potentially increasing the sum of money spent on benefit payments, depending on the financial characteristics of those leaving the labour market. As a result, it is in the governments' best interest to understand the impact of the pandemic on the economic inactivity rate, in order to understand which policies can be most effective at encouraging people back into the labour force.

Overall, the UK has seen significant movements into inactivity during the pandemic (ONS, 2023), experiencing a more persistent increase, relative to other G7 countries, where the increase in

inactivity has largely reversed (ONS, 2022). This dissertation aims to analyse which factors play a significant role across local authorities in England and Wales and determine if there are significant differences between men and women.

2. Literature Review

Various studies have been conducted across the world in an attempt to determine the impact of Covid-19 on the labour market, with the majority of studies indicating substantial moves into economic inactivity. It is important to note that the studies discussed in this literature review are based in the US and internationally as similar studies have, at time of writing, not yet been conducted in the UK.

Moreover, due to the time frame, all of the papers discussed are at working level. Unemployment and labour participation figures are examples of lagging indicators, which change after other macroeconomic indicators, such as GDP have changed (Investopedia, 2021). Therefore, the following results, although useful to provide pre-liminary estimates of the impact of the pandemic on economic inactivity, should be interpreted with caution. This dissertation will add to existing research by studying a longer time period, from the start of the pandemic in March 2020 and throughout 2021 and provide evidence for England and Wales. Despite this, it is worthwhile to note that an in-depth analysis of the impacts of the pandemic on the labour market will not be able to be carried out for several years to determine if the impacts from the pandemic have long-run permanent implications for economic inactivity and the labour market.

The first study analyses the effect of the pandemic on labour force participation of different demographic groups (Corr, 2022). The paper finds that females with children experienced significantly lower labour force participation in Q3 2020 and Q4 2021, implying the pandemic may widen gender disparities in labour participation rates.

Moreover, to support this theory, the paper indicates that all female demographics experienced lower labour force participation during the pandemic, however the effect was smaller for women without children, implying there is a separate effect of having children, alongside the gender effect. This creates important implications for childcare policies to help women return to work.

The paper suggests the impact on women is largely due to increased care for children, as schools were shut during lockdown periods (Corr, 2022). Supporting this, they found no statistically significant difference in participation during the summer months when children are typically on their summer holidays, yet participation dropped again as schools opened remotely for the next academic year. However, it could be suggested that economic inactivity may recover to pre-pandemic levels as the economy reopens and children return to school, allowing mothers to return

to work. However, the discouraged worker effect may hinder this, as some people may have given up looking for a job as they believe there are no suitable employment opportunities available (Corr, 2022).

Moreover, the study found this was not the case for men with children, who experienced a smaller decline in labour force participation, highlighting gender disparities in the impacts of the pandemic on labour force participation, showcasing why separate regression models are needed to compare the impacts on males and females separately.

An important difference between the model used in the paper above and the one used in this dissertation is that it also controls for individual specific characteristics, such as gender, marital status, ethnicity and having children under 18 (Corr, 2022). This contrasts the model used in this dissertation which focuses on characteristics of local authority areas in England and Wales, as opposed to individuals.

Moreover, an additional study measures differences in changes in employment and non-participation in the US between two phases of the pandemic, where March to May 2020 represents phase one and the second, June to November 2020 (Albanesi & Kim, 2021). The study notes that past recessions have historically led to a larger employment drop for men than women in the US, however during the pandemic employment losses have been larger for women throughout, with flows from employment into non-participation doubling during the pandemic. They find this had a greater impact for women with children, supporting findings from existing literature (Corr, 2022).

The paper highlights that the substantial impacts on women during the pandemic may widen the gender wage gap and have persistent consequences. This is supported by estimates that 13 percent of the gender wage gap can be explained by periods of non-participation (Albanesi & Kim, 2021), as this is associated with depreciation of human capital and a loss of job skills. Alternatively, it could be suggested that the increased uptake of remote working may allow women increased flexibility to return to work, whilst also carrying out care responsibilities (Albanesi & Kim, 2021).

Additionally, the study found the demand for workers in high contact and inflexible service occupations declined during the Covid shock, whilst also noting these occupations are dominated by women (Albanesi & Kim, 2021). Contrasting this study, this dissertation will control for industrial composition using the International Labour Review classification of high-risk sectors, as the international classification is more likely to be applicable to England and Wales.

Furthermore, The International Labour Review (Verick, et al., 2022) analyses how the impact of Covid on labour markets differs to that of the GFC. Their main finding relating to this research was that the fall in employment was accounted for by a greater rise in inactivity, as opposed to unemployment as a result of the pandemic, this contrasts the GFC, where the move was into unemployment. The review highlights this is partly due to the unique nature of the shock as lockdown measures limited the ability of the unemployed to apply for jobs, due to social distancing

requirements and office closures. This may result in widening inequalities as evidence suggests that higher earners, alongside those in professional occupations, are more likely to work in a job that is suitable for remote work (ONS, 2020).

The review found that the effect is larger for those in high-risk sectors, females and young people. The study classifies four sectors as high-risk sectors during the pandemic, including sectors such as accommodation and food service activities, alongside manufacturing which experienced a 7.9 percent fall in the global employment growth rate (Verick, et al., 2022). This methodology has been utilised in this dissertation as it highlights the sectoral impact of the pandemic was not just limited to service sectors as many research papers assume. This will be discussed in further detail in Chapter 4.

Furthermore, the review finds that the gendered impact of the pandemic appears to be the opposite of the GFC. Supporting previously discussed research, finding that women and service sectors have been more susceptible to the negative impacts on employment. They indicate this is partly due to the unequal childcare burden, as a result of school closures during lockdowns making them unavailable to work or search for jobs. The review suggests a number of policy recommendations such as increased flexibility in work arrangements to help those with dependents work around their care responsibilities and encourage women back into the workforce (Verick, et al., 2022). Additionally, the review suggests the pandemic is likely to worsen the existing pre-crisis inequalities, consequently government intervention will be required to support people back into employment after the pandemic.

The research highlights a global rise in inactivity of 81 million (International Labour Organisation, 2021). However, despite considering an array of countries, the review does not include the UK, therefore this dissertation will build on existing research to analyse if the same impacts are present in England and Wales. This is particularly important during the pandemic due to differing policies to control the spread of the virus across countries. Moreover, it could be suggested that the UK was more affected by labour supply shortages due to Brexit and strict migration policies amplifying the restriction of movement of workers during the pandemic, highlighting it is important to further this research to understand specific impacts for England and Wales.

Finally, many studies suggest the impact on labour force participation has been worse for older workers, (Bui, et al., 2020), partially due to their increased risk of mortality and morbidity from Covid. As of May 2023, approximately 95 percent of Covid deaths in England were those aged 55 and older (Coronavirus (COVID-19) in the UK, 2023). Consequently, this may lead to age discrimination for those seeking work during the pandemic, as some companies may consider older workers to be a riskier hire due to increased health risks (Bui, et al., 2020). This may cause older workers to enter early retirement if they struggle to get a job, highlighting the importance of controlling for age in the regression model.

In previous recessions, older workers may have decided to re-enter the workforce, into bridge jobs, part-time or temporary work to cover pension losses before retiring, if their pensions had been negatively affected by a collapse in stocks and shares during a recession (Bui, et al., 2020). However, the paper suggests bridge jobs are less likely to allow for remote work and have higher rates of face-to-face contact, particularly for women. As a result, the increased risk to health from bridge jobs may have caused older workers to retire early during the pandemic, alongside restrictive measures imposed making this type of employment inaccessible, contrasting trends in previous recessions (Bui, et al., 2020).

Moreover, symptoms of long Covid may cause older people to exit the labour market due to poor health, the most common reason for inactivity in the UK, accounting for 28 percent of total inactivity, across all age groups, in 2023 (Kirk-Wade & Harker, 2023), up from 25 percent at the start of the pandemic. However, more research is required to clarify the long-term impacts of Covid on health outcomes.

This research speculates at reasons why an increased proportion of people have become economically inactive, however, further research will be required, as more data becomes available, to understand people's thoughts behind their decisions. An individual's rationale for becoming inactive will have important policy implications for encouraging people back into the labour market. If the fall in labour participation persists over time, government intervention will be required to ensure economic growth, without this, there will be significant negative consequences for the economy.

Collectively, existing research indicates there has been a significant impact of the pandemic on economic inactivity in the US and across the world. Moreover, multiple papers indicate there has been a larger impact for women, particularly those with children and that older workers have driven the increase in inactivity. The next section will discuss the economic theory that underpins this study.

3. Economic Theory

The neoclassical model of labour-leisure choice suggests individual's aim to maximise their utility, which is a function of the benefits they gain from consumption of goods, and leisure time (Borjas, 2013). The model highlights that each consumer is subject to a budget constraint which defines all the potential combinations of consumption of goods and leisure an individual can afford, as a result of their income levels from working, alongside non-labour income such as interest from bonds or investments in stocks and shares.

Individuals are able to choose the level of consumption and leisure that maximises their utility, however, it should be noted, that in the neoclassical model of labour-leisure choice, there is a trade-off between consumption and leisure, but consumers must allocate all their time between labour and leisure, as no other options are available. Labour hours only includes paid work and therefore informal hours such as looking after the household or family are considered to be leisure time (Borjas, 2013).

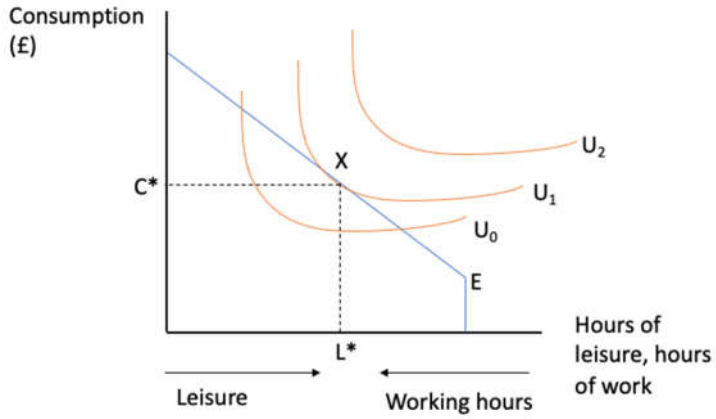

Figure 2: Neoclassical model of labour-leisure choice (Borjas, 2013)

The level of optimal consumption and leisure is shown in Figure 2, at point X, where the budget line is tangent to the indifference curve, U_1, as consumers aim to be on the highest indifference curve to maximise their utility. This is the point where the marginal rate of substitution, defined as, the willingness of a consumer to change one good for another whilst maintaining the same level of utility, between consumption and leisure, is equal to the wage (Borjas, 2013). Moreover, at any other point on the diagram, with a different combination of consumption and leisure, the individual would receive less utility or satisfaction, such as U_0. The final indifference curve, represented by U_2, would give an individual a higher level of utility, however it is outside their budget constraint, indicated by the blue line, and is therefore unaffordable at this income level.

In addition, point E represents an individual's non-labour income, which includes earnings from stocks and shares or other similar investments. A higher level of non-labour income is likely to reduce the number of hours an individual is willing to work to maximise their utility. Non-labour income is likely to increase as people age (Borjas, 2013), due to increased earnings over the life cycle and the increased probability of older people being able to access their state retirement fund. Therefore, as people age, excluding the younger age categories where individuals are likely to still be in education, theory predicts people are less likely to participate in the labour market, this is highlighted in Figure 3 below (ONS, 2023).

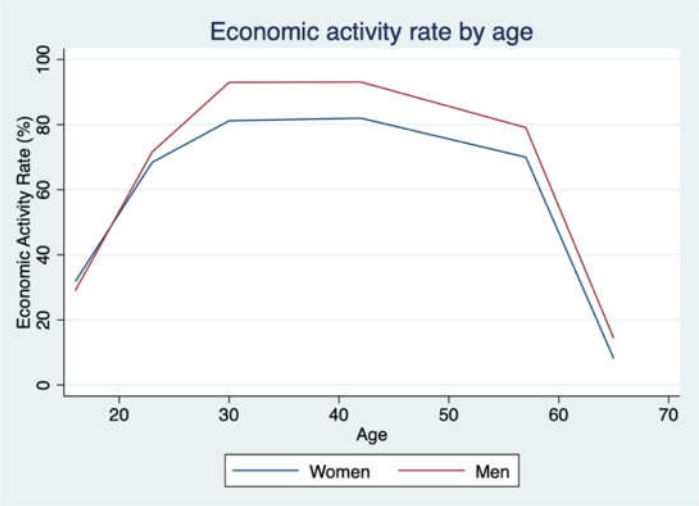

Figure 3: Economic activity rate by age (2019), (ONS, 2023)

During the pandemic, there has been a rise in the number of people moving from employment to inactivity (ONS, 2022). The neoclassical model suggests this could be due to a change in preferences away from consumption, moving instead towards increased hours of leisure (Borjas, 2013). However, it is important to note, that in the neoclassical model of labour-leisure choice, household work or caring for the family is classified as leisure time, which increased substantially during the pandemic, as school closures forced parents to home-school their children during this period. Therefore, leisure time is likely to have increased due to the increase in informal work around the home, as opposed to what is traditionally thought of as leisure activities.

Moreover, this also indicates why female participation has been hit harder during the pandemic, as looking after the family or home is classed as economic inactivity. These tasks are more likely to be done by women for a number of reasons. Due to gender wage disparities, for couples the opportunity cost of a women giving up work relative to her male partner is lower (Albanesi & Kim, 2021). As a result, the woman in the relationship may decide to give up work in order to take care of the household, instead of the male, as the opportunity cost of forgone income is lower, than if the male stopped working. As a result, this study hypothesises there will be a greater impact of the pandemic on female inactivity, relative to males.

In order for an individual to enter the labour market and move away from inactivity, the reservation wage, which is the lowest wage rate that would make an individual indifferent between working and not working, must be high enough to encourage them to work (Borjas, 2013). If the market

wage is less than the reservation wage, then the person will not work. The pandemic may have increased an individual's reservation wage for a number of reasons. For example, the fear of catching the disease may cause people to prefer leisure time if the risk is considered too great for the wage offered, as a result they may require extra compensation to return to the labour market to accommodate the increased risks. Although this may have been more of an issue before the vaccine was developed, these fears may persist for some time, especially amongst older workers.

Moreover, school closures increased the childcare burden for many families, having to care for their children, when they would have usually been in school. Childcare represents a major expense for households, as a result, many families will have increased their reservation wage as parents would have needed to earn more in income than they would have spent on childcare during the pandemic. Consequently, many parents may have chosen to become economically inactive in order to care for children or older shielding relatives during the pandemic, increasing informal care hours at home. In the neoclassical model this implies individuals have substituted labour hours for increased leisure time.

Economic theory predicts that the labour market adjusts over the business cycle in response to economic shocks, such as the pandemic induced recession (Borjas, 2013). Labour demand, as suggested by theory, is likely to fall during a recession and increase during the recovery phase. In addition, cyclical unemployment occurs when there is a downturn in the business cycle, as firm's layoff staff in response to a period of low demand and falling business revenue. However, as an economy recovers and enters the expansionary phase, businesses should start to rehire more workers. Despite this, hysteresis, which often occurs after a recession, indicates that short-run fluctuations in unemployment can cause the natural rate of unemployment to change. Hysteresis can also occur due to technological change, as firms increase automation during an economic downturn, this occurred during the pandemic, due to the increased adoption of working from home technologies (Valero, et al., 2021).

Furthermore, the closure of certain sectors for long periods of time may have accelerated deskilling. Consequently, this may lead to a permanent change in the workforce due to a loss of job skills making workers less employable, even after the recession has ended. Persistence of unemployment or inactivity in the labour market, even after the technical end of a recession, can lead to potential long-term scarring impacts. The (Office for Budget Responsibility, 2021) predict this fall in labour force participation accounts for 0.3 percentage points, of the 2 percent expected scarring due to the pandemic. This could be due to a number of factors discussed above, consequently, government policy may be required to boost the economy if long-term issues persist, such as job retraining programs to reskill workers that may have been displaced.

The labour supply during a recession can be affected via two main channels, either the added-worker effect or the discouraged worker effect (Borjas, 2013). The added-worker effect suggests that during a recession, secondary workers that were previously not in the labour market may enter

the labour market in the downturn if the main income earner experiences a wage cut or becomes unemployed. The added-worker effect is considered to be counter-cyclical, implying a fall in GDP would cause an increase in the added worker effect, highlighting why it occurs during recessions (Borjas, 2013). The pandemic presented an unprecedented shock to the economy and virus containment measures would have limited the added-worker effect as it became harder for people to get jobs due to lockdown restrictions, causing more people to become inactive as a result.

However, the discouraged worker effect highlights that the unemployed find it more difficult to find jobs during a recession, consequently becoming discouraged and exiting the labour market (Borjas, 2013). This is highlighted by large flows into inactivity during the Covid-19 pandemic, with approximately 565,000 more people in economic inactivity in the UK in 2022, relative to pre-pandemic (ONS, 2022). Furthermore, hysteresis suggests that as unemployment increases, a larger number of people adjust to a lower standard of living, as a result more unemployed people become economically inactive as they become less interested in returning to work. Furthermore, as more people become economically inactive, it becomes more socially acceptable for this to occur. This can result in a persistence of unemployment and inactivity in the labour market, even after the economy begins to recover.

In summary, hysteresis predicts that after a recession there is likely to be a persistence of unemployment and inactivity due to the discouraged worker effect and deskilling in the economy. Moreover, the pandemic is likely to have increased an individual's reservation wage as a result of increased risk to health and the childcare burden. Finally, the neoclassical model of labour-leisure choice suggests there may have been a shift in preferences towards increased leisure time during the pandemic, however, a large proportion of this may be caused by increased informal activities around the home, such as looking after the house and family, which are not counted as working hours in the model. The next section will discuss the econometric model and methodology used to test the impact of Covid cases on economic inactivity rates.

4. Econometric Model and Methodology

This dissertation utilises a linear random effects model to determine if Covid case rates across local authorities in England and Wales, amongst other control variables, had a significant impact on economic inactivity rates during the pandemic. A number of studies have been conducted across the world, particularly in the United States, however this study will analyse if similar patterns exist for England and Wales and if this impact varies by gender. The study tests a two-tailed hypothesis, where the alternative hypothesis predicts there will be a statistically significant impact of Covid cases on economic inactivity. Whereas the null hypothesis predicts Covid cases have no statistically significant impact. In addition, the study also hypothesises this effect is likely to be

larger for women, consistent with findings from existing US literature, as discussed in Chapter 2. This section will outline how the hypothesis has been tested and why certain models were dismissed.

A number of models were explored during the dissertation process, alongside various control variables. In the end, a linear random effect model best represented the relationship between the dependent variable, economic inactivity, and the main explanatory variable, Covid case rates.

To determine initial effects and to outline whether a relationship existed, a basic pooled regression was conducted in Stata, a computer software that is used for estimating econometric models. This indicated that Covid cases did have a statistically significant positive impact on inactivity, causing it to rise as the case rate increased. However, due to the panel nature of the data, which means it has both time series and cross-sectional elements, as the local authorities are followed over time, using a pooled model may bias the results. A pooled model is likely to provide inaccurate representations of the true impact of the pandemic on inactivity as it does not account for variations within or between the local authorities, which can be ascertained from random and fixed effects models.

As a pooled model was discounted the study considered using a fixed effects model. Fixed effects models are used to establish the causes of changes in variables within a group, (Wooldridge, 2012) in this case, within a local authority area. However, a fixed effect model requires variables to change over time. Unfortunately, due to the granularity of the data at a local authority level, not all the variables were available at the same time intervals over the period and sample. As a result, the fixed effect model could only include a limited number of control variables, making it to be likely subject to omitted variable bias.

Subsequently, based on the models trailed, it was decided that a linear random effects model would be the most appropriate model to utilise, represented by the equation below, which highlights all the variables used. The subscripts represent that this study uses panel data, where the *i* implies the variable is a specific characteristic of a local authority group, representing the cross-sectional element of panel data and the *t* indicates that the variable also changes over time. Finally, previous inactivity is a lagged variable and is therefore represented by the subscript t-1, to control for pre-pandemic levels.

$$inactivity_{it} = \beta_0 + \beta_1 covid\ cases_{it} + \beta_2 previous\ inactivity_{it-1} + \beta_3 gva\ per\ head_i + \beta_4 \text{degree}_i + \beta_5 \text{median pay}_i + \beta_6\ \text{percentage over } 50_i + \beta_7 \text{high risk}_i\ + \mu_{it} + e_{it}$$

Using a random effects model for panel data, accounts for the fact that some variables may vary randomly across the local authority areas. It is impossible to control for every variable that may impact the dependent variable, therefore the model includes two error components, denoted by μ and e, where μ represents the within-group, in this case within local authority error term and e is

the overall error term. These are combined to make a composite error term, which reflects all the variation in economic inactivity rates that are not explained by the model.

After trialling an initial random effects model, a Breusch and Pagan (BP) Lagrangian multiplier test was conducted in Stata to determine if random effects were significant in the model. The results will be discussed in further detail in Chapter 6. However, the test statistic highlighted that random effects are significant in the model and therefore using a random effects model is justified.

Moreover, alongside the proven presence of random effects from the BP test, this model was chosen as it had the highest R-squared, out of all the models trialled. The R-squared describes approximately how much of the variation in inactivity can be explained by the other inputs in the model, indicating this model had the best goodness of fit. However, R-squared statistics should be interpreted with caution as a model with a high R-squared value can indicate multicollinearity, which occurs when two or more independent variables are highly correlated, which consequently impacts the significance of the results (Wooldridge, 2012).

The same model was used for both men and women in order to be able to compare the impacts of the pandemic, proxied by Covid cases per the population, between the two sexes. However, it is important to note that although the model provided a strong fit for women, the model had few significant outcomes for men.

Across all the reviewed literature the timescale that defined the pandemic varied greatly, with many of the studies providing an early stage look at the pandemic, whilst it was still ongoing. As a result of this, it was difficult to determine what timescale would be appropriate for this study. In order to avoid potential confounding effects from additional economic challenges during 2022 such as the Russian invasion of Ukraine and the subsequent energy and cost of living crises, this study covers data from March 2020, when the UK went into its first lockdown and Covid case data begins to be reported at substantial levels, through to the end of 2021, when most restrictions had been lifted in the UK. Although timescales will vary from study to study, it is a sensible assumption to limit the influence of the current recession and inflationary pressures on the inactivity rate, as this is outside the scope of this dissertation.

Furthermore, using a random effects model allowed the inclusion of time-invariant variables in the regression to control for confounding factors that may also impact economic inactivity. Although it should be noted that there may be additional effects present in this study that are not accounted for, partly due to data availability, using a random effects model will attempt to minimise this by including a large selection of variables that may influence inactivity, as stated above in my research model.

The existing literature discussed in Chapter 2 provides similar studies, however, does not provide a cross-sectional element in the same way as this study. As a result, the model does vary from

those that have been mentioned previously. The next section will discuss the data sources used in this dissertation and provide rationale for the various control variables used.

5. Data

5.1 Covid cases

To conduct the analysis of the impact of Covid-19 on economic inactivity rates, data was mainly sourced data through NOMIS, alongside the UK government Coronavirus data website. The latter provided the data on new Covid cases by specimen date, the date the test sample was taken, by Lower Tier Local Authority area for England and Wales. This provided the level of cases, however, in order to make comparisons, the data was converted to Covid cases per local authority population to make it representative of each local authority, to determine Covid intensity across different areas.

US evidence (Albanesi & Kim, 2021) suggests there has been a greater impact on female participation during the pandemic, therefore analysing the two sexes separately to establish if this trend existed in the UK would build on existing evidence and provide insights for the UK. Unfortunately, Covid case data was not available by gender at the local authority level which added a further challenge to the research. Consequently, Covid deaths data was trialled, as this was available by gender, to represent Covid intensity, however, this was insignificant. As a result of the gender specific data being unavailable, the study uses total Covid case rates as a proxy of Covid intensity. Ideally if the data were to become available in the future, this would be split by gender to determine the true effect, as it might be that women or men were more susceptible to catching the virus, thus impacting the final inactivity outcomes.

Moreover, there were some additional challenges using Covid case data as up to 5 percent of cases tested by PCR tests are false positives (Government Office for Science, 2020). This could have sizeable implications for estimating the level of Covid cases. In addition to this, there was a change in test requirements to confirm Covid cases. At the start of the pandemic, tests had not been developed, therefore cases are likely to have been understated during the early stages of data gathering. Similarly, in the later stages of the pandemic, cases no longer had to be confirmed by a PCR test and a lateral flow test sufficed, therefore, this is likely to have increased the inaccuracy of testing. In addition, in peak periods, PCR tests were not available, effecting the accurate reporting of case levels. As a result, it should be noted that the Covid case rate variable may not be entirely accurate, however it is the best data available at this time.

5.2 Economic Inactivity Rate

For this study, the dependent variable, economic inactivity, was sourced from the Annual Population Survey, through NOMIS, for local authorities at the district level, separated by gender.

The economic inactivity rate allows for changes in the labour market, whilst acknowledging changes in the population levels, making it more representative to compare trends and variations over time. The study considers both economic inactivity rates during the pandemic, from March 2020 through till the end of 2021 and also controls for previous inactivity rates throughout 2018 and 2019, as this is likely to be a predictor of future inactivity, as the longer someone is out of the labour market, the more unlikely it becomes that they will re-enter it, partly due to a loss of job skills, as discussed in Chapter 3.

Using data from a number of sources presented some challenges, one of these included matching up local authority areas across data sets, as the Covid case data used different classifications for local authorities, relative to the NOMIS data. For example, in the Covid cases dataset Wycombe, South Bucks, Chiltern and Aylesbury Vale are listed separately, however in the labour market data they are collectively written as Buckinghamshire. To overcome this, the datasets were cross-checked to ensure comparability across them, so each local authority is matched up.

5.3 Industrial Composition

Moreover, the model also controls for the proportion of workers in high-risk sectors, as defined by the International Labour Review (Verick, et al., 2022). This variable was created using industrial composition data by gender for each local authority, then combining this into either the high or low risk category. The high-risk category included sectors such as accommodation and food services and manufacturing. The study trialled using the proportion of service sector workers in each local authority, however the International Labour Review (Verick, et al., 2022) highlighted it may be important to not just consider the services sectors, as many studies (Corr, 2022), discussed previously have done, as the high-risk sectors include a combination of manufacturing and services.

5.4 Education Level

Furthermore, the model also controlled for education level using the percentage of the population with a degree. Higher levels of education are likely to encourage people into the labour market due to higher earnings potential throughout their career. However, as people age, they may retire early and exit the labour market if their earnings are sufficient, highlighting the potential impact education level, proxied by having a degree, may have on inactivity.

5.5 Age

Similarly, age is controlled for in the model using the 2021 Census for the data, as existing literature suggests there has been a substantial increase in inactivity for those aged 50 and above (Murphy & Thwaites, 2023). Consequently, the study focussed on England and Wales as Scotland's Census was delayed to 2022 due to the impacts of the pandemic (Scotland's Census, 2020) and therefore would not be released in time to include in the analysis.

5.6 Wealth Effects

The final two variables in the model controlled for wealth effects across the local authorities, including Gross Value Added (GVA) per head, a measure of the value generated by any unit engaged in the production of goods and services (ONS, 2023), and median annual pay, from the Annual Survey of Hours and Earnings. If the wealth of an area has a significant impact in the regression this could have important implications for reducing inequalities in England and Wales, which may have worsened as a result of the pandemic.

5.7 Summary Statistics

The following table presents summary statistics of all the variables used in this dissertation. The sample includes all local authorities across England and Wales, however there are some data points missing for certain variables, notably median pay and GVA per head, highlighted by a slightly lower number of observations in the final column. Taking this into account, it is a fairly representative sample for England and Wales. In addition, the large standard deviations of the variables highlight the importance of analysing the impact of Covid case rates on economic inactivity at the local authority level, as there are substantial differences between the local authorities.

Table 1: Summary statistics of variables used in regression models

Variable	Mean	Standard Deviation	Min.	Max.	Number of Observations
FEMALE					
Economic inactivity rate	24.464	6.028	5.3	56	2,629
Previous economic inactivity rate	24.881	6.039	9.1	45.4	2,632
Degree	38.102	12.179	12	78.5	2,632
Median Pay	26616.83	4158.168	19795	4152.168	2,360
Percentage of population above 50	41.155	7.180	16.245	58.159	2,632
Percentage of workforce in high-risk sectors	49.447	8.016	11.5	74	2,632
MALE					
Economic inactivity rate	17.150	5.118	3.4	37.2	2,608
Previous economic inactivity rate	15.888	4.778	3.1	33.7	2,619
Degree	31.920	13.139	6.000	74.800	2,616
Median Pay	33422.25	4859.161	24260	48903	2,384
Percentage of males above 50	38.879	6.803	16.414	54.874	2,632
Percentage of workforce in high-risk sectors	65.301	8.522	0	92	2,632
OTHER VARIABLES					
Covid case rate	2.344	2.638	0	11.15	2,632
Gross Value Added per head	23219.27	8053.966	10980	74851	2,608

Table 1 highlights that average inactivity rates are higher for women than men, at 24.46 and 17.15 respectively. The next section will discuss the regression results, to determine if inactivity rates have been significantly impacted by Covid case rates and analyse if this impact varies by gender.

6. Interpretation and Analysis of Results

6.1 Covid Case Rate Results

Table 2 presents the results of the final model for females, and Table 3 contains the male results. A random effects model was chosen as the Breusch and Pagan Lagrangian multiplier test for random effects indicated random effects were present in the model, as discussed in Chapter 4. Overall, the Covid case rate did have a significant effect on the economic inactivity rate for both males and females, however, the effect was larger for women. This was significant at the 1 percent

level with P-values of 0.01 and 0.001 for males and females respectively. This implies that there is only a 1 percent chance of falsely rejecting the null hypothesis, indicating the results are highly significantly different from zero.

The random effects model predicts that for a 10 percent increase in Covid cases per the population, there would be a 1.02 percentage point increase in the rate of economic inactivity. Moreover, for males, a 10 percent increase in cases, would cause a 0.65 percentage point increase in inactivity rates. Although these numbers may seem small, these increases could cause thousands of people to leave the labour force. This in turn could have negative impacts on the overall economy through lost potential output causing potentially large falls in GDP. This implies that the null hypothesis, that Covid cases have no statistically significant impact on economic inactivity, can be rejected in favour of the alternative, as the coefficients are statistically different from zero. Therefore, it can be concluded that an increase in Covid case rates will lead to an increase in economic inactivity for both males and females, with the relationship being significant at the 1 percent level.

Table 2: Female Random Effects Model Results

Variable	Coefficient	Standard error	Test Statistic	P-Value
Covid cases	0.102***	0.030	3.470	**0.001**
Past economic inactivity	0.146***	0.024	6.060	**0.000**
GVA per head	0.000**	0.000	-2.170	**0.030**
Percentage of females with a degree	-0.060**	0.029	-2.040	**0.041**
Median pay	0.000**	0.000	-2.020	**0.043**
Females above 50	-0.153***	0.040	-3.870	**0.000**
Percentage of females in high-risk sectors	-0.009	0.035	-0.260	0.791
Constant (Intercept)	36.412***	3.188	11.420	**0.000**

1% significance level ***, 5% significance level **

Table 3: Male Random Effects Model Results

Variable	Coefficient	Standard error	Test Statistic	P-Value
Covid cases	0.065***	0.026	2.56	**0.011**
Past economic inactivity	0.013	0.025	0.52	0.604
GVA per head	0.000	0.000	-0.92	0.356
Percentage of males with a degree	0.000	0.024	-0.01	0.992
Median pay	0.000***	0.000	-5.83	**0.000**
Males above 50	-0.017	0.037	-0.45	0.652
Percentage of males in high-risk sectors	-0.031	0.026	-1.16	0.248
Constant (Intercept)	31.428***	3.053	10.29	**0.000**

1% significance level***

6.2 Lagged Economic Inactivity Rates Results

Lagged economic inactivity rates were used as a control for factors that may have impacted current inactivity but also had confounding impacts from Covid. The results from the female random effects model indicated a significant impact, implying that an increase in previous economic inactivity of 10 percent, would cause present inactivity rates to increase by 1.46 percentage points, highlighting that areas with higher levels of female previous inactivity are likely to have higher economic inactivity today.

However, in the random effects model, past economic inactivity is insignificant for males at the 5 percent level, despite having a small positive impact on inactivity rates at the 10 percent significance level. Using the 10 percent level of significance implies that there is a 10 percent chance of inaccurately concluding there is a significant relationship between the variables, when in fact there may not be, known as a type 2 error. As a result, this study will focus on variables that are significant at the 1 and 5 percent levels, due to their increased reliability when interpreting the results.

6.3 Education Results

Education was also controlled for in the model, proxied by the percentage of the population with a degree. For women, the model indicates a negative relationship between economic inactivity and having higher levels of education, however for men education was found to be insignificant. For women, the negative coefficient of -0.06, significant at the 5 percent level, implies that for an increase in the percentage of individuals with a degree in a local authority area, there will be a decrease in the economy inactivity rate. This is supported by economic theory and existing

literature, as higher levels of education improve earnings potential, consequently increasing the incentive to participate in the labour market.

6.4 Insignificant Variable Results

Moreover, a number of additional variables were insignificant. This was particularly the case for the male random effects model as, at the 5 percent level, past economic inactivity, GVA per head, the percentage of males with a degree, the percentage of males above 50 and those working in high-risk sectors were all insignificant, indicating there is no statistical relationship between economic inactivity rates and the given control variable. Unfortunately, this model does not best represent the male outcomes, however, it presented the most significant results for women, therefore in order to make comparisons between the two, it was also used for males.

6.5 Wealth Results

Furthermore, median gross annual pay and GVA per head, the two variables used to control for wealth effects of the local authorities had significant impacts for women, with median pay also being significant for men. This result, as quantified in this study, is an additional facet which will add to existing literature and is a variation compared to the models discussed in Chapter 2. Median pay and GVA per head were included in the model to allow for variations in wealth across the local authority areas, as it is likely that, in particular median pay would have an impact on inactivity. A higher median pay can encourage workers to work less hours and potentially become inactive as they have benefitted from residual income and investments. Despite this, the coefficients are very small, therefore they are likely to have minimal impact on overall economic inactivity rates.

6.6 Age Results

The majority of results from the female random effects model supports the theoretical framework outlined in Chapter 3, excluding the age control variable, the percentage of males or females that are over 50 within a local authority. Economic theory predicts that as people get older, they are more likely to become inactive due to a number of reasons outlined in Chapters 2 and 3. However, the results indicate as females age there is a negative impact on inactivity, implying that having a higher proportion of females over 50 reduces economic inactivity rates. Although this result is significant for women, it is likely to be an anomaly of the model as it is unlikely to be the case in reality, highlighted by trend data in Figure 1 in Chapter 1.

Moreover, various controls for age were trialled, including median age of a local authority and the percentage over 60 and 65, however, these all implied a negative relationship between the two variables, which trend data shows not to be the case. As a result, this should be noted as an anomaly and presents a flaw with the model and results. If more data becomes available at the local authority level, additional methods of constructing an age control variable should be trialled in the future to ensure the results aligned with economic theory and existing literature.

6.7 Additional Random Effects Model Results

In terms of the R-squared, a measure of the goodness of fit of a model, this was substantially higher for the female model, with an overall score of 0.19, relative to 0.14 for males, this implies the female model explains more of the variation in economic inactivity, relative to the male model. However, it should be noted that the between effects for both models was larger, at 0.28 for females and 0.21 for males respectively, however, a small within R-squared caused a lower overall score. This implies the model explains more of the variance in economic inactivity rates between the local authorities in the study, relative to differences within the local authorities. This is due to the type of model used, as a fixed effect model controls for differences within local authorities. However, as discussed in Chapter 4, R-squared statistics should be interpreted with caution as even a model with a high R-squared can be subject to bias.

Moreover, Stata also calculates the proportion of the unexplained variance in the dependent variable, economic inactivity rates, that is explained by differences between the local authority areas. Both the female and male random effects models report similar results, implying that 51 percent of the variance in economic inactivity is explained by differences between local authorities.

Finally, the intercept, indicated by constant, was highly significant at the 1 percent level in both the male and female random effects model. The intercept represents the value of inactivity rates if all the other explanatory variables in the model are equal to zero. This is highly unlikely in this model due to the control variables used and is therefore not relevant to the interpretation of this model.

6.8 Breusch and Pagan Lagrange Multiplier Test Results

After the random effects model had been conducted, a Breusch and Pagan Lagrange multiplier test was utilised to test if random effects were significant in the model, in order to determine whether a random or fixed effects model should form the main part of the analysis. The null hypothesis states that random effects are insignificant, however Table 4 highlights that the null hypothesis could be rejected as the P-values for both men and women were 0.00. Therefore, it can be concluded that random effects are significant in the model at the 1 percent level and justifies the use of a random effects model.

Table 4: Lagrange Multiplier Test for Random Effects Results

	Male		Female	
	Variance	**Standard Deviation**	**Variance**	**Standard Deviation**
Economic Inactivity	25.413	5.041	36.466	6.039
Overall error term	10.209	3.195	13.525	3.678
Random effect term	10.648	3.263	14.076	3.752
Chi-bar-squared	1973.120		1935.90	
P-value	0.000		0.000	

6.9 Fixed Effects Model Results

Alongside the random effects model, a fixed effect model was also conducted for both males and females. Unfortunately, due to data availability, as discussed previously, the fixed effects model contains minimal control variables and therefore may be subject to omitted variable bias, consequently the results should be interpreted with caution. However, it can be used to estimate the effect of unobservable characteristics that vary between the local authority areas that have not otherwise been accounted for in the model.

The fixed effects model highlights that for Covid cases, the coefficients remain positive, but it predicts a smaller impact of Covid cases on economic inactivity, at 0.08 for women and 0.05 for men, however they are both statistically significant at the 1 percent and 5 percent level respectively. This implies that for women, an increase in the Covid case rate of 10 percent, would lead to a 0.8 percentage point increase in the economic inactivity rate. However, the impact is smaller for males resulting in a 0.53 percentage point increase in inactivity. This could have substantial implications for the UK's economic growth if this persists after the pandemic, as lower levels of labour market participation imply fewer people are contributing to the UK's goods and services output, resulting in a fall in GDP. Moreover, a rise in economic inactivity suggests less people are paying income tax, this may in turn cause tax rates to rise in the future to overcome this, which may be harmful to the UK's growth.

Despite this, lagged economic inactivity becomes insignificant for women and the coefficient becomes negative for males, despite being significant at the 10 percent level. However, many studies consider the 10 percent level to be insignificant as it increases the chance of a type 2 error, concluding there is a significant impact of a variable, when in fact there is not.

Table 5: Female Fixed Effect Model Results

Variable	Coefficient	Standard error	Test Statistic	P-Value
Covid cases	0.080***	0.029	2.78	**0.006**
Past economic inactivity	0.036	0.026	1.38	0.169
Constant (Intercept)	23.381***	0.667	35.03	**0.00**

1% significance level ***, 5% significance level **, 10% significance level *

Table 6: Male Fixed Effect Model Results

Variable	Coefficient	Standard error	Test Statistic	P-Value
Covid cases	0.053**	0.024	2.17	**0.03**
Past economic inactivity	-0.044*	0.026	-1.74	0.082
Constant (Intercept)	17.748***	0.415	42.75	**0.00**

1% significance level ***, 5% significance level **

If more data becomes available in the future, ideally a fixed effect model with additional control variables would be conducted to determine if further control variables used in the random effects model also had a significant impact under a fixed effect model. However, due to the recent nature of the pandemic, only a basic fixed effect model could be used in this study, as it requires the variables to change over time.

7. Conclusion and Discussion of Results

Overall, the study finds that during March 2020 to the end of December 2021, Covid case rates per population had a statistically significant positive impact on economic inactivity rates. The results show that for a 10 percent increase in Covid case rates, there would be a 1.02 percentage point increase in the rate of economic inactivity for women and a smaller increase of 0.65 percentage points for men, significant at the 1 percent level.

Corroborating this, existing studies have indicated there is a larger impact for women with children during the pandemic (Corr, 2022). This may imply additional childcare policies should be

introduced to encourage workers back into the workforce, as there is a trade-off between earning a wage and paying for childcare. It is worthwhile to note that in the Spring 2023 Budget the government announced plans to expand childcare support by providing 30 hours a week of free childcare for children under 3 (HM Treasury, 2023). Amongst other policies, this should encourage more mothers back into the workforce by reducing their reservation wage and removing barriers to work. Furthermore, the disproportionate impact of the pandemic on the service sector may have amplified the increase in inactivity for women, due to their dominance in service sector roles.

Moreover, particularly for women, many of the control variables had a significant impact on inactivity. Notably, those controlling for the wealth of an area, GVA per head and median pay had a significant, albeit small impact on inactivity. This aspect differs from the discussed literature in Chapter 2, however is particularly important in the UK as it has implications for the government's levelling up agenda, indicating the government may need to focus on additional policies to improve GVA in the local area, to help reduce the economic inactivity rate.

Existing literature indicates that in the UK, 76 percent of the increase in economic inactivity has been due to the increase for those aged 50 and above (Murphy & Thwaites, 2023). The report also notes that the majority of the older workers who have left the labour market since the start of the pandemic have taken early retirement from a high paying professional job. This implies that the distributional impacts across society may not be as negative as once thought. This may provide a potential explanation as to why the age coefficients in this study did not show the relationship predicted by economic theory. Moreover, in the recent Spring Budget, the government increased tax relief on pensions with the intention of encouraging skilled older workers, which make up an increasing proportion of inactivity, back into the workforce (HM Treasury, 2023).

In addition to this, research also suggests the UK is facing a longer-term widespread issue as a large proportion of the rise in inactivity is due to an increase in long-term sickness across all age groups (Murphy & Thwaites, 2023). This implies government policy should focus their efforts on making the workforce more accessible for workers with long-term illnesses or disabilities, in addition to encouraging older workers back into the labour force. This was unable to be considered as part of this dissertation as the data was unavailable at a local authority level, however an area for future research would be to consider potential reasons why people become inactive, to further inform policy decisions. The recent Spring Budget implies measures are being taken to combat this by introducing a Universal Support programme to match people with long-term sickness and disabilities with jobs and training (HM Treasury, 2023). This could help to further reverse the pandemic trend of a rising economic inactivity rate.

Contrasting the International Labour Review (Verick, et al., 2022), this model does not indicate a statistically significant relationship for those that work in high-risk sectors, relative to those who do not. This may be due to variations in the occupational composition of the UK, compared to those included in the review, as sectors considered to be high risk in the UK may vary from the

international definition. It is also likely to be partially due to the economic support policies the UK government put in place during the pandemic, in particular the CJRS which may have provided increased employment protection for workers in high-risk sectors in the UK, relative to other countries discussed in the review. This may imply why the trends and results found in the existing literature, mainly from US studies, vary relative to some of the outcome in this study.

Although it is unclear to what extent these effects will persist as the effects of the pandemic unwind, this is an area for additional research. However, it is important to understand the impact of the pandemic on economic inactivity to prepare policymakers for any unprecedented exogenous shocks that may occur in the future. This research has important implications for government policy as many control variables had a statistically significant impact and this can help to inform government policy in areas that can be specifically targeted in the labour market recovery from the pandemic.

In conclusion, the results from this study build on existing literature to provide evidence for England and Wales, utilising a random effects panel data model, controlling for lagged inactivity rates, gender, education, wealth, age and industrial composition. The model predicts a positive statistically significant impact of Covid case rates on economic inactivity rates at the local authority level. Moreover, the results indicate there is a larger impact for women, significant at the 1 percent level, supporting findings from existing papers and economic theory. As more data becomes available further research will be required, but the evidence presented in this paper provides crucial results that will assist in further policy planning to facilitate the lowering of the economic inactivity rate in England and Wales. Without appropriate intervention, large increases in the economic inactivity rate could lead to a potentially substantial fall in GDP and further negative consequences for the economy.

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