economies

MDPI

Article

Employment Support and COVID-19: Is Working Time Reduction the Right Tool?

Luigi Aldieri , Bruna Bruno and Concetto Paolo Vinci *

Department of Economic and Statistical Sciences, University of Salerno, 84084 Fisciano, Italy; laldieri@unisa.it (L.A.); brbruna@unisa.it (B.B.)
* Correspondence: cpvinci@unisa.it

Abstract: The main objectives of this study are to take into account the effects of COVID-19 on labor market functioning, and to evaluate the effects of policies regarding working time reduction, in terms of both containing the spread of infection and economic activity. Accordingly, we describe a macroeconomic model wherein we test the effects of reducing working hours in the Keynesian unemployment framework, which comprises a fixed prices and wages regime, and a consumption demand that is dependent on salaries and autonomous demand components. Moreover, we also describe a neoclassical unemployment framework, wherein the labor market is only governed by dynamic demand forces. Theoretical results show that, according to the epidemiological phase, a reduction in working hours may be a good policy for containing the virus and improving employment in the Keynesian framework when established conditions are maintained. In the neoclassical framework, a work sharing policy will fail if some conditions do not occur, and it could cause an increase in the spread of the virus when a reduction of epidemic containment measures occurs. Employment will increase when the pandemic ends. A numerical simulation confirms that a reduction in working hours could reduce virus diffusion, but only under established, constrained parameters in both frameworks.

Keywords: COVID-19; working time policy; simulation

check for updates

Citation: Aldieri, Luigi, Bruna Bruno, and Concetto Paolo Vinci. 2022. Employment Support and COVID-19: Is Working Time Reduction the Right Tool? *Economies* 10: 141. https://doi.org/10.3390/economies10060141

Academic Editor: Franklin G. Mixon

Received: 12 May 2022
Accepted: 8 June 2022
Published: 14 June 2022

1. Introduction

The COVID-19 pandemic in 2020 heavily impacted work organizations and economic activities. Permanent job losses were expected due to COVID-induced demand shifts, together with firms not surviving the pandemic, and jobs lost due to post-pandemic concerns about the transmission of infectious diseases (Ahmed et al. 2018).

Two major effects can be distinguished in terms of workplace functioning. During phases of intensive diffusion of the virus, many countries adopted more or less severe lockdown measures, causing drastic interruptions to productive activities. Moreover, when gradually reopening production lines, social distancing was also considered a relevant preventative measure to be adopted in workplaces.

As to the first effect, workplace closures were required or recommended to prevent the diffusion of COVID-19, which caused huge losses of working hours during 2020. The ILO reported that 81% of the world's workforce was affected by workplace closures as of 7 April 2020 (Autor and Reynolds 2020), and the percentage only decreased to 68% by 29 April 2020 (Autor et al. 2020).

Working hour losses are expected to last, at lower or higher intensities, and the subsequent effects on individual income, unemployment, consumption, and economic growth could be wide and persistent. Temporary closures have prompted many firms and corporations to arrange working hour reduction agreements to avoid layoffs, whereas other firms face the risk of definitive closures.

Some countries have adopted programs at the governmental level to provide incentive agreements for working hour reductions, or to provide direct financial support to employees obliged to stay at home. France, Ireland, Japan, The Netherlands[1], and other countries, applied work sharing as a temporary measure, and provided financial support to employers, whereas other countries, such as Norway[2], Brazil, Chile[3], and others, aimed to provide financial support to employees. Other countries have simply made it easier to sign agreements for reductions in working hours; for example, Canada extended the application of work sharing agreements, up to a maximum of 38 weeks, for businesses impacted by the economic downturn due to COVID-19[4]. Italy, the UK, and Denmark directly pay a variable percentage of wages to prevent layoffs.

As to the second effect, many authors have investigated the impact of social distancing measures on pandemic diffusion or on overall economic activity; however, little attention has been paid to the long-term effects of social distancing rules on individual and team productivity. Workers need much more time to accomplish their tasks because prevention devices have to be adopted, cleaning procedures are needed, and workplace crowding must be avoided. All production workflows become slower, and productivity is likely to be influenced from a long-term perspective, as habits and routines become entrenched within organizations. Furthermore, sectoral differences in working organization should be considered, as in-person services may be more impacted by social distancing restrictions.

A related issue concerns the impact of teleworking ("smart working") on productivity, as many tasks can be accomplished by smart working methods, but others cannot. How smart working influences productivity is open to debate (Barrero et al. 2020).

On the whole, it is clear that the adoption of measures to prevent virus diffusion has several strong effects on economic activity. On the other hand, this inverse relationship should be verified, as the reorganization of working activities may reduce the need to adopt preventative measures. In this paper, we investigated the effects that using reduced working hours as a tool had upon managing productive activities during the pandemic. When regulating economic activities in workplaces, the policymaker should account for the technological and macroeconomic rules governing production choices. It is well known that containment policies vary significantly across countries in terms of strictness and the kind of measures adopted. It is therefore a relevant issue to assess how a specific measure affects virus diffusion.

More specifically, we consider working hour reductions according to different macroeconomic views, investigating the capital–labor relationship in terms of time spent working, in order to underline how altering working arrangements may modify the perceived effect of reducing working hours. We evaluate the effects of COVID-19 prevention measures on working hours, by considering tasks that cannot be performed through smart working.

2. Literature Review

In this section, we will approach the literature by discussing the two main variables concerned in our analysis—measures to contain virus diffusion and working hour reduction—in conjunction with their effects on economic activity. In this sense, the consequent relationship between pandemic measures and working hour reductions can be investigated in a more comprehensive way.

2.1. Working Hour Reduction and Its Economic Effects

Reducing one's time spent working is a proposal that has periodically emerged in the economic literature as a way to increase employment through work sharing. In the 1980s, considerable debate arose with regard to this issue (Bartik et al. 2020), and a new series of work sharing considerations emerged during the 2000s (Betancourt and Clague 1981). More recently, the effects of reducing time spent working have been simulated using the Spanish economy, outside of the pandemic scenario, which resulted in a decreased unemployment rate (Bosworth and Westaway 1987).

Given the economic crisis caused by the spread of COVID-19, renewed interest in this issue seems to have appeared in political spheres, but few scientific analyses are available.

The employment consequences of working hour reductions have been broadly discussed in the economic literature, but several relevant matters have long remained unsettled; very few studies have examined capital operating times (COT) and routines of workers' shifts. The economic debate concerning COT has undergone many changes over the years. Beginning in the post-war era and continuing until the first oil crisis, economists focused on matters relating to long-term growth. At that time, the dispute concerning the role of physical capital with regard to economic growth emerged in its totality, and researchers started to contemplate production functions in terms of COT.

In the early 1960s, the length of COT had played an important role in explaining economic growth during that period (Bughin and Cincera 2020). In the 1970s, as their object of study, many studies examined the microeconomic foundations of workers' shifts and COT (Cajner et al. 2020; Calmfors and Hoel 1988; Cárdenas and Villanueva 2021; Cette 1990).

Contrasting effects have been underlined. In France, the implementation of reduced working hours had no effect on COT (Chetty et al. 2020), whereas other studies showed that a reduction in COT, that was smaller than the reduction in working time, caused capital to be substituted for labor (Coibion et al. 2020).

In light of this, this paper argues that any existing relationship between working time and employment cannot ignore the presence of COT.

2.2. Pandemic Measures and Their Economic Impact

The COVID-19 pandemic prompted discussion concerning whether it is most appropriate to consider economic shock from a supply or demand perspective. This debate has been replicated from both a macro- and labor market perspective.

Considering both teleworking and non-teleworking tasks (Collins et al. 2020), the labor supply effect concerning the 'fear of going back to work' (FOG) during pandemics has been analyzed, and it was found that older people decreased their active participation in the workforce. More generally, in the US, a decline in labor force participation of seven percentage points has been reported (Cortes and Forsythe 2020).

Some researchers have investigated the impact of COVID-19 on the labor market through data from Homebase, which provides the hours worked and wages paid for many small businesses. The results are mostly due to the closure and reopening processes of businesses, and/or to the layoff and hiring procedures, rather than fully structured programs of reductions to working hours. Focusing on small businesses in the leisure and hospitality sectors, average weekly hours declined sharply during the lockdown period, but this decline fully recovered upon reopening (d'Autume and Cahuc 1997). Long-term employment losses arose, caused by firms' definitive closures and difficulties in re-entering the labor market for many workers (Foss 1963). More losses are expected in low-wage and retail sectors, which is in contrast with the previous recession, where greater difficulties arose for the high-wage, construction, and manufacturing sectors (Gilles 2015). This implies that there needs to be different policy responses to increased unemployment. Similar evidence concerning sectors impacted by the pandemic reported that the largest employment losses were in the leisure and hospitality sectors, in addition to other services, including trade, transportation, and utility services, and in general, sectors which were less able to make use of teleworking (Gilles 2015). The sectoral differences in crisis severity may also produce a widening gender gap, given the incidence of female employment in the most affected sectors (Gilles and L'Horty 2003). The varied impact of the COVID-19 pandemic on certain sectors does not fully explain the disproportionate decline in employment for some disadvantaged groups, such as Hispanic people, less educated people, and younger workers, which has thus exacerbated pre-existing inequalities (Hoenig and Wenz 2020).

Evidence regarding labor market outcomes during the pandemic shows that the impact of one's employment level is strongly related to sectoral characteristics. This is because different working organizations have varying levels of physical proximity to others and varying levels of teleworking availability, with workers employed in pre-crisis jobs having few possibilities to work from home and greater levels of physical proximity to others, as well as a greater unemployment risk (Hunt 1999). Policy interventions need to be calibrated to different technological and working arrangements, in order to consider the peculiarities of each sector.

Many economic policy interventions to mitigate COVID-related economic effects have also been discussed in the recent literature. Some authors suggested facilitating job reallocations instead of preserving pre-COVID jobs that would lengthen the overall recovery time (Ahmed et al. 2018). Other authors suggested that traditional macroeconomic tools, such as demand stimulations or liquidity facilitations, may have had a limited effect during the pandemic because consumer spending is constrained by health concerns, and thus, it would be more fruitful to adopt social insurance schemes (ILO 2020a).

2.3. Working Hour Reduction and Pandemic Measures

In the recent and vast literature on pandemic measures, much attention has been devoted to working from home measures, but few studies have considered the effects of working hours.

Some authors have investigated the relationship between social distancing and virus transmission using a pre-pandemic framework. A review concerning influenza transmission and social distancing (ILO 2020b) concluded that social distancing is effective in reducing virus transmission in workplaces, and the effects are stronger if social distancing is accompanied by other interventions. Nevertheless, the efficacy of distancing in the workplace decreases with higher R_0 values, because virus reproduction cannot be reduced to below one if R_0 is high. The authors observed that, in 2018, there were few empirical studies on contact rates within workplaces. In a simulation model (Kurmann et al. 2020), it was found that the estimated rate of transmission in workplaces accounts for 6–10% of total cases, depending on the prevailing production structure in the economy, with prevailing industrial–administrative, or prevailing self-employed workplaces, producing lower estimates.

Some authors investigated how individuals responded to the adoption of various prevention measures, distinguishing between health behaviors adopted by the individual (social distancing, increased hygiene, and mask wearing) and changes to work conditions (teleworking, reduced working hours, and not working) (Mongey et al. 2020). Their results showed that Germans were impacted by working hour reductions, with no significant differences among educational groups. When analyzing employment and relationship satisfaction (Nemțeanu et al. 2021a), about one fifth of workers reported that they spent a short amount of time at work (including decreased working hours, time off in lieu, special leave, and paid leave arrangements). Among workers who were able to telework, professional isolation and worse performances were highlighted (Nemțeanu et al. 2021b).

It is worth underlining that the pandemic may have had an indirect effect upon people's time spent working due to the spontaneous reduction of work hours. This was needed in order to meet growing caregiving responsibilities as a consequence of school and daycare closures, thus exacerbating an existing gender gap (Ollo-López et al. 2020), and highlighting that the pandemic response was generally gender-regressive (Power 2020).

It emerged that the relationship between non-pharmaceutical pandemic containment measures, such as social distancing in the workplace, and working hour reductions, is an under-investigated issue. A better comprehension of mechanisms linking working hour rearrangements and virus diffusion could be useful.

With regard to the above literature review, one can observe some relevant facts. First, sectoral working frameworks are fundamental for assessing the effects of the pandemic on firms and employment, and these frameworks are expected to be relevant for a long time. These differences concern different working environments and the related use of teleworking to rearrange working conditions. Furthermore, different technologies imply different COT, which is a relevant variable to assess the effects of reduced working hours.

Although the effects of the pandemic on economic activities are undeniable given the multiple detrimental economic effects, less evidence and fewer arguments are available to assess the effectiveness of some measures—such as working hour reductions—in terms of the necessity of implementing prevention policies.

3. Methodology

Moreover, it is obvious that most of the protocols that were put in place to fight against the spread of COVID-19 require compliance with social distancing directives within the workplace. This directive takes the form of reducing the simultaneous presence of large numbers of workers within the workplace.

In accordance with these protocols, one of the tools considered for achieving this could be a reorganization of the labor force using different working hours and shift plans.

Moreover, the differentiation of timetables, in addition to reducing the incidence of workers being simultaneously present in the workplace, may yield the beneficial effect of preventing crowds at entrances and exits, thus avoiding excessive and dangerous assemblages on public transport on the way from home to work.

Accordingly, we describe a macroeconomic model wherein the changes to working hours are evaluated with regard to both their effects on the adopted measures that aim to reduce the spread of infection, and to their effects on employment, which are assumed to be the policymakers' main objectives. In a pandemic framework, social distancing measures may affect the organization of a workplace by changing the number of workers per team, and consequently, the capital operating time and productivity. Indeed, we hypothesize that an increase in the diffusion index will affect how a workplace is reorganized after a working week is reduced. This is due to the drop in the number of teams working, caused by the need to sanitize workplaces in order to reduce the workers' probability of infection.

The following sections illustrate the main assumptions of, and derive implications from, two macroeconomic perspectives, as differentiated by labor market functioning. In the Keynesian unemployment framework, fixed prices and wages determine the consumption demand, which is dependent on salaries and autonomous demand components, whereas in the neoclassical unemployment framework, the labor market is governed only by the dynamic demand forces. This double perspective helps to disentangle working hour policies by considering markets with different levels of flexibility, in order to generate implications which have wider applications.

3.1. Basic Concepts and Main Assumptions

In order to analyze the relevance of a work sharing policy as a remedy against worsened employment due to the spread of COVID-19, in this paper, we will consider (Priem 2021) working hours and employees as different inputs in the production function. Furthermore, if it is clearly evident that a drop in working hours will impact employees' effort, it must be noted that such a reduction, together with the subsequent process of workplace reorganization, will adjust the number of workers, teams, and capital use. Today, more so than in the past, it is quite clear that production requires not only capital and work, but it also depends on a composite of work organizations that combines human and physical capital in ways that can be more or less stringent. Many industrial processes, despite using the most modern equipment, malfunction without constant human monitoring. The interruption costs may be so high as to impose continuous operation of the machines.

In addition, we will introduce a variable measuring the spread of the pandemic within the economic system in order to allow for the interaction between operational labor market policies and rates of infection in the context of both Keynesian and classical unemployment. The effort function we are going to consider takes into account possible effects of a pandemic threat. A rise in the COVID-19 diffusion index will increase the fear of a possible contagion among workers, with obvious negative outcomes in terms of their efficiency. We further hypothesize that an increase in the diffusion index will have effects on workplace reorganization after the working week is reduced. This is due to a drop in the number of teams working, caused by the need to sanitize workplaces in order to reduce workers' probability of infection, to create sufficient space between workstations (desks left vacant in open spaces, placed in separate rooms, or positioned so that people work side by side rather than face to face), and to use protective equipment such as plastic screens and walls to compartmentalize workspaces.

Our calculations use these terms:

- $Y =$ weekly production,
- $\lambda =$ number of achieving *equips*,
- $h =$ working hours per week,
- $e =$ worker effort,
- $n =$ workers per team,
- $K =$ capital stock,
- $N = n\lambda =$ employed workers,
- $T = \lambda h =$ COT,
- $L = Nh = nT = n\lambda h =$ total working hours,
- $R =$ COVID-19 diffusion index.

Furthermore, we will assume that:

$$e = e(h, R) \text{ where } e_h < 0;\ e_R < 0;\ \varepsilon_h = \frac{e\lambda_h}{e} \text{ ,with } \varepsilon_h \in [-1, 0];\ \mu_R = \frac{Re_R}{e}, \text{ with } \mu_R \in [-1, 0],$$

and also:

$$\lambda = \lambda(h, R) \text{ where } \lambda_h < 0;\ \lambda_R < 0;\ \varepsilon_\lambda = \frac{h\lambda_h}{\lambda} \text{ , with } \varepsilon_\lambda \in [-1, 0];\ \mu_\lambda = \frac{R\lambda_R}{\lambda}, \text{ with } \mu_\lambda \in [-1, 0].$$

The per-week production function may be:

$$Y = F(TK; eL),$$

which is assumed to have a constant return to scale with respect to labor input in efficiency units, and physical capital may be expressed as follows:

$$Y = \lambda(h, R)hF\left(K; \frac{e(h, R)N}{\lambda(h, R)}\right) \quad (1)$$

In this paper, the production function from Equation (1) will be considered to evaluate the process used when a working time drop is initiated in a virus flow environment.

3.2. Working Time Reduction, Employment, and Virus Infection Containment

We begin our analysis by considering a case in which there are no significant changes in the contagion index R. Denoting with α the production elasticity, with respect to the labor input N, and assuming $\alpha \in [0, 1]$ as the given physical capital level, we may easily obtain the following:

$$\frac{dY}{Y} = \beta\frac{dh}{h} + \alpha\frac{dN}{N} \quad (2)$$

where $\beta = 1 + \alpha\varepsilon_h + (1 - \alpha)\varepsilon_\lambda$.

The parameter β captures the effect that a change in working hours has on total production. From inspection of Equation (2), as emphasized in d'Autume and Cahuc (1997), we may distinguish various possible cases:

- $\varepsilon_h = \varepsilon_\lambda = 0$ thus $\beta = 1$;
- $\varepsilon_h = 0$ but $\varepsilon_\lambda = -1$ so $\beta = \alpha$;
- all other cases in which β may be greater or less than α.

The first case means that a drop in working hours does not affect the employees' level, and thus, it spawns a proportional production decrease. The second case concerns a situation where a decline in hours leaves the effort level unchanged, and thus, the number of teams with no change in COT increases. In all other cases, $\beta < \alpha$ will be supposed. From the analysis of Equation (2):

$$\frac{dN}{N} = -\frac{\beta}{\alpha}\frac{dh}{h} \tag{3}$$

Referring back to Equation (1), and allowing for an index R change, we may ascertain the following:

$$\frac{dY}{Y} = [1 + \alpha\varepsilon_h + (1-\alpha)\varepsilon_\lambda]\frac{dh}{h} + \alpha\frac{dN}{N} + [\alpha\mu_R + (1-\alpha)\mu_\lambda]\frac{dR}{R}$$

$$\frac{dY}{Y} = \beta\gamma\frac{dh}{h} + \alpha\frac{dN}{N} + \gamma\frac{dR}{R} \tag{4}$$

with $\gamma = [\alpha\mu_R + (1-\alpha)\mu_\lambda]$. Finally, for the given production we can use the following:

$$\frac{dN}{N} = -\frac{\beta}{\alpha}\frac{dh}{h} - \frac{\gamma}{\alpha}\frac{dR}{R} \tag{5}$$

After inspecting Equation (4), we may observe that work sharing effects will be influenced by trends resulting from the COVID-19 pandemic.

3.3. Keynesian Unemployment Framework

If we assume management of an economic environment with a fixed prices and wages regime, a consumption demand dependent on salaries and autonomous demand components, and a marginal propensity to consume for profit earners that are assumed to be equal to zero, we have the following situation:

$$Y = Y^d = cWN + D \tag{6}$$

where the parameters Y^d, W, c, and D stand for the aggregate demand, total real wages[5], marginal propensity to consume, and autonomous demand, respectively.

Concerning total wages, which are taken to be exogenous, we will assume that:

$$\frac{dW}{W} = (1-m)\frac{dh}{h} \tag{7}$$

where the parameter m captures the wage compensation share. We may distinguish three possible cases:

- $m = 0$; this is the case that represents no wage compensation, with constant hourly wages, and total wages dropping proportionally in accordance time spent working;
- $m = 1$, with full wage compensation and invariant total wages;
- $0 < m < 1$; this situation, which is most likely to occur, covers all cases of partial wage compensation.

If we define $\hat{\alpha} = \frac{WN}{Y}$, which is the output share aimed at rewarding the labor input in terms of Keynesian unemployment, it will be $\hat{\alpha} < \alpha$[6].

By totally differentiating Equation (5), we may easily obtain the following:

$$\frac{dY}{Y} = c\hat{\alpha}\left(\frac{dW}{W} + \frac{dN}{N}\right) + (1-c\hat{\alpha})\frac{dD}{D} \tag{8}$$

which, bearing in mind Equations (3) and (6), with simple algebraic passages, allows us to derive:

$$\frac{dN}{N} = \left\{\frac{[c\hat{\alpha}(1-m)-\beta]}{(\alpha - c\hat{\alpha})}\right\}\frac{dh}{h} + \left\{\frac{(1-c\hat{\alpha})}{(\alpha - c\hat{\alpha})}\right\}\frac{dD}{D} - \frac{dR}{R}\left\{\frac{\gamma}{(\alpha - c\hat{\alpha})}\right\} \tag{9}$$

Upon inspection of Equation (8), it seems clear that the validity of a work sharing policy will hold for $m > \left(1 - \frac{\beta}{c\hat{\alpha}}\right)$.

Let us now proceed with evaluating the effects of a drop in working times on the profits, defined as π. Knowing that π + WN = Y, we can derive the following:

$$(1-\hat{\alpha})\frac{d\pi}{\pi}+\hat{\alpha}\left(\frac{dW}{W}+\frac{dN}{N}\right)=\frac{dY}{Y} \tag{10}$$

which, after some simple algebraic manipulations, will be:

$$\frac{d\pi}{\pi}=\frac{dh}{h}\left\{\frac{\hat{\alpha}(1-c)[\beta+\alpha(1-m)]}{(\alpha-c\hat{\alpha})(1-\hat{\alpha})}\right\}+\frac{dR}{R}\left\{\frac{\gamma\hat{\alpha}(1-c)}{(\alpha-c\hat{\alpha})(1-\hat{\alpha})}\right\}+\frac{dD}{D}\left\{\frac{(\alpha-\hat{\alpha})(1-c\hat{\alpha})}{(\alpha-c\hat{\alpha})(1-\hat{\alpha})}\right\} \tag{11}$$

From Equation (10), it is clear that work sharing policies, and/or expansionary measures of autonomous demand, will have a positive impact on profits; these will obviously drop during a strong pandemic phase.

Returning to Equation (8), this may be written as:

$$g_N(\alpha-c\hat{\alpha})+\gamma g_R=g_h[c\hat{\alpha}(1-m)-\beta]+g_D(1-c\hat{\alpha}) \tag{12}$$

with $g_N, g_R, g_h,$ and g_D standing for the growth rates of $N, R, h,$ and D, respectively, and where g_N and g_R are strategic economic objectives, whereas g_h and g_D operate as possible economic policy instruments.

In line with the epidemiological trend, we can distinguish three possible scenarios:

1. ***Global pandemic*** According to the World Health Organization, there are three conditions which cause a true pandemic to occur: 1. the appearance of a new pathogen; 2. the ability of this agent to target humans; and 3. the ability of this agent to spread rapidly via contagion. In such a phase, the only objective of an economic policy will be $g_R < 0$. Upon inspection of Equation (11), we may recall that the validity of a working time reduction policy will cause a drop in R $\forall$ $m > \left(1-\frac{\beta}{c\hat{\alpha}}\right)$. More specifically, we can also distinguish the following three subcases in which a reduction in working hours can reduce the virus diffusion:
    - $\beta > c\hat{\alpha}, \forall m \in [0,1]$;
    - $\beta = c\hat{\alpha}, \forall m \in [0,1]$;
    - $\beta < c\hat{\alpha}, \forall m \in \left[\left(1-\frac{\beta}{c\hat{\alpha}}\right),1\right]$.

    Furthermore, the direct negative effect on profits has to be registered, even if it is mitigated by a positive indirect impact via R.

    As far as the other economic policy instrument is concerned, a containment of the pandemic (drop in R) can be always registered in case of an autonomous demand expansive policy.
2. **Phase 2.** Phase 2 consists of a progressive reduction of epidemic phase containment measures. The transition from the epidemic phase to Phase 2 implies that institutions are able to diagnose, treat, and isolate cases of COVID-19 and those who have been in contact with the virus; in other words, this will be a period of time in which the number of positive cases, as well as the number of deaths, will gradually continue to decline. In Phase 2, we will consider two economic policy objectives: $g_R < 0$ and $g_N > 0$. Similarly to the epidemic phase, a reduction in working hours may be a good policy to contain the virus, and given the phase, to improve employment $\forall$ $m > \left(1-\frac{\beta}{c\hat{\alpha}}\right)$. This is also true for the three previous subcases. An expansive autonomous demand-side policy will always operate as a remedy to reduce R and improve N.
3. **Phase 3.** Phase 3 is the end of the pandemic and the restoration of the absolute normality of work and social activities. It is the phase of the reconstruction and revitalization of our social and economic life. The main aim of policymakers will be $g_N > 0$. In such a phase, both work sharing and expansive demand-side policies will operate as in Phase 2.

3.4. Neoclassical Unemployment Framework

Let us now consider a world with neoclassical unemployment, where the labor market is governed only by dynamic demand forces. Given the physical capital, and that a pandemic increases the labor cost function $CT(R)$ with no fixed costs, the profits of a representative company may be given as follows:

$$\Pi = \lambda(h,R)hF\left(K; \frac{e(h,R)N}{\lambda(h,R)}\right) - WN - CT(R)N \tag{13}$$

with $CT_R > 0$, $CT_{RR} > 0$, $CT(0) = 0$, and $\xi = \frac{RCT_R}{CT}$.

The labor demand function will be:

$$\lambda(h,R)hF' \frac{e(h,R)}{\lambda(h,R)} = W + CT(R) \tag{14}$$

Stating σ as the capital and labor input substitution elasticity, with r = the interest rate, we may write:

$$\left\{ \frac{d(W+CT)}{W+ct} - \frac{dr}{r} \right\} \sigma = \left\{ \frac{dK}{K} - \frac{dN}{N} \right\}.$$

Furthermore, with:

$$\widetilde{\alpha} = \frac{N(W+CT)}{Y}, (1-\widetilde{\alpha}) = \frac{rK}{Y}, f = \frac{CT}{W+CT},$$

after some algebraic manipulations we may derive:

$$\frac{dh}{h}\left\{wh(1-m) - (wh+CT)\left[1+\varepsilon_h\left(1-\frac{(1-\widetilde{\alpha})}{\sigma}\right) - \varepsilon_\lambda \frac{(1-\widetilde{\alpha})}{\sigma}\right]\right\} = \frac{dN}{N}\left[\frac{(1-\widetilde{\alpha})(W+CT)}{\sigma}\right] - \frac{dR}{R}\left\{\xi CT - \frac{\widetilde{\alpha} Y \mu_R}{N} - \frac{(1-\widetilde{\alpha})(W+CT)}{\sigma h}\right\} \tag{15}$$

which may be expressed in a compact way:

$$g_h B_h = g_N B_N - g_R B_R \tag{16}$$

with $B_h < 0$; $B_N > 0$ and finally: $B_R \lesseqgtr$ if $\xi f - \mu_R \lesseqgtr \frac{(1-\widetilde{\alpha})}{\sigma h}$.

As for the Keynesian unemployment framework, we come back to the income distribution between wages and profits in order to consider their dynamic. After a few simple algebraic steps, we may obtain the following:

$$\frac{d\pi}{\pi}(1-\hat{\alpha}) = \frac{dh}{h}\left\{[\beta - \hat{\alpha}(1-m)] + (\alpha - \hat{\alpha})\frac{B_h}{B_N}\right\} + \frac{dR}{R}\left[\gamma + (\alpha - \hat{\alpha})\frac{B_R}{B_N}\right] \tag{17}$$

Upon inspection of Equation (16), we find an uncertain effect of $\frac{dh}{h}$ on $\frac{d\pi}{\pi}$. The only certainty concerns a drop in profits after the working week is reduced due to total wage compensation.

Let us now consider the three epidemiological scenarios:

1. ***Global pandemic.*** The effect of a drop in working hours will only reduce the pandemic for $\xi f - \mu_R < \frac{(1-\widetilde{\alpha})}{\sigma h}$.
2. **Phase 2.** In this phase, a work sharing policy will fail and cause an increase in the spread of the virus.
3. **Phase 3.** Work sharing will improve employment, whatever the compensation wage level.

Figures 1 and 2 summarize the main features of the theoretical schemes developed in this section, which will also be illustrated in the next section that is dedicated to a numerical simulation.

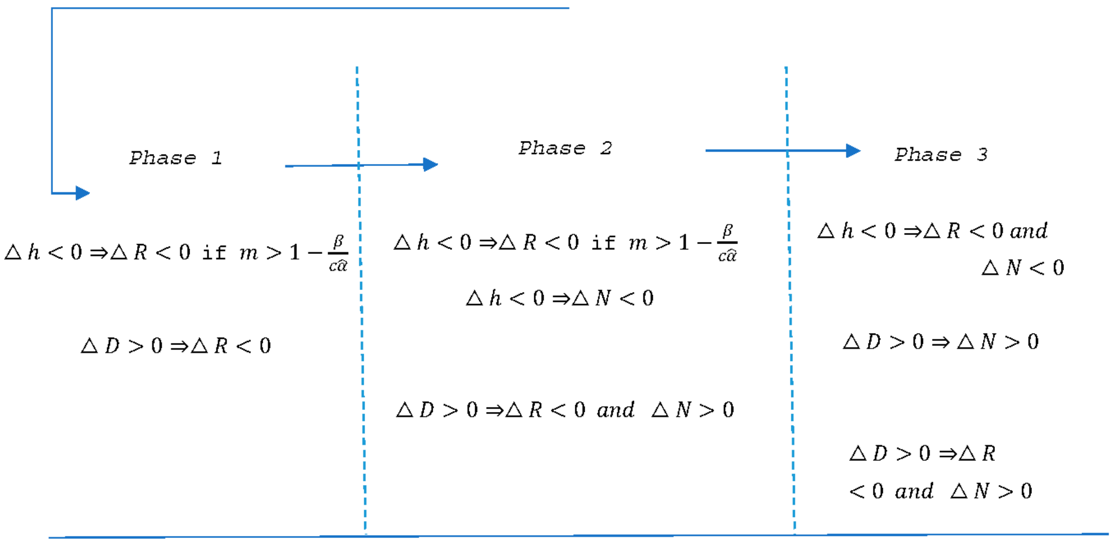

Figure 1. Keynesian Framework.

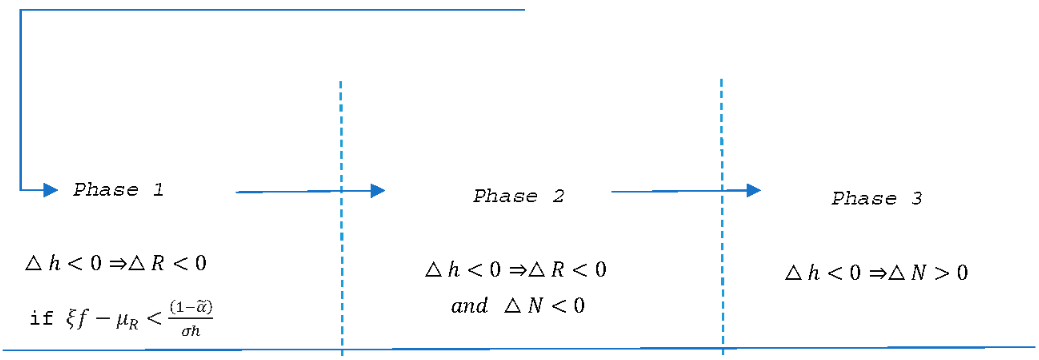

Figure 2. Neoclassical Framework.

4. Results

In this section, we show the impact of the reduction in work sharing on the COVID-19 diffusion index through a numerical simulation.

In particular, we distinguish the economic system according to the Keynesian and neoclassical frameworks.

As explained above, the Keynesian framework appears to manage an economic environment with a fixed prices and wages regime, a consumption demand dependent on salaries and autonomous demand components, and with a marginal propensity to consume for profit earners that are assumed to be equal to zero. Total wages are taken to be exogenous.

Let us start from Equation (11): $g_N(\alpha - c\hat{\alpha}) + \gamma g_R = g_h[c\hat{\alpha}(1-m) - \beta] + g_D(1 - c\hat{\alpha})$.

Upon inspection of Equation (11), we see that the validity of a working time reduction policy will yield a drop in $R \;\forall\; m > \left(1 - \frac{\beta}{c\hat{\alpha}}\right)$. Assuming that the parameters have the following values, $(\alpha - c\hat{\alpha}) = 0.44$; $m = 0.8 > \left(1 - \frac{\beta}{c\hat{\alpha}}\right) = 0.78125$; $(1 - c\hat{\alpha}) = 0.84$, a reduction in working hours ($g_h < 0$) could produce a drop in the COVID-19 diffusion index (g_R), as illustrated in Table 1:

Table 1. Keynesian Framework Simulation.

	g_h = −10%	g_h = −30%
g_R	−0.07556%	−0.2267%

In the neoclassical economic world, the labor market is only governed by dynamic demand forces. Let us observe Equation (16):

$$\frac{d\pi}{\pi}(1-\hat{\alpha}) = \frac{dh}{h}\left\{[\beta - \hat{\alpha}(1-m)] + (\alpha - \hat{\alpha})\frac{B_h}{B_N}\right\} + \frac{dR}{R}\left[\gamma + (\alpha - \hat{\alpha})\frac{B_R}{B_N}\right]$$

Upon inspection of Equation (16), we see that the validity of a working time reduction policy will yield a drop in R if $\xi f - \mu_R < \frac{(1-\tilde{\alpha})}{\sigma h}$. Assuming that the parameters have the following values, $\xi f - \mu_R = 0.4$; $\frac{(1-\tilde{\alpha})}{\sigma h} = 0.8$, a reduction in working hours ($g_h < 0$) could produce a drop in the COVID-19 diffusion index (g_R), as illustrated in Table 2 and Figure 3:

Table 2. Neoclassical Framework Simulation.

	g_h = −10%	g_h = −30%
g_R	−0.0632%	−0.1898%

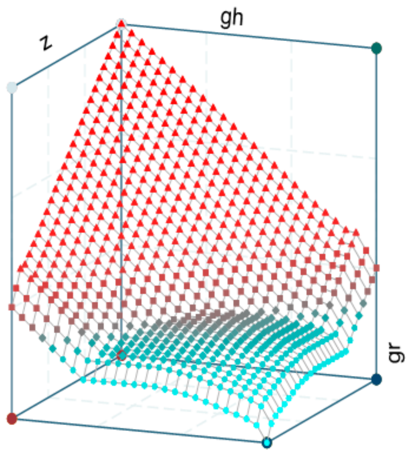

Figure 3. Keynesian Framework Policy and Neoclassical Framework Policy.

As we can observe from the above computations, a work sharing policy based on the reduction of work hours could be an instrument that is used against the COVID-19 diffusion index. This finding can be evidenced using two theoretical perspectives: a Keynesian policy framework identifies aggregate demand as the key to market welfare, whereas neoclassical economists consider the forces in the labor market to be the more opportune tool for achieving market equilibrium. The targeted task of policy intervention can differ, but with regard to labor reorganization through team management, based on the work sharing policy, policy intervention could cause a reduction in terms of the rate at which the virus spreads; however, for this to occur, economic intermediation is needed, such as through wage compensation for support.

Thus, in the future, further analysis should focus on identifying opportune labor organization schemes (Rose 2020).

5. Conclusions

The effects of COVID-19 on the labor market can be analyzed using different perspectives. For some authors, the resulting company closures will accelerate the growing dominance of large companies in numerous sectors (Schmid et al. 2020), which will have negative consequences for workers. The negative consequences can exacerbate a long-term trend of labor share reduction due to the rise of superstar firms with low labor shares (Schmid et al. 2020), less productive markets (Rose 2020) and changing financial behaviors (Tertilt et al. 2020), with increasing job insecurity and instability (Timpka et al. 2016). These trends will reinforce the relevant decline in the labor share of national income that is seen in industrialized countries. Technological advances, along with restrictions imposed by the pandemic crisis, may determine a perverse effect on low-wage jobs (Rose 2020). Due to social distancing requirements and shelter-in-place residential orders that have caused a profound temporary labor shortage, companies have introduced new technologies in order to employ fewer workers and continue production in more automated ways (Rose 2020; Timpka et al. 2016). Moreover, governments were forced to automate systems that were previously in citizens' control to avoid in-person contact. On the whole, the COVID-19 crisis has prompted a powerful push towards increased automation (Rose 2020). The overall reorganization of economic activities, witnessed by several employers (Rose 2020), has changed the weight of labor share, and it may cause relevant consequences in terms of future unemployment. From this perspective, the work sharing policy could be an efficient governmental instrument, depending on the main features of the economic context assumed, as summarized through the opportune parameters. The results of this study show that the impact of work sharing policies on the spread of infection is quite different depending on the macroeconomic framework assumption. In particular, in a Keynesian unemployment framework and a neoclassical unemployment framework, we can also distinguish three subcases in which a reduction in working hours could reduce the virus diffusion, but only under established constraints or parameters, which is also supported in the numerical simulations; however, these results ought to be investigated with caution because the epidemiologic shock of COVID-19 is still ongoing, and thus, the application of work sharing policies need to be further explored in the future.

Author Contributions: Conceptualization, L.A., B.B. and C.P.V.; methodology, C.P.V.; software, L.A.; formal analysis, C.P.V.; writing—original draft preparation, L.A., B.B. and C.P.V.; writing—review and editing, L.A., B.B. and C.P.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Notes

1 https://static.eurofound.europa.eu/covid19db/countries/IE.html (accessed on 1 February 2020).

2 https://home.kpmg/xx/en/home/insights/2020/04/norway-government-and-institution-measures-in-response-to-covid.html (accessed on 31 May 2022).

3 https://home.kpmg/xx/en/home/insights/2020/04/chile-government-and-institution-measures-in-response-to-covid.html (accessed on 31 May 2022).

4 https://www.canada.ca/en/employment-social-development/corporate/notices/coronavirus/employees-factsheet.html (accessed on 2 February 2021).

5 It is obvious that, respecting the assumption of unit prices, $W = wh$, where w stands for hourly wages.

6 In a competitive framework it will be $\hat{\alpha} = \alpha$.

References

Ahmed, Faruque, Nicole Zviedrite, and Amra Uzicanin. 2018. Effectiveness of workplace social distancing measures in reducing influenza transmission: A systematic review. *BMC Public Health* 18: 518. [CrossRef] [PubMed]

Autor, David, and Elisabeth Reynolds. 2020. *The Nature of Work after the COVID Crisis: Too Few Low-Wage Jobs*. Essay 2020-14, The Hamilton Project. Washington, DC: Brookings Institution.

Autor, David, David Dorn, Lawrence Katz, Christina Patterson, and John Van Reenen. 2020. The fall of the labor share and the rise of superstar firms. *Quarterly Journal of Economics* 135: 645–709. [CrossRef]

Barrero, Jose, Nicholas Bloom, and Steven Davis. 2020. *SARS-COVID-19 Is Also a Reallocation Shock (No. w27137)*. Cambridge: National Bureau of Economic Research.

Bartik, Alexander, Marianne Bertrand, Feng Lin, Jesse Rothstein, and Matt Unrath. 2020. *Measuring the Labor Market at the Onset of the SARS-COVID-19 Crisis (No. w27613)*. Cambridge: National Bureau of Economic Research.

Betancourt, Roger, and Christopher Clague. 1981. *Capital Utilization: A Theoretical and Empirical Analysis*. Cambridge: Cambridge University Press.

Bosworth, Derek, and Tony Westaway. 1987. The demand for hours of work. *Scottish Journal of Political Economy* 34: 368–87. [CrossRef]

Bughin, Jacques, and Michele Cincera. 2020. *FOG and Teleworking: Some Labor Economics of SARS-COVID-19 (No. 2020-21)*. Bruxelles: Universite Libre de Bruxelles.

Cajner, Tomaz, Leland Crane, Ryan Decker, Adrian Hamins-Puertolas, and Christopher J. Kurz. 2020. Tracking Labor Market Developments during the SARS-COVID-19 Pandemic: A Preliminary Assessment. FEDS Working Paper No. 2020-030. Available online: https://www.federalreserve.gov/econres/feds/tracking-labor-market-developments-during-the-covid-19-pandemic.htm (accessed on 1 September 2020).

Calmfors, Lars, and Michael Hoel. 1988. Work sharing and overtime. *The Scandinavian Journal of Economics* 90: 45–62. [CrossRef]

Cárdenas, Luis, and Paloma Villanueva. 2021. Challenging the working time reduction and wages trade-off: A simulation for the Spanish economy. *Cambridge Journal of Economics* 45: 333–51. [CrossRef]

Cette, Gilbert. 1990. La durée d'utilisation du travail. In *Economique e Statistique*; Malakoff: INSEE, p. 231.

Chetty, Raj, John Friedman, Nathaniel Hendren, and Michael Stepner. 2020. *How Did SARS-COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data (No. w27431)*. Cambridge: National Bureau of Economic Research.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber. 2020. *Labor Markets during the SARS-COVID-19 Crisis: A Preliminary View (No. w27017)*. Cambridge: National Bureau of Economic Research.

Collins, Caitlyn, Liana Landivar, Leah Ruppanner, and William J. Scarborough. 2020. COVID-19 and the gender gap in work hours. *Gender, Work & Organization* 28: 101–12. [CrossRef]

Cortes, G. Matias, and Eliza Forsythe. 2020. *The Heterogeneous Labor Market Impacts of the SARS-COVID-19 Pandemic*. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3634715 (accessed on 1 September 2020).

d'Autume, Antoine, and Paul Cahuc. 1997. Réduction de la durée du travail: De la contrainte légale à la négociation. *Revue Économique* 48: 549–58. [CrossRef]

Foss, Murray. 1963. The utilization of capital equipment. *Survey of Current Business* 43: 8–17.

Gilles, Fabrice. 2015. Evaluating the impact of a working time regulation on capital operating time: The French 35-h work week experience. *Scottish Journal of Political Economy* 62: 117–48. [CrossRef]

Gilles, Fabrice, and Yannick L'Horty. 2003. 35 heures et inégalités. *Revue Economique* 54: 583–94.

Hoenig, Kerstin, and Sebastian Wenz. 2020. Education, health behavior, and working conditions during the pandemic: Evidence from a German sample. *European Societies* 23: S275–S288. [CrossRef]

Hunt, Jennifer. 1999. Has work-sharing worked in Germany? *The Quarterly Journal of Economics* 114: 117–48. [CrossRef]

ILO. 2020a. *ILO Monitor: SARS-COVID-19 and the World of Work*, 2nd ed. April 7. Available online: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_740877.pdf (accessed on 1 September 2020).

ILO. 2020b. *ILO Monitor: SARS-COVID-19 and the World of Work*, 3rd ed. April 29. Available online: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_743146.pdf (accessed on 1 September 2020).

Kurmann, Andre, Etienne Lale, and Lien Ta. 2020. The Impact of SARS-COVID-19 on US Employment and Hours: Real-Time Estimates with Homebase Data. Available online: https://www.lebow.drexel.edu/people/andrekurmann/papers/covid-2019-employment (accessed on 1 September 2020).

Mongey, Simon, Laura Pilossoph, and Alex Weinberg. 2020. *Which Workers Bear the Burden of Social Distancing Policies? (No. w27085)*. Cambridge: National Bureau of Economic Research.

Nemțeanu, Marcela Sefora, Dan Christian Dabija, and Liana Stanca. 2021b. The Influence of Teleworking on Performance and Employee's Counterproductive Behaviour. *Amfiteatru Economic* 23: 601–19.

Nemțeanu, Marcela Sefora, Vasile Dinu, and Dan Christian Dabija. 2021a. Job Insecurity, job instability and job Satisfaction in the Context of COVID 19 Pandemic. *Journal of Competitiveness* 13: 65–82. [CrossRef]

Ollo-López, Andrea, Salomé Goñi-Legaz, and Amaya Erro-Garcés. 2020. Home-based telework: Usefulness and facilitators. *International Journal of Manpower* 42: 644–60. [CrossRef]

Power, Kate. 2020. The SARS-COVID-19 pandemic has increased the care burden of women and families. *Sustainability: Science, Practice and Policy* 16: 67–73.

Priem, Randy. 2021. An Exploratory Study on the Impact of the COVID-19 Confinement on the Financial Behavior of Individual Investors. *Economics, Management, and Financial Markets* 16: 9–40. [CrossRef]

Rose, Nancy. 2020. *Will Competition Be Another SARS-COVID-19 Casualty?* Essay 2020-15. The Hamilton Project. Washington, DC: Brookings Institution.

Schmid, Lisa, Jonathan Wörn, Karsten Hank, Barbara Sawatzki, and Sabine Walper. 2020. Changes in employment and relationship satisfaction in times of the SARS-COVID-19 pandemic: Evidence from the German family Panel. *European Societies* 23: S743–S758. [CrossRef]

Tertilt, Michèle, Matthias Doepke, Titan Alon, and Jane Olmstead-Rumsey. 2020. *This Time It's Different: The Role of Women's Employment in a Pandemic Recession*. IZA DP N. 13562. Available online: https://www.iza.org/publications/dp/13562/this-time-its-different-the-role-of-womens-employment-in-a-pandemic-recession (accessed on 1 September 2020).

Timpka, Toomas, Henrik Eriksson, Einar Holm, Magnus Strömgren, Joakim Ekberg, Armin Spreco, and Örjan Dahlström. 2016. Relevance of workplace social mixing during influenza pandemics: An experimental modelling study of workplace cultures. *Epidemiology & Infection* 144: 2031–42.