Welfare Effects of Short-Time Compensation

Helge Braun
University of Cologne
braun@wiso.uni-koeln.de

Björn Brügemann
VU University & Tinbergen Institute
b.a.brugemann@vu.nl

Klaudia Michalek
University of Cologne
michalek@wiso.uni-koeln.de

April 2013

Abstract

In addition to unemployment insurance (UI), many advanced economies operate short-time compensation (STC) schemes which partially compensate workers for a loss of income due to a reduction in hours. We study the welfare effects of STC in a model in which firms experience idiosyncratic shocks to profitability and can respond by adjusting employment and hours per worker. Firms have only limited access to external private insurance, hence public insurance can be welfare-improving. When introduced into an economy with an existing UI scheme, STC can affect welfare through two channels. First, it modifies the distortions of the composition of labor input caused by UI. Second, it can directly affect the provision of insurance. We find that the desirability of STC depends on how well firms are insured against profitability shocks in the absence of STC. If firms are already well-insured, then STC raises welfare by mitigating inefficient layoffs caused by UI. Furthermore, STC improves insurance indirectly by increasing the optimal level of UI. If instead firms are poorly insured, then STC cannot improve welfare. Its direct insurance effect is negative and it fails to counteract excessive layoffs, because distressed choose high hours and thus forego STC.

1 Introduction

All advanced economies operate unemployment insurance (UI) systems. In addition, many countries run short-time compensation (STC) schemes, which pay benefits to workers that have not lost their job entirely but are working reduced hours. In contrast to UI, however, STC is far from universal among advanced economies: the OECD is about evenly split between countries with and without STC. The political debate about the desirability of STC has recently been reignited by the severe labor market difficulties of the Great Recession.

In this paper we examine the welfare effects of STC, pursuing the following two questions. First, we ask whether introducing STC can improve on UI. As a benchmark we consider a system that limits itself to UI, choosing the level of UI optimally. Starting from this benchmark, we examine whether it is possible to raise welfare by introducing STC for a given level of UI. Second, we ask how STC and UI should be combined optimally.

We study these questions using a static model in which firms experience idiosyncratic profitability shocks. Labor input at the firm level can vary both at the extensive and the intensive margin. Optimal hours per worker are determined by trading off fixed costs of working against increasing marginal disutility of working longer hours. For simplicity we abstract from the distinction between employers and employees, and consider firms that are jointly owned and operated by a group of identical risk averse individuals. Firms can adjust to adverse profitability shocks on both margins, that is, through layoffs, through work sharing in the sense of a reduction of hours per worker, or a combination of both. We assume that firms have only limited access to external private insurance against profitability shocks. This implies that government-provided insurance can improve welfare. We consider a government that has access to two policy instruments. First, UI, which is modeled as providing a payment for each worker that is working zero hours. Second, STC, which is modeled as providing a payment for each hour by which working time is reduced below some threshold of normal hours.[1]

[1] In our model the government could achieve the first-best allocation by directly conditioning insurance payments on the profitability of the firm, since we model profitability as exogenous. We do not explicitly incorporate frictions such as moral hazard that would interfere with insuring profitability shocks directly. Even if such frictions are incorporated, it may still be desirable to take profitability into account. Interestingly, while existing UI systems do not condition eligibility or level of payments on the profitability of the previous employer, some STC systems do require that the employer documents a shortfall of profitability or demand. We leave an analysis of these issues for future research.

The welfare effects of UI in this type of environment are well understood: it provides valuable insurance at the cost of distorting labor inputs. First, UI reduces labor input below the efficient level as in Feldstein (1976), because firms do not internalize the effects of layoffs on the government's budget. Second, UI biases the mode of labor input reductions towards layoffs and against work sharing. Given this, there are two channels through which STC could improve on a system that is limited to UI. First, it could counteract the distortion of the composition of labor input induced by UI. Second, it could directly improve the provision of insurance by better aligning insurance payments with the level of distress of the firm. In particular, UI does not provide any insurance payments to firms that adjust to a decline in profitability solely through work sharing, that is, by reducing hours without any layoffs.

We first provide an analytical examination of how labor input choices of firms respond to profitability shocks in the presence of UI and STC. This analysis focuses on the trade-off between hours and employment. It shows how STC can eliminate the distortion of the composition of labor input induced by UI. It also yields an insight that is important for the direct insurance role of STC: comparing two firms that have experienced uninsured declines in profitability and engage in layoffs, the firm with the larger decline in profitability will have higher hours per worker. This holds because the scarcity of consumption in more distressed firms implies that marginal utility of consumption is high relative to the marginal disutility of increasing hours. This induces firms to move towards higher hours in order to economize on fixed costs when profitability is low. This mechanism is amplified by UI, which acts as an additional fixed cost of employment. This result implies that in terms of insurance, STC is poorly targeted among firms that engage in layoffs: more distressed firms may not take up STC because it is optimal for retained workers to work relatively high hours.

We then turn to computational experiments to examine the welfare effects of STC quantitatively. In our calibration we leave unidentified one feature that turns out be critical for the desirability of STC, namely the extent to which firms are insured against profitability shocks in the absence of public insurance. While the theory suggests that the extent of insurance can be identified from the response of labor inputs to adverse shocks, implementing this identification approach is beyond the scope of this paper. Instead, we consider two scenarios that differ in the extent to which shocks are privately insured. Our model has two types of shocks. The first type forces the firm to shut down production, and it is always uninsured. We interpret this as a permanent shock. The second type of shock is less severe, and firms can adjusts through layoffs and/or changes in hours. We interpret these shocks as temporary. The two scenarios differ in whether this second type of shock is privately insured.

In the first scenario firms are insured perfectly against temporary shocks. This scenario corresponds to the view expressed by Feldstein (1976, p. 941), who abstracts from worker risk aversion in his theoretical examination of temporary layoffs motivated by the observation that “the spells of unemployment are both temporary and brief”. Thus only permanent shocks are uninsured in this scenario. This means that only UI can provide insurance, and the only potential role of STC is to mitigate distortions caused by UI. We carry out three policy experiments in this scenario. First, we determine the optimal level of UI under the restriction that STC is not available. Second, we determine the optimal level of STC given this level of UI. Third, we determine the optimal combination of STC and UI. In the second experiment we find that it is optimal to introduce STC, and that the optimal level of STC (given the level of UI) results in a large increase in employment and a sizable improvement in welfare. In the third experiment we find that the availability of STC makes it optimal to provide more generous UI. This is intuitive, given that STC provides a way to mitigate the distortions of UI. In this sense STC indirectly enables better insurance. While we find that positive STC is desirable, our results indicate that it should be less generous than UI.

In the second scenario both temporary and permanent shocks are uninsured in the absence of public insurance. Now STC has a direct effect on insurance, but this effect is negative. As discussed above, the reason is that distressed firms optimally choose to have high hours per worker and to forego STC. Furthermore, since it is this set of firms for which UI induces excessive layoffs, STC also loses the ability to counteract this distortion. Consequently the introduction of STC is not optimal in this scenario.

Overall, our results indicate that the extent to which temporary profitability shocks are insured is a key determinant of the optimality of STC.

Our model builds on the analysis of UI and STC provided by Burdett and Wright (1989, henceforth BW). BW examine how UI and STC distort labor inputs. Their main results are that UI causes inefficient layoffs, while STC does not cause inefficient layoffs but induces inefficient hours. BW do not study the welfare implications of UI and STC in their model.

The paper is organized as follows. We introduce the model in Section 2. In Section 3 we first derive the allocations for autarky and first-best, and then characterize the allocation for a given system of UI and STC. Section 4 contains the computational experiments, the robustness of our results ins examined in Section 5, and Section 6 concludes.

2 Model

There is a single firm with a continuum of positions of mass N. All positions are initially filled by risk averse workers that are ex ante identical. We assume that the firm is jointly owned and operated by these workers. We normalize $N = 1$.

Technology. The firm's production function is

$$xf(nh) - nF$$

where n denotes the mass of workers working strictly positive hours, and h denotes the number of hours worked by each of these workers. Here x parametrizes the profitability of the firm. It is subject to stochastic shocks that can be of technological or other origin, and which will be specified in more detail below. The function $f : [0, +\infty) \to [0, +\infty)$ is strictly increasing and strictly concave. It is twice continuously differentiable and satisfies $\lim_{nh \downarrow 0} f'(nh) = +\infty$. Working strictly positive hours is associated with a fixed cost $F \geq 0$ for each worker, thus the total fixed costs incurred by the firm are given by nF.

Shocks and Limited Access to External Insurance. Profitability x is subject to stochastic shocks. Specifically, it is a function $x(s)$ of the state $s \in S$. The probability of state s is denoted $\theta(s)$. The firm has limited access to external insurance. To capture this in a simple way we allow for two sets of shocks, insured and uninsured. Specifically, we partition the state space into two subsets $S = S_I \cup S_U$, and assume that the firm can perfectly insure itself across realizations in S_I, but cannot insure itself at all for realizations in S_U. This setup allows us to accommodate the two scenarios we will consider in our computational experiments. In the first scenario the set S_U only consists of a single state s_P with $x(s_P) = 0$, so that the firm shuts down production in this case. We interpret this as a permanent shock that breaks the attachment between the workers and the firm. All other shocks, which we interpret as temporary shocks, are in the insured set S_I in this scenario. In the second scenario all shocks, both permanent and temporary, are in the uninsured set S_U.

Preferences. The expected utility of a worker is given by

$$\sum_{s\in S} \theta(s) \left\{ n(s)[u(w(s)) - v(h(s))] + (1 - n(s))u(b(s)) \right\}.$$

The expectation is taken with respect to the state s since this is the only source of uncertainty. The firm chooses labor inputs conditional on s. If total employment in state s is $n(s)$, then $n(s)$ is also the probability that a given worker is working positive hours. Utility is separable between consumption and hours. Here $w(s)$ and $b(s)$ denote the consumption levels of workers with positive and zero hours, respectively, and the function u is twice differentiable, strictly increasing, and strictly concave. The common level of hours worked by those with positive hours in state s is denoted $h(s)$. The disutility of working h hours is given by $v(h)$. The function v satisfies $v(0) = 0$, is twice continuously differentiable differentiable, strictly increasing, strictly convex, and satisfies the Inada condition $\lim_{h\uparrow h^{max}} v'(h) = +\infty$ for some $h^{max} > 0$.

Differences from BW. Our model largely follows BW. There are some differences, however. First, BW assume that the firm is owned by a risk averse employer, and they analyze optimal risk sharing between workers and the employer. The assumption of owner-operators simplifies the analysis by allowing us to ignore considerations of risk sharing between workers and employers, which are not our focus.

Second, our production function differs slightly. BW allow for a more general function of hours and employment. More importantly, they impose an assumption that rules out any fixed costs associated with employment. Specifically, they assume that if two combinations of hours per worker and employment yield the same total number of hours, then the combination with higher employment delivers higher output. The opposite is true in our specification when the fixed cost F is strictly positive. In their analysis, this assumption insures that layoffs are never optimal in the absence of policy.

Finally, we simplify the analysis by assuming additively separable preferences over consumption and leisure.

3 Firm Behavior and Allocations for Given Policy

In this section we analyze optimal firm behavior and characterize the resulting allocation. We begin with the benchmark allocations of first best and autarky, and then turn to the allocation for a given system of UI and STC.

3.1 First Best

First we examine the allocation that would arise if the firm were able to obtain perfect insurance across all profitability shocks.

Throughout the paper we maintain the assumption of perfect risk sharing within the firm. Together with the separability of utility between consumption and hours, this implies that consumption of workers with positive hours and workers with zero hours is equalized, that is, $w(s) = b(s)$. Using this property to simplify the objective, the first-best allocation is obtained as the solution to

$$\max_{c(s),n(s)\in[0,1],h(s)\in[0,h^{\max}]} \sum_{s\in S} \theta(s) \left\{u(c(s)) - n(s)v(h(s))\right\}$$
$$\text{s.t.} \sum_{s\in S} \theta(s) \left\{x(s)f(n(s)h(s)) - n(s)F - c(s)\right\} = 0.$$

The first-order condition for consumption $c(s)$ is

$$u'(c(s)) = \lambda \tag{1}$$

where λ denotes the multiplier associated with the constraint. This first-order condition implies that marginal utility of consumption and thereby consumption are equalized across states.

Next we will discuss the first-order conditions for the choice of labor inputs. There are two cases to consider, depending on whether the employment constraint binds.

Case 1: $n(s) \leq 1$ **slack.** For this case it is convenient to consider the first-order condition associated with a variation that reduces employment while keeping total hours constant:

$$u'(c(s))F = h(s)v'(h(s)) - v(h(s)). \tag{2}$$

While we already know that marginal utility is equalized across states here, we continue to write consumption as state-dependent so that we can reuse this condition when discussing autarky. To interpret this condition, first consider the function of hours that appears on the right-hand side:

$$V(h) \equiv hv'(h) - v(h).$$

It gives the increase in the expected disutility of working associated with this variation. If an additional worker is laid off, this reduces disutility by $v(h)$. Total hours fall by h. To keep total hours constant, these hours must be reallocated to the remaining workers, which increases disutility by $hv'(h)$. The strict convexity of v implies that the function $V(h)$ is strictly increasing. Condition (2) can now be written as

$$u'(c(s))F = V(h(s)). \tag{3}$$

Since the variation leaves total hours unchanged, gross output $f(n(s)h(s))$ remains unchanged while net output increases due to a drop in fixed costs. The left-hand side gives the increase in utility due to this reduction in fixed costs. Importantly, condition (3) does not directly depend on profitability x. Since marginal utility of consumption is equalized across states, it follows that hours do not vary across states with interior employment.

The first-order condition for employment is

$$u'(c(s))\left[x(s)f'(n(s)h(s))h(s) - F\right] = v(h(s)). \tag{4}$$

If $x(s)$ is strictly positive, then employment $n(s)$ is strictly positive due to the Inada assumption imposed on f. Since both hours and marginal utility due not vary with profitability, it follows from equation (4) that employment is increasing in profitability across states in which this case applies.

Case 2: $n(s) \leq 1$ binds. With the employment constraint binding, hours are determined by the condition

$$\frac{v'(h(s))}{u'(c(s))} = x(s)f'(h(s)). \tag{5}$$

The left-hand side is the marginal rate of substitution between leisure and consumption, and the right-hand side is the marginal product of hours when employment equals one. Since marginal utility is constant across states, it follows that hours are increasing in profitability across states in which this case is applicable.

Summary. Case 1 applies for low levels of profitability, Case 2 for high levels of profitability. Consequently, as profitability increases, at first hours are constant while employment increases. Eventually all workers are employed and switch from constant to strictly increasing.

3.2 Autarky

In autarky the firm does not have any insurance for realizations of the shock in the uninsured set S_U. Thus the autarky allocation solves

$$\max_{c(s),n(s)\in[0,1],h(s)\in[0,h^{\max}]} \sum_{s\in S} \theta(s)\left\{u(c(s)) - n(s)v(h(s))\right\}$$

$$\text{s.t.} \quad \sum_{s\in S_I} \theta(s)\left\{x(s)f(n(s)h(s)) - n(s)F - c(s)\right\} = 0$$

$$\text{and} \quad c(s) = x(s)f(n(s)h(s)) - n(s)F \quad \forall s \in S_U.$$

The first constraint now reflects that insurance occurs only across states in the insured set S_I. The second constraint reflects that in other states consumption must equal output.

The problem of choosing the optimal allocation across the insured states does not interact with choosing the allocation for the remaining states. Furthermore, the former problem is identical to the first-best problem. Thus here we only need to discuss the problem of choosing the allocation for the uninsured states.

Substituting the second constraint into the objective, for each state $s \in S_U$ the firm solves

$$\max_{c(s),n(s)\in[0,1],h(s)\in[0,h^{\max}]} \left\{u\left[x(s)f(n(s)h(s)) - n(s)F\right] - n(s)v(h(s))\right\}.$$

Again there are the same two cases for employment, but the qualitative behavior of labor inputs within the regions with positive employment is modified by the absence of insurance.

Case 1: $n(s) \leq 1$ slack. Across states in this region consumption and hours are linked through equation (3). Marginal utility is decreasing in profitability due to the absence of insurance, hence hours are also decreasing in profitability. This is driven by the fact that the fixed cost of employing a worker is incurred in terms of the consumption good, and economizing on consumption becomes relatively more important when profitability is low.

Case 2: $n \leq 1$ binding. Across states in this region profitability and hours are linked through equation (5). The direct effect of higher profitability is to increase hours. Yet the marginal utility of consumption is now decreasing in profitability, which works in the opposite direction. Thus the total effect of higher profitability on hours across states in this region depends on the relative strength of substitution and income effect.

Summary. In the first-best allocation it is guaranteed that employment is monotone increasing in profitability. In contrast, here the effect of profitability on employment depends on the relative strength of income and substitution effect, so depending on parameters it is possible that employment moves from case 2 to case 1 as profitability increases.

3.3 Unemployment Insurance and Short-Time Compensation

We now specify the two policy instruments, and study the firm problem in the presence of policy.

3.3.1 Parametrization of Policy

In modeling the two policy instruments we largely follow BW. UI takes the form of a payment g_{UI} to workers with zero hours worked. STC takes the form of a payment g_{STC} to employed workers for every hour that hours worked fall short of some "normal" level of hours H. BW assume that the government balances the budget of the insurance system by imposing a lump-sum tax on firms.[2] For our main results we depart from BW and assume that the budget is balanced through a proportional tax τ on total hours nh. Our motivation is that this specification is closer to the observed financing of unemployment insurance through payroll taxes.[3] We will compare our main results to lump-sum taxation in the robustness analysis.

With the proportional tax on total hours, the net transfer received by a firm with employment level n and hours per worker h is given by

$$(1-n)g_{UI} + n\max[0, H-h]g_{STC} - \tau nh.$$

[2]BW assume that financing occurs in part through experience rating. It is easy to see that experience rating is redundant in the model, as it is equivalent to lower values of the insurance instruments g_{UI} and g_{STC}. This is precisely the point why BW consider experience rating: for given values of g_{UI} and g_{STC}, experience rating can be used to eliminate any effects of UI and STC on the allocation of resources, including any distortionary impact on labor inputs. In contrast, our objective is study the effects of g_{UI} and g_{STC} on the allocation when firms' access to insurance is limited, and given this purpose it is redundant to allow for experience rating.

[3]Of course a payroll tax would be based on wages. Thus it would not only depend on total hours, but also on profitability. Here we exclude policy instruments that condition of profitability.

It is instructive to rearrange this schedule to isolate an intercept, a coefficient on n, and a coefficient on nh:

$$\begin{cases} g_{UI} - n[g_{UI} - Hg_{STC}] - nh[g_{STC} + \tau], & h < H, \\ g_{UI} - ng_{UI} - nh\tau, & h \geq H. \end{cases} \tag{6}$$

Consider first the subsidy received by a firm with below-normal hours $h < H$. The first term is the intercept and represents the transfer received by a firm that shuts down production: it receives the unemployment benefit g_{UI} for all of its workers. The second term is linear in employment n, and the coefficient captures the additional fixed cost of employment that is induced by policy: switching a worker from zero hours to a positive but negligible amount of hours results in the loss of unemployment benefits g_{UI}, which is offset partially or fully by the fact that the worker becomes eligible for the maximal STC benefit Hg_{STC}. The last term is linear in nh and shows that an increase in total hours by one results in a reduction in the net transfer consisting of the sum of the proportional tax τ and the STC benefit g_{STC}.

As hours cross the normal threshold H, the coefficient on n rises to g_{UI} since STC no longer offset the policy-induced fixed cost, and the coefficient on nh drops to the tax rate τ.

Our policy specification differs from BW in two important ways, apart from a different tax instrument balancing the budget. First, BW sidestep the issue of normal hours by setting $H = 1$ and adopting preferences for which the maximal level of hours is also $h^{max} = 1$. This insures that hours are always below the "normal" level. This simplifies the analysis and does not matter for their main results. In our analysis we permit $H < h^{\max}$, and in our computational experiments we set H equal to the average level of hours. The possibility of hours exceeding the normal level turns out to be relevant for the welfare effects of STC. Second, BW restrict attention to two regimes: an American regime in which $g_{STC} = 0$, and a European regime in which UI and STC are equally generous, that is, $Hg_{STC} = g_{UI}$. In our analysis we allow any g_{STC} as long as $Hg_{STC} \leq g_{UI}$. In the computational experiments it turns out that usually it is not optimal to make STC as generous as UI.

3.3.2 Firm Problem with Policy

The firm problem with policy is

$$\max_{c(s),n(s)\in[0,1],h(s)\in[0,h^{\max}]} \sum_{s\in S} \theta(s)\left\{u(c(s)) - n(s)v(h(s))\right\}$$

$$\text{s.t.} \quad \sum_{s\in S_I} \theta(s)\Big\{x(s)f(n(s)h(s)) - n(s) - c(s) + (1-n)g_{UI} + n\max[0, H-h]g_{STC} - \tau nh\Big\} = 0$$

$$\text{and} \quad c(s) = x(s)f(n(s)h(s)) - n(s)F + (1-n)g_{UI} + n\max[0, H-h]g_{STC} - \tau nh \qquad \forall s \in S_U.$$

We will now discuss the first-order conditions for labor input choices. There are four cases to consider, depending on whether the employment constraint is binding and whether hours are below or above normal.

Case 1: $n(s) \leq 1$ slack and $h(s) < H$. Consider again the variation of reducing employment while keeping total hours constant. This yields the following generalization of equation (3):

$$u'(c(s))[F + g_{UI} - Hg_{STC}] = V(h(s)). \tag{7}$$

The new term on the left-hand side $g_{UI} - Hg_{STC}$ is the additional fixed cost associated with policy, as identified in the upper branch of equation (6). If employment is reduced by one worker, this results in the gain of unemployment benefits g_{UI}. Since $h(s) < H$ this worker loses $[H - h(s)]g_{STC}$ in STC payments. Furthermore, since total hours are kept constant in this variation, hours by other workers are increased by $h(s)$, resulting in a further reduction of STC payments by $h(s)g_{STC}$. Thus the gain of g_{UI} is offset by a combined loss of Hg_{STC} in STC payments. UI distorts the allocation in the direction of lower employment and higher hours per worker by acting like an additional fixed cost. STC counteracts this distortion and eliminates it entirely if UI and STC are equally generous, that is, if $Hg_{STC} = g_{UI}$.

The first-order condition for employment is the following generalization of equation (4):

$$u'(c(s))\left[x(s)f'(n(s)h(s))h(s) - (F + g_{UI} - Hg_{STC}) - h(s)(g_{STC} + \tau)\right] = v(h(s)). \tag{8}$$

Policy instruments appear in this condition in two ways. First, there is again the additional fixed cost $g_{UI} - Hg_{STC}$. Second, g_{STC} adds to the tax on total hours.

Marginal utility of consumption is constant across insured states, hence hours are constant as in the absence of policy. Also as in the absence of policy, hours are decreasing in profitability across uninsured states, that is, hours per worker are higher in distressed firms. In autarky this is driven by the assumption that the fixed cost of employing a worker is incurred in terms of the consumption good. Here this is amplified by unemployment insurance, which increases the effective fixed cost that is incurred in terms of consumption.

Case 2: $n(s) \leq 1$ **binding and** $h(s) < H$**.** The first-order condition determining hours is the following generalization of equation (5):

$$\frac{v'(h(s))}{u'(c(s))} = x(s)f'(h(s)) - (g_{STC} + \tau). \tag{9}$$

STC distorts hours downwards in firms that employ all workers. At the margin and holding constant the tax rate τ, an increase in g_{UI} does not affect labor input choices of firms for which this case applies.

Case 3: $n(s) \leq 1$ **slack and** $h(s) > H$**.** With hours above the eligibility threshold for STC, the variation of reducing employment while maintaining total hours yields the following generalization of equation (3):

$$u'(c(s))[F + g_{UI}] = V(h(s)). \tag{10}$$

In contrast to equation (7), here the distortion induced by unemployment benefits g_{UI} is not mitigated by STC. The first-order condition for employment is

$$u'(c(s))\,[x(s)f'(n(s)h(s))h(s) - (F + g_{UI}) - h(s)\tau] = v(h(s)).$$

In comparison to equation (8), STC has dropped out of the fixed cost as well as the effective tax on total hours.

Case 4: $n(s) \leq 1$ **binds and** $h(s) > H$**.** The first-order condition determining hours is the following generalization of equation (5):

$$\frac{v'(h(s))}{u'(c(s))} = x(s)f'(h(s)) - \tau. \quad (11)$$

In contrast to equation (9), hours are not distorted by STC, but they remain distorted by the proportional tax on total hours.

3.4 Discussion

We conclude this section with a discussion of the qualitative features of the allocations derived above that will be important determinants of the welfare effects of UI and STC.

The lack of external insurance is the only friction in this model. Achieving the first-best allocation would require non-distortionary transfers toward firms that experience uninsured adverse shocks to profitability. The problem of the government in our model, whose policy instruments are limited to UI and STC, is to approximate the first-best schedule of transfers while minimizing the distortions of the composition and level of labor input induced by these policy instruments.

Distressed firms in the model, that is, firms experiencing uninsured declines in profitability, tend to have low employment. High marginal utility of consumption pushes the composition of labor input in the direction of high hours and low employment, hence employment is low unless income effects are very strong. Low employment in distressed firms implies that UI is targeted well from an insurance perspective. However, it transfers resources to distressed firms at the cost of distorting both the level and the composition of labor input. Introducing STC affects welfare through two channels. First, it can mitigate and even eliminate the distortion of the composition of labor input induced by UI. Second, it directly modifies the provision of insurance. Yet this effect reallocates resources in the wrong direction among distressed firms that engage in layoffs, since more distressed firms have higher hours per worker within this group of firms, hence they may not qualify for STC and receive less STC if they do. In this sense STC can be poorly targeted from an insurance perspective.

4 Computational Experiments

4.1 Calibration

We calibrate the model using US evidence. The functional from for gross output is:

$$f(nh) = (nh)^{\alpha}.$$

We set $\alpha = \frac{2}{3}$, implicitly assuming that capital cannot be adjusted in response to profitability shocks. For preferences we assume

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma},$$
$$v(h) = \eta \frac{h^{1+\psi}}{1 + \psi}.$$

The parameter η only affects the level of hours, so we can use it to normalize average hours to one. We also set the level of normal hours H to one, so it is assumed to coincide with averages hours in the calibration. We set the coefficient of relative risk aversion to $\sigma = 2$, in the lower middle part of the plausible range (about one to five) indicated by microeconomic evidence. The parameter ψ is the inverse of the Frisch elasticity of labor supply. Based on the recent survey of the microeconomic evidence in Hall (2009), we set $\psi = 1.43$ to obtain a Frisch elasticity of 0.7.

Concerning profitability shocks we have to separately specify the distribution of insured and uninsured shocks. We assume that there is always a shock s_P with $x(s_P) = 0$ that leads to a shutdown of production and is uninsured. This is interpreted as a permanent shock that breaks the attachment of workers to the firm. We assume that the probability of this shock is $\theta(s_P) = 0.06$, so that 6% of workers are affected by non-temporary layoffs. The presence of this group of workers is the primary reason why UI can improve welfare in the model. With complementary probability $1 - \theta(s_P)$ the firm receives a less severe shock, which we interpret as a temporary shock. It is drawn from a log-normal distribution with standard deviation of $\sigma_x = 0.1$ (discretized using 250 grid points) and mean normalized to one. As discussed above, in this paper we make no attempt to identify the extent to which firms are insured against these shocks in the absence of public insurance. Rather, we consider two scenarios. In the first scenario we assume that temporary shocks are insured, that is, they are part of the set S_I. In this scenario STC does not have a direct effect on insurance, and can only improve welfare by mitigating labor-input distortions caused by UI. In the second scenario we assume that temporary shocks are uninsured, that is, all states are in S_U and S_I is empty.

We assume that the calibrated economy has UI but no STC. This leaves two parameters to be calibrated. The per-worker fixed cost F and the level of unemployment benefits g_{UI}. These parameters are jointly calibrated to match the following two targets. First, we target that 2% of workers are unemployed due to a temporary shock. This means that total unemployment is 8%, and 25% of the unemployed are on temporary layoff. This target is chosen based on the empirical prevalence on temporary layoffs, defined as unemployment in spells which end with the unemployed person being rehired by the same employer. On average, the fraction of the unemployed in the US that is reported in the CPS to be on temporary layoff is 14%.[4] Based on the SIPP, Fujita and Moscarini (2012) report that a group of unemployed workers of at least equal size is not classified as on temporary layoff, but ultimately returns to the same employer.[5] Second, we target that the unemployment benefit g_{UI} amounts to 25% of average consumption of workers. The latter is our definition of the replacement rate for this model. Recall that experience rating is neutral in our model and g_{UI} corresponds to the actual subsidy provided by the government. To map our model to replacement rates in the US, we need to eliminate the non-subsidy component of observed replacement rates associated with experience rating. Topel (1983) reports that on average the subsidy component is 31% of earnings. Furthermore, notice that in our model workers jointly own and operate firms, hence implicitly their average consumption reflects income from both wages and profits. This leads us to adopt the somewhat lower target of 25%.

We associate parameters with targets as follows. Equation (10) shows that in the absence of STC, the total fixed cost in terms of consumption of working positive hours is given by $F + g_{UI}$. The higher these fixed costs, the more attractive it is for the firm to have low employment and high hours. Thus the target for the fraction of temporary layoffs identifies the sum $F + g_{UI}$. The target for the replacement rate then identifies how this sum is composed of physical fixed costs and unemployment insurance.

The calibration is summarized in Table 1. The policy parameter g_{UI} is pinned down quite directly by the replacement rate target. The parameter for which the approach is

[4]The average is taken over the years 1967-2012.

[5]Compared with other countries for which evidence is available, the incidence of temporary layoffs in the US is about average. In a survey of the available evidence, OECD (2002) reports that temporary layoffs account for almost 40% of unemployment in Canada, 20% of unemployment in Austria and Denmark, and fractions closer to 10% in other European countries such as Germany, Norway and Sweden.

most indirect is the per-worker fixed cost F: to generate that 2% of all workers are on temporary layoff, this fixed cost must absorb about 12 percent of output.

4.2 Welfare Effects of STC when Temporary Shocks are Insured

We use the calibrated model to carry out the following sequence of three policy experiments. First, we restrict the set of policy instruments to unemployment insurance and determine the welfare-maximizing level of g_{UI}. We refer to this level of benefits as g^*_{UI}, and also use g^*_{UI} to label this experiment. Second, we determine the optimal level of g_{STC} holding constant g_{UI} at g^*_{UI}. Thus by construction the introduction of g_{STC} in this way does not improve the level of consumption of workers affected by the uninsured permanent shocks in this experiment. Therefore, to the extent that STC does improve the allocation, it can only do so by mitigating the distortion of labor inputs induced by UI. We refer to the corresponding level of STC and also the entire experiment as $g^*_{STC}|g^*_{UI}$ to indicate that g^*_{STC} is optimal given that UI is fixed at g^*_{UI}. Finally, we determine the welfare-maximizing combination of g_{STC} and g_{UI}. We denote this pair as $(g^{**}_{UI}, g^{**}_{STC})$. Results from these experiments are displayed in Table 2, along with the allocations for the calibration, the first-best and autarky as points of reference. For each allocation, the first three rows show the values of the policy instruments g_{UI} and g_{STC}, along with the replacement rate implied by the value of g_{UI} (defined as g_{UI} as a fraction of average consumption). The next three rows show the average of employment and hours across temporary shocks, denoted $\bar{n}_T$ and $\bar{h}_T$, respectively, along with average output $\bar{y}_T$ (employment, hours, and output are all zero in the single non-insured state by construction in this calibration). The next two rows show consumption levels for after temporary shocks (consumption is equalized across all insured states) and the single permanent shock state, denoted by $c(s_T)$ and $c(s_P)$, respectively. The final row shows, for each allocation, how much lower welfare is compared to the first best, in consumption-equivalent terms.[6]

The results for experiment g^*_{UI} show that it is optimal to make UI slightly more generous than it is in the calibration. This is despite the fact that the modest increase in g_{UI} from the calibrated level to g^*_{UI} would more than triple the number of workers on temporary layoff.

The results for experiment $g^*_{STC}|g^*_{UI}$ show that it is optimal to introduce a modest

[6]This is not reported for the autarky allocation. Technically the solution to the autarky problem is not well defined given our specification of utility, since consumption in the uninsured state is zero. What we report is the allocation that maximizes expected utility across temporary shocks.

amount of short-time compensation when UI is held fixed at g^*_{UI}. Introducing this level of STC is quite effective in reducing temporary layoffs, roughly to the level targeted in the calibration. However, hours per worker drop substantially, so that output is lower than in the g^*_{UI} experiment. The optimal level of STC is lower than g^*_{UI}, hence it is not optimal to completely eliminate the distortion of the composition of labor input.

The optimal combination of UI and STC is associated with substantially more generous UI than what is optimal if STC is not available: the benefit increases by 13% (from 0.248 to 0.279), which corresponds to an increase in the replacement rate from 29% to 34%. The mechanism underlying this result is that STC counteracts the distortion of the composition of labor input associated with UI. As a consequence, the availability of STC makes it optimal to offer more generous UI. As in experiment $g^*_{STC}|g^*_{UI}$ it is optimal to make STC less generous than UI, so the distortion of the composition of labor input is not eliminated entirely.

The overall welfare gain of moving from g^*_{UI} to $(g^{**}_{UI}, g^{**}_{STC})$ corresponds to about 1.5% of first-best consumption. About half of this gain can be obtained by moving to $g^*_{STC}|g^*_{UI}$.

Figure 1 illustrates how policy affects labor inputs across realizations of the temporary shock. The top panel shows the net transfers firms at different levels of profitability receive. The middle and bottom panel show hours and employment, respectively. Each panel contains plots for the three policy experiment, and the first best is shown as a point of reference.

Recall that the only social benefit of UI in this setting is that it transfer resources to firms suffering from a permanent shock. By construction any transfers within the set of insured states have no insurance value, but they distort the allocation of labor inputs. In this sense the first best does not call for any transfers within the set of insured states, as indicated by the flat solid line in the top panel. The plots for the three policy experiments show that in all experiments resources are transferred from more profitable to less profitable firms. This pattern of transfers is induced by the labor input choices shown in the middle and bottom panel.

As shown by the solid lines in the bottom and middle panel, first-best employment is one irrespective of profitability, and first-best hours are increasing in profitability throughout. The dotted lines show labor inputs associated with experiment g^*_{UI}, in which STC is not available and UI is chosen optimally subject to this constraint. Here employment is below one at sufficiently low levels of profitability, and increasing in profitability. As implied by the theoretical analysis, hours are constant over the profitability range with positive layoffs. The dash-dotted lines show labor inputs for the experiment $g^*_{STC}|g^*_{UI}$, in which STC is chosen optimally given that UI remains fixed at g^*_{UI}. Compared to the experiment g^*_{UI} employment is uniformly higher. The hours schedule is somewhat more complicated. At low levels of profitability firms combine layoffs with a substantial reduction in hours in order to receive STC. As implied by the theory, hours are constant over this range. At intermediate levels of profitability, firms retain all employees, while hours remain low and STC is received. At some threshold level of profitability hours increase discontinuously. Above this threshold profitability is sufficiently high such that reducing hours below normal to qualify for STC is too costly. Finally, the dashed lines show labor inputs for the experiment $(g^{**}_{UI}, g^{**}_{STC})$. Qualitatively the pattern is very similar to the experiment $g^*_{STC}|g^*_{UI}$. However, both hours and employment are lower since both UI and STC are more generous.

One noteworthy feature of the calibrated model is that (un)employment is very sensitive to policy. To put this into perspective, we will now compare this sensitivity to the available empirical evidence. For this purpose, it is useful to express the sensitivity of unemployment with respect to the replacement rate as a semielasticity. The change in unemployment from the calibrated level to g^*_{UI} implies a semielasticity of 14.84. Costain and Reiter (2008) survey the literature using international cross-sectional or panel-data studies. Semi-elasticities from such studies are around 1.3. In their own empirical work they attempt to overcome several shortcomings of this literature, and find a semielasticity of 3.09. This is substantially smaller than the semielasticity implied by our calibration. This suggests that the model may be missing features that reduce the semielasticity. Interestingly, the model implies that STC can play an important role in reducing the semielasticity. Specifically, the impact of an increase in the replacement rate on unemployment is much weaker when STC is adjusted optimally. The change in unemployment and replacement rate when moving from experiment $g^*_{STC}|g^*_{UI}$ to experiment $(g^{**}_{UI}, g^{**}_{STC})$ implies a semielasticity of 4.75.

4.3 Welfare Effects of STC when Temporary Shocks are Uninsured

We now turn to the second scenario in which temporary shocks are uninsured. This allows STC to directly affect the quality of insurance. At face value, the results from Section

4.2 suggest that this could be a second source of welfare benefits of STC. Specifically, in Figure 1 hours per worker are increasing in profitability (weakly so in the region with positive layoffs). Thus total hours are rising faster in profitability than employment. Given this pattern of labor inputs, from an insurance perspective it may be better to condition on total hours rather than employment. However, this pattern of adjusting labor inputs is optimal for the firm if temporary shocks are insured. If this is not the case, then the pattern of adjusting labor input will be different and the insurance benefits of STC are less clear. Specifically, the theoretical analysis in Section 3 shows that hours per worker are relatively high in distressed firms. Thus STC is poorly targeted if the goal is to insure these firms.

The calibration is shown in Table 3 and very similar to the calibration in Table 1. The only substantial difference is that the per-worker fixed cost is now inferred to be higher. The mechanical reason for this is that uninsurability of shocks makes firms more reluctant to carry out layoffs, thus the fixed cost must be higher to match the targeted level of temporary layoffs.

We carry out the same sequence of policy experiments using this calibration. It turns out, however, that introducing STC is not optimal here. This is true for experiment $g^*_{STC}|g^*_{UI}$ which keeps UI fixed at g^*_{UI}, and also for the experiment $(g^{**}_{UI}, g^{**}_{STC})$. The fact that STC is not utilized also means that $g^{**}_{UI} = g^*_{UI}$, that is, the availability of STC does not change the optimal level of UI.

There are two closely related reasons why utilizing STC is not optimal here. First, the direct insurance effect of STC is negative. Second, when temporary shocks are uninsured, the pattern of labor input adjustment is such that STC does not exhibit the beneficial effects that arise in the case with insured temporary shocks.

We illustrate these reasons through an experiment in which we set g_{STC} to half of g^*_{UI}, which is about the level of STC that is optimal with insured temporary shocks. Figure 2. is the counterpart of Figure 1, illustrating how the net transfer, hours per worker, and employment vary across realizations of the temporary shock. The key difference in the pattern of labor inputs in comparison to Figure 1 is that hours per worker are now declining rather than increasing in profitability. Employment, however, is once again increasing in profitability. Over the profitability range with positive layoffs, the pattern of hours per worker is driven by the mechanism discussed in Section 3: in distressed firms marginal utility of consumption is high relative to the marginal disutility of working more hours, hence hours per worker are high to economize on fixed costs. Hours continue to decline over the range of profitability levels where all workers are employed. This is due to the fact that the income effect dominates the substitution effect in our calibration.[7] The implication of this pattern of hours is that STC is poorly targeted when it comes to providing insurance. The most distressed firms are not eligible for STC. Rather, STC is collected by the most profitable firms.

Furthermore, STC no longer has a beneficial effect on the composition of labor input. Unemployment insurance distorts the composition of labor input towards excessive layoffs and high hours, but only among firms that have a positive level of layoffs. Here these firms have high hours and thus are not eligible for STC. There is only a small range of intermediate levels of profitability where firms substantially increase employment and reduce hours in order to receive STC. Most firms eligible for STC employ all their workers, hence STC only induces inefficiently low hours. This can also be seen by comparing Tables 2 and 4. With insured temporary shocks in Table 2, introducing STC (in the sense of moving from g^*_{UI} to $g^*_{STC}|g^*_{UI}$) increases employment by 0.049 (from 0.932 to 0.981), while reducing hours by 0.061 (from 1.02 to 0.958). With uninsured temporary shocks in Table 4, introducing $g_{STC} = \frac{1}{2}g^*_{UI}$ while keeping UI at g^*_{UI} generates a substantial drop in average hours by 0.037 (from 1.01 to 0.973), but there is no corresponding large increase in employment: employment only increases by 0.004 (from 0.949 to 0.953).

Quantitatively, the adverse direct effect of STC on insurance is quite small. The last row of Table 4 shows that moving from g^*_{UI} to $g_{STC} = \frac{1}{2}g^*_{UI}$ reduces welfare by about 0.3% of first-best consumption. We can decompose this loss into the direct insurance effect and the effect due to distortions of labor inputs. The direct insurance effect is only 0.04%. Consequently, if STC had retained its ability to improve welfare by 1.5% solely by mitigating labor-input distortions, this benefit would have easily outweighed the adverse direct insurance effect. In this sense, the primary reason why STC is not desirable here is not the adverse insurance effect, but the loss of the ability to improve the efficient allocation of labor inputs.

5 Robustness

In this section we carry out two types of robustness checks for the welfare gain associated with STC when temporary shocks are insured. First, we consider an alternative

[7] This is a consequence of additive separability in conjunction with the level of risk aversion.

parametrization of policy, namely a parametrization with a lump-sum tax as considered by BW. Second, we examine the sensitivity of the welfare gain computed in Section 4.2 with respect to parameters and targets.

5.1 Alternative Parametrization of Policy

In Section 3.3.1 we assumed that UI and STC are financed through a proportional tax on total hours. This is a departure from BW, who assume that the budget is balanced through a lump sum tax. In this section we examine how our results are affected when this alternative parametrization of policy is used. To distinguish the two parametrizations, let $\hat{g}_{UI}$, $\hat{g}_{STC}$, and $\hat{\tau}$ denote the levels of UI, STC, and the lump sum tax in this parametrization, respectively. The net transfer received by the firm is now

$$(1-n)\hat{g}_{UI} + n\max[0, H-h]\hat{g}_{STC} - \hat{\tau}.$$

To compare this to the parametrization with a proportional tax, we rewrite this in a format that parallels equation (6):

$$\begin{cases} [\hat{g}_{UI} - \hat{\tau}] - n[\hat{g}_{UI} - H\hat{g}_{STC}] - nh\hat{g}_{STC}, & h < H, \\ [\hat{g}_{UI} - \hat{\tau}] - n\hat{g}_{UI}, & h \geq H. \end{cases} \tag{12}$$

Were it not for the cutoff H, the two parametrizations (6) and (12) would be isomorphic with $g_{UI} = \hat{g}_{UI} - \hat{\tau}$, $g_{STC} = \hat{g}_{STC} - \hat{\tau}$, and $\tau = \hat{\tau}$. While this isomorphism works for $h < H$, it breaks down for $h \geq H$: here the lump-sum specification restricts the coefficient on total hours nh to zero, while it is given by the proportional tax rate in specification (6). Thus the allocations that can be implemented differ across the two parametrizations even if both policy instruments are available.

The two parametrizations also differ in what can be implemented if the instrument of STC is not available in the sense of g_{STC} and $\hat{g}_{STC}$ being set to zero, respectively. With $g_{STC} = 0$ the subsidy schedule (6) reduces to

$$g_{UI} - ng_{UI} - nh\tau$$

while with $\hat{g}_{STC} = 0$ the subsidy schedule (12) becomes

$$[\hat{g}_{UI} - \hat{\tau}] - n\hat{g}_{UI}.$$

Thus in the latter case, the absence of STC restricts the coefficient on total hours nh

to zero, while in the former case the absence of STC restricts the intercept and the coefficient on employment n to sum to zero. One of our questions is whether introducing STC improves upon UI. For the answer to this question, in principle it could matter which parametrization we adopt.

We will now repeat our analysis for parametrization (12). However, parametrization (12) would deliver results which are somewhat difficult to interpret in the experiment in which we introduce STC while keeping UI constant. Introducing positive $\hat{g}_{STC}$ while keeping $\hat{g}_{UI}$ constant leads to an increase in the lump-sum tax $\hat{\tau}$, so that the net unemployment benefit $\hat{g}_{UI} - \hat{\tau}$ actually falls. We find it more insightful to study an introduction of STC that keeps the net benefit constant. Thus we will parametrize UI by the net benefit $\tilde{g}_{UI} = \hat{g}_{UI} - \hat{\tau}$ while maintaining that STC is the coefficient on nh for $h < H$, that is, $\tilde{g}_{STC} = g_{STC}$. This yields the parametrization

$$\begin{cases} \tilde{g}_{UI} - n[\tilde{g}_{UI} + \tilde{\tau} - \tilde{g}_{STC}] - nh\tilde{g}_{STC}, & h < H, \\ \tilde{g}_{UI} - n[\tilde{g}_{UI} + \tilde{\tau}], & h \geq H. \end{cases} \tag{13}$$

where now $\tilde{\tau}$ adjusts to balance the budget for given $\tilde{g}_{UI}$ and $\tilde{g}_{STC}$, so in effect the benefits are financed by a tax on employment. This parametrization is isomorphic to (12), while parametrization (6) is not.

Table 5 presents the results from the three policy experiments for this parametrization. We maintain the parameters from the original calibration of Table 1 rather than recalibrating the model. Thus this exercise allows us to compare the welfare effects under the two parametrizations. The results for experiment $\tilde{g}^*_{UI}$ show that with UI as the only policy instrument, the optimal net transfer to the unemployed and the associated replacement rate are lower than in experiment g^*_{UI}, resulting in a larger welfare loss compared to the first best. This is intuitive given our previous results. Even when financed by a tax on total hours, UI already imposes an implicit tax on employment which distorts the composition of labor input. This is exacerbated if UI is financed solely by a tax on employment. While welfare in all three experiments is lower than in the corresponding experiment under the original parametrization, the gains of moving from $\tilde{g}^*_{UI}$ to $\tilde{g}^*_{STC}|\tilde{g}^*_{UI}$ and from $\tilde{g}^*_{STC}|\tilde{g}^*_{UI}$ to $(\tilde{g}^{**}_{UI}, \tilde{g}^{**}_{STC})$ are very similar to the corresponding gains in Table 2. The levels of STC are slightly larger relative to UI here. The reason is that STC is similar to the payroll tax in that it acts as a tax on total hours. Of course it differs from the payroll tax in that STC acts as a tax on total hours only over the range where firms are eligible for STC. Nonetheless, since under the original parametrization there is already a tax on total hours even in the absence of STC, the optimal level of STC turns out to be somewhat lower relative to UI. In this sense, the finding that using the policy instrument of STC is optimal given parametrization (6) is stronger than the corresponding finding for parametrization (13).

5.2 Sensitivity Analysis

In this section we examine the sensitivity of the welfare results of Section 4.2 to changes in parameters and targets. Recall that the parameters σ, ψ, α, $\theta(s_P)$ and σ_x were chosen independently, while F and g_{UI} were pinned down by targets for the temporary layoff rate and the replacement rate. For each parameter in the first group we choose a low and a high value. Similarly, for each of the two targets we choose a low and a high value. We vary one parameter or target at a time, and for each deviation from the benchmark we recalibrate the model and repeat the welfare analysis. The results are shown in Table 6. In the table, $\bar{u}_T$ and $\bar{u}_P$ denote the targets of the temporary layoff rate and the permanent layoff rate, respectively. We report two results from the welfare analysis. First, the total welfare gain is shown in the third column, expressed in consumption equivalent terms relative to the first best. The fourth column shows what fraction of this gain is achieved by moving from g^*_{UI} to $g^*_{STC}|g^*_{UI}$, that is, without adjusting the level of UI. The remainder is then due to moving from $g^*_{STC}|g^*_{UI}$ to $(g^{**}_{UI}, g^{**}_{STC})$.

There are several parameters for which variations over a plausible range have little impact on the results. This includes the curvature of the production function α, the standard deviation of temporary shocks σ_x, and the temporary layoff rate $\underline{u}_T$. The following discussion will focus on the important determinants of the magnitude of welfare gains.

Naturally, the degree of risk aversion is a key determinant of the magnitude of welfare gains. Insuring workers hit by uninsured permanent shocks is the only motivation for using UI in the model. If this motivation is weaker, then the optimal level g^*_{UI} is lower, meaning that the composition of labor inputs is less distorted. This leaves less room for STC to mitigate the distortions induced by UI.

The Frisch elasticity is also an important determinant of welfare gains: cutting the elasticity in half to 0.35 cuts the total welfare gain in half. This is intuitive, as the hours margin must be active for STC to play a beneficial role.

The fraction of workers becoming unemployed due to a permanent shock plays a role very similar to that of risk aversion. The benefit of UI is to insure this group of workers, and the magnitude of this benefit is determined by risk aversion in conjunction with the size of this group.

A higher target for the replacement rate also reduces the total welfare gain. If the target for the replacement rate is low, then the physical fixed cost F is inferred to be large. This yields a constellation in which the temporary layoff rate is already 0.02 for a replacement rate that is far below optimal. Consequently, the optimal UI rate g^*_{UI} is associated with a very large temporary layoff rate. In this situation the welfare gains of STC are large. In contrast, when we target a replacement rate of 33%, then the physical fixed cost F is inferred to be zero. Thus all temporary layoffs are attributed to UI. Furthermore, the calibrtated level of UI is close to optimal, so the rate of temporary layoff associated with g^*_{UI} is also quite low. Thus the scope for STC to reduce the extent of inefficient temporary layoffs is small.

6 Conclusion

In this paper we have studied the welfare effects of short-time compensation (STC) in a model in which firms have limited access to private insurance and respond to idiosyncratic profitability shocks by adjusting both employment and hours per worker.

When introduced into an economy with unemployment insurance (UI), STC can affect welfare through two channels. First, it can mitigate the distortion of the composition of labor input towards low employment and high hours per worker associated by UI. Second, STC can directly modify the extent of insurance provided.

We find that the desirability of STC depends on how well firms are already insured against temporary shocks in the absence of public insurance. If this insurance is good, introducing STC improves welfare by mitigating the distortions induced by UI. Furthermore, the availability of STC indirectly improves insurance by raising the optimal level of UI. The effects of STC are quite different when firms are poorly insured against temporary shocks. In this situation firms respond to adverse shocks by combining layoffs with high hours per worker. The most distressed firms choose to forego STC, with the consequence that the direct insurance effect of STC is negative, and that STC is unable to counteract excessive layoffs carried out by these firms.

In this paper we did not attempt to identify how well firms are insured against temporary shocks in the absence of public insurance. Our analysis suggests that the extent of insurance can be identified from the adjustment of labor inputs in response to profitability shocks. We leave an empirical investigation along these lines for future work.

References

Burdett, K., and R. Wright. 1989. "Unemployment insurance and short-time compensation: The effects on layoffs, hours per worker, and wages." *Journal of Political Economy*, pp. 1479–1496.

Costain, James S, and Michael Reiter. 2008. "Business cycles, unemployment insurance, and the calibration of matching models." *Journal of Economic Dynamics and Control* 32 (4): 1120–1155.

Feldstein, M. 1976. "Temporary layoffs in the theory of unemployment." *Journal of Political Economy*, pp. 937–957.

Fujita, Shigeru, and Giuseppe Moscarini. 2012. "Recall and Unemployment." Technical Report, Mimeo, Yale University, USA.

Hall, R.E. 2009. "Reconciling cyclical movements in the marginal value of time and the marginal product of labor." *Journal of Political Economy* 117 (2): 281–323.

OECD. 2002. "Employment Outlook."

Topel, Robert H. 1983. "On layoffs and unemployment insurance." *The American Economic Review* 73 (4): 541–559.

Table 1: Calibration, Temporary Shocks Insured

	Value	Target
σ	2	
ψ	1.43	Frisch elasticity of 0.7
α	0.667	
$\theta(s_P)$	0.06	unemployment due to permanent shocks 0.06
$F(F/\overline{y})$	0.108(0.121)	unemployment due to temporary shocks 0.02
σ_x	0.1	
η	0.40	normalization of average hours to one
H	1	setting normal hours equal to average hours
g_{UI}	0.219	replacement rate 0.25%
g_{STC}	0	no STC in calibration

Table 2: Allocations for Different Policy Configurations, Temporary Shocks Insured

	Calibr.	Aut.	g^*_{UI}	$g^*_{STC} \mid g^*_{UI}$	$(g^{**}_{UI}, g^{**}_{STC})$	FB
g_{UI}	0.219	0	0.248	0.248	0.279	NA
g_{STC}	0	0	0	0.107	0.171	NA
Replacement Rate	0.25	0	0.288	0.292	0.339	NA
$\bar{n}_T$	0.98	1	0.932	0.981	0.962	1
$\bar{h}_T$	1	0.991	1.02	0.958	0.929	1.03
$\bar{y}_T$	0.891	0.894	0.877	0.866	0.839	0.92
$c(s_T)$	0.877	0.894	0.862	0.851	0.822	0.865
$c(s_P)$	0.219	0	0.248	0.248	0.279	0.865
Welf. rel. to FB	−12.1%		−11.1%	−10.3%	−9.64%	0%

Table 3: Calibration, Temporary Shocks Uninsured

	Value	Target
σ	2	
ψ	1.43	Frisch elasticity of 0.7
α	0.667	
$\theta(s_P)$	0.06	unemployment due to permanent shocks 0.06
$F(F/\overline{y})$	0.155(0.186)	unemployment due to temporary shocks 0.0201
σ_x	0.1	
η	0.4	normalization of average hours to one
H	1	setting normal hours equal to average hours
g_{UI}	0.206	replacement rate 0.25%
g_{STC}	0	no STC in calibration

Table 4: Allocations, Temporary Shocks Uninsured

	Calibr.	Aut.	g^*_{UI}	$g_{STC} = \frac{1}{2}g^*_{UI}$	FB
g_{UI}	0.206	0	0.219	0.219	NA
g_{STC}	0	0	0	0.11	NA
Replacement Rate	0.25	0	0.269	0.278	NA
$\bar{n}_T$	0.98	1	0.949	0.953	1
$\bar{h}_T$	1	0.989	1.01	0.973	1.02
$\bar{y}_T$	0.836	0.839	0.828	0.802	0.866
$\bar{c}_T$	0.823	0.839	0.814	0.788	0.814
$c(s_P)$	0.206	0	0.219	0.219	0.814
Welf. rel. to FB	−13.2%		−12.8%	−13.1%	0%

Table 5: Allocations for Alternative Parametrization of Policy, Temporary Shocks Insured

	Aut.	$\tilde{g}^*_{UI}$	$\tilde{g}^*_{STC}\|\tilde{g}^*_{UI}$	$(\tilde{g}^{**}_{UI}, \tilde{g}^{**}_{STC})$	FB
g_{UI}	0	0.236	0.236	0.257	NA
g_{STC}	0	0	0.111	0.174	NA
Replacement Rate	0	0.271	0.274	0.304	NA
$\bar{n}_T$	1	0.939	0.985	0.978	1
$\bar{h}_T$	0.991	1.03	0.973	0.951	1.03
$\bar{y}_T$	0.894	0.889	0.877	0.861	0.92
$c(s_T)$	0.894	0.874	0.862	0.846	0.865
$c(s_P)$	0	0.236	0.236	0.257	0.865
Welf. rel. to FB		−11.7%	−10.9%	−10.1%	0%

Table 6: Sensitivity Analysis, Temporary Shocks Insured

Parameter	Value	Total Gain	Fraction fixed g_{UI}
Benchmark	NA	1.455	0.534
σ_{low}	1.000	0.174	0.544
σ_{high}	2.500	2.618	0.499
$(1/\psi_{low})$	0.350	0.751	0.676
$(1/\psi_{hi})$	1.000	1.874	0.448
α_{low}	0.533	1.393	0.444
α_{high}	0.800	1.311	0.580
$\overline{u}_{P,low}$	0.040	1.006	0.556
$\overline{u}_{P,high}$	0.080	1.832	0.502
$\overline{u}_{T,low}$	0.010	1.306	0.497
$\overline{u}_{T,high}$	0.030	1.560	0.513
$\sigma_{x,low}$	0.050	1.699	0.390
$\sigma_{x,high}$	0.170	1.250	0.574
Repl.Rate$_{low}$	0.200	1.941	0.556
Repl.Rate$_{high}$	0.330	0.741	0.471

Figure 1: Subsidy, Hours, and Employment, Temporary Shocks Insured

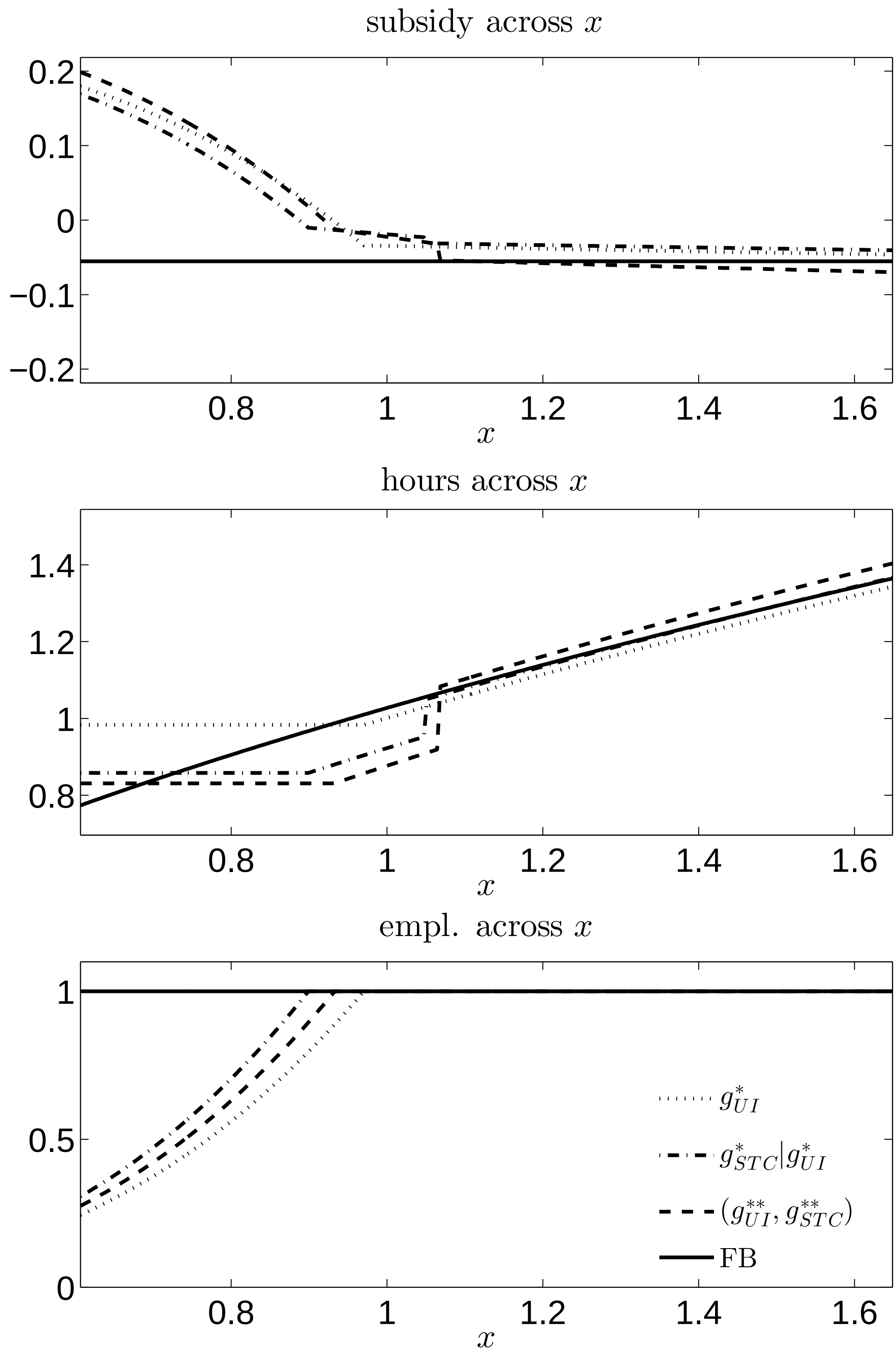

Figure 2: Subsidy, Hours, and Employment, Temporary Shocks Uninsured