Abstract: Workers value job security. If at least some workers value it enough, then it is efficient for at least some firms to adopt policies in which they commit not to dismiss employees except for “just-cause,” as opposed to policies in which employers are free to dismiss employees “at-will.” In this paper, we develop a simple model in which the equilibrium distribution of workers between just-cause firms and at-will firms is not generally efficient: there can be inefficiently many workers in just-cause firms or inefficiently few. If there are inefficiently few, a tax or ban on at-will firms can be welfare-improving.

Keywords: Job security, employment protection, just-cause employment, at-will employment.

JLE classification: J63, J83, K31
**I. Introduction:**

Workers value job security. Specifically, they value protection against income risk arising from the possibility of a negative shock to their productivity or to the productivity of their job match. In a first-best world, it would be possible for individuals to buy full private insurance against that risk, but for moral hazard reasons this is generally not possible. An alternative, second-best way to insure against that risk is to work for an employer that adopts a “just-cause” employment policy in which it commits, implicitly or explicitly, not to dismiss employees except in cases of objectively verified poor job performance. As emphasized by Pissarides (2001), this insurance function should be at the heart of any analysis of job security provisions such as just-cause employment policies.

If at least some workers value job security highly enough, then some firms may adopt just-cause policies, rather than “at-will” policies that place no restrictions on their freedom to dismiss employees. This is true even though workers in just-cause firms have lower average output, which they do because those workers remain at their jobs even when a negative productivity shock has caused their current job match to no longer be efficient, and also because some workers, when working in just-cause firms, exploit the greater job security by shirking. Just-cause firms will offer a correspondingly lower wage, which some workers will nevertheless accept. There is a tradeoff, and the reduced output can be the (efficient) price paid for increased job security.

The main purpose of this paper is to investigate whether the market efficiently allocates workers to just-cause jobs vs. at-will jobs, and how policy interventions to influence that allocation affect total social welfare. We show that the unregulated allocation of workers is not generally welfare-maximizing. This is due to the presence of externalities. A non-shirker who joins a just-cause firm raises average output (and hence the wage) for all other just-cause workers, but does not internalize this effect and so is inefficiently reluctant to join a just-cause firm. A shirker who joins a just-cause firm has the opposite effect. Policy makers cannot distinguish shirkers from non-shirkers, and so cannot cause only non-shirkers to move into just-cause jobs. Rather, they can only provide incentives (such as a tax or a ban on at-will employment) that affect both shirkers and non-shirkers. A policy that encourages just-cause employment will cause
some non-shirkers (of which there were inefficiently few) and some shirkers (of which there were inefficiently many) to switch to just-cause firms, and we show that in some circumstances on net this can be welfare-improving.

To see why this is so, consider the effect of a tax on at-will employment, which has the effect of moving some workers from at-will to just-cause firms. Infra-marginal workers who choose at-will firms even with the tax will be worse off by the amount of the tax, but this loss will be exactly offset by the government’s gain from tax receipts. Infra-marginal workers who choose just-cause firms even without the tax will be affected by it only insofar as it affects the wage that prevails in just-cause firms. That wage can increase or decrease as a result of the tax, and an increase is necessary and sufficient to make those workers better off. Marginal workers who switch from at-will to just-cause jobs as a result of the tax will be made strictly worse off if the just-cause wage decreases or stays the same, as these workers preferred at-will to just-cause employment at the pre-tax just-cause wage. These workers can only be made better off by a tax if it causes a sufficiently large increase in the just-cause wage.

The ideal policy would be to set the tax (or the subsidy if the market allocation contained too few at-will workers instead of too many) that achieves the welfare-maximizing allocation of workers. If setting the tax at the optimal level is not practically possible, then it becomes worth asking whether a ban on all at-will firms (which can be thought of as a sufficiently high tax) can increase welfare even though it causes there to be inefficiently many just-cause firms. We show that a ban can increase or decrease total welfare relative to the unregulated equilibrium.

A key assumption of the model is that in just-cause firms pay differences must be smaller than productivity differences. If firms could cut wages down to the level of a worker’s output, then workers who had suffered a negative productivity shock would receive correspondingly lower wages (which may or may not cause the employee to quit), in which case just-cause employment could not serve the insurance-like function that makes it socially valuable.

The remainder of the paper is organized as follows. Section II discusses the previous literature on employment protection. Section III lays out the setup of the model. Section IV contains our main result,
which is that a tax or ban on at-will employment can increase total social welfare. Section V examines the
distributional effects of a tax or ban, and the implications for the political economy. Section VI contains a
discussion of the results. Section VII concludes.

II. Previous Literature:
Like our paper, Levine (1991) contains a model in which a ban on at-will employment can be welfare-improving. In that model, at-will firms pay efficiency wages to induce effort. These efficiency wages cause equilibrium unemployment, which is welfare-reducing. This welfare loss can be mitigated if firms have workers post performance bonds, which are forfeited if they are fired for shirking; greater use of bonds means less reliance on efficiency wages. Just-cause employment enables increased reliance on bonds, improving efficiency, because workers have less fear that the bonds will be expropriated by the firm. On the other hand, some worker in just-cause firms will shirk, which also reduces welfare. Levine shows that there are parameter values such that total welfare is higher if all firms are just-cause firms, but where an individual just-cause firm could not survive because it would attract a disproportionate number of shirkers. For this reason, a ban on at-will employment can increase welfare.

In our model, as in Levine’s, there are efficiency benefits to just-cause employment, but adverse se-
lection of shirkers into just-cause jobs introduces an inefficiency, which can be mitigated by a policy of banning or taxing at-will firms.\(^1\) But the mechanism in our paper is completely different.\(^2\) Our model does not require efficiency wages or performance bonds; we assume standard fixed-wage contracts. Rather, the benefits of just-cause employment come from the quite weak assumption that workers value job security, and are willing to pay for it by choosing to work for lower wages at a just-cause firm.

\(^1\) In Levine, the only policy is a total ban on at-will firms. We consider both bans and taxes.

\(^2\) We do not model the full general equilibrium impact on unemployment. The goal of our paper is to show that through a simple model without frictions, we can obtain the result that a ban on at-will work can be welfare improv-
ing. This does not mean that the impact of just-cause policies on unemployment is not important. But those implica-
tions have been discussed at length elsewhere. Levine (1991) documents an example where labor demand increases (and thus unemployment is decreased) when just-cause policies are adopted. Others, such as Ljungqvist and Sargent (1998) have shown that increasing firing costs can decrease hiring and increase unemployment. Because these con-
cepts have been explored in depth elsewhere, we chose not to include these features in our model.
In our paper, externalities between workers mean that negotiations for job protection between individual workers and firms need not result in the optimal allocation of resources. Other papers have examined aspects of this subject. Saint Paul (2002) examines the political economy of just-cause protection. Schmitz (2004) begins with this argument: job protection law restricts the class of contracts that two parties may write, and therefore must reduce welfare. Schmitz then provides an example where this is not true. Schmitz shows that when workers have private information, employers may implement a firing mechanism to remove low-types, and this may happen more often than is socially optimal. Just-cause protection may remove this type of inefficiency. Burguet and Caminal (2005) ask why private contracts cannot provide efficient job protections. They find that when firms and workers cannot commit to future wages, incomplete information will lead to excess dismissals.

While these papers argue that JC protection can improve welfare, most papers in this area acknowledge that employment protections can lead to inefficient allocation of resources because firms cannot destroy jobs that have lost their productive value (this is true in our model as well, just-cause protection always reduces output). Furthermore, if job destruction is difficult, it may lead to less job creation and higher unemployment (Lazear (1990), Ljungqvist and Sargent (1998)). But there are also a number of papers that develop models in which employment protection can increase aggregate output. Bertola (2004) shows that requiring risk-neutral firms to insure risk-averse employees against negative income shocks can enhance aggregate output if job switching is costly. The idea is that job switching is likely to be efficient precisely when current income is low, but that is when risk-averse workers are least willing to pay the job-switching costs. Similarly MacLeod & Nakavachara (2007) argue that just-cause employment laws can, under certain conditions, provide workers with better incentives to make relationship-specific investments.

Even if job protection laws reduce productivity, it does not necessarily mean that they are economically inefficient. If workers suffer disutility from job insecurity, then the welfare harm from some reduction in output can be overbalanced by the benefits of greater job security. Pissarides (2001) points out that most models of employment protection ignore this, and hence rule out the most natural reason why such
protections would exist in the first place. In that paper and in Pissarides (2010), he shows that severance payments and advance notice requirements can serve as a form of efficient insurance for risk-averse employees, though the mechanism in his model differs from ours. Blanchard & Tirole (2008) also argue that worker risk-aversion means that layoffs have a social cost that is not internalized by firms, but they argue that forcing firms to pay a layoff tax to internalize this cost is superior to just-cause protection. We do not take a position on the relative effectiveness of alternative government interventions. Instead we focus solely on just-cause protection, which appears to be the relevant policy question in some cases. Moreover, the basic intuition that we develop in this paper may be applicable in other situations where workers and firms bargain over job characteristics, and where the outcome of such bargaining can be sub-optimal. See the discussion in Section VI below for such an example.

A literature has also developed that demonstrates some of these concepts empirically. Levine showed a model based on adverse selection, and Clark and Postel-Vinay (2009) use European Panel data to show that workers self-select into jobs with more just-cause protection. Scoppa (2010), Olsson (2010), and Engelandt and Riphahn (2005) show that just-cause protection leads to lower productivity. Autor, Kerr, and Kugler (2007) also find lower productivity from just-cause protection, and further examine the impacts on employment. DiTella and MacCulloch (2002) find that flexible labor markets generally increase employment. In contrast, Nickell (1997) finds no significant effect of employment protection on unemployment across the OECD countries. MacLeod & Nakavachara (2007) find that “wrongful discharge” law enhances employment. Acharya et al. (2012) find that employment protection increases innovation; workers are more willing to undertake valuable but risky projects when they are partially protected from failure by employment protection. It is important to note that none of these papers attempt to measure the social value of the insurance provided by just-cause employment. In summary, even though there is a theory literature showing that employment protection can increase output, the empirical literature seems to suggest that this is not the case.
III. Model Setup:

A. Firms.

There are two types of firms: “at-will” (AW) firms, which can fire workers for any reason, and “just-cause” (JC) firms, which commit to only fire workers who exert less than the required effort. To make this commitment credible, JC firms bind themselves so they can only fire workers if they can prove to a third party that insufficient effort was exerted.

The socially efficient level of worker effort is the same in both types of firm. All firms nominally require that level of effort from their workers, and can always detect shirking. AW firms fire any worker who shirks, so all workers in AW firms exert the efficient effort.³ For this reason, we denote the efficient effort level by \( e_{AW} \).⁴ JC firms can only fire a worker if it can prove that the worker exerted less effort than this. When discussing shirking in this paper, we are going to talk about shirking that cannot be documented and verified. Some workers in JC firms put in a lower level of effort (shirk) and avoid being fired.

We assume that the only input to firms’ production is labor, and firms operate in perfectly competitive labor and output markets so in equilibrium all output is paid out as wages. This simplifies the analysis by allowing us to abstract from the effect of policy on the welfare of firm owners or consumers.

B. Workers.

i. Uninsurable Productivity Risk.

As discussed above, a key assumption of the model is that workers face some downside risk that their realized labor productivity, or the productivity of the match with their employer, will be low.⁵ We refer to this as “productivity risk.” The first-best response to this risk would be to purchase insurance against it,

³ Alternatively, the \( AW \) firm could have a policy of cutting such a worker’s wage down to the worker’s output. Since the firm requires the efficient level of effort, either policy will result in efficient effort being exerted in \( AW \) firms.

⁴ The efficient effort level is the same in both types of firms, It is denoted by \( e_{AW} \) because (as shown below) only in \( AW \) firms is this effort exerted by all workers.

⁵ A realization of low productivity could in principle occur at any time in a worker’s life. Typically we may model a workers skills as becoming obsolete later in life, but adding multiple periods to the model does not add any additional insights. For simplicity we will assume a one period model where the low productivity shock occurs immediately after joining the workforce.
but for moral hazard and adverse selection reasons, such insurance is generally unavailable. This unavailability of insurance is crucial because in our model the benefit of JC employment is that it serves as a form of second-best insurance against this risk.

For worker $i$, the disutility associated with productivity risk is denoted $\alpha_i$, which has a probability distribution function $f(\alpha)$ with support $[\alpha^{\text{MIN}}, \alpha^{\text{MAX}}]$. This heterogeneity is central to our results, because the primary policy instrument that we consider (a tax on AW employment) works by drawing workers from AW employment into JC employment; increasing the tax rate does this for workers with successively lower levels of $\alpha_i$. In the main text, we do not specify the micro-foundations of $\alpha_i$. The reason is that productivity risk can have multiple sources, as can the reason for the heterogeneity of $\alpha_i$ across workers, and our results do not depend on any particular one. In the Appendix we develop an example where the micro-foundations are specified. There, the existence of productivity risk means that the expected earnings of AW workers are lower than the AW wage. In addition, workers are risk-averse, so their utility is lower than if they received their expected wage with certainty. In this environment, $\alpha_i$ captures both the reduction in expected earnings and the fact that those lower expected earnings come in the form of a risky gamble. The heterogeneity of $\alpha_i$ comes from worker differences in the degree of risk aversion.

JC employment has value as insurance against productivity risk only insofar as that risk cannot be insured against directly. We follow Pissarides (2010) and assume that direct private productivity insurance is not feasible. Note that even if it were possible to insure against direct financial risk, that insurance would still be incomplete, potentially leaving a role for JC employment protection. For example, Jahn and Wagner (2005) argue that in addition to income risk, job loss may also lead to the loss of networking opportunities and social status. They argue that these other factors may not be perfectly insurable and may lead to permanent scarring for fired workers. The empirical literature has also shown that workers who lose jobs often suffer multiple job losses, and that job loss can lead to permanently lower income on average (Stevens 1997). These results also suggest alternative possible sources of micro-foundations for $\alpha_i$, which is another reason for keeping the treatment general.
ii. Inefficient Job Matches and Shirking.

We assume that for workers with low realized productivity (and only for them), it is ex-post efficient that they separate from their employer and move to their next-best alternative activity, such as work in an informal sector, self-employment, or possibly unemployment.\(^6\) In \(AW\) firms, these workers’ private incentives are aligned with social welfare; they receive their full marginal product as wages, so any job match that reduces total welfare also reduces their utility, which would make them want to quit.\(^7\) For low-productivity workers in \(JC\) firms, the situation is different. They also bear the full social cost of their effort, but the wage compression assumption (discussed below) means that their wage can be greater than their marginal product. If this wage premium is large enough they will not quit, and the just-cause employment protection means they cannot be fired. That is, while just-cause employment serves as insurance against productivity risk, it also has an efficiency cost arising from some low-productivity workers remaining in job matches that are ex-post inefficient.

In addition to differing in their disutility from bearing productivity risk, workers are also heterogeneous in their skill at avoiding effort. There are two types of workers: “skilled shirkers” and “non-skilled shirkers.” Skilled-shirkers have the ability to exert substantially less than the required effort, but in a way that cannot be documented. Non-skilled shirkers are less adept at shirking in a way that is difficult to document, or perhaps are intrinsically motivated not to shirk. For ease of exposition, we will refer to skilled-shirkers simply as “shirkers” and to non-skilled shirkers as “non-shirkers,”

A worker’s type is irrelevant to \(AW\) firms; \(AW\) firms always detect shirking, and have no need to prove it, so they can and do fire any worker who shirks. For this reason, in \(AW\) firms all workers exert the efficient effort \(e_{AW}\). But in \(JC\) firms, shirkers exploit the fact that their shirking cannot be proven, and so they cannot be fired, even when their shirking is detected (which it always is). These workers exert lower

\(^6\) By “ex-post efficient,” we mean that for low-productivity workers (and only for them), output, net of the utility cost of effort, is higher in the alternative activity.

\(^7\) If for some reason they did not quit, their \(AW\) employer will want to fire them unless it is possible to cut their wages. We assume that firms cannot simply lower the wages of unproductive workers down to their marginal product. We do this by assuming wage compression where shirkers and non-shirkers are paid the same amount. A less restrictive assumption (such as wage nominal wage rigidity) could also be used to generate our conclusions.
effort $e_{JC}^S < e_{AW}$. In the interest of generality, we also allow for the possibility that “non-shirkers” in JC firms engage in some amount of shirking, but less than the shirkers do; their effort is (weakly) less than $e_{AW}$, so that $e_{JC}^S < e_{JC}^N \leq e_{AW}$. The existence of these two types generates adverse selection into JC firms, which are more attractive to shirkers than to non-shirkers. Following Levine (1991), we assume full JC wage compression, meaning there is a single JC wage $w_{JC}$ that is paid to all JC workers, shirkers and non-shirkers alike. Wage compression is crucial to our model (though the assumption of full compression is not), because if JC firms had wage flexibility they could pay lower wages to workers with low realized productivity, and then JC employment would no longer serve as insurance against productivity risk.

There is a mass of non-shirkers of measure $N^{NS}$ and a mass of shirkers of measure $N^S$. Firms cannot identify which workers are of which type when hiring. The mass of non-shirkers who join JC firms ($N_{JC}^{NS}$) is equal to $N^{NS}$ times the fraction of non-shirkers for whom $\alpha_i > \alpha^{NS}$, where $\alpha^{NS}$ is the (endogenous) threshold level of $\alpha_i$ above which a non-shirker prefers a JC firm to an AW firm. Similarly, the mass of shirkers who join JC firms ($N_{JC}^S$) is equal to the total mass of shirkers $N^S$ times the fraction of shirkers for whom $\alpha_i > \alpha^S$, where $\alpha^S$ is defined analogously to $\alpha^{NS}$.

C. Wages.

The output, and hence the wage, of workers who join AW firms and whose realized productivity is not low (none of whom shirk in equilibrium) is denoted by $w_{AW}$. The assumption of full wage compression means there will be a single JC wage $w_{JC}$, which is equal to the average output of JC workers. Average output in JC firms is lower than in AW firms, both because of shirking ($e_{JC}^S < e_{JC}^N \leq e_{AW}$), and also because the high JC wage causes some low-productivity JC workers (both shirkers and non-shirkers) to remain in their jobs despite the fact that the efficient outcome would be for them to switch to their next-best alternative activity. Let the average output reduction of JC workers, relative to $w_{AW}$ (i.e., the wage of AW
workers whose realized probability is not low and who therefore remain with their AW employer) be denoted by \( \lambda^{NS} \) for non-shirkers and by \( \lambda^S \) for shirkers. The JC wage, denoted by \( w_{JC} \), is:

\[
(1) \quad w_{JC} = \frac{(w_{AW} - \lambda^{NS})N^{NS}_{JC} + (w_{AW} - \lambda^S)N^S_{JC}}{N^{NS}_{JC} + N^S_{JC}} = \frac{(w_{AW} - \lambda^{NS})\int_{a^s}^{a^{max}} f(\alpha)d\alpha + (w_{AW} - \lambda^S)\int_{a^s}^{a^{max}} f(\alpha)d\alpha}{\int_{a^s}^{a^{max}} f(\alpha)d\alpha + \int_{a^s}^{a^{max}} f(\alpha)d\alpha}.
\]

Utility is linear and additively separable in expected wages, disutility from exerting effort, and productivity risk. The utility that the two types of workers receive from choosing to work in the two types of firms is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Shirker</th>
<th>Non-shirker</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW Firm</td>
<td>( w_{AW} - e_{AW} - \alpha_i )</td>
<td>( w_{AW} - e_{AW} - \alpha_i )</td>
</tr>
<tr>
<td>JC Firm</td>
<td>( w_{JC} - e^S_{JC} )</td>
<td>( w_{JC} - e^{NS}_{JC} )</td>
</tr>
</tbody>
</table>

D. Thresholds.

We assume that there is no way for policy-makers to identify shirkers or non-shirkers, but policy can influence the thresholds \( \alpha^{NS} \) and \( \alpha^S \), and hence the choices of marginal workers (both shirkers and non-shirkers) about whether to join AW or JC firms. However, policy cannot manipulate \( \alpha^{NS} \) and \( \alpha^S \) independently, as they have a fixed relationship to each other; to change one threshold is to change the other by the same amount, so the effect of changing the thresholds on the composition of the JC workforce will depend on the specifics of \( f(\alpha) \). This fixed relationship between the thresholds means that feasible policy can only be constrained-optimal. This is shown in the following lemma.

Lemma 1: \( \alpha^{NS} = \alpha^S + (e^{NS}_{JC} - e^S_{JC}) \)

Proof: A non-shirker is indifferent between AW and JC employment if

---

8 Recall that there are no low-productivity workers in AW firms.
A non-shirker is indifferent if

\[ w_{AW} - e_{AW} - \alpha^S = w_{JC} - e_{JC} \Rightarrow \alpha^S = (w_{AW} - w_{JC}) - (e_{AW} - e_{JC}). \]

These expressions only implicitly define \( \alpha^NS \) and \( \alpha^S \), because \( w_{JC} \) is dependent on them. Nevertheless, it is immediate that (2) and (3) differ by \( e_{JC}^{NS} - e_{JC}^S \), which is a positive and fixed quantity.

Lemma 1 plays an important role in what follows. It shows that all else equal, shirkers value jobs in JC firms more than non-shirkers do, so if the distribution of \( \alpha_i \) is the same for shirkers and non-shirkers, then there will a higher proportion of shirkers than non-shirkers in JC jobs.

E. Equilibrium.

A detailed discussion of the equilibrium is in the Appendix. There we show that, when \( \alpha_i \) is distributed uniformly and identically for shirkers and non-shirkers, there is at most one equilibrium in each of the following cases: (i) where some shirkers and no non-shirkers join JC firms; (ii) where some shirkers and some non-shirkers join JC firms; and (iii) when all shirkers and some non-shirkers join JC firms.

IV. Main Results:


We consider the effect of a per-worker tax \( \tau \) on AW firms. It is clear from (2) and (3) above that as the wage differential between AW and JC jobs falls, the thresholds \( \alpha^NS \) and \( \alpha^S \) also fall, which causes some workers to switch from AW to JC firms. How many workers of each type switch will determine the effect on JC wages. Lemma 1 shows that \( \alpha^NS \) and \( \alpha^S \) must always differ by \( e_{JC}^{NS} - e_{JC}^S \), which means that the tax must cause the two thresholds to decrease by the same amount, which we call \( \Delta \). This causes the AW wage to fall by \( \tau \), and changes the wage in JC firms from \( w_{JC} \) to \( w'_{JC} \), which is equal to.
In the presence of wage compression, individual job choices have external effects. Each non-shirker who “switches” (the model is static so workers do not actually switch; the tax simply causes some workers to make a different job choice in the first place) to a JC firm raises the proportion of non-shirkers among JC workers, and so raises the wage for all JC workers. Similarly each shirker lowers the JC wage. But neither takes this into account when deciding which type of firm to work in. The effect of a tax on AW employment on the JC wage depends on how many workers of each type are induced to switch. Specifically, it depends on whether the tax causes the proportion of non-shirkers in JC firms to increase or decrease, which in turn is determined by whether the proportion of non-shirkers among those who switch from AW to JC firms as a result of the tax is larger or smaller than the proportion of non-shirkers among infra-marginal JC workers, which in turn depends on the distribution of $\alpha_i$ and on the (fixed) difference between $\alpha^{NS}$ and $\alpha^S$.

Lemma 2: When $\alpha_i$ is distributed uniformly and identically for shirkers and non-shirkers, $w'_{JC} > w_{JC}$. However, $w'_{JC} < w_{JC}$ can also occur.

Proof: Let $\alpha_i$ be distributed $U[\alpha^{MIN}, \alpha^{MAX}]$ for both shirkers and non-shirkers. The mass of non-shirkers who switch from AW to JC firms as a result of a tax is

$$N^{NS} \int_{\alpha^{NS} - \Delta}^{\alpha^{NS}} \frac{1}{\alpha^{MAX} - \alpha^{MIN}} d\alpha = \frac{\Delta N^{NS}}{\alpha^{MAX} - \alpha^{MIN}}.$$

The mass of shirkers who switch from AW to JC firms is

$$N^S \int_{\alpha^{S} - \Delta}^{\alpha^{S}} \frac{1}{\alpha^{MAX} - \alpha^{MIN}} d\alpha = \frac{\Delta N^S}{\alpha^{MAX} - \alpha^{MIN}}.$$
Since the tax enters the equations for $\alpha_{NS}$ and $\alpha_S$ linearly, the proportion of shirkers among switchers is the population proportion

$$\frac{\Delta N^S}{\alpha_{\text{MAX}} - \alpha_{\text{MIN}}} = \frac{\Delta N_{NS}^{\alpha}}{\alpha_{\text{MAX}} - \alpha_{\text{MIN}}} + \frac{\tau N^S}{\alpha_{\text{MAX}} - \alpha_{\text{MIN}}} = \frac{N^S}{N_{NS} + N^S}.$$ 

Lemma 1 shows that the proportion of shirkers among infra-marginal JC workers is greater than the population proportion. If the proportion of shirkers among switchers is equal to the population proportion, then a tax on AW employment reduces the proportion of shirkers in JC firms, which increases the wage.

The opposite case, in which $w_{JC} > w_{JC}$, is also possible. The simplest example occurs if $\alpha_i$ is allowed to have a different distribution for shirkers and non-shirkers. For example, if $\alpha_i$ is distributed such that originally only non-shirkers are in JC firms, then moving workers to JC firms will increase the proportion of shirkers in JC firms and lower the JC wage.  

$\blacksquare$

**B. Total Welfare Effects of a Tax or a Ban on At-Will Firms.**

In this section we consider the effect on total social welfare of a tax on AW employment, and also of a complete ban on AW firms, which can be thought of as a tax large enough that no workers choose to join an AW firm. Total welfare adds up the utility of all agents in the economy. Since the agents in the model are heterogeneous, this ignores potentially important distributional issues, which we discuss in Section V below. We include in the welfare calculations the utility that workers gain from shirking. If it were excluded from the calculations, then a tax or a ban would be less likely to improve welfare, as then the lost

---

9 Note that if the tax is large enough so that $\alpha^S - \Delta < \alpha_{\text{MIN}}^{\alpha}$, then there are no more shirkers to move to just-cause firms, and the proportion of shirkers among switchers will be less than the population proportion.

10 Here is a numerical example. Let non-shirkers have $\alpha_i$ distributed uniformly from $[0, 0.3]$; let shirkers have $\alpha_i$ distributed uniformly from $[0, 0.2]$; let $e_{AW} = 0.1$; $e_{JC}^{\alpha_S} = 0.07$; $e_{JC}^{\alpha_S} = 0.02$; $\lambda^{\alpha_S} = 0.3$; $\lambda^S = 0.8$; $N^{NS} = 800$, and $N^S = 200$. Let expected output in the AW sector be 1, so $w_{AW} = 1$. In equilibrium, no shirkers will work at the just-cause firms, so $w_{JC} = 0.7$. At this wage, all shirkers prefer AW jobs. The biggest $\alpha_i$ is 0.2, and even at this level $w_{AW} - \alpha_i - e_{AW} > w_{JC} - e_{JC}^S$, $1 - 0.2 - 0.1 > 0.7 - 0.02$. At this wage, a few non-shirkers prefer JC jobs. The biggest $\alpha_i$ is 0.3, and at this level $w_{AW} - \alpha_i - e_{AW} < w_{JC} - e_{JC}^S$, $1 - 0.3 - 0.1 > 0.7 - 0.07$. And with only non-shirkers in the JC firms, the $w_{JC} = 0.7$. With a total ban (or very high tax), all shirkers will join just-cause firms, and the just-cause wage will fall to $w_{JC} = \frac{(w_{AW} - \lambda^S)N^{NS} + (w_{AW} - \lambda^S)N^S}{N_{JC}^S + N^S} = \frac{(0.7)800 + (0.2)200}{1000} = 0.6$. 

---
output from moving shirkers into JC firms would not be partially offset by the fact that those workers were spared the disutility of effort.

Our main results rely on the existence of heterogeneity in \( \alpha_i \). We consider this case in sub-section (i) below. In sub-section (ii) we consider the case where that disutility is a constant \( \alpha_i = \bar{\alpha} \), as in Levine (1991).

\( i. \) Heterogeneous \( \alpha_i \).

Our main result is that a tax or a ban on AW employment can increase or decrease total welfare. This is the subject of the following proposition.

Proposition 1: When \( \alpha_i \) is heterogeneous, a per-worker tax \( \tau \) on AW employment may increase or decrease total welfare, and a ban on AW employment may increase or decrease total welfare.

Proof: A tax \( \tau \) reduces the real wage of infra-marginal AW workers by \( \tau \). This is a direct transfer from those workers to the government, and so has no effect on total welfare. The effect of the tax on infra-marginal JC workers is

\[
N^{\alpha_{NS}} \int_{\alpha_{NS}}^{\alpha_{\text{MAX}}} (w_{JC}' - w_{JC}) f(\alpha) d\alpha + N^{\alpha_{S}} \int_{\alpha_{S}}^{\alpha_{\text{MAX}}} (w_{JC}' - w_{JC}) f(\alpha) d\alpha.
\]

The sign of this effect depends only on the sign of \( w_{JC}' - w_{JC} \), which Lemma 2 shows can be positive or negative. The effect on marginal workers (those who switch from AW to JC firms) is

\[
N^{\alpha_{NS}} \int_{\alpha_{NS}}^{\alpha_{\text{MAX}}} \left( \alpha_i + (e_{AW}^{\alpha_{NS}} - e_{JC}) - (w_{AW}' - w_{JC}') \right) f(\alpha) d\alpha + N^{\alpha_{S}} \int_{\alpha_{S}}^{\alpha_{\text{MAX}}} \left( \alpha_i + (e_{AW}^{\alpha_{NS}} - e_{JC}) - (w_{AW}' - w_{JC}') \right) f(\alpha) d\alpha.
\]

A worker (shirker or non-shirker) who switches from an AW firm to a JC firm gains \( \alpha_i \), because that worker no longer experiences the disutility of job insecurity; gains \( (e_{AW}^{\alpha_{NS}} - e_{JC}) \) (if a non-shirker), or \( (e_{AW}^{\alpha_{NS}} - e_{JC}) \) (if a shirker), because of the lower effort exerted in JC firms; and loses \( (w_{AW}' - w_{JC}') \). The net effect is negative if \( w_{JC}' \leq w_{JC} \), because these marginal workers preferred to work in AW firms when the JC wage was \( w_{JC} \), and so must be worse off if induced to switch to a JC firm at an equal or lower wage. So a strictly positive JC wage increase is necessary for this group to be made better off. The net effect of the tax is the sum of (5) and (6). Below we show with a numerical example that this can be positive or negative.

The effect of a complete ban on AW employment is as follows. A ban increases the proportion of non-shirkers in JC firms to its maximum possible level (the population proportion), and so increases \( w_{JC} \) to its
maximum possible level \( w_{JC}^{MAX} = \frac{(w_{AW} - \lambda^{NS})N^{NS} + (w_{AW} - \lambda^{NS})N^{S}}{N^{NS} + N^{S}} \). The total welfare effect on non-shirkers of a total ban on \( AW \) employment is

\[
N^{NS} \left( \int_{\alpha^{NS}}^{\alpha^{MAX}} \left( w_{JC}^{MAX} - w_{JC} \right) f(\alpha) d\alpha + \int_{\alpha^{NS}}^{\alpha^{MAX}} \left( \alpha_i + (e_{AW} - e_{JC}^{NS}) - (w_{AW} - w_{JC}^{MAX}) \right) f(\alpha) d\alpha \right).
\]

In the case of a ban, there are no infra-marginal \( AW \) workers, there are only infra-marginal \( JC \) workers and switchers. All infra-marginal non-shirkers in \( JC \) firms benefit from the increase in the \( JC \) wage to \( w_{JC}^{MAX} \). All switchers who were in \( AW \) firms before the ban gain \( \alpha_i \) (they no longer face income risk) and also gain utility from reduced effort if \( e_{JC}^{NS} < e_{AW} \). But they lose the difference between the \( AW \) wage and the post-ban \( JC \) wage \( w_{JC}^{MAX} \).

Similarly, the total welfare effect on non-shirkers of a ban on \( AW \) employment is

\[
N^{S} \left( \int_{\alpha^{S}}^{\alpha^{MAX}} \left( w_{JC}^{MAX} - w_{JC} \right) f(\alpha) d\alpha + \int_{\alpha^{S}}^{\alpha^{MAX}} \left( \alpha_i + (e_{AW} - e_{JC}^{S}) - (w_{AW} - w_{JC}^{MAX}) \right) f(\alpha) d\alpha \right).
\]

Below we show with numerical examples that the sum of (7) and (8) can be positive or negative. The reason is that while infra-marginal \( JC \) workers must be made better off by the ban, switchers can be better or worse off: they preferred \( AW \) to \( JC \) employment at the original \( JC \) wage, so a switch at that wage would make them worse off. But following the ban the \( JC \) wage increases to \( w_{JC}^{MAX} \), which means the ban might make them better off.

Figure 1 graphically illustrates how welfare changes in response to changes in the tax on \( AW \) firms.\(^{11}\)

The x-axis represents the size of the tax, and the y-axis represents utility. Moving from left to right, as the tax \( \tau \) on \( AW \) employment increases, it lowers the wage in \( AW \) firms, causing workers to switch to \( JC \) firms. At the far right is a tax high enough that it amounts to a ban on \( AW \) firms.

To interpret Figure 1, start at the unregulated equilibrium. Because \( \alpha_i \) is distributed uniformly, by Lemma 2 the proportion of shirkers among the workers who switch as a result of the tax is equal to the population proportion. This switch causes an inefficient reduction in effort due to shirking, which

\(^{11}\) Here are the numerical values for Figure 1. Expected output in \( AW \) firms is 1, so \( w_{AW}=1 \), and \( e_{AW}=0.1 \). When shirkers move to \( JC \) firms let them lower their effort level to \( e_{JC}^{S} = 1/3 e_{AW} \), and let this cause a corresponding drop in output, so that \( \lambda^{S} = 2/3 \). We could let non-shirkers maintain full effort in the \( JC \) firms and have no drop in output, but let there be a small cost associated with moving shirkers to the \( JC \) firm. Let \( e_{JC}^{NS} = 49/50 e_{AW} \) and let \( \lambda^{NS} = 1/50 \). Let \( \alpha_i \) be distributed normally from \([0, 0.5]\) for both types of workers. Finally, let 10% of the workers be shirkers.
Figure 1

Note: There are two y-axis scales, one in Marginal Utils and one in Total Utils.

- Total Welfare
- Marginal Social Cost
- Marginal Social Gain
represents a marginal social cost of the tax. Another marginal social cost comes from the fact that some
workers have suffered productivity shocks that make their job matches no longer efficient, but JC workers
remain in these inefficient matches instead of separating and choosing the efficient alternative as they
would have at an AW firm. The marginal social cost curve jumps down discretely at the level of \( \tau \) such
that all shirkers are in JC firms. Beyond that, further tax increases only cause non-shirkers to switch.

The tax also has a marginal social benefit, which is that workers who switch from AW to JC firms are
spared the disutility of lacking job security. The marginal benefit of an incremental increase in \( \tau \) is the
marginal disutility from job insecurity that the workers are spared. This is downward-sloping because the
marginal workers that are induced to switch as \( \tau \) increases have successively lower disutility of job inse-
curity. The slope of this line changes at the tax rate such that all shirkers are in JC firms, because there are
fewer switching workers for a given increase in \( \tau \). But because shirkers are only 10% of the marginal
workers, the change in slope is small.

Total social welfare is also graphed in Figure 1. Note that this is not on the same scale as the other
lines and curves in the figure, as it represents total utility and the others represent components of marginal
utility. They are presented in the same figure to illustrate how the relationships between the marginal so-
cial costs and benefits affect total welfare. Starting at the unregulated equilibrium and moving to the right,
at first an increase in \( \tau \) causes total welfare to increase because the workers who move from AW firms to
JC firms have high disutility from job insecurity. But at certain point the marginal benefit of the tax be-
comes smaller than the marginal cost and total welfare begins to fall. When \( \tau \) becomes high enough that
all shirkers are in JC firms, the total marginal cost drops discretely and falls below the marginal benefit,
and total welfare discretely increases. But the marginal benefit continues to fall as \( \tau \) increases, and event-
ually it falls below the total marginal cost and so total welfare starts to fall. For the parameter values rep-
resented in Figure 1, a tax on JC firms high enough that no AW firms exist (which is equivalent to a total
ban on AW firms) causes welfare to increase relative to the unregulated equilibrium. But a ban is not the

---

12 If the worker suffers a negative productivity shock that does not render the JC job match inefficient, then this
marginal social cost will not be present.
(constrained) optimal policy, because a smaller (but still positive) tax results in welfare that is even higher. A ban “overshoots” the optimum, eliminating all $AW$ firms when the optimal number of such firms is positive. By increasing the amount of lost output due to shirking and/or job mismatches ($\lambda^{NS}$ and $\lambda^S$), it is easy to construct examples where a ban would lower total welfare relative to the unregulated equilibrium, but where there exists a positive tax that would increase it.

\textit{ii. Homogeneous $\alpha_i = \bar{\alpha}$.}

The above results rely on the assumption that $\alpha_i$ varies across workers. When $\alpha_i$ is a constant, a ban can still increase welfare, but the conditions for it to do so are quite restrictive. Levine (1991) depends on a coordination failure. (We use our notation instead of Levine’s notation for ease in comparison.) In Levine’s model, as in Lemma 1, there is adverse selection into $JC$ firms. Levine assumes that if all firms adopt a $JC$ policy, everyone is better off (i.e. $w_{AW} - e_{AW} - \bar{\alpha} < w_{JC}^{MAX} - e_{NS}$). But if this was the only assumption, a ban would be unnecessary. Since non-shirkers prefer $JC$ employment at that wage, individual employers could offer that wage and hire from the applicant pool at random, and thereby avoid adverse selection. Thus the efficient number of $JC$ firms could operate, even absent a ban. Levine’s result (1991) relied on the concept of a “migration cost” that only shirkers were willing to bear, so that adverse selection prevented an individual $JC$ firm from operating.

Our model does not rely on a migration cost. The above results rely instead on heterogeneity in $\alpha$. However, in our framework, it is still possible to generate a similar result with constant $\alpha_i = \bar{\alpha}$ if shirkers produce positive output, and so $JC$ firms can operate with just shirkers. If only shirkers work in $JC$ firms, then $JC$ firms pay the lowest possible wage, $w_{JC}^{MIN} = (w_{AW} - \lambda^S)$. This is the subject of the following proposition.
Proposition 2: If $w_{JC}^{MAX} - e_{JC}^{NS} < w_{AW} - e_{AW} - \bar{\alpha} < w_{JC}^{MIN} - e_{JC}^{S}$ and $\lambda_{NS}^{MIN} < \bar{\alpha}$, a ban on $AW$ work will increase total welfare.\(^{13}\)

Proof: The conditions in the proposition mean that non-shirkers all prefer $AW$ employment even when the $JC$ wage is at its maximum possible value, and shirkers all prefer $JC$ employment even when the $JC$ wage is at its minimum possible value. Thus the only effect of a ban on $AW$ employment is to move non-shirkers to $JC$ firms. The social benefit of this is the reduction in job insecurity $\alpha$, which by assumption is more than the lost productivity $\lambda_{NS}$.  

In Proposition 2, a ban increases total welfare because non-shirkers are efficiently moved to the $JC$ sector. The reason non-shirkers do not voluntarily choose $JC$ firms absent a ban is that the social gain comes from a transfer from non-shirkers to shirkers, and so the ban makes non-shirkers worse off.

C. Necessary Condition for a Tax on $AW$ firms to be Welfare-Increasing.

In the above examples, we show that a tax or a ban on $AW$ firms can either increase or decrease total welfare. In this sub-section, we show a necessary condition for a tax to be welfare-increasing.

Corollary to Proposition 1: A necessary condition for a tax to increase total welfare is that $w_{JC}^{'} > w_{JC}$.

Proof: The proof to Proposition 1 showed that: (i) the effect of a tax on infra-marginal $AW$ workers is exactly offset by the effect on the government; (ii) the effect on infra-marginal $JC$ workers has the same sign as the $JC$ wage change; and (iii) the effect on marginal switchers is negative if $w_{JC}^{'} < w_{JC}$. Thus $w_{JC}^{'} > w_{JC}$ is a necessary condition for a tax on $AW$ employment to be welfare-increasing.  

The condition that $w_{JC}^{'} > w_{JC}$ is necessary for a tax on $AW$ firms to be welfare-increasing. So evidence that a proposed tax would make the $JC$ wage go down would be sufficient to conclude without further analysis that such a policy would reduce welfare. While the $w_{JC}^{'} > w_{JC}$ condition is necessary, it is not sufficient. For example in Figure 1, the fact that $a_i$ is distributed uniformly and identically for shirkers and

\(^{13}\) For example, let expected output in the $AW$ sector be 1, so $w_{AW} = 1$. Let $e_{AW} = e_{JC}^{NS} = 0.5$, $e_{JC}^{S} = 0$, $\lambda_{NS} = 0$, $\lambda_{S} = 0.5$, $\bar{\alpha} = 0.05$, and 20% of the workers are shirkers. Then $w_{JC}^{MIN} = 0.5$, $w_{JC}^{MAX} = 0.9$, and the inequality becomes $0.9 - 0.5 < 1 - 0.05 - 0.5 < 0.5 - 0$, or $0.4 < 0.45 < 0.5$.  

20
non-shirkers means that the JC wage always gets higher the higher the tax (see Lemma 2), yet there are still some levels of $\tau$ that result lower welfare than in the unregulated equilibrium. We do not have a general sufficient condition for a tax on $AW$ firms to be welfare-increasing. But we observe that both infra-marginal JC workers and marginal switchers are better off the higher the JC wage, and no one is worse off. So a sufficiently large increase in the JC wage would guarantee that a tax improves total welfare.

**V. Distributional Effects:**

In our total welfare results we simply sum utility across workers. But there are significant concerns with using this approach with a heterogeneous group of workers, and in this section we explore some distributional questions.

First note that even when a tax or a ban increases total welfare, it does not lead to a Pareto improvement: as the proof to Proposition 1 showed, the policy benefits some workers at the expense of others. The government cannot identify shirkers and non-shirkers, and so cannot remedy this through transfers targeted to those made worse off.

Second, the tax or ban disproportionately benefits shirkers. As Proposition 1 noted, workers who would be in JC firms in the unregulated equilibrium are unambiguously better off with the tax or ban, while workers who would be in AW firms in the unregulated equilibrium are often harmed by the tax or ban. And following from Lemma 1, there will likely be a disproportionate number of shirkers in JC firms, so the tax or ban will disproportionately benefit shirkers. But the idea that shirkers benefit more is not unique to our model. For example, in Levine (1991) all workers are better off because of the coordination failure, but shirkers get a larger benefit with the ban because they do not have to exert effort. Note also that while shirkers benefit disproportionately in our model, that does not mean shirkers benefit more overall. In the numeric example in Figure 1, because there are substantially more non-shirkers in the economy, there are more non-shirkers in JC firms in the unregulated equilibrium, and more non-shirkers benefit from the tax or ban.
Third, note that because of these distributional consequences, workers will not necessarily vote for a policy that minimizes the resource costs.

Proposition 3: Assume welfare is maximized when $\tau$ is at some level $\tilde{\tau}$. A majority of voters may prefer an alternative policy.

Proof: To prove the result, we need only one example of an optimal policy that is voted down. We choose to focus on the case of homogeneous $\alpha_i = \bar{\alpha}$, because in that case there are no intermediate alternatives, so voters are presented with a binary choice between a total ban and the unregulated equilibrium. As shown in Proposition 2, in this case a ban will improve total welfare if $w_{jc}^{MAX} - e_{NS} < w_{AW} - e_{AW} - \bar{\alpha} < w_{jc}^{MIN} - e_s$ and $\lambda_{NS} < \lambda_s$. But, even if these condition hold, the ban will be voted down if $N^{NS} > N^S$, because the ban makes all non-shirkers worse off.

The situation is more complicated when the policy that maximizes total welfare is a tax and not a total ban, because it is not obvious which policy choices would be given to the voters. (Presumably a number of hypothetical taxes are possible.) But it should be obvious that the same conclusion will hold. There is no reason to expect that the policy that balances productivity losses and harm from job security, will be the preferred choice of the majority of workers.

VI. Discussion:
In the above analysis, we assumed that “shirkers” were workers who were better able to get away with shirking. An alternative assumption is that workers differ in their honesty, meaning how much they dislike exerting less than the required effort. Under this assumption, it is possible that the desire of a worker to shirk is not fixed, but instead depends on the firm’s reputation for how it treats employees and/or that worker’s attitude towards the employer, which may in turn be affected by the worker’s treatment at the hands of past employers. That is, there may be some workers who only want to shirk if they believe that their employer is not loyal to them.

If this is the case, then firms will have an incentive to treat their workers better and thereby generate good will if the number of workers who wish to shirk only at a non-loyal employer is sufficiently large. But there may be external effects that cause firms to under-invest in loyalty. For example, if workers are
mobile, then a firm that invests in loyalty in one period may not be able to enjoy the benefits of it in a future period. Also, it may be the case that effective gestures of loyalty involve industry-wide economies of scale. An example may be promising that workers will be dealt with by trained Human Resource professionals, which is only possible if enough firms do it to support specialized HR training. This may only be worth doing if a sufficiently large number of other firms are doing it, which will be the case if such gestures are mandatory.

If these conditions hold, the argument for a tax (or a ban) becomes stronger: if more workers having the experience of working in JC firms reduces the number of shirkers in the economy, and if individual firms do not realize the full benefit of bringing this about, then the benefits of a tax are greater. Recall that a tax achieves reduced aggregate disutility from job insecurity at the cost of more aggregate shirking and job mismatch. To the extent that a tax also has a dynamic effect of reducing the desire to shirk, the case for it becomes stronger. In other words, forcing employers to act loyal may lead to a better equilibrium in which fewer workers are required to endure job insecurity and in which fewer workers shirk.

Even in cases where a tax on at-will firms improves welfare, it would be difficult to actually identify the optimal tax. A better alternative, if possible, would be to find technological or other means that make it easier to distinguish low productivity due to shirking from low productivity due to skill obsolescence. If shirking could be clearly identified in a provable way, then firms would be able to fire shirkers while still keeping their “just-cause” commitments to non-shirkers, which would be an unambiguous improvement.

The basic idea of this paper can be applied to other settings as well. For example, some firms in some poor countries lock workers in their factories in order to prevent theft. The tradeoff in that case (workers bearing the disutility of being locked in vs. the economic cost of theft) is similar to the tradeoff in this paper (workers bearing the disutility of job insecurity vs. the economic cost of shirking and job mismatch). As in this paper, it is possible to show that the market equilibrium is not necessarily optimal, and so a tax or a ban on firms that lock their factories could be welfare-improving.14
VII. Conclusions:

In this paper we emphasize the tradeoff between maximizing output and reducing workers’ exposure to negative exogenous shocks to their productivity. A policy that shifts workers from at-will to just-cause jobs will generate job security benefits, but will also lead to more shirking and to more misallocated workers. The paper models a scenario in which externalities arising from individual job choice decisions cause adverse selection of shirkers into just-cause jobs, so that there can fewer such jobs than is socially optimal. This raises the possibility that a tax or a ban on at-will firms can be welfare-improving. It is worth noting that any tax that increases welfare by the criteria of our model has the added benefit of raising government revenue in a manner such that the induced changes in behavior increase welfare, making it possible to cut other taxes that induce welfare-decreasing distortions.

Even a tax or a ban that increases total welfare will not improve welfare for all agents in the economy. It will benefit those workers who value job security the most, harm those workers who value it the least, and have intermediate and ambiguous effect on those in the middle. It will also tend to benefit shirkers more than non-shirkers. Also, the most efficient policy may not be politically sustainable.

As discussed in Section II above, the empirical evidence regarding the welfare effects of employment protection is mixed. None of those papers, however, attempt to measure the value of the insurance function that such protection provides, and so cannot determine the social benefits of such protection. The theoretical framework laid out in this paper suggests that a complete empirical analysis should incorporate such an estimate.

\[14\] A draft of an earlier version of this paper that focuses on locked factories is available from upon request.
References:


Appendix

Existence and Uniqueness of Equilibria:

For tractability, we assume that $\alpha_i$ is distributed uniformly and identically for shirkers and non-shirkers. We will not prove an example where $\alpha_i$ is allowed to have another distribution or vary between worker types, but the basic methodology would be similar.

Equation (2) above determines the wage required to induce any given number of non-shirkers to join JC firms. This relationship is depicted by the darkly-shaded plane in Figure A1 below. The lightly-shaded plane depicts the analogous relationship for shirkers, as determined by equation (3). Note that both planes are strictly positive at the origin: a strictly positive wage is required for any worker to join a JC firm.

As shown in Lemma 1, all else equal JC workers derive higher utility from JC employment than do AW workers, so there are values of $w_{JC}$ such that some shirkers but no non-shirkers join JC firms. Call the corresponding line segment in Figure A1 Segment A. For higher values of $w_{JC}$, some shirkers and some non-shirkers join JC firms. For these values, any equilibrium must satisfy (2) and (3), and so must lie somewhere on the line segment where the two planes intersect. Call this Segment B. For still higher values of $w_{JC}$ such that all shirkers and some non-shirkers join JC firms, any equilibrium must lie on the line segment depicting (2) and where $N_{JC}^s = N^s$. Call this Segment C. The three segments are depicted in Figure A1.\(^\text{15}\)

**Figure A1**

![Diagram of segments A, B, and C](image)
Equation (1) represents the fact that the \(JC\) wage must equal average \(JC\) output. Notice that it is non-linear, as depicted in Figure A2.

The equilibria can be seen by combining Figures A1 and A2, which is depicted in Figure A3.

\[\text{Figure A2}\]

\[\text{Figure A3}\]

\[15\] The parameters underlying Figures A1-A3 are the same as the unregulated equilibrium in Figure 1.
If we move along Equation (1) in the direction of Segment A, it is flat; when only shirkers are in JC firms, \( w_{JC} \) must be at its minimum possible value \( w_{JC}^{MIN} = w_{AW} - \lambda^S \), and adding additional shirkers has no effect. This equilibrium is stable, because a small change in \( w_{JC} \) will not change the composition of the workforce, as the wage required to attract any non-shirkers into JC employment is discretely higher than \( w_{JC}^{MIN} \). However, this equilibrium is not particularly interesting, as we usually think of joining a JC firm and then shirking as being attractive to shirkers because the presence of non-shirkers increases average output and hence the wage. In the extreme case where shirkers produce nothing at all, \( w_{JC}^{MIN} \) will be equal to zero.

If we move along Equation (1) in the direction of Segments B and C, \( w_{JC} \) is increasing, because moving workers from \( AW \) to JC firms has a positive effect on average output (as seen in Lemma 2). But this effect is diminishing, and so the curve is concave. This is shown in the following lemma:

**Lemma A1**: Equation (1) is strictly increasing and strictly concave along Segment B, and is also strictly increasing and strictly concave along Segment C.

**Proof**: Lemma 1 shows that \( \alpha_{NS} - \alpha^S = e_{JC}^{NS} - e_{JC}^S \). From (2) and (3), the relationship between the two types of labor in Segment B is

\[
N_{JC}^S = \frac{(e_{JC}^{NS} - e_{JC}^S)N_{NS}^S}{\alpha_{MAX} - \alpha_{MIN}} + \frac{N_{NS}S}{N^S_{NS}N^S_{JC}}.
\]

Substituting this relationship into equation (1), we get

\[
w_{JC} = \frac{(w_{AW} - \lambda^S)N_{JC}^S + (w_{AW} - \lambda^S)\left(\frac{(e_{JC}^{NS} - e_{JC}^S)N_{NS}^S}{\alpha_{MAX} - \alpha_{MIN}} + \frac{N_{NS}S}{N^S_{NS}N^S_{JC}}\right)}{N_{JC}^S + \left(\frac{(e_{JC}^{NS} - e_{JC}^S)N_{NS}^S}{\alpha_{MAX} - \alpha_{MIN}} + \frac{N_{NS}S}{N^S_{NS}N^S_{JC}}\right)}.
\]

We can now take derivative with respect to \( N_{JC}^S \). The first and second derivatives are
\[
\frac{dw_{jc}}{dN_{jc}} = \frac{(\lambda^S - \lambda^{NS})}{N_{jc} + \left(\frac{e^{NS}_j - e^S_j}{\alpha^{MAX} - \alpha^{MIN}}\right)^2} \left(\frac{e^{NS}_j - e^S_j}{\alpha^{MAX} - \alpha^{MIN}}\right)N^S
\]

and

\[
\frac{d^2w_{jc}^2}{d^2N_{jc}^2} = -2\left[1 + \frac{N^S}{N^{NS}}\right] \left(\frac{\lambda^S - \lambda^{NS}}{N_{jc} + \left(\frac{e^{NS}_j - e^S_j}{\alpha^{MAX} - \alpha^{MIN}}\right)^2} \left(\frac{e^{NS}_j - e^S_j}{\alpha^{MAX} - \alpha^{MIN}}\right)N^S\right)
\]

Since \( \lambda^S > \lambda^{NS} \), \( e^{NS}_j > e^S_j \), and \( \alpha^{MAX} > \alpha^{MIN} \), the first derivative is strictly positive and the second derivative is strictly negative, so (1) is strictly increasing and strictly concave along that line segment.

To prove the second statement, we note that all shirkers are in JC firms \( (N_{jc}^S = N^S) \), and thus

\[
w_{jc} = \frac{(w_{aw} - \lambda^{NS})N_{jc} + (w_{aw} - \lambda^S)N^S}{N_{jc}^S + N^S}
\]

The first and second derivatives with respect to \( N_{jc} \) are \( (\lambda^S - \lambda^{NS})N^S \) and \( \left(\frac{N^S}{N_{jc}^S + N^S}\right)^2 \)

\[-2(\lambda^S - \lambda^{NS})N^S \left(\frac{N_{jc}}{N_{jc}^S + N^S}\right)^2 \]

respectively. Since \( \lambda^S > \lambda^{NS} \), the first derivative is strictly positive and the second derivative is strictly negative, so (1) is strictly increasing and strictly concave.

We now turn to the equilibrium. We have already discussed the equilibrium if the wage is such that only shirkers join JC firms where \( w_{jc}^{MIN} = w_{aw} - \lambda^S \). For any equilibrium with strictly positive numbers of both types of workers in both types of firms, (1) must cross Segment B. And for any equilibrium in which \( w_{jc} \) is high enough that all shirkers are in JC firms, (1) must cross Segment C. With equation (1) strictly concave, it is possible for (1) to cross at most twice in a segment, once from above, and once from below. In Figure A3 above, (1) is depicted as crossing Segment B twice.

Lemma A2: Equilibria in which equation (1) cuts Segment B or Segment C from below are not stable. Equilibria in which equation (1) cuts Segment B or Segment C from above are stable.

Proof: Equation (1) essentially acts as demand for labor and the Segment B or C is essentially the supply of labor. Assume (1) crosses from below, and then increase \( w_{jc} \) above the equilibrium by a small amount. Now the quantity demanded for labor will exceed quantity supplied, and thus the wage will increase further, moving away from the equilibrium. Similarly, decrease the wage below the equilibrium by a small amount. Then quantity demanded will be below quantity supplied, and thus the wage will decrease further, moving away from the equilibrium. The analogous argument shows that crossings from above are stable.

Combined, these lemmas lead to the following proposition:

Proposition A1: If \( \alpha_i \) is distributed uniformly and identically for shirkers and non-shirkers, there is at most one stable equilibrium in each of the three line segments.
Proof: Segment A depicting (3) and \(N_{JC}^{NS} = 0\) is linear and increasing and crosses equation (1) at most one point where \(w_{JC}^{MIN} = w_{AW} - \lambda^S\). Segment B where (2) and (3) intersect is linear and increasing and equation (1) is strictly concave along it (Lemma A1), which means that it can cross from above at most once. Since only crossings from above are stable (Lemma A2), this proves the result. And Segment C depicting (2) and \(N_{JC}^S = N^S\) is linear and increasing and equation (1) is strictly concave along it (Lemma A1), which means that it can cross from above at most once. Since in Segment B and Segment C only crossings from above are stable (Lemma A2), this proves the result.

Figure A3 depicts one stable equilibrium and one unstable equilibrium in Segment B (where some shirkers and some non-shirkers are in each type of firm), and no equilibria in Segment C (where all shirkers and some non-shirkers are in JC firms). It could easily have instead depicted one stable equilibrium in Segment C and none in Segment B. While Proposition A1 rules out the possibility of more than one stable equilibrium per segment, it does not rule out the possibility of two stable equilibria: one in Segment B and one in Segment C. However, it is worth pointing out that the condition for this to happen is quite restrictive. The proof of Proposition A1 works through the fact that the line segments are linear and (1) is concave. It can only cross from above twice if it happens to be near the kink point between Segment B and Segment C, and then only if the kink and (1) are shaped just right.

Uninsured Risk Aversion:

In Section IIIB(i) we claimed that the reduced-form variables \(\alpha, \lambda^{NS},\) and \(\lambda^S\), can be derived from micro-foundations in multiple ways. Here we present one specific example based on worker risk-aversion, though others would work as well.

At the beginning of their working lives, each worker decides whether to work in an AW or a JC firm. Each firm of a given type is ex-ante identical, so workers choose a specific firm at random. All workers have a common baseline level of productivity (where “productivity” is the relationship between worker effort and output), which is realized with probability \(\rho\). Workers with baseline productivity who exert efficient the effort level \(e_{AW}\) produce output \(\eta\). Workers face a common probability \((1-\rho)\) that their produc-

\[\text{16 Figure A3 also depicts a stable equilibrium in Segment A, but that equilibrium is not marked.}\]
tivity will turn out to be a common low level. For convenience, we assume that these workers have zero output, though our results do not depend on this. The realization of each worker’s productivity happens immediately after joining a firm.\textsuperscript{17}

When realized productivity is low, the efficient outcome is for the worker to separate from his or her employer and move to the next-best alternative activity, producing output $\theta < \eta$ while exerting the same effort $e_{AW}$. In $AW$ firms, the efficient outcome occurs (the worker quits or is fired). In $JC$ firms, workers with low realized productivity cannot be fired. Consider cases where $w_{JC}$ is higher than $\theta$ so they do not quit (the interesting case).

The utility of a worker (shirker or non-shirker) who initially chooses an $AW$ firm (before productivity is realized) is $U_{AW} = w_{AW} - e_{AW} - \alpha$. In $JC$ firms, only non-shirkers exert effort and produce output. The utility of a non-shirker who initially chooses a $JC$ firm is $U_{JC}^{NS} = w_{JC} - e_{AW}$, and the utility of a shirker who initially chooses is $JC$ firm is $U_{JC}^{S} = w_{JC}$.\textsuperscript{18} The $JC$ wage is a function of the number of shirkers and of non-shirkers in $JC$ firms.\textsuperscript{19} Since proportion $\rho$ of non-shirkers produce $\eta$, while the rest produce zero, the average output of a $JC$ non-shirker is $\rho \eta$. And since shirkers produce zero output, the $JC$ wage will be $w_{JC} = \frac{\rho \eta N_{JC}^{NS}}{N_{JC}^{NS} + N_{JC}^{S}}$.

The disutility from productivity risk $\alpha_i$ has two components. The first is the fact that there is a probability $(1-\rho)$ that a worker will have low realized productivity, which means that expected income is not $w_{AW}$ (which in this example is equal to $\eta$), but rather is equal to $\rho \eta + (1-\rho) \theta$; even a risk-neutral worker would have a positive $\alpha_i$ because the expected wage is lower than $w_{AW}$. The second is that this expected

\textsuperscript{17} A more natural way to model this may be to have a two-period model where workers skills become obsolete at some point in time (rather than immediately after joining the firm.) But algebraically, having two periods instead of one adds nothing to the equilibrium and thus we present the simpler model.

\textsuperscript{18} For simplicity, characterization, we assume that $e_{JC}^{NS} = e_{AW}$ (non-shirkers exert efficient effort), and $e_{JC}^{S} = 0$ (shirkers exert no effort and produce no output). Even under this assumption, $\lambda_{JC}^{NS} > 0$ because low-productivity workers in $JC$ firms do not separate.

\textsuperscript{19} As in the main text, we assume full wage compression, so that there is a single $JC$ wage. While our results do require wage compression, the assumption of full compression is merely for convenience.
income comes in the form of a gamble, and the risk from that gamble imposes additional disutility $\bar{R}_i$ on worker $i$. Combining these, $\alpha_i$ is equal to

$$\alpha_i = (1 - \rho)(\theta - \eta) - \bar{R}_i.$$  

To calculate $\bar{R}$, we assume a Constant Relative Risk Aversion utility function $U(w) = \frac{w^{1-\sigma} - 1}{1-\sigma}$.

Now let $X$ represent the certainty equivalent, the amount of guaranteed money that would make an $AW$ worker equally well-off as the gamble. Here a worker $i$’s expected wage utility from the gamble is $U(w) = \rho(\eta^{1-\sigma_i} - 1)/(1-\sigma_i) + (1-\rho)(\theta^{1-\sigma_i} - 1)/(1-\sigma_i)$, and the certainty equivalent is $X = ((1-\sigma_i)U(w) + 1)^{1/(1-\sigma_i)}$. $\bar{R}_i$ is the difference between $\rho \eta + (1-\rho)\theta$ and $X$, which is equal to

$$\bar{R}_i = \rho \eta + (1-\rho)\theta - \left( \rho(\eta^{1-\sigma_i} - 1) + (1-\rho)(\theta^{1-\sigma_i} - 1) + 1 \right)^{1/(1-\sigma_i)}.$$  

Because shirkers produce zero output in $JC$ firms, their lost output is $\lambda^S = \eta$. And because non-shirkers do not produce anything in $JC$ firms if their skills become obsolete, their lost output is $\lambda^{NS} = (1-\rho)\eta$. Thus we have derived $\alpha_i$, $\lambda^{NS}$, and $\lambda^S$ and the main propositions in the paper hold. Given risk aversion to skill erosion that cannot be insured, a tax or ban on $AW$ work can have ambiguous welfare consequences.

---

20 In this treatment, workers are homogeneous in the productivity of their outside option, and heterogeneous only in their degree of risk-aversion. But that is not necessary; there could easily be heterogeneity in both. For this reason, we treat $\alpha_i$ as encompassing both negative consequences of low realized productivity (lower average earnings plus risk).