BILATERAL CONTRACTS AND SOCIAL WELFARE

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Abstract

This paper defines and analyzes default delegation, an indirect mechanism that describes how the government influences bilateral contracts to maximize social welfare. In default delegation, the government chooses the default contract and a possibly-limited set of contract terms it is willing to enforce. Our analysis of this mechanism provides a implementation-theoretic foundation for immutable and default rules in contract law: immutable rules mitigate externalities, while default rules achieve particular distributions of surplus in non-contractible states of the world. We derive conditions under which default delegation implements the entire set of first-best contracts. We then characterize how optimal default delegation responds to changes in the underlying contracting environment and in the social welfare function’s weighting of efficiency, externalities and distributional concerns.

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1 Introduction

Contract law is composed of “default” and “immutable” rules. Default rules can be contracted around, but will be enforced if the contracting parties do not agree to an alternative. Meanwhile, immutable rules cannot be modified. They will be enforced even if the parties attempt to contract around them. The literature generally agrees that the law uses immutable rules to constrain contracting when parties within or outside the contract cannot adequately protect themselves. That is, immutable rules mitigate “internalities” and externalities.

The role of default rules is less well understood and is a subject of intense debate in legal theory. A common view is that default rules fill in gaps in incomplete contracts by supplying the contract terms that parties “would have wanted” if they had full information and could bargain costlessly.

This paper provides a theoretical analysis of the role of immutable and default rules. It highlights that immutable rules manage the tradeoff between promoting efficiency and curbing externalities, while default rules ensure particular distributions of surplus across unverifiable states of the world.

There are many settings in which governments have concerns about the distribution of surplus between contracting parties, which we will refer to as “equity” concerns. In incomplete contracting environments, default rules can reduce the risk of non-contractible states of the world by ensuring a desirable distribution of surplus in those states. In other settings, the law may seek to ensure a particular distribution of surplus for fairness reasons. For example, the laws governing marital contracts in many U.S. states enforce default rules that stipulate an “equitable division” of assets in the event of divorce. In both of these settings, the default rules can be seen as achieving distributional objectives while immutable rules internalize externalities. More generally, we argue that the tradeoffs between efficiency, equity and externalities affect the optimal policy whenever the state seeks to influence the outcome of bilateral contracts.

In our model, a social planner or government (whom we call the “regulator”) designs the contracting environment in order to maximize social welfare. How the contracting parties value features of the contract is information (the “state of the world”) that is observable (to the agents) but not verifiable (by the regulator). The regulator uses a decentralized indirect mechanism, inspired by default and immutable rules, which we

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1 See Ayres and Gertner (1989) for a discussion of the legal literature on immutable and default rules.

2 A few expressions of the “would have wanted” view of default rules, as quoted in Ayres and Gertner (1989): Easterbrook and Fischel (1989) write that the default rule should be “the term that the parties would have selected with full information and costless contracting;” Posner (1986) writes that the default rule should supply “the contract that most well-informed persons would have adopted if they were to bargain about the matter;” Goetz and Scott (1983) write, “the preformulated rules supplied by the state should mimic the agreements contracting parties would reach were they costlessly to bargain out each detail of the transaction.”
call *default delegation*. This mechanism involves choosing a default which serves as a disagreement point in the parties’ negotiations, and also has a delegation aspect, in that agents are able to bargain from the default to their preferred contract within a restricted set of enforceable contracts.

Default delegation thus joins ideas about renegotiation in incomplete contracts to theories of delegation. Our model is close in spirit to the model of renegotiation design for incomplete contracts in [Aghion et al.](1994), but differs in that we introduce a regulator whose preferences may not align with the contracting parties’ preferences. We differ from classical models of delegation ([Holmstrom](1977, 1984); [Alonso and Matouschek](2008)) in that a principal chooses a delegation set for two agents who efficiently bargain instead of delegating to a single agent.

The first major contribution of this paper is to provide mechanism design foundations for the use of immutable and default rules in contract law. With this in mind, we start from a general analysis of implementable outcomes based on the model of implementation with renegotiation in [Maskin and Moore](1999). We then characterize the conditions under which default delegation achieves first-best social welfare, which depend on the degree to which efficiency, equity and externalities are weighted in the regulators’ social welfare function. The result of this analysis is a mechanism design foundation for default and immutable rules: default rules ensure particular distributions of surplus while immutable rules curb externalities. In laying bare the tradeoffs inherent in the choice of default and immutable rules, our analysis illustrates the broader appeal and applicability of default delegation mechanisms.

The second major contribution of this paper is to provide comparative statics for the optimal default delegation policy. This analysis illustrates how the optimal policy depends on the social welfare function as well as other primitives such as bargaining parameters and the regulator’s beliefs with regard to the true state of the world. Furthermore, we apply our results to the regulation of app-based platform work, illustrating how our results deliver insights into the design of regulation and public policy.

The regulation of app-based platform work provides a useful case study because regulators seeking to pass laws about platform work have stated objectives including efficiency, equity and externalities. For example, Secretary of Labor Marty Walsh, who has been vocal about rethinking the classification of platform workers, spoke to the need to balance efficiency and equity in early 2021: “These companies are making profits and revenue and I’m not (going to) begrudge anyone for that... But we also want to make sure that success trickles down to the worker.”

California’s Assembly Bill 5, which attempted to reclassify platform workers as employees in 2019, cited the externalities that may accompany misclassification. The court noted the potential harm borne by taxpayers due to “the loss to

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3 https://www.washingtonpost.com/business/2021/04/29/labor-walsh-gig-workers-employees/
the state of needed revenue from companies that use misclassification to avoid obligations such as payment of payroll taxes, payment of premiums for workers’ compensation, Social Security, unemployment, and disability insurance.”

Though stylized, our framework delivers a rich set of predictions that help to organize the debate about the regulation of platform work. For instance, our comparative statics highlight the importance of beliefs about workers’ valuations of benefits and how such beliefs interact with externalities, equity concerns and bargaining power in shaping the optimal policy.

By generating predictions about how optimal regulatory policies change as fundamentals in the economy shift, we complement recent work on the declining labor share and worker bargaining power discussed in Autor et al. (2020) and Summers and Stansbury (2020), respectively. Specifically, our results highlight how a regulator might optimally adjust the contracting environment in order to maximize welfare in light of these recent macro trends. This can help explain recent pushes for increased minimum wages and improved working standards. It can also be used to highlight the value of soft power that the U.S. Congress applies to large firms, which can be seen as a means of shifting the default in terms of either quality or wages (Stewart and Stanford, 2017).

Related literature. This paper contributes to the literatures on contracting and implementation with renegotiation, and on delegated decision-making in organizations.

Our model is cast in the incomplete contracts framework of Hart and Moore (1988). The two parties in our model have observable information that is unverifiable by a third party (in our case, the regulator). Several papers have studied the role of renegotiation in incomplete contracts (Hermalin and Katz, 1991; Green and Laffont, 1992; Rubinstein and Wolinsky, 1992). Closest in spirit to our paper is Aghion et al. (1994), which focuses on how an initial contract might include provisions that govern the ex-post renegotiation process. “Renegotiation design,” as the authors describe it, has two elements: it specifies a “default outcome” in the event of a disagreement, and it specifies an allocation of bargaining power to one or the other contracting party. By contrast, in the standard incomplete contracts framework without renegotiation design, “no trade” is the only possible “default outcome.” In the language of the US legal system, standard incomplete contracts frameworks focus on “at-will contracts” while renegotiation design allows for “specific performance contracts.”

Our analysis extends Aghion et al.’s and differs in interpretation and emphasis. Rather than supposing that the two parties to a contract write their ex-post renegotiation provisions (default outcomes, allocation of bargaining power) into the initial contract, we

4Assembly Bill 5 was signed into law in September 2019 only to be largely overridden by a statewide referendum, Proposition 22, in November 2020.

5A paper that makes a similar point to Aghion et al. (1994) is Chung (1991).
assume that there is a regulator or social planner who has the authority to set and enforce default outcomes (and we treat bargaining power as exogenous). This shift in interpretation reflects that we are studying not the provisions of bilateral contracts themselves, but rather how lawmakers regulate bilateral contracts in the interests of the public. Our analysis gives us a rich description of how the optimal defaults change with different planner preferences over efficiency, equity and externalities, whereas Aghion et al. focus on whether, with some optimally-specified default and allocation of bargaining power, efficient investment is possible.

In providing foundations for the default mechanism, we also contribute to the literature on Nash implementation (Maskin, 1999; Moore and Repullo, 1988). In this context, the possibility of renegotiation restricts the set of implementable outcomes—any outcome that is not on the agents’ Pareto frontier will be renegotiated to realize a Pareto improvement. Maskin and Moore (1999) fully characterize implementability when renegotiation cannot be prevented. Extending their analysis, we add a detailed characterization of implementable outcomes when the planner has preferences over the distribution of surplus between the agents.

The model can also be viewed through the lens of delegation. In fact a special case of our model reduces to a standard delegation problem as introduced by Holmström (1977, 1984) and generalized in Alonso and Matouschek (2008). When the regulator cares only about externalities, then only the “quality” dimension of the contract is relevant, and the worker and firm can be thought of as a single agent maximizing the two parties’ joint surplus.

Much of the existing delegation literature focuses on delegation to a single agent. Our model analyzes delegation to two agents. While Martimort and Semenov (2008) considers a two-agent delegation problem in a legislative context when agents are asymmetrically informed, we assume agents have symmetric information. Delegation differs from standard mechanism design problems in that it assumes neither the principal nor any third parties (as in Tirole (1986) and Laffont and Martimort (1998)) can collect or disburse transfers to or from the agents. In the analysis in section 4 we assume the principal can commit to decision rules, and therefore this analysis differs from related cheap talk models like Krishna and Morgan (2001).

Our model takes a particular perspective on what it means to delegate a decision to two agents. We assume that the agents bargain efficiently over outcomes in the delegation set and that the principal can anticipate the outcome of agents’ bargaining. Although our analysis in section 4 begins in a territory covered by the Revelation Principle, it departs from the premises of the Revelation Principle when it introduces costly communication and the requirement of message-independence. Our analysis thus contributes to the study of tradeoffs between decentralization and centralization in organizational economics and mechanism design, thoroughly surveyed in Mookherjee (2006).
A common motivating example in the delegation literature is the regulation of a monopolist à la Baron and Myerson (1982). In the extant delegation literature, the results about the optimality of interval delegation are used to make sense of the widespread use of price caps in regulatory settings. Our model offers a new interpretation of regulation-as-delegation: when the government’s social welfare function incorporates distributional concerns, optimal regulation takes into account the bargaining process between a firm and its stakeholders.

2 Examples: Incomplete Contracts and Social Welfare

There is a central dichotomy in contract law between “default” rules and “immutable” rules. Default rules affect the contracting outcome without constraining the set of potential contracts. Immutable rules prevent the enforcement of specific contracts. We analyze the rationale behind these distinct tools and highlight how such rationales may be applied to regulation more broadly. We discuss three motivating examples. The first two examples—commercial contracts and marriage contracts—build toward our main example: the regulation of platform work.

Example 1 (Commerce) The Uniform Commercial Code and “Reasonable” Defaults.

We first discuss default delegation in the context of the Uniform Commercial Code (UCC). Here, default delegation is a response to a canonical incomplete contracting problem. The UCC’s primary objectives are to “simplify, clarify and modernize the law governing commercial transactions; to permit continued expansion of commercial practices through custom, usage and agreement of the parties; to make uniform the law among the various jurisdictions.” In other words, this law is intended to ease and standardize contracting environments between commercial actors.

One of the key features of this standardization is to make clear how courts will enforce contracts. There are two aspects of enforcement: 1) a statement of contract terms which courts will not enforce (immutable rules) and 2) a statement of terms the court will enforce if the parties do not specify otherwise (default rules).

Consider a simple example where a buyer and a seller enter into a delivery contract for a widget. The contract specifies the time to delivery $q$ as well as the price $c$. The seller invests a fixed cost of $k$ to produce the good. There is some uncertainty about an ex-ante indescribable state of the world $(\omega, \theta)$ which influences the buyer and sellers’ valuations of the contract. The state of the world has a component $\omega \in \{\omega_1, \omega_2\}$ which is ex-post verifiable (even though it is ex-ante indescribable). The other component of the state $\theta \in \{\theta_1, \theta_2\}$ is unverifiable. All together, the state could represent a variety of exogenous factors that influence delivery times, some of which are verifiable (e.g. a
container ship blocking the Suez Canal).

As in Aghion et al. (1994) the buyer and seller could agree to an initial contract 
\((q_0, c_0)\) from which they can negotiate once \(\omega\) and \(\theta\) are revealed. Suppose \((\omega_1, \theta_1)\) is a “bad” state of the world in which it is prohibitively costly for the seller to deliver at the pre-specified time \(q_0\). When \(\omega_1\) occurs, the buyer and seller can renegotiate the contract to some \(h((q_0, c_0), k, \omega_1, \theta_1)\), where \(h\) is an arbitrary bargaining function. But, there is a canonical hold up problem: there may be no guarantee that the seller can recoup its fixed cost \(k\) in the bad state \((\omega_1, \theta_1)\). This sequence is shown in Figure 1a.

The Uniform Commercial Code (UCC) default rules governing delivery times offer the buyer and the seller a different option. The UCC states that “time for shipment or delivery... if not provided in this article or agreed upon shall be a reasonable time.” That is, if the buyer and seller choose not to specify a delivery time in their initial contract, the UCC fills in the gap with a “reasonable” delivery time default rule. Crucially, when the gap is filled in, the regulator will use all verifiable information that is available at that time, including the realization of \(\omega\) to determine what is reasonable: the default rule is a function of the verifiable portion of the state \((q(\omega), c(\omega))\). When the parties renegotiate in the state \((\omega_1, \theta_1)\), they arrive at \(h((q(\omega_1), c(\omega_1)), k, \omega_1, \theta_1)\). The reasonable default \((q(\omega_1), c(\omega_1))\) can be chosen to guarantee that the seller recoups its fixed cost \(k\), even in the “bad” state. This case is shown in Figure 1b.

To summarize, the default rules can overcome the hold up problem in incomplete contracting problems when there is an ex-ante indescribable but ex-post verifiable component of the state \(\omega\). The government has the power to commit to enforcing a “reasonable” contract after the true state of the world is revealed, to the extent that the state is verifiable. This commitment allows the contracting parties to avoid the disaster case for the seller \((\omega_1, \theta_1)\), which might otherwise jeopardize the contract. Furthermore, as shown in Appendix A, the regulator can achieve this by ensuring a distribution of surplus consistent with the ex ante bargaining position of the agents. In this sense the regulator provides a default that the agents “would have wanted” by ensuring a particular distribution of

Figure 1: (a) Bargaining from an Explicit Prespecified Contract \((q_0, c_0)\); (b) Bargaining from the U.C.C.’s “Reasonable” Default \((q_d(\omega), c_d(\omega))\)
surplus. Our analysis in section 4 will generalize this example.

Example 2 (Marriage) The “Equitable Division” Default and Limited Enforcement of Premarital Contracts.

Another setting which has fallen under the purview of a uniform act in the U.S. is the law governing premarital agreements. The Uniform Premarital Agreement Act, adopted (often with slight differences) by 28 states, specifies the default marriage contract which holds in the absence of an alternative premarital agreement. Beyond the default rules outlined in the UPAA, states can also decide the extent to which they will enforce particular alternative contracts.

In the case of marriage, the government explicitly considers issue of fairness when choosing default and immutable rules (Bix, 1998). When it comes to the division of assets, divorce laws in the majority of states enforce an “equitable division” default (Hersch and Shinall, 2019). For example, in Mass. Gen. Laws ch. 208 § 34 (2018), the division of assets upon divorce is decided through a holistic evaluation of “the length of the marriage, the conduct of the parties during the marriage, the age, health, station, occupation, amount and sources of income, vocational skills, employability, estate, liabilities and needs of each of the parties.”

However, the division of assets in the event of divorce is often written into enforceable pre-marital agreements. That is, spouses can contract around “equitable division” default rules by explicitly specifying how assets are to be divided in the event of divorce. The Uniform Premarital Agreement Act puts few limitations on pre-marital contracts, with the primary exceptions being: a) the agreed division of assets cannot be “extremely unfair” and involve a lack of disclosure, and b) the agreed division of assets cannot necessitate government assistance for one of the spouses. Courts will also not enforce any premarital contract term related to the division of custody. These limits on premarital contracts are immutable laws that specifically address the presence of externalities which affect the government and potential children.

Recall that in the previous example, the U.C.C. supplies a “reasonable” default delivery time when not otherwise specified, at least in part to ensure particular distributions of surplus in ex-ante noncontractible states of the world. In marriage contracts, the “equitable division” default rules serve a similar purpose, however, in this case, the government has explicit distributional concerns for fairness reasons.

It is telling to put these default rules in historical perspective. Until the mid-1970s, most states refused to enforce any pre-marital contracts. There was a widely held view, at the time, that premarital agreements were unfair because they were designed to “protect the wealth and earnings of an economically superior spouse from being shared with an economically inferior spouse” (Bix, 1998). As social facts and attitudes have shifted, the government has increased the scope for bargaining while maintaining a default which
is predicated on equity. Meanwhile, in instances where there are outside parties involved (the government or children), the government has maintained some immutable terms. Thus, the regulation of marriage illustrates how notions of equity and externality naturally lead to the application of defaults and restricted delegation sets, respectively.

**Example 3 (Work) The Classification of Platform Workers.**

The last two examples lean on the presence of (or potential for) incomplete contracts as a reason for government intervention in the form of default and immutable rules. This paper argues that this method of regulating contracts is more general. The regulation of bilateral contracts more generally can be viewed through the lens of default delegation: default rules affect the disagreement outcome of agents’ bargaining in order to affect the distribution of surplus across unverifiable states of the world, while limits on enforceable contracts curb externalities.

To show the generality of the logic of default delegation, we will focus on the example of regulating app-based platform workers, which has led to contentious debate in the U.S. and abroad. The debate has largely focused on whether these workers should be classified as employees or independent contractors. As independent contractors, there are very few limitations on the contracting space. On the other-hand, employee status entails a minimum suite of benefits as well as firm contributions for programs such as social security, unemployment insurance, payroll taxes, and premiums for worker’s compensation.

Thus, the imposition of employee status, constrains the set of contracts that the government enforces. More subtly, the change in employment status also affects the workers’ outside options, and thus their disagreement outcome in employment negotiations. Employee status raises the minimum levels of benefits and wages that workers’ can expect to receive from a different company. In this sense the government can indirectly influence a worker’s outside option.

One way of understanding what has happened in the rise of platform work is that some ex-ante indescribable state of the world \( \omega \) was realized, where \( \omega \) was a unique work arrangement that could not have been foreseen. In the absence of reclassification, the workers in this work arrangement remained classified as independent contractors with the default defined by \((q_i, c_i)\). Despite being distinct from traditional independent contractors, these workers are only able to negotiate a contract based on independent contractor status resulting in \( h(q_i, c_i, \tilde{\omega})\). If the firm has all of the bargaining power, any negotiation will lead to a distribution of surplus that favors the firm over the workers. This can be especially detrimental to workers in situations where there may have been up-front investments in gig-work such as quitting full-time employment, purchasing a vehicle, etc. In this case, the worker could be viewed as suffering from a “hold up” problem. While this version of the “hold-up” problem may not be so detrimental as to prevent workers from entering in the first place, it may prevent the government from
achieving a desired distribution of the surplus from the agreement.

The goal of the regulation of employment contracts is to update worker classification in light of these changing circumstances. In the U.S., the two main classifications of work arrangements are independent contractors and employees, which can be understood as coming along with contracts \((q_i, c_i)\) and \((q_e, c_e)\). Labor regulations are thus analogous to default and immutable rules. They do not fill gaps in incomplete contracts, but they do use verifiable information available at a given time to smooth the distribution of surplus across states, as well as protect parties within and outside the contract.

Any attempt to reclassify workers can thus be understood as a drive to change the default contract in light of an ex-ante indescribable but ex-post verifiable state of the world. Ex-ante, workers, employees, and the government had not foreseen the unique working arrangements \(\tilde{\omega}\) that would arise out of the spread of platform work. So, what regulations of platform work seek to do is to update the default contract to some \((q_d(\tilde{\omega}), c_d(\tilde{\omega}))\), where the default is contingent on verifiable information.

The search for a better classification of platform work can thus be understood as the search for a more appropriate default contingent on new information. Furthermore, the appropriate default depends on the government’s preferences over efficiency, equity and externalities. To see this, recall California’s 2019 Assembly Bill No. 5 (AB5). The goal of the bill was “to ensure workers who are currently exploited by being misclassified as independent contractors instead of recognized as employees have the basic rights and protections they deserve under the law, including a minimum wage, workers’ compensation if they are injured on the job, unemployment insurance, paid sick leave, and paid family leave.” In the language of our model, AB5 argued that \(q_d(\tilde{\omega}), c_d(\tilde{\omega})\) should be changed from \((q_i, c_i)\) to \((q_e, c_e)\).

After the passage of AB5, Lyft and Uber spent more than $200MM in order to pass a referendum, Proposition 22, which returned the employment classification of app-based drivers to independent contractors. The proposition made the argument that the classification of employee was not desirable for workers who placed a high value on flexi-
bility. Proposition 22 did however include some minimum earnings requirements, non-discrimination protections and some minimum health insurance. In some sense, Proposition 22 thus resulted in a new form of default contract, \((q, c)\) which is a new classification tailored to the state of the world \(\hat{\omega}\). See Figure 2 for an illustration of these contracts.

The rhetoric surrounding the debates over Proposition 22 were largely focused on questions of equity versus efficiency\(^6\) Those that opposed Proposition 22 argued that the classification of workers as employees would improve their expected outcomes by entitling them to benefits and wage standards. Classifying workers as employees would lead to a more equitable split of the total surplus generated from these contracts. The proponents of Proposition 22 argued that platform workers have a relatively low valuation for employment benefits that come with employee status and profit from being able to accept contracts with lower benefits and higher pay. While there are aspects of the “state of the world” that are unverifiable—such as the degree to which workers in different companies actually value benefits relative to cash—there are aspects of the state that are verifiable that the government can optimally condition its worker classification upon.

3 Model

To fix ideas, we present our general model in terms of an employment contract between a worker and a firm. The firm and the worker, more generally, can be understood to be any two parties that are negotiating the terms of a bilateral contract. In line with the delegation perspective of our model, we sometimes refer to the firm and the worker collectively as the “agents,” while the regulator in this setting is the “principal.” The principal aims to maximize social welfare by influencing the contracting environment and choosing which contracts to enforce. The state of the world, which governs agent preferences (and thus social welfare), is observable but unverifiable—so the principal is limited in that it cannot enforce contracts that are contingent on the state. We also rule out the possibility that the principal can make monetary transfers to or from the agents, as is standard in the delegation literature.

Contracts. Agents bargain over the terms of a contract \((q, c) \in Q \times C \subseteq \mathbb{R}^2\). The term \(q\) in the contract represents a dimension over which agents have possibly state-dependent valuations. We often refer to \(q\) as “quality.” For example, \(q\) might represent a particular benefit in an employment contract, such as the degree of health insurance coverage provided by the firm to the worker. Meanwhile, \(c\) captures the money that

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\(^6\) See, for example, [https://pmcinsurance.com/blog/how-assembly-bill-5-differs-from-proposition-22/](https://pmcinsurance.com/blog/how-assembly-bill-5-differs-from-proposition-22/)

\(^7\) See, for example, [https://www.americanactionforum.org/insight/whats-next-for-prop-22-and-debates-around-independent-workers/](https://www.americanactionforum.org/insight/whats-next-for-prop-22-and-debates-around-independent-workers/)
will be transferred from one agent to the other. In an employment contract, \( c \) is the compensation (salary, wages) paid to the worker by the firm.

**Preferences.** The regulator and the agents’ utilities depend on the negotiated contract and on the state of the world. The state of the world is \( \theta \in \Theta \subset \mathbb{R} \).

The two agents, the firm \((f)\) and the worker \((w)\), both have quasilinear state-dependent utility functions over the outcome \((q, c)\):

\[
\text{Firm: } U_f(q, c; \theta) = u_f(q; \theta) - c \quad \text{Worker: } U_w(q, c; \theta) = u_w(q; \theta) + c. 
\]

The principal’s goal is to maximize a generalized social welfare function,

\[
\text{SWF}(q, c; \theta) = \text{SWF}(U_f, U_w, U_r; \theta) = U_f + U_w - \beta(U_f - U_w)^2 + \gamma U_r(q; \theta)
\]

where \( \beta \geq 0 \) and \( \gamma \geq 0 \) scale the magnitude of the social cost associated with equity and externalities, respectively. Equity concerns are represented by a quadratic penalty. The equity term is maximized when the worker and firm attain the same utility. This “equal split” equity objective is assumed to simplify exposition.\(^8\) Externalities are represented by \( U_r(q; \theta) \). For example, in an employment contract, the government may end up paying for health care that is not covered in an employer provided health insurance program. This may be more or less costly depending on the risks of the occupation.

The generalized social welfare function nests more specific social welfare functions. For instance, when \( \beta = 0 \) and \( \gamma = 0 \), the regulator’s objective simplifies to maximizing efficiency. When \( \beta = 0 \) and \( \gamma > 0 \), the regulator additionally attempts to internalize externalities that may arise out of the contract. When \( \beta > 0 \) and \( \gamma = 0 \), the regulator trades-off efficiency losses with equity gains.

**Information.** The agents have complete and symmetric information about the state \( \theta \). However, the state is not verifiable by the principal. The principal’s beliefs over the state are represented by the cumulative distribution function \( G(\theta) \) with probability density function \( g(\theta) \). All other details of the environment are common knowledge among the principal and the agents, including the outcome of bargaining.

**Bargaining.** Agents Nash bargain over the terms of the contract \((q, c)\) given an outside option \( d = (q_d, c_d) \) and the state of the world \( \theta \). The worker has Nash bargaining weight \( \delta \) while the firm has weight \((1 - \delta)\). These weights, in the case of employment negotiations, are influenced by the presence or absence of a union, collective bargaining protections,\(^8\) It is straightforward to verify that the results presented here hold for broad set of equity objectives, i.e. any particular desired distribution of surplus \( x \) and \( 1 - x \). A discussion of the form of the inequity penalty appears in subsection D.1.
as well as employer concentration and monopsony power. The default contract which obtains in the event of a disagreement is \( d \). That is, the bargained contract is given by

\[
\hat{h}(d; \theta) \equiv \arg \max_{q \in Q, c \in C} (U_w(q, c; \theta) - U_w(d; \theta))^{\delta}(U_f(q, c; \theta) - U_f(d; \theta))^{1-\delta}.
\]  

We write \( \hat{h} \) to refer to the maximand in (1). Here \( Q \) and \( C \) refer to the set of enforceable quality levels and transfers, respectively.

**The regulator’s problem.** The regulator’s goal is to maximize social welfare. Section 4 will consider a variety of different assumptions about the degree to which the regulator is constrained in its choice of social welfare-maximizing mechanisms.

**Default delegation.** The analysis in Section 4 leads to a particular indirect mechanism that we call *default delegation*. In default delegation, the regulator uses two tools to affect the contracting environment: (1) it chooses the *delegation set* \( Q \) of contracts it is willing to enforce and (2) it sets the *default outcome* outcome \( d \) which serves as a disagreement point in the agents’ negotiations. That is, the regulator maximizes

\[
\max_{Q, d} \mathbb{E}_\theta[\text{SWF}(q^*(\theta), c^*(\theta); \theta)]
\]

with

\[
(q^*(\theta), c^*(\theta)) \equiv \arg \max_{q \in Q, c \in C} \hat{h}(d, \theta).
\]

In section 4, we will discuss the properties of this indirect mechanism in depth, comparing its performance to an unconstrained direct mechanism. In section 5 we assume that the regulator uses a default delegation mechanism, and analyze the optimal policy choice.

**Timing of default delegation.** The regulator chooses a delegation set and default outcome \( \{Q, d\} \). Then with common knowledge of the true state \( \theta \), the agents bargain over the terms of the contract \( (q, c) \), with \( d \) serving as the disagreement outcome, and \( Q \times C \) defining the feasible bargaining outcomes. Then the contracts are signed and utilities are realized.

### 4 First Best Analysis

In this section, we characterize the set of contracts that are implementable via default delegation. We begin by noting that first-best contracts are trivially implementable with default delegation when the regulator is concerned only about the efficiency of the
contract. Then, we build off the approach in Maskin and Moore (1999) in order to show when it is without loss for the regulator to choose default delegation in the presence of equity and efficiency concerns. The main departure from Maskin and Moore is that we derive explicit conditions on implementability assuming that agents engage in Nash bargaining, and that the regulator has specific preferences over the distribution of surplus and externalities captured by $\beta > 0$ and $\gamma > 0$, respectively. Adding this structure allows us to investigate the implications of Maskin and Moore’s general implementation theorems for specific applications of interest.

In other words, the goal of this section is to understand when the regulator can achieve the first-best outcome with default delegation for different social welfare functions. We define first-best as follows.

**Definition 4 (First Best Outcomes)** The first best outcomes are $(q^*, c^*) = \{(q_\theta, c_\theta)\}_{\theta \in \Theta}$ where

$$(q_\theta, c_\theta) \in \arg \max_{(q,c)} \text{SWF}(q,c;\theta)$$

for $\theta \in \Theta$.

### 4.1 Implementation of efficient contracts

We consider different social welfare functions in turn, beginning with the most familiar one based only on (ex-post) efficiency. When $\beta = 0$ and $\gamma = 0$, there are neither equity nor externality concerns, and the regulator’s goal is only to implement the efficient contract. In particular, the regulator does not have a preferred distribution of surplus, and thus each state corresponds to a set of first-best contracts $(q_\theta, c_\theta)$ where $c_\theta$ is any value in $C$ and $q_\theta$ is the efficient level of quality.

Since bilateral bargaining is efficient, and the regulator is indifferent about the transfers $c$ that result from the bargaining process, the first-best outcome is achieved with default delegation as long as the regulator is willing to enforce the first-best quality level in each state (i.e. $q_\theta \in Q$).

**Lemma 1** Assume $\beta = 0, \gamma = 0$. Then if $q_\theta \in Q$ for all $\theta$, the first-best is implementable with default delegation for any choice of $d$ including the status quo.

In this case, there is no reason for the regulator to constrain the set of enforced outcomes $Q$ nor to judiciously select a default outcome $d$. With no intervention, the parties reach the first-best outcome.

### 4.2 Default delegation with equity concerns

It may be that in order to achieve the first best level of quality $q_\theta$, the transfers that result from agents’ bargaining $c_\theta$ constitute an undesirable distribution of the surplus.
In our examples, the undesirability of a particular distribution could be derived from ex ante contracting efficiency (as in incomplete contracts, see Example 1 in section 2) or from fairness or other social concerns about distribution (as in marriage and employment contracts, see Examples 2 and 3 in section 2). Either way, when the regulator has equity concerns, the first best in state $\theta$ is a single pair $(q_\theta, c_\theta)$ where $q_\theta$ is the efficient quality level and $c_\theta$ evenly distributes the surplus between the two parties (this particular first-best distribution is due to our simplified social welfare function, but as noted in subsection D.1, the results hold for general objectives regarding the distribution of surplus).

In this subsection we begin by characterizing the full set of implementable contracts when the regulator has equity concerns and can design any mechanism. We show that under some circumstances, any outcome implementable with a general direct mechanism can also be achieved through default delegation. That is, the regulator can do just as well with a decentralized default mechanism as it can with an arbitrary centralized direct mechanism.

We begin by characterizing the full set of implementable outcomes when the regulator cannot prevent the parties from renegotiating, using the results in Maskin and Moore (1999). The regulator’s problem can be translated into an optimization over incentive compatible direct mechanisms in which both parties submit reports of the state $\theta$.

The regulator’s problem: Direct mechanism. In the direct mechanism, the action space is $\Theta^2$. We refer to the worker’s report as $\hat{\theta}_w$ and the firm’s report as $\hat{\theta}_f$, resulting in a profile of agents’ reports $\hat{\theta} = (\hat{\theta}_w, \hat{\theta}_f)$. We will begin by assuming that the regulator will enforce any contract, $Q = \mathbb{R}$. The regulator’s problem is to maximize

$$\max_{g(\theta)} \mathbb{E}_\theta[\text{SWF}(h(g(\hat{\theta}), \theta); \theta)]$$

subject to incentive compatibility constraints

$$U_i(h(g(\theta, \theta), \theta)) \geq U_i(h(g(\theta', \theta), \theta))$$

for all $\theta, \theta' \in \Theta$. The following proposition characterizes first-best implementable outcomes.

**Proposition 1** (Maskin and Moore 1999) Assume that the Pareto frontier is linear in all states $\theta \in \Theta$. The first-best is implementable in Nash equilibrium and any refinement if and only if there exists a function $g : \Theta \times \Theta \to Q \times C$ such that

$$(i) \quad h(g(\theta, \theta), \theta) \in \arg \max_{g(\theta, \theta)} \text{SWF}(h(g(\theta, \theta), \theta), \theta),$$
(ii) and for $i \in \{w, f\}$

$$U_i(h(g(\theta, \theta), \theta)) \geq U_i(h(g(\theta', \theta), \theta))$$  \hspace{1cm} (4)

for all $\theta, \theta' \in \Theta$.

In general, default delegation will be restrictive in the sense that the regulator could implement more outcomes if any direct mechanism were available. However, when there are only two states, default delegation can replicate any implementable outcome under mild conditions on agents’ utility functions. We proceed by discussing the two state case in depth.

**Direct mechanism: Two states.** To make Proposition 1 more concrete, consider the two state case where $\Theta = \{\theta_l, \theta_h\}$. Here, we write the first best outcomes to be $(q_l, c_l)$ and $(q_h, c_h)$ in state $\theta_l$ and $\theta_h$, respectively. Proposition 1 says that the first best is implementable in any refinement of Nash equilibrium as long as neither player would deviate in the reduced form game shown in Table 1.

| $\hat{\theta}_w$ | $\hat{\theta}_f$ | $\hat{\theta}_w$ |
|------------------|------------------|------------------|
| $\theta_l$       | $(q_l, c_l)$     | $(q_l, c_l)$     |
| $(q_l, c_l)$     | $(q_h, c_h)$     | $(q_h, c_h)$     |

Table 1: Direct mechanism for implementing $(q_\theta, c_\theta)$ in state $\theta$.

The regulator’s problem then is to choose a mechanism $g(\hat{\theta})$ so that the only equilibria of the game are $(q_\theta, c_\theta)$ for $\theta \in \Theta$. This amounts to a selection of off-path “threats” $(q_{lh}, c_{hl})$ and $(q_{lh}, c_{lh})$.

In characterizing implementable outcomes, it will be useful to introduce notation for a difference operator $\Delta(u, q, \theta) \equiv u(q_\theta, \theta) - u(q, \theta)$. The off-path threats must satisfy

$$(1 - \delta)[\Delta(u_w, q_{mn}, \theta_n) - \Delta(u_w, q_{mn}, \theta_m)] - \delta[\Delta(u_f, q_{mn}, \theta_n) - \Delta(u_f, q_{mn}, \theta_m)] \geq c_m - c_n \hspace{1cm} (5)$$

for $m, n \in \{l, h\}$ with $m \neq n$. This condition is very closely related to the cross partials of the agents’ utility with respect to $q$ and $\theta$, which will be useful in building intuition below.

**Default delegation: Two states.** How does default delegation differ from the general direct mechanism? Default delegation is decentralized, in the sense that it is message-independent. It does not require a solicitation of agents’ reports.

To understand what is possible with message-independence, let’s first consider a restriction to games in which only the off-path threats are message-independent in the sense
that there is only one outcome for when the agents’ reports disagree. That is, \( g(\theta, \theta') = d \) for \( \theta \neq \theta' \). This game is represented in Table 2.

| \( \hat{\theta}_f = \theta_l \) | \( \hat{\theta}_f = \theta_h \) |
|--------------------------|--------------------------|
| \( \hat{\theta}_w = \theta_l \) | \( (q_d, c_d) \) | \( (q_d, c_d) \) |
| \( \hat{\theta}_w = \theta_h \) | \( (q_d, c_d) \) | \( (q_d, c_d) \) |

Table 2: Direct mechanism with message-independent threats (\(|\Theta| = 2\)).

Here, \((q_d, c_d)\) must satisfy all the constraints characterized by (5). This implies that these constraints must hold with equality. Since they hold with equality, for well-behaved \( U_i \) it must be that \( h((q_d, c_d), \theta) = h((q_d, c_d), \theta) = (q_d, c_d) \).

Therefore, the game that implements first-best with message-independent threats in Table 2 results in the same outcome as default delegation. The next proposition characterizes when it is without loss for the regulator to choose the fully decentralized, message-independent default delegation mechanism.

**Proposition 2** Assume that \(|\Theta| = 2\). If the first-best is implementable and \( U_f \) and \( U_w \) are continuous, then the first-best is implementable with default delegation. The default \( d = (q_d, c_d) \) satisfies

\[
(1 - \delta)[\Delta \Delta(u_w, q_d, \theta_h, \theta_l)] - \delta[\Delta \Delta(u_f, q_d, \theta_h, \theta_l)] = c_l - c_h
\]

(6)

where \( \Delta \Delta(u, q, \theta, \theta') \equiv \Delta(u, q, \theta) - \Delta(u, q, \theta') \).

As mentioned above, the cross-partials of the worker and firm utility functions with respect to \( q \) and \( \theta \) give intuition for the logic behind the condition in Proposition 2. The following corollary contains a sufficient condition for implementation with default delegation in the absence of externality concerns:

**Corollary 1** Assume that \(|\Theta| = 2\) and \( \gamma = 0 \). If there exists \( x \in \mathbb{R}_+ \) such that at all points \((q, \theta)\)

\[
\left| (1 - \delta) \frac{\partial^2 U_w}{\partial q \partial \theta} - \delta \frac{\partial^2 U_f}{\partial q \partial \theta} \right| > x
\]

(7)

then the first-best is implementable via default delegation.

This implies that if the worker has supermodular preferences and the firm has submodular preferences then there exists a contract \((q_d, c_d)\), which implements the first best. Furthermore, these cross-partials provide insight into the feasibility of specific transfers with different bargaining parameters. Specifically, corollary 2 shows conditions under which the government may find it less difficult to achieve a desired distribution of surplus:
Corollary 2 If the worker and firm have supermodular and submodular preferences, respectively such that
\[ \frac{\partial^2 U_w}{\partial q \partial \theta} = b > 0 \quad \text{and} \quad \frac{\partial^2 U_f}{\partial q \partial \theta} = -a < 0 \]
with \( b > a \), the regulator is able to achieve the same difference in transfer, \( c_l - c_h \) with a lower default quality level, \( q_d \), when the workers have less bargaining power.

In other words, corollary 2 states that when the workers’ preferences over \( q \) are more responsive to the state \( \theta \), the regulator can achieve a broader set of transfers \( \{c_l, c_h\} \) when the firm has higher bargaining power. More generally, the regulator has more scope for achieving particular distributions of surplus when the party with more state-dependent preferences has less bargaining power.

As discussed in Maskin and Moore (1999), when the regulator enforces any contract written between agents \( Q = R + Q \), this significantly constrains the set of implementable outcomes. Furthermore, we could imagine that the regulator can choose to only enforce contracts where \( (q, c) \in \{(q_l, c_l), (q_h, c_h), d\} \) noting that the default \( d \) must be enforceable for the negotiation to be well defined but can itself equal \( (q_l, c_l) \) or \( (q_h, c_h) \). In this case, the planner’s problem becomes:

\[
\max_{\{(q_l, c_l), (q_h, c_h), d\}} \mathbb{E}_{\theta}[\text{SWF}(q^*(\theta), c^*(\theta); \theta)]
\]

with

\[
(q^*(\theta), c^*(\theta)) \equiv \arg\max_{(q, c) \in \{(q_l, c_l), (q_h, c_h), d\}} (U_w(q, c; \theta) - U_w(d; \theta))^\delta(U_f(q, c; \theta) - U_f(d; \theta))^{1-\delta}.
\]

Allowing the regulator to constrain the set of enforceable contracts, we get the following result:

**Proposition 3** The first-best is implementable with constrained default delegation if there exists a default \( d = (q_d, c_d) \) such that

\[
(U_w(q_{\theta'}, c_{\theta'}; \theta) - U_w(d_{\theta'}; \theta))^\delta(U_f(q_{\theta'}, c_{\theta'}; \theta) - U_f(d_{\theta'}; \theta))^{1-\delta} > (U_w(q_{\theta'}, c_{\theta'}; \theta) - U_w(d_{\theta'}; \theta))^\delta(U_f(q_{\theta'}, c_{\theta'}; \theta) - U_f(d_{\theta'}; \theta))^{1-\delta}
\]

for all \( \theta, \theta' \in \Theta \).

Before the regulator needed to ensure agents’ incentive compatibility conditional on the transfer based on their optimal division of surplus. Now, the regulator can refuse to enforce contracts which they would optimally choose to bargain to. This generally makes the set of implementable contracts broader. However, an implication of corollary 2 is that if (7) is satisfied then the regulator does not expand the set of implementable outcomes.
by choosing to limit the set of enforceable contracts. In other words, when the regulator has distributional concerns, it does not increase welfare by restricting the set of enforced contracts when (7) holds. We summarize this observation in the following Corollary.

**Corollary 3** Assume that $|\Theta| = 2$ and $\gamma = 0$. If the condition from corollary 1 is satisfied, then the regulator cannot increase the set of implementable outcomes by limiting the set of enforceable contracts.

4.3 Default delegation with externality concerns

So far, this section has considered cases in which the regulator has preferences over efficiency and equity alone. In such cases, it is never beneficial for the regulator to restrict the set of enforced outcomes $Q$ because the agents’ bargaining always achieves the efficient $q_\theta$. When the regulator has only equity and efficiency concerns, it influences the distribution of surplus by choosing the default $d = (q_d, c_d)$ which serves as a disagreement outcome in agents’ bargaining.

Now, we include social welfare functions where externalities affect the first-best outcomes. In such cases, the first best $(q_\theta, c_\theta)$ will not be on the agents’ Pareto frontier, and so the regulator will not be able to attain first best without restricting the set of enforced contracts.\[9\]

If the externality depends on the quality level such that $\frac{\partial U}{\partial q} \neq 0$ and $\gamma > 0$, the regulator may still be able to achieve first best by delegating the choice to the agents, and letting them choose from a reduced set of contracts that contain the optimal quality levels corresponding to the first-best outcomes in each state. In other words, the regulator can achieve first best via default delegation by setting the delegation set to be a discrete set $Q = \{q_\theta\}_{\theta \in \Theta}$. This delegation set will achieve first best when the agents’ total surplus in state $\theta$ is higher at the first best level of quality, $q_\theta$, than at an alternative quality level $q_\theta'$.\[10\] The following proposition characterizes when first-best is implementable with default delegation when there are externality concerns ($\gamma > 0$) but not equity concerns ($\beta = 0$).

**Proposition 4** Assume that $\Theta$ is a discrete set and $\beta = 0$. Then the first-best is imple-

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9 Note that once we allow the regulator to restrict the set of enforced contracts, the framework in Maskin and Moore (1999) no longer applies. In Maskin and Moore the social planner cannot place any restrictions on renegotiation. We now assume that the social planner can restrict the set of enforceable quality levels $q \in Q$. This allows us to study what happens when the planner can partially, but not completely, prevent renegotiation. This restriction on “quality” $q$ but not transfers $c$ is valuable as a theoretical exploration of the degree to which renegotiation constrains implementation. Furthermore, this restriction aligns with the perspective in Glaeser and Shleifer (2001), which posits that regulations that place limits on prices are more difficult to enforce because compliance is less observable.

10 Recall that we have assumed that when the Nash bargaining solution is not in the feasible set, the agents select the point in the feasible set that maximizes their joint surplus.
mentable via default delegation with $Q = \{ q_\theta \}_{\theta \in \Theta}$ if

$$u_f(q_\theta, \theta) + u_w(q_\theta, \theta) \geq u_f(q_{\theta'}, \theta) + u_w(q_{\theta'}, \theta)$$

(10)

for all $\theta, \theta' \in \Theta$.

Condition (10) is restrictive. It is easier to satisfy when the externality term is small. Furthermore, note that we are only allowing the regulator to limit the delegation set through quality. As discussed above, we could have allowed the regulator to limit the set of enforceable contracts such that we repeat the result of Proposition 3. This expands the set of implementable contracts because it is able to implement quality levels which do not satisfy equation (10) by making the distribution of surplus less favorable in particular states relative to the gains from increasing total surplus. However, as discussed in Glaeser and Shleifer (2001), the regulator might be limited in its ability to enforce particular transfers across states.

The next proposition adds back equity concerns $\beta > 0$. Essentially combining Propositions 2 and 4 we get the general result:

**Proposition 5** Assume that $|\Theta| = 2$. Then the first-best is implementable via default delegation if

(i) there exists $d = (q_d, c_d)$ that satisfies (6), and

(ii) $Q = \{ q_\theta \}_{\theta \in \Theta}$ satisfies (10) for all $\theta, \theta' \in \Theta$.

The important takeaway from this section is that we can provide a mechanism design rationale for the distinction between immutable and default contract rules. The default rules are used in order to obtain a particular distribution of the surplus in different states of the world while immutable rules internalize externalities. Notice that Proposition 5 requires that the state space $\Theta$ has cardinality two. This is because Proposition 2 does not hold when there are more than two states. Now that we have discussed the ways in which default delegation allows a regulator to do the best it could do, we next turn to a discussion of the limitations of default delegation.

### 4.4 Limitations of default delegation

We first generalize Proposition 5 to more than two states in Proposition 6 below. Then we discuss the implications.

**Proposition 6** Assume $|\Theta| > 2$ and $\Theta$ is a discrete set. Then the first best outcomes $\{(q_\theta, c_\theta)\}_{\theta \in \Theta}$ are implementable with default delegation mechanism $(d, Q)$ if
(i) \( d = (q_d, c_d) \) satisfies

\[
(1 - \delta)[\Delta \Delta(u_w, q_d, \theta, \theta')] - \delta[\Delta \Delta(u_f, q_d, \theta, \theta')] = c_{\theta'} - c_{\theta}
\]  

for all \( \theta, \theta' \), and

(ii) \( Q = \{(q_{\theta}, c_{\theta})\}_{\theta \in \Theta} \) satisfies (10).

An implication of the first hypothesis (i) in this proposition is that default delegation does not implement the full set of implementable outcomes when there are more than two states, even when \( U_f \) and \( U_w \) are continuous in \( q \) and \( \theta \). To give intuition for why this is the case, we consider a setting with three states, i.e. when the state space is \( \Theta = \{\theta_l, \theta_m, \theta_h\} \).

As before, it is useful to study the direct mechanism in which the regulator is restricted to using message-independent threats. In this case the game takes the form presented in Table 3 (which is a simple extension of Table 2 to three states).

| \( \hat{\theta}_f = \theta_l \) | \( \hat{\theta}_f = \theta_m \) | \( \hat{\theta}_f = \theta_h \) |
|---|---|---|
| \( \hat{\theta}_w = \theta_l \) | \( q_l, c_l \) | \( q_d, c_d \) |
| \( \hat{\theta}_w = \theta_m \) | \( q_d, c_d \) | \( q_m, c_m \) |
| \( \hat{\theta}_w = \theta_h \) | \( q_d, c_d \) | \( q_h, c_h \) |

Table 3: Direct mechanism with message-independent threats (\(|\Theta|=3\)).

In general, it will not be possible to find a \((q_d, c_d)\) that implements the first-best outcomes. This is due to the constraints imposed by equation (6), which relates the differences in utility at \( q_\theta \) and \( q_d \) in each state to the difference in desired transfers \( c_h - c_l \). When there is a third state, there is now another value \( c_m \), which appears in two other conditions analogous to (6). In order to implement the first-best, the value \( c_m \) must satisfy

\[
(1 - \delta)[\Delta \Delta(u_w, q_d, \theta_h, \theta_m)] - \delta[\Delta \Delta(u_f, q_d, \theta_h, \theta_m)] = c_m - c_h
\]

(12)

\[
(1 - \delta)[\Delta \Delta(u_w, q_d, \theta_m, \theta_l)] - \delta[\Delta \Delta(u_f, q_d, \theta_m, \theta_l)] = c_l - c_m
\]

(13)

where again \( \Delta \Delta(u, q, \theta, \theta') \equiv \Delta(u, q, \theta) - \Delta(u, q, \theta') \). In general, it will not be the case that \( c_m \) satisfies both of these equations. So, there are outcomes \((q^*, c^*)\) that are implementable with a general direct mechanism that are not implementable when the regulator is restricted to message-independent threats. Thus, Proposition 2 does not hold when there are three states. In fact, as the following proposition highlights, Proposition 2 does not hold when \(|\Theta| > 2\).
**Corollary 4** Assume $|\Theta| > 2$ and $\Theta$ is a discrete set. Then there are outcomes that are implementable in a general direct mechanism that are not implementable with default delegation, regardless of whether $u_f$ and $u_w$ are continuous in $q, \theta$.

The logic is that default delegation allows for two degrees of freedom which establish the level and difference between transfers across two states. With those degrees of freedom occupied there is no adjustment available for a third (or fourth or fifth...) state. Outcomes which may be implementable in a message-dependent mechanism in general will not be implementable in a default delegation mechanism.

To summarize, it is without loss to restrict to default delegation when there are only two states—Proposition 2 says that the entire set of implementable outcomes is implementable with default delegation under mild conditions. However, when there are more than two states, default delegation will, in general, meaningfully constrain the regulator’s ability to achieve first-best relative to any unconstrained message-dependent direct mechanism.

Nonetheless, there are some scenarios that may be of interest in which results derived in the $|\Theta| = 2$ case extend to the $|\Theta| > 2$ case. One such situation is when the regulator has a maxmin objective function, which is discussed in Appendix C.

Beyond analyzing implementability, it is important to consider the important tradeoffs which occur when we extend this mechanism to many states. The regulator must consider efficiency, equity and externality both within a particular state and across states. With this in mind the next section looks at a particular example with a continuum of states in an attempt to gain intuition for how a regulator may adjust policies as underlying parameters evolve when using default delegation. But first we fix terms by interpreting the preceding analysis through the lens of our examples.

### 4.5 Interpreting results

The preceding analysis helps to clarify that the government aims to set or influence defaults in order to ensure particular distributions of surplus in unverifiable states. Meanwhile, the government sets limits on enforceable contracts in order to curb externalities. The key results are summarized in Table 4.

| Efficiency + Equity | Efficiency + Externalities | Efficiency + Equity + Externalities |
|---------------------|----------------------------|-------------------------------------|
| (Proposition 2)     | (Proposition 4)            | (Proposition 5)                     |
| achieved with $d$   | achieved with $Q$          | achieved with $\{d, Q\}$            |

Table 4: Summary of results: First-best implementation with default delegation

We interpret the results of the first-best analysis in the context of the examples presented in section 2. Table 5 outlines examples of defaults and limits in commercial law, marriage law and labor law.
Table 5: Examples of Defaults and Limits in Settings from Section 2

| # | Example   | Default $d$                                      | Limits $Q$                                      |
|---|-----------|--------------------------------------------------|------------------------------------------------|
| 1 | Commerce  | “reasonable” times                               | no “manifestly unreasonable” delivery times     |
| 2 | Marriage  | “equitable division” of assets                    | no terms about custody                          |
| 3 | Work      | “employee” classification                         | minimum health insurance coverage              |

Example 1 (Commerce). The Uniform Commercial Code and “Reasonable” Defaults.

We can use the results of this section to understand aspects of the Uniform Commercial Code. Consider first the issue of contracting on delivery times. Suppose that $\theta$ takes on only two states, leading to a high or a low surplus, respectively. Section 2 showed that without a default rule, the “low” realization of $\theta$ may be so bad for the seller that the seller would avoid entering the contract to begin with. In other words, the distribution of surplus in this state is such that the seller would not enter. In this scenario, the government has an “equity” objective ($\beta > 0$), to smooth the distribution of surplus, which is based in a goal of providing efficient investment incentives. Proposition 2 suggests that when the government has some “equity” objective $\beta > 0$, it can implement a “reasonable” default rule for delivery times which achieves the first best distribution of surplus (and therefore the efficient contract) in both states of the world $\{\theta_l, \theta_h\}$.

The U.C.C. also has some immutable rules, which place limits on the kinds of contracts that will be enforced in court. For instance, the law prevents contract terms stipulating times deemed “manifestly unreasonable.” If times for delivery are too extreme, there will likely be the need for arbitration. Arbitration can be costly and therefore strain public resources. In other words, there is an externality that arises out of contracts with extreme times for delivery, which is mitigated with the “manifestly unreasonable” immutable rule.

Example 2 (Marriage). “Equitable Division” Defaults and Limited Enforcement.

In the regulation of marriage contracts in the U.S., the government supplies default marriage rules that govern unless expressly contracted around. For instance, if to-be-spouses get married without signing a prenuptial agreement that specifies otherwise, the division of assets upon divorce will follow an “equitable division” rule in many states. The default rule fills a gap in an incomplete contract, and ensures a particular distribution of surplus in the event of divorce. In this case, unlike in Example 1, the government may have preferences directly over the “equity” of a contract, for fairness reasons (Bix, 1998). That is $\beta > 0$ because the government wants to avoid unjust outcomes. Proposition 1 thus helps to illustrate why this equitable division rule exists: it serves as a default that allows the regulator to achieve first best.

Proposition 3 can help to understand the limits on the contracts the government is willing to enforce. The best allocation of custody from the perspective of the government is the allocation that is best for the child. This allocation may not align with what the spouses view to be the best allocation. Suppose the government has an infinitely negative
payoff when full custody is given to the “wrong” spouse. Then, our model predicts that the government would not enforce any contract terms involving custody of children, child support, or visitation. In line with this prediction of our model, there is no state in the U.S. which will enforce terms about children in prenuptial contracts.\footnote{https://www.findlaw.com/family/marriage/what-can-and-cannot-be-included}

Example 3 (Work). The Classification of Platform Workers.

We return to the case of regulating app-based platform work in detail in section 5. For now, it is sufficient to establish the premise that to the extent that the regulator is able to affect the default, they will choose to shift the default contract in order to push the resulting distribution of outcomes across states closer to their preferred distribution. Furthermore, the presence of externalities justifies the restriction of the contracting space inherent in mandating minimum health and unemployment insurance coverage.

One aspect of this setting that makes interpretation more subtle is that there are multiple policy levers through which the government influences “default” labor contracts, i.e. the labor contracts that serve as an outside option in specific employee-employer negotiations. (This subtlety contrasts with the incomplete contracting setting where the regulator directly establishes defaults which hold in case they are not explicitly contracted away.) A primary avenue through which governments affect worker “defaults” is worker classifications, which establish that certain forms of work in certain sectors must be governed by “employee” rules and not “independent contractor” rules. Regulators also use the threat of legislation and other forms of soft power to shift the default (Stewart and Stanford, 2017). For instance, Bernie Sanders’ Stop BEZOS Act may be partially responsible for Amazon’s subsequent decisions to raise wages.\footnote{See, for example, Bhattarai (2018).}

In the platform work example, the unverifiable state of the world $\theta$ is the degree to which workers value benefits relative to cash. Direct surveys show that there is a large degree of heterogeneity in $\theta$ (e.g. Gruber (2022)) justifying our continuous treatment of $\Theta$. We use the platform work example to characterize the optimal default delegation policy. Comparative statics on the optimal policy help us understand recent and anticipated shifts in the approach to regulating platform work.

5 Second Best Analysis: An Application to the Regulation of Platform Work

To summarize, the prior section showed that default delegation attains any implementable first-best contract when the regulator has only equity concerns (Proposition 2), and can attain the first-best contract in the presence of both equity and externality concerns in
some special cases (Proposition 5). Although a range of settings can be reduced to a two-state case (see Appendix C), the limitations detailed above suggest that developing intuition for regulation in practice requires understanding optimal default delegation when it does not attain the first best, i.e., when the conditions in Proposition 6 do not hold.

In this section, we characterize the expected welfare-maximizing default delegation policy via comparative statics and closed-form solutions for a specific example. We find that the intuition developed in section 4 helps to understand the trade-offs a regulator faces when the first best is unattainable with default delegation: even when it does not achieve first best, default delegation balances the distribution of surplus across states (to mitigate inequities between parties) and internalizes externalities. Comparative statics show how the welfare-maximizing default delegation policy \( \{Q, d\} \) changes with: (1) the regulator’s preferences over equity (\( \beta \)) and externalities (\( \gamma \)), (2) the regulator’s prior about the unknown state of the world, and; (3) differences in the agents’ bargaining weights.

This section also doubles as an in-depth investigation into the regulation of a rapidly evolving form of labor contract. We use the theory of default delegation to generate predictions about the regulation of platform work.

### 5.1 Set up

Consider a regulator concerned about the contracts written between a continuum of firms and their app-based workers. The regulator is uncertain about how any given worker values benefits \( q \) relative to cash \( c \). To fix ideas, let \( q \) be the demand for health insurance which varies in terms of its coverage. We capture the regulator’s uncertainty by \( \theta \), an unknown state of the world drawn independently from a distribution \( G(\theta) \) with support \( [\underline{\theta}, \overline{\theta}] \).

Although \( \theta \) is unknown to the regulator, it is common knowledge to each worker-firm pair. Each worker’s preference is quadratic and reaches a maximum at \( q = \theta \). Some workers put relatively high value on additional worker benefits relative to additional pay while others receive relatively little additional surplus from additional benefits.\(^{13}\)

The firm’s costs are state-independent: \( q^2 \) is the known cost of providing benefits.

These costs are convex, and the firm always prefers to provide the minimum level of coverage. To summarize, workers and the firm have preferences

\[
\text{Firm: } U_f(q, c) = \Pi = R - q^2 - c \quad \text{Worker: } U_w(q, c; \theta) = WS = w - (q - \theta)^2 + c
\]

where \( w \) refers to an exogenous worker wage and \( R \) is the firm’s revenue net of this wage.

\(^{13}\)See Gruber (2022) for survey data reporting substantial heterogeneity in gig-worker’s valuations of benefits.
We model the externalities generated by the contract as linear in $q$, for ease of exposition. (The results presented in this section would be qualitatively similar for increasing functions of $q$.) Since the externality term is linear, the socially optimal level of $q$ is always above the agent-optimal quality level. This externality term captures the fact that the regulator would be forced to cover health care that is not covered in the employer provided health insurance.

**Externality:**  \[ U_r(q) = \gamma q \]

All of these terms enter into the SWF presented in [section 3](#). The regulator’s program. In a second-best environment, the regulator aims to maximize expected welfare. The regulator solves for the expected social welfare-maximizing default delegation policy by solving the following program:

\[
\max_{\{Q, (q_d, c_d)\}} \mathbb{E}_G[SWF(q_\theta, c_\theta; \theta)] \quad \text{s.t.} \quad q_d \in Q
\]

where

\[
(q_\theta, c_\theta) = \arg \max_{q \in Q, c \in \mathbb{R}} (WS(q, c; \theta) - WS(q_d, c_d; \theta))^{\delta}(\Pi(q, c) - \Pi(q_d, c_d))^{1-\delta}.
\]

That is, the regulator chooses a delegation set $Q$ and default $q_d, c_d$ to maximize expected welfare with respect to its prior $G(\theta)$, foreseeing that the agents will Nash bargain. The default quality level must lie in the delegation set ($q_d \in Q$).

In order to solve the regulator’s program, we make use of results from single-agent delegation problems. Note that conditional on a particular default, the regulator interacts with the agents as if they were a single combined agent (maximizing their joint surplus). Alonso and Matouschek (2008) characterizes settings in which the optimal delegation set for a single agent is an *interval*. Building on their results, we restrict attention to cases in which $Q$ is an interval, i.e. $Q = [q, q]$. Let $q_\theta$ be the quality level that the agents choose conditional on $\{Q, d\}$ when the state of the world is $\theta$. Note that $q_\theta$ is the value of $q$ that maximizes the joint surplus of the workers and the firm. The agents will bargain to the value in the delegation interval that maximizes their joint surplus. If the joint surplus-maximizing value of $q$ is not in the delegation interval, then $q_\theta$ will be an endpoint of the interval.

Using the fact that the optimal delegation set is an interval, and assuming that the worker and firm bargain to the value $q_\theta$ in the delegation set that maximizes their joint surplus, $q_\theta$ will be an endpoint of the interval. This is because if $q_\theta$ were not an endpoint, the regulator could always find a delegation set that is wider and still maximizes expected welfare.

\footnote{We discuss the use of interval delegation in more detail in Appendix [E.1.1](#) and show conditions under which the optimal default delegation mechanism will take the form of a closed set.}
surplus, we can rewrite the regulator program:

$$\max_{\left\{ c, q, \bar{q}, \underline{q}\right\}} \int_{\underline{q}}^{\bar{q}} \left( WS(c, q; \theta) + \Pi(c, q) + \gamma q - \beta (WS(c, q; \theta) - \Pi(c, q))^2 \right) dG(\theta)$$

subject to

$$c = c(q, c_d, q_d; \theta) = c_d + (1 - \delta)(-(q_d - \theta)^2 + (q - \theta)^2) - \delta(-q_d^2 + q^2).$$  \hspace{1cm} (14)$$

In the remainder of this section, we solve the regulator’s program in three different bargaining regimes. As the regulator’s program is sensitive to the exogenous bargaining parameter $\delta$, we simplify the analysis by considering three cases: equal bargaining ($\delta = .5$), firm control ($\delta = 0$) and worker control ($\delta = 1$). In order to get explicit solutions, we will sometimes make specific assumptions about the distribution of types (e.g. that the regulator’s prior is uniformly distributed on the unit interval, i.e. $G(\theta) = \text{Unif}[0, 1]$).

5.2 Firm control

We begin our second-best analysis with the case in which the workers have no bargaining power, i.e. $\delta = 0$. In this case, the firm makes take-it-or-leave-it contracts to the workers. This assumption on $\delta$ aligns best with the facts about gig work in the U.S. Since gig-workers are not classified as employees, they are not protected by collective bargaining laws and so cannot form unions. Furthermore, factors that are not specific to gig-work contribute to low worker bargaining power in the U.S.: declining unionization [Farber et al. 2021], rising employer concentration [Benmelech et al. 2020], and diminished worker protections all contribute to low levels of worker bargaining power across sectors [Summers and Stansbury, 2020], even as superstar firms capture exceptional profits [Autor et al. 2020].

Solving the regulator problem. When $\delta = 0$, the welfare-maximizing default delegation policy is complex. In particular, the endpoints of the delegation set $\underline{q}$ and $\bar{q}$ as well as the default $q_d, c_d$ are all interdependent. Each is a function of the other terms, as well as the equity and externality parameters $\beta$ and $\gamma$.

As a baseline, it is useful to begin our analysis with a simple closed-form solution that
obtains under further assumptions. We assume that types are distributed uniformly on the unit interval.

**Assumption 1** Types \( \theta \) are drawn from the uniform distribution, \( \theta \sim \text{Unif}[0, 1] \).

We first consider a case in which the maximum \( \bar{q} \) and minimum \( q \) do not constrain bargaining in any state of the world.\(^{15}\)

**Assumption 2** The outcome of bargaining \( q_{\theta} \) is \( \frac{\theta}{2} \) in all states.

Under Assumptions 1 and 2 we get the following expected welfare-maximizing default:

\[
q_d^* = \frac{3}{8}, \quad c_d^* = \frac{R - w}{2} + \frac{1}{64}.
\]

(15)

The default transfer is above the level which equates the exogenous components of surplus, \( \frac{R-w}{2} \). Similarly, the default quality level is closer to the worker’s expected optimal quality level, \( q = \frac{1}{2} \), then the firm’s optimal, \( q = 0 \). This default illustrates the following, more general observation.

**Result 1** When the firm has all the bargaining power (\( \delta = 0 \)), the welfare-maximizing default \((q_d^*, c_d^*)\) favors the worker in terms of both the quality level and the transfer.

To see why this result holds more generally, recall that \( \delta = 0 \) implies that the firm receives all of the surplus from bargaining. So, in order to equalize the surplus between the two parties, the equity-concerned regulator uses the default to improve the worker’s position before bargaining occurs.

But the optimal \( q_d^* \) does not deliver an exactly equal split of the surplus—instead, it minimizes the inequity across all possible states. The leftmost graph in Figure 3 plots the worker’s utility, firm’s profits, and the inequity term in the social welfare function (squared difference between worker profit and firm profit) evaluated at \( q_d^* \), as a function of the state \( \theta \). The worker utility is \( u(q_d^*; \theta) \), i.e. their value of the default across states. The firm’s profit is their value of the default plus the bargaining surplus. In this case the observed inequity is minimized across states.

To see more clearly how inequity is affected by the default, the middle and right graphs in Figure 3 show how decreasing \( q_d \) above or below the optimal level exacerbate inequity. In particular, a lower default quality level \( q_d < q_d^* \) exacerbates inequity in the high states while mitigating it in the low states (middle). A higher default quality level \( q_d > q_d^* \) exacerbates inequity in low states while mitigating it in the high states (right).

### 5.2.1 Minimums mitigate externalities and influence the default

So far we have focused exclusively on the optimal default \((q_d^*, c_d^*)\), since under Assumption 2 the delegation set does not constrain the agents. How does the optimal default change

\(^{15}\)This occurs when \( \beta \) and \( \gamma \) are both small.
as the regulator constrains the delegation set $Q$, i.e. as the regulator raises the minimum ($q$) or lowers the maximum ($\overline{q}$)?

Recall from the results in section 4 that the main reason the regulator constrains the delegation interval is to internalize externalities. In this example, since there is a positive externality associated with increased benefits, the regulator imposes a minimum quality level when the value of the externality is large. This, in turn, influences the optimal default. When Assumption 2 does not hold, the optimal default quality is a function of the minimum and maximum:

$$q^*_{d} = \frac{1 + 2\overline{q} - 8(1 - \overline{q})\overline{q}^3 + 8(1 - q)q^3}{4}.$$  (16)

The optimal default is increasing in the minimum $q$ and decreasing in the maximum $\overline{q}$. This is because raising the minimum reduces the extent to which an increase in the default leads to higher inequity in the low states.

**Result 2** The default quality level $q^*_{d}$ is increasing in the minimum quality level $q$ and decreasing in the maximum quality level $\overline{q}$.

**Discussion of Results 1 and 2.** The first two results help us understand how regulators with preferences over efficiency, equity and externalities choose regulatory policies when one party has all the bargaining power.

In the context of regulating the platform worker contracts in the U.S., the assumption that firms have all the bargaining power is a natural one in light of the fact that workers are not protected under collective bargaining laws. Result 1 suggests that an equity-concerned regulator would set a default level of benefits $q_d$ and default wages $c_d$ to be closer to the worker’s optimum than to the firm’s optimum.

As we’ve discussed, regulators may not be able to influence the default directly. Unlike in standard incomplete contracting environments, the default in an employment contract is a worker’s outside option—this default will be influenced by labor laws but also by industry characteristics that may be outside the regulator’s control. However, the default is likely to be an increasing function of the minimum level of benefits $q$. This implies
that a regulator attempting to internalize externalities and increase the default quality level can do so by raising $q$. Furthermore, Result 2 suggests that these measures are not opposed but rather reinforcing. Raising the minimum benefit level would further raise the optimal default. Together, these results suggest that raising the enforced minimum benefits provision in platform work could serve two purposes: it helps the regulator internalize externalities (shifting social insurance costs onto the firm) while also helping the regulator achieve equity goals (by shifting the default upward).

In the U.S., platform workers were initially classified as contractors and not employees. As contractors, the default favors the firm as there are no enforced minimums: firms are neither expected nor required to provide benefits. This fact suggests that initially, regulators may not have been concerned about the inequities and externalities that may result from the contract. To summarize:

- Result 1 predicts that equity-concerned regulators set the default level of benefits provision and pay to be closer to the worker’s desired level than the firm’s desired level.
- If the regulator cannot influence the default directly, it can increase the minimum benefits level. In such a case, the minimum serves to both internalize externalities and equalize surplus between the parties.

5.2.2 How changes in the social welfare function affect default delegation

Results 1 and 2 give insight into how the optimal default $(q_d^*, c_d^*)$ is set when the firm has all the bargaining power. These results help us explain how a regulator with equity and externality concerns maximizes social welfare. We next look at how the expected welfare-maximizing default delegation policy changes with the parameters in the regulator’s social welfare function.

Governments’ preferences over equity and externalities are not fixed. The social cost of inequities between different parties, captured by $\beta$, changes over time as social preferences shift and as different political parties transition into and out of power. Externalities from a particular kind of contract also change as the composition of people and firms entering that contract shift over time. Our analysis of optimal default delegation helps us understand how regulatory policy reacts to such shifts.

We first consider how the optimal default delegation policy changes with the size of the inequity penalty $\beta$. We continue to assume that types are uniform (Assumption 1 holds). Panel (a) of Figure 4 plots the optimal default delegation policy $(Q^*, d^*)$ as a function of the inequity penalty parameter $(\beta)$, assuming there are no externality concerns $(\gamma = 0)$ to isolate the effect of $\beta$. When $\gamma = 0$, the optimal delegation interval $Q^* = [q^*, \bar{q}^*]$ simply trades off losses in efficiency for gains in equity. Figure 4 panel (a) shows that at low levels of $\beta$ ((precisely: $\beta \in (0, 2)$), the efficiency concerns dominate equity concerns, and
the regulator does not constrain the interval \([q, q]\). Note that on this interval \(\beta \in (0, 2)\) the optimal default \(q_d\) is constant at the value in (15) because Assumption 2 holds, and as soon as \(\beta\) is strictly positive, the regulator’s first-best has an equal distribution of surplus. We call the point beyond which equity concerns dominate efficiency concerns (\(\beta = 2\) in this example) the equity-efficiency threshold.

When \(\beta\) passes the equity-efficiency threshold, further increases in \(\beta\) shrink the optimal delegation interval: the maximum \(\bar{q}^*\) decreases and the minimum \(\underline{q}^*\) increases. This is because the bargaining is unequal (\(\delta = 0\)), so if inequity is very costly to the regulator, it wants to limit the degree to which parties can bargain. It is somewhat counterintuitive that the regulator would want to decrease the maximum since higher benefits \(q\) make the worker better off. Recall that all of the gains from bargaining are accrued by the firm, leading to high levels of inequity as we have defined it. Eventually, the maximum converges to the default and further improvements in equity are obtained by increasing \(\bar{q}^*, q_d^*\) and \(\underline{q}^*\).

\[\begin{align*}
\text{(a)} & \quad \delta = 0, \gamma = 0 \\
\text{(b)} & \quad \delta = 0, \beta = 0
\end{align*}\]

Figure 4: As Externality (\(\gamma\), left) and Equity (\(\beta\), right) Concerns Increase, the Optimal Delegation Interval Constrains and the Default Quality Responds

Result 3

When the firm has full bargaining power (\(\delta = 0\)), as equity (\(\beta\)) concerns increase,

(i) up to the equity-efficiency threshold, the optimal delegation interval \([\underline{q}^*, \bar{q}^*]\) and default quality \(q_d^*\) are constant, and

(ii) beyond the equity-efficiency threshold, \([\underline{q}^*, \bar{q}^*]\) shrinks to reduce the unequal gains from bargaining. The default quality \(q_d^*\) responds following Result 2, and the default transfer \(c_d^*\) compensates this adjustment.

\[\text{(16)}\]This is one of main differences between the first-best and second-best analysis: in the first-best analysis, Proposition 2 shows that the regulator cannot do better from an equity perspective by constraining the set of enforced contracts. However, as most cases of interest will feature levels of \(\beta\) that are below the equity-efficiency threshold, the intuition that the regulator constrains the interval mainly to curb externalities holds.
Panel (b) in Figure 4 shows how changes in $\gamma$ affect the optimal default delegation policy assuming (to isolate the effect of $\gamma$) that there are no equity concerns ($\beta = 0$). As the externality term $\gamma$ increases, the minimum $q$ increases. This straightforwardly highlights the primary rationale for limiting the interval of enforced contracts as introduced in Proposition 4: restricting the interval of enforced contracts mitigates externalities. The default quality level $q^*_d$ is also increasing in $\gamma$ through $q^*$ (this is solely through the channel presented in Result 2, which tells us that $q^*_d$ is increasing in $q^*$).

**Result 4** When the firm has full bargaining power ($\delta = 0$), as externality concerns ($\gamma$) increase, the optimal default-delegation policy restricts the delegation interval $[q^*, \overline{q}^*]$ in the direction which internalizes the externality. The default quality $q^*_d$ responds to the change in $q^*$ or $\overline{q}^*$ following Result 2, and the default transfer $c^*_d$ compensates this adjustment.

**Discussion of Results 3 and 4** Results 1 and 2 suggest that regulators set defaults and minimums to favor workers in the presence of externality and equity concerns. The fact that initially platform workers were classified as contractors in the U.S. is out of step with this prediction, and suggests that regulators may not have been concerned about externalities and inequities resulting from platform labor contracts, at least initially. The results of this subsection help us understand one reason why discussions about the classification of platform workers (which affects both enforced minimums and the default contract) are now widespread in the U.S. and other markets: the social welfare function may have shifted.

Result 3 shows that when the inequity penalty is below the equity-efficiency threshold, increases in the inequity penalty parameter do not affect the optimal default-delegation policy. Beyond the equity-efficiency threshold, Result 3 part (ii) shows that increases in the inequity penalty $\beta$ begin to constrain the delegation interval to avoid unequal bargaining. There is no reason to believe that the extreme case described in part (ii) is relevant to the regulation of platform work in the U.S.: when $\beta$ is beyond the equity-efficiency threshold, the regulator is willing to burn surplus in order to improve equity outcomes. Rather it is more likely that a shift has occurred in the externalities or (regulator perceptions of) average preferences of workers, which we discuss below.

The externalities from gig work contracts may also be shifting. Evidence suggests that as platform work has gained popularity, the share of platform workers who treat platform work as a full time job has increased. This suggests that more gig workers do not have benefits provided by another employer, and so may rely on public benefits (ADP Research Institute (2020)). In our model, this suggests an increase in the externality term $\gamma$. Result 4 predicts that when this term increases, the optimal minimum increases. This prediction thus explains one reason for passing a bill such as AB5. To summarize:
• Result 3 part (i) suggests that when regulators have non-zero equity concerns, small changes in the inequity penalty would not affect the regulatory approach to platform work.

• Result 4 suggests that as externalities from platform work contracts increase, regulators increase enforced minimums of benefits provision \( q^* \).

5.3 Equal bargaining

We next turn to the special case in which the worker and the firm have equal bargaining power, i.e. \( \delta = \frac{1}{2} \). This is a special case in which the allocation of bargaining power is aligned with the regulator’s equity objective (to split the surplus equally). More generally, we say that bargaining power is aligned with social welfare when the regulator prefers to give the worker some \( \alpha \in (0, 1) \) share of the surplus, and the worker’s bargaining power is \( \delta = \alpha \). In such cases, bargaining does not have the potential to exacerbate inequity.

5.3.1 Default delegation simplifies under aligned bargaining

As a result of the alignment of bargaining power and social objectives, the optimal default-delegation policy dramatically simplifies. The default \((q_d^*, c_d^*)\) plays a single role: it addresses the expected inequity between the parties. The delegation interval also plays a single role: it mitigates the externalities. We characterize the optimal default delegation policy in Proposition 7.

**Proposition 7** Suppose the regulator’s social welfare function is

\[
U_w + U_f - \beta(\alpha U_f - (1 - \alpha)U_w)^2 + \gamma Ur(q)
\]

where \( \alpha \) represents the worker share of total surplus that is socially optimal. If \( \delta = \alpha \) then

(i) \( q^* \) and \( \overline{q}^* \) do not depend on \( q_d^* \) or \( c_d^* \), and

(ii) \( q_d^* \) and \( c_d^* \) do not depend on \( \gamma, \beta, q^* \) or \( \overline{q}^* \).

To illustrate this case more fully, we return to our example and solve for the optimal default-delegation policy under the uniform assumption (Assumption 1). The optimal default-delegation policy is given by

\[
q_d^* = \frac{1}{2}, \quad c_d^* = \frac{R - w}{2} - \frac{1}{12}, \quad q^* = \overline{q}^* = \frac{\gamma}{2}.
\]

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The default quality $q^*_d$ is equal to the worker’s ex-ante expected optimal quality level,

$$\mu_\theta \equiv \int_\theta \theta dG(\theta).$$

In this case, it is efficient for the regulator to “pay” the workers in kind by setting the default quality level $q^*_d$ to their expected optimal $\mu_\theta$. The default transfer $c^*_d$ instead favors the firm. This arrangement is optimal in this case because the workers have state-dependent preferences whereas the firm does not. The regulator minimizes the expected losses due to sub-optimal quality for the worker and equalizes the surplus through transfers to the firm. The minimum $q^*$ is strictly a function of the externality term. Its slope is determined by equating the loss of efficiency to the gains coming from mitigating the externality.

**Discussion of Proposition 7.** When the allocation of bargaining power is aligned with the regulator’s desired distribution of surplus, the optimal default-delegation policy is simpler. This result helps us understand two aspects of the regulation of platform work.

First, recall that what is special about this case is *not* that the bargaining parameter takes on a particular value, but that the bargaining parameter is aligned with the regulator’s equity objective. The key insight Proposition 7 raises in the context of platform work is that when bargaining is aligned and the regulator can set an optimal default, the rationale for increasing minimum benefits provision in platform employment contracts is purely based in mitigating externalities. Comparing this result to Result 2 shows that as soon as the bargaining parameters are misaligned with social objectives, there is an additional, equity-based rationale for increasing minimums (when $\delta < \alpha$).

Second, the result on aligned bargaining raises a provocative question: what if the regulator could also choose the bargaining parameter? The comparison of these two cases show that the regulator would have significant incentive to adjust the bargaining parameter such that it is aligned with the regulator’s objective. To summarize:

- Proposition 7 shows that when bargaining power is aligned with equity objectives ($\delta = \alpha$), the regulator sets minimums only to mitigate externalities.

- Proposition 7 is an analogue of the “countervailing power” argument (Galbraith, 1952): it suggests that the regulator’s role is much more straightforward when there are institutions such as labor unions that align the share of bargaining power with social objectives.

- Proposition 7 may explain why some advocacy groups (who are not lawmakers and so cannot directly set the minimums) are seeking alternative means of build-
ing worker power given that workers are not currently protected under collective bargaining laws.\footnote{See, for example, \url{https://www.vox.com/2019/5/8/18535367/uber-drivers-strike-2019-cities}}

5.3.2 How changes in the regulator’s prior affect default delegation

We next take advantage of the simplicity of the aligned bargaining case to study how shifts in the regulator’s prior influence the optimal default-delegation policy. In particular, we compare the optimal default-delegation policy in (18) under the uniform distribution (Assumption 1) to a distribution with higher density in higher states.

Assumption 3 Types $\theta$ are drawn from the distribution $G(\theta) = \theta^2$.

Under Assumption 3, the optimal default-delegation policy is given by

$$q_d^* = \frac{3}{5}, \quad c_d^* = \frac{R - w}{2} - \frac{3}{20}, \quad q^* = \frac{3\gamma}{4}. \quad (19)$$

Comparing (18) and (19) is instructive. As the cumulative distribution function of $\theta$ shifts towards higher states, the default quality $q_d^*$ increases. However, the default quality level does not increase one for one with the expected state $\mu_\theta$. In the uniform case, (18) shows that $q_d^* = \mu_\theta = \frac{1}{2}$. With $G(\theta) = \theta^2$, (19) shows that $q_d^* = \frac{3}{5}$ whereas $\mu_\theta = \frac{2}{3}$. In the quadratic case, $\mu_\theta > q_d^*$ because the cost of raising the default quality $q_d^*$ is relatively high in the low states. Even so, the higher default quality level $q_d^*$ imposes a greater cost on the firm, which must be offset through the default transfer $c_d^*$: the transfer from the worker to the firm grows from $\frac{1}{12}$ in the uniform case to $\frac{3}{20}$ in the quadratic case.

Meanwhile, the minimum $q^*$ in the quadratic case is steeper in $\gamma$ than in the uniform case. This is because the efficiency cost of raising the minimum is reduced due to the lower density in the low states.

Result 5 Let $G'(\theta)$ be a distribution that first-order stochastically dominates $G(\theta)$. The optimal default quality level $q_d^*$ and the optimal minimum quality level $q^*$ are higher under $G'(\theta)$ than under $G(\theta)$, and the optimal default transfer $c_d^*$ is lower.

Discussion of Result 5. When the regulator’s prior about worker types shifts upward, both the optimal default and minimum benefits level shift upward as well. In the case of platform work, the unknown state of the world is how workers value benefits relative to additional income. This effect suggests another explanation for why regulators may attempt to reclassify platform workers.
• Result 5 suggests that if more workers come to value benefits more highly (or if the regulator believes this to be the case) then the regulator would optimally increase the minimum level of benefits and increase the default.

• The effect of an upward-shifted prior, described in Result 5, has a similar result to a shift in the externality parameter, described in Result 4. The two hypothesized shifts are related: as more platform workers value benefits more highly, this is likely to come along with fewer platform workers getting benefits from other sources (and thus higher externalities). In both cases, the regulator would like to raise the minimum (and the default). In the case of Result 5, this effect occurs because more workers valuing benefits more highly makes the efficiency-externality trade-off more favorable (higher $q$ is less costly from an efficiency perspective). In the case of Result 4, this effect occurs because the value of mitigating the externality is simply “worth more” to the regulator, in terms of efficiency.

5.4 Worker control

Finally, we consider the case in which workers have all of the bargaining power ($\delta = 1$). Although this case does not align with the facts about platform work in any context we know of, it is a theoretically valuable case. In particular, it highlights the role that state-dependent preferences are playing in the preceding analysis.

Proposition 8 Assume that only one agent $i$ has state-dependent preferences, and that this agent has all of the bargaining power (i.e. $\delta_i = 1$). Then,

(i) the optimal default $q_d^*,c_d^*$ is not uniquely determined, and

(ii) the expected social welfare under the optimal default-delegation policy is strictly lower when $\delta_i = 1$ than when $\delta_i = 0$.

Proposition 8 stems from the fact that the regulator has limited ability to distribute surplus across states when the agent with state-independent preferences has no bargaining power. So, any attempt to improve equity necessitates a greater efficiency trade-off. As a result, the expected welfare from the optimal default delegation policy is lower when the agent with state-independent preferences has no bargaining power.

In the context of regulating new labor contracts, Proposition 8 is somewhat counter-intuitive. It implies that regulatory solutions that place all of the bargaining power on the workers—to the point where workers are making take-it-or-leave-it offers to the firm—are unappealing from the perspective of an equity-concerned regulator who would like to achieve a particular distribution of surplus between the worker and the firm assuming an “equal split” objective. The optimal solution when workers have all the bargaining power
\(\delta = 1\) leads to strictly lower social welfare than the optimal solution when workers have no bargaining power \(\delta = 0\).

Proposition 8 is related to Corollary 2 in section 4, which highlights that the set of implementable outcomes is larger when the party that is less sensitive to the state has more bargaining power. In both cases, the regulator loses some of its ability to influence the state-dependent distribution of surplus when the party with more bargaining power is less sensitive to the state. In other words, when bargaining power shifts away from alignment and toward the agent with more sensitive preferences, the regulator’s trade-off between discretion and control is exacerbated.

6 Conclusion

This paper makes two main contributions. First, we provide mechanism design foundations for the widespread use of default and immutable rules in contract law. Governments primarily use immutable rules to mitigate externalities while they use default rules to affect the distribution of surplus between contracting parties. We argue that the logic behind default and immutable rules applies directly in the case of incomplete contracts but can also be applied more generally to the regulation of bilateral contracts whenever the government’s social welfare function weights efficiency, equity and externalities to some degree. We characterize circumstances under which default delegation achieves first-best in terms of the government’s tradeoffs among efficiency, distributional concerns, and externalities.

Second, we show how the government’s optimal default delegation policy depends on underlying parameters of the contracting environment as well as its social welfare function. We apply our results to the regulation of platform work, a vast and growing labor arrangement in the U.S. and abroad. Our results organize the debate around the classification of app-based platform workers.

Overall, this paper has provided a theoretical lens for the design of bilateral contracting environments and its effects on social welfare. In future theoretical work, we hope to use this framework to directly analyze the tradeoffs in particular organizational contexts in which a principal delegates a decision to bargaining agents. On the empirical side, we hope to use this framework to explain observed heterogeneity in government regulation.

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A Numerical Example: The Uniform Commercial Code and “Reasonable” Defaults

In this section, we discuss the role of default rules in a slight modification to a canonical incomplete contracting problem, which closely follows an example in Easterbrook and Fischel (1982).

A buyer and a seller enter into a delivery contract for a widget. The contract specifies the time to delivery \( q \) as well as the price \( c \). The seller invests a fixed cost of \( k \) to produce the good.

There is some uncertainty about an ex-ante indescribable but ex-post verifiable state of the world \( \omega \in \{\omega_1, \omega_2\} \) which affects the time it takes the seller to deliver the widget. Suppose \( \omega_1 \) is a “bad” verifiable state of the world and \( \omega_2 \) is a “good” verifiable state of the world. For instance, a buyer and seller contracting in early 2021 may not have been able to foresee, and therefore contract on, a “bad” event \( \omega_1 \) in which a 1300-ft container ship blocks the Suez Canal for six days.

Furthermore, we assume that there is an unverifiable component of the state of the world which affects the benefits from trade, represented by \( \theta \in \{\theta_1, \theta_2\} \). The timing is as follows:

- At \( t_0 \), the buyer and seller sign an initial contract \((q, c)\).
- At \( t_1 \), the seller invests \( k \).
- At \( t_2 \), \( \omega \) (ex-ante indescribable but ex-post verifiable) is revealed, \( \theta \) (observable but unverifiable) is revealed.
- At \( t_3 \), the buyer and seller renegotiate to \( h((q, c), k, \omega, \theta) \) where \( h \) is an arbitrary efficient bargaining function.

Contractual possibilities are limited by the fact that the buyer and seller cannot contract on \( \omega \) or \( \theta \) at \( t_0 \), and that, although they can renegotiate at \( t_3 \), they cannot enter the relationship at \( t_3 \) (because the seller must make a relationship-specific investment before \( \omega \) and \( \theta \) are realized). As in Aghion et al. (1994) the buyer and seller could agree to an initial contract \((q_0, c_0)\) from which they can negotiate once \( \omega \) and \( \theta \) are revealed. This sequence is shown in Figure 5a.

The Uniform Commercial Code’s default rules governing delivery times offer the buyer and the seller another option. The UCC states that “time for shipment or delivery... if not provided in this article or agreed upon shall be a reasonable time.” If the buyer and seller choose not to specify a delivery time at \( t_0 \), they know that the default rule—will fill in the gap with a “reasonable” delivery time. Crucially, when the gap is filled in, at \( t_2 \), the regulator will use all verifiable information that is available at that time, including the realization of \( \omega \). So the contract that the parties implicitly sign when they leave out a delivery time is a contract with the default delivery time, which is function of \( \omega \). This
To understand the benefits of the U.C.C.’s default we look at a simple numerical example. We focus on the “bad” state of the world where $\omega = \omega_1$, and consider buyer and seller payoffs in $t_3$ when the initial contract is fully determined and when it is left open.

The buyer and seller’s final $t_3$ payoffs have three components: 1) the payoff they would have gotten under the default contract, 2) the total surplus generated after efficient renegotiation, and 3) their investment costs. Consider the valuations for the buyer and seller under state $\theta_1$ to be given by $V_0(\theta_1) = (2, -2)$ and $V_0(\theta_2) = (1, -1)$. The total surplus generated in state $\theta_1$ is given by $S(\theta_1) = 4$ and $S(\theta_2) = 6$. Lastly, suppose that the seller has to pay an up front cost of 1 in every state so that the cost to buyer and seller are given by $C = (0, 1)$. Assume that the buyer and the seller have equal bargaining power, so that the gains from renegotiating the default contract will be split evenly.

When the buyer and seller write an explicit delivery contract $(q_0, c_0)$, their payoffs are shown in Figure 6a. In this case, there is a state of the world $(\omega_1, \theta_1)$, where the seller is unable to recoup the cost of their initial investment. This is a typical hold-up problem. The contingency in which the seller fails to recoup costs may jeopardize the entire contract. Even under the ex-ante expected welfare maximizing initial contract $(q_0, c_0)$ the buyer and seller may not agree to the contract.

Compare the case in Figure 6a to the case represented in Figure 6b, in which the buyer...
and seller leave the delivery terms unspecified, so that the U.C.C.’s “reasonable” default will be enforced as a function of the verifiable information, \((q(\omega_1), c(\omega_1))\). When the \(\omega\)-contingent default contract reigns, the reasonable default results in the buyer and seller having valuations \(V_1(\theta_1) = (1, 2)\) and \(V_1(\theta_1) = (0, 1)\). When the default is renegotiated, the buyer and seller’s payoffs are shown in Figure 6b.

Note that the default adjusts when \(\omega\) is realized to ensure that the division of the surplus net of investment costs is evenly distributed in both unverifiable states of the world \(\{\theta_1, \theta_2\}\). This aligns with the “would have wanted” views of the role of the default in legal theory. The buyer and seller have equal bargaining weights and thus, would be expected to write contracts which evenly split the surplus. Furthermore, the “reasonable” default ensures that there are no states where the seller is unable to recoup their costs.

To summarize, in this example any explicit initial contract the parties could agree to \((q_0, c_0)\) would be suboptimal in an ex-ante indescribable but ex-post verifiable \((\omega_1)\) state of the world. The government can play a valuable role in such cases. The government has the power to commit to enforcing a “reasonable” contract after the true state of the world is revealed, to the extent that the state is verifiable. This commitment allows the contracting parties to avoid the disaster case for the seller \((\omega_1, \theta_1)\), which might otherwise jeopardize the contract.

## B Proofs

**Proposition 1.**

See Maskin and Moore (1999), Theorem 2.

**Proposition 2.**

We take as a starting point the reduced form game shown in Table 1 and replicated below:

| \(\hat{\theta}_w = \theta_l\) | \(\hat{\theta}_f = \theta_l\) | \(\hat{\theta}_f = \theta_h\) |
|----------------|----------------|----------------|
| \(q_l, c_l\) | \(q_l, c_l\) | \(q_h, c_h\) |
| \(q_h, c_h\) | \(q_h, c_h\) | \(q_h, c_h\) |

Table 6: Direct mechanism for implementing \((q_\theta, c_\theta)\) in state \(\theta\).

Utilities from strategy \(\theta_h, \theta_l\) will depend on who deviated. Specifically, if \(w\) deviates in state \(\theta_l\), their payoff will be

\[
u_w(q_\theta; \theta_l) + \delta \left( \sum_i u_i(q_l; \theta_l) - \sum_i u_i(q_{\theta l}; \theta_l) \right) + c_{hl}\]
If $f$ deviated in state $\theta_h$, their payoff will be

$$u_f(q_h; \theta_h) + (1 - \delta) \left( \sum_i u_i(q_h, \theta_h) - \sum_i u_i(q_h, \theta_h) \right) - c_{hl}$$

In order for $w$ and $f$ to not deviate in these cases, the following two inequalities must hold:

$$\begin{align*}
(1 - \delta) (u_w(q_h, \theta_l) - u_w(q_l, \theta_l)) - \delta (u_f(hl, \theta_l) - u_f(q_l, \theta_l)) & \leq c_l - c_{hl} \quad (20) \\
\delta (u_f(q_h, \theta_h) - u_f(q, \theta_h)) - (1 - \delta) (u_w(q_h, \theta_h) - u_w(q_h, \theta_h)) & \leq c_{hl} - c_h \quad (21)
\end{align*}$$

Define $c_{hl}$ to be the smallest value of $c_{hl}$ such that (20) holds. That is,

$$c_{hl} = c_l - (1 - \delta) (u_w(q_h, \theta_l) - u_w(q_l, \theta_l)) + \delta (u_f(q_h, \theta_l) - u_f(q_l, \theta_l)).$$

We can then plug this expression into equation (21) to get

$$(1 - \delta)[\Delta(u_w, q_h, \theta_h) - \Delta(u_w, q_h, \theta_l)] - \delta[\Delta(u_f, q_h, \theta_h) - \Delta(u_f, q_h, \theta_l)] \geq c_l - c_h \quad (22)$$

where $\Delta(u, q, \theta) \equiv u(q, \theta) - u(q, \theta)$. We can do a similar calculation for the other off diagonal entry resulting in (5) found in the text. Next note that we can satisfy both (22) as well as the analogous condition for deviating in state $\theta_h$:

$$(1 - \delta)[\Delta(u_w, q_l, \theta_h) - \Delta(u_w, q_l, \theta_l)] - \delta[\Delta(u_f, q_l, \theta_h) - \Delta(u_f, q_l, \theta_l)] \leq c_l - c_h \quad (23)$$

by choosing $q_d = q_{hl} = q_{lh}$. This ensures that both (22) and (23) hold with equality.

Lastly, we want to show that any implementable mechanism can be implemented by default delegation. It is sufficient to show that any mechanism which implements a specific difference in transfer $c_l - c_h$, can be implemented by choosing $q_d = q_{hl} = q_{lh}$. Beginning from Proposition 1, implementability requires finding $q_{lh}$ and $q_{hl}$ which satisfy equations (22) and (23). If $u_w$ and $u_f$ are smooth, then it must be the case that if there exist $q_{lh}$ and $q_{hl}$ which satisfy equations (22) and (23), then there must exist $q \in [q_{lh}, q_{hl}]$, which satisfy them with equality. This is the default in the optimal default delegation mechanism.

**Corollary 1.**

We have shown that when $u_w$ and $u_f$ are continuous, if the first best is implementable, then there exists $q_d$ such that
\[(1 - \delta)[(u_w(q_h, \theta_h) - u_w(q_d, \theta_h)) - (u_w(q_l, \theta_l) - u_w(q_d, \theta_l))] - \delta[(u_f(q_h, \theta_h) - u_f(q_d, \theta_h)) - (u_f(q_l, \theta_l) - u_f(q_d, \theta_l))] = c_l - c_h\] (24)

where we’ve expanded terms in equation (6). We begin the proof by assuming that the condition from the corollary is met such that

\[\left| (1 - \delta) \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} - \delta \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} \right| > x\]

where \(x \in \mathbb{R}_+\). Furthermore, we will prove this for the specific case where

\[\left| (1 - \delta) \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} - \delta \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} \right| > x\]

noting that the symmetric argument will hold in the opposite case. We can rewrite equation (24), above as

\[(1 - \delta) \int_{\theta_l}^{\theta_h} \int_{q_d}^{q_h} \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} dqd\theta - \delta \int_{\theta_l}^{\theta_h} \int_{q_d}^{q_h} \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} dqd\theta + (1 - \delta)(u_w(q_h, \theta_l) - u_w(q_l, \theta_l)) - \delta(u_f(q_h, \theta_l) - u_f(q_l, \theta_l)) = c_l - c_h\]

where we have used the fundamental theorem of calculus to substitute

\[\int_{\theta_l}^{\theta_h} \int_{q_d}^{q_h} \frac{\partial^2 u_i(q, \theta)}{\partial q \partial \theta} dqd\theta = u_i(q_h, \theta_h) - u_i(q_d, \theta_h) - (u_i(q_h, \theta_l) - u_i(q_d, \theta_l)).\]

Define \((1 - \delta)(u_w(q_h, \theta_l) - u_w(q_l, \theta_l)) - \delta(u_f(q_h, \theta_l) - u_f(q_l, \theta_l)) = \kappa, \text{ with } \kappa \in \mathbb{N}_+.\) An outcome is implementable if there exists \(q_d\) which satisfies

\[(1 - \delta) \int_{\theta_l}^{\theta_h} \int_{q_d}^{q_h} \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} dqd\theta - \delta \int_{\theta_l}^{\theta_h} \int_{q_d}^{q_h} \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} dqd\theta = c_l - c_h - \kappa\] (26)

Now using our assumption (25) we know that

\[(1 - \delta) \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} - \delta \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} dqd\theta > x\]

This means that beginning from \(q_d = q_h\) and decreasing the default we can achieve any
positive value of $c_l - c_h - \kappa$. By increasing the default we can achieve any negative value of $c_l - c_h - \kappa$. Thus, we have proven that when equation 25 holds and $\gamma = 0$ such that the first best aligns with the agent negotiated outcome, the first best is implementable. The same argument holds changing the inequality in equation 25.

**Corollary 2.**

The result stems directly from the proof for Corollary 1. Note that as long as the condition in corollary 1 is met such that

$$ \frac{\partial^2 U_w}{\partial q \partial \theta} = b > 0 \quad \text{and} \quad \frac{\partial^2 U_f}{\partial q \partial \theta} = -a < 0 $$

with $b > a$, then decreasing $\delta$ will increase

$$ (1 - \delta) \frac{\partial^2 u_w(q, \theta)}{\partial q \partial \theta} - \delta \frac{\partial^2 u_f(q, \theta)}{\partial q \partial \theta} dq d\theta $$

That for a given $q_d$, the left hand side of Equation 26 is decreasing in $\delta$. This proves the result as the left hand side of Equation 26 is also strictly increasing in $q_d$. Therefore, a given transfer can be implemented with a lower level of $q_d$ if $\delta$ is also lower.

**Proposition 4**

We continue to assume that agents Nash bargain and therefore the agents choose $(q_\theta, c_\theta)$ satisfying:

$$ \max_{q_\theta \in Q, c_\theta \in \mathbb{R}^+} (U_w(q_\theta, c_\theta; \theta) - U_w(d; \theta))^{\delta} (U_f(q_\theta, c_\theta; \theta) - U_f(d; \theta))^{1-\delta} $$

Note that because the transfers are unrestricted, bargaining will be constrained efficient. The agents will choose $q_\theta$ to maximize total surplus and then choose the transfers in order to satisfy (27).

Another way to see this is through a contradiction. Assume that agents have chosen $q_{\theta'}$ in state $\theta$. This implies:

$$ (U_w(q_{\theta'}, c_{\theta'}; \theta) - U_w(d; \theta))^{\delta} (U_f(q_{\theta'}, c_{\theta'}; \theta) - U_f(d; \theta))^{1-\delta} $$

$$ > (U_w(q_\theta, c_\theta; \theta) - U_w(d; \theta))^{\delta} (U_f(q_\theta, c_\theta; \theta) - U_f(d; \theta))^{1-\delta} \quad ((*)$$

Next, posit that

$$ u_w(q_\theta, \theta) + u_f(q_\theta, \theta) > u_w(q_{\theta'}, \theta) + u_f(q_{\theta'}, \theta), \quad (28) $$

i.e. the agents’ joint surplus from $q_\theta$ in state $\theta$ is higher than their joint surplus from $q_{\theta'}$.
in state $\theta$.

We can show that if (28) holds, then $q_{\theta'}$ cannot satisfy (*) and therefore would not satisfy equation (27). To see this, note that if (28) holds then there must be a transfer $c_{\theta}$, which satisfies

$$U_f(q_{\theta}, c_{\theta}; \theta) - U_f(d; \theta) \geq U_f(q_{\theta'}, c_{\theta'}; \theta) - U_f(d; \theta)$$

and

$$U_w(q_{\theta}, c_{\theta}; \theta) - U_w(d; \theta) \geq U_w(q_{\theta'}, c_{\theta'}; \theta) - U_w(d; \theta).$$

Furthermore, one of the two inequalities must be strict, and so we have a contradiction to (*) and therefore (27). The agents would not choose $q_{\theta'}$ in state $\theta$ as long as (28) holds.

Note that this is simply an outcome of bargaining being constrained efficient. It is also useful to note that because in this case we have $\beta = 0$ the default does not play a role in achieving the first best as the regulator is unconcerned about the resulting transfers.

**Corollary 3**

This corollary follows directly from corollary 1. Because any set of transfers is implementable with the condition in corollary 1, then there exists a default which can replicated the desired transfers without having to restrict the set of enforceable contracts.

**Proposition 5**

From the proof of Proposition 5, the agents will only choose the corresponding quality if the corresponding conditions are satisfied. Note that if this is the case then we transpose into the identical situation as Proposition 2. Therefore, the same argument applies.

**Proposition 6**

This a multi-state extension of Proposition 5 and the proof follows directly.

**Corollary 4**

This corollary is proven in the text.

**Proposition 7**

This proposition is derived in Appendix Section E 5.2.

**Proposition 8**

This proposition is derived in Appendix Section E 5.3.
C Max-Min Social Welfare Functions

We show that when a regulator has a maxmin objective function, the results characterizing first-best implementability with default delegation apply when there are more than two states.

A max-min objective function takes the form

$$\max_{Q,d} \min_{\theta} E[\text{SWF}(q^*, c^*; \theta)]$$

subject to incentive constraints. We say a SWF is max-min implementable if the first-best outcome corresponding to the worst-case state can be implemented in Nash equilibrium and any refinement.

Suppose $\theta_k$ is the state that delivers the worst welfare for the principal, i.e.

$$\theta_k \in \arg \min_{\theta} \text{SWF}(q, c; \theta).$$

Then, the principal can partition the state space $\Theta$ into cells $\{\theta_1, \theta_2, \ldots, \theta_k\}$. The states that are not $\theta_k$ can be treated as one, and the principal can offer a delegation set $\{(q_{-k}, c_{-k}), (q_k, c_k)\}$ and a use a default that satisfies $\mathfrak{D}$. Although social welfare will not be “first-best” in all states that are not $k$, it can be first best in state $k$.

Consider the following example:

**Example 5** Consider the following specification of preferences:

- $u_w(q, \theta) = -(q - \theta)^2$ (worker’s bliss point $q = \theta$),
- $u_f(q) = -q^2$ (firm’s bliss point $q = 0$), and
- $\Theta = \{\theta_l, \theta_m, \theta_h\} = \{0, \frac{1}{2}, 1\}$.

With these preferences, the regulator’s welfare is minimized in the high state $\theta_h$. So, a max-min regulator cares only about maximizing welfare in state $\theta_h$. In such a case, the regulator can design the direct mechanism in Table 7. The first-best outcome in the high state is $(q_h, c_h) = (\frac{5}{2}, \frac{1}{3})$.

| $\hat{\theta}_w \in \{\theta_l, \theta_m\}$ | $\hat{\theta}_f \in \{\theta_l, \theta_m\}$ | $\hat{\theta}_f = \theta_h$ |
|---------------------------------|---------------------------------|------------------|
| $(q_{-h}, c_{-h})$ | $(q_d, c_d)$ | $(q_h, c_h)$ |
| $\hat{\theta}_w = \theta_h$ | $(q_d, c_d)$ | $(q_h, c_h)$ |

Table 7: Default delegation with max-min regulator (\(|\Theta| = 3\)).

The conditions for implementation of $(q_{-h}, c_{-h})$ in states $\theta_l$ and $\theta_m$ and $(q_h, c_h)$ in
state $\theta_h$ are

$$(1-\delta)[\Delta(u_w, q_h, q_d, \theta_h) - \Delta(u_w, q_{-h}, q_d, \theta_{-h})] - \delta[\Delta(u_f, q_h, q_d, \theta_h) - \Delta(u_f, q_{-h}, q_d, \theta_{-h})] \geq c_{-h} - c_h$$

and

$$(1-\delta)[\Delta(u_w, q_h, q_d, \theta_h) - \Delta(u_w, q_{-h}, q_d, \theta_{-h})] - \delta[\Delta(u_f, q_h, q_d, \theta_h) - \Delta(u_f, q_{-h}, q_d, \theta_{-h})] \leq c_{-h} - c_h$$

for $\theta_{-h} \in \{\theta_l, \theta_m\}$. The regulator here has many degrees of freedom to choose $(q_{-h}, c_{-h})$ and $(q_d, c_d)$ so that the constraints above are both satisfied with equality for $\theta_{-h} \in \{\theta_l, \theta_m\}$, i.e.

$$(1-\delta)[\Delta(u_w, q_h, q_d, \theta_h) - \Delta(u_w, q_{-h}, q_d, \theta_{-h})] - \delta[\Delta(u_f, q_h, q_d, \theta_h) - \Delta(u_f, q_{-h}, q_d, \theta_{-h})] = c_{-h} - c_h.$$  

This example shows that even with $|\Theta| > 2$, the two state case offers valuable insight. For instance, when a regulator has max-min preferences, the results from the two state case (under some further conditions) show us that the regulator can implement the first best in the worst-case state.

More generally, we can learn from the two state cases in order to understand the relative importance of particular states. Note that in the case where the regulator only has concerns about efficiency and equity, the optimal transfers lead to equal surplus in a particular state. Thus, the deviation from optimal can be measured by the difference between the optimal transfer and the transfer induced by a particular default. Thus, we can imagine solving for $q_d, c_d$ by using Equation 12 and then plugging in that value into equation Equation 13 in order to solve for the transfer outcome $\tilde{c}_2$ where the tilde denotes that it is not necessarily optimal. You could similarly perform this exercise to extract $\tilde{c}_1$. The losses from optimizing across states 1 and 3 would be smaller than the losses from optimizing across 2 and 3 if $|\tilde{c}_2 - c_2| < |\tilde{c}_1 - c_1|$.

D Extensions

D.1 Inequity penalty in SWF.

Our model assumes that the social welfare function the regulator wants to maximize takes on a particular functional form. The efficiency and externality terms in the social welfare function are standard—efficiency is total surplus between the worker and the firm ($U_w + U_f$) and the externality is captured by $\gamma U_r$, where $U_r$ is some well-behaved function. The equity term, on the other hand, is less standard. We model the regulator’s preference for equality as a quadratic penalty $-\beta(U_w - U_f)^2$, which may appear extreme
in its implications. In particular, it suggests that for any positive $\beta$, the first-best contract results in a perfectly equal distribution of the surplus in all states of the world.

Although this assumption may not always align with how regulators and lawmakers think about equity in practice, there are two key reasons why it is a useful assumption for understanding the theoretical limits faced by the regulator.

First, the equality quadratic penalty term is really a stand-in for a broader class of weighted quadratic penalty terms: it captures the idea that in the first-best contract, the regulator wants a particular distribution of the surplus. The fact that the regulator wants an equal distribution of the surplus is besides the point—the analysis would be largely unchanged if the SWF featured a weighted penalty term with

$$-\beta(\alpha U_w - (1 - \alpha)U_f)^2$$

for $\alpha \in (0, 1)$. For example, with $\alpha = .75$, the first-best would always feature a 75-25 split of the surplus.

Second, our focus on a particular distribution of surplus is the most restrictive assumption we could make about the regulator’s equality preferences. In practice, lawmakers tolerate inequality up to point. So the first-best distributions of surplus often are not a single division, but instead feature a range of possible ways of dividing the surplus. For example, a lawmaker may only think inequality is objectionable if the worker’s utility is less than (greater than) some fraction $\bar{k}$ ($\underline{k}$) of the firm’s utility. That is, the regulator’s inequity penalty may be

$$\beta(1[U_w/U_f < \bar{k}])$$

which implies that the first-best is a set of contracts, rather than a singleton. Since we are interested here in understanding the limits on implementation, we focus on singleton case which will be the most limited case. If the first-best featured a range of possible distribution splits, first-best would be “easier” to implement. In this sense, our assumption about the quadratic penalty term is a limiting case that offers bounds on implementability of more realistic equity preferences.

### D.2 Exogenous income

The firm and worker may enter the contracting environment with exogenous income. Exogenous income has consequences for the regulator’s distributional preferences, and also may affect limited liability constraints, which we have not discussed. With exogenous income, the worker and firm preferences are given by

**Firm:** $U_f(q, c; \theta) = y_f + u_f(q; \theta) - c$  
**Worker:** $U_w(q, c; \theta) = y_w + u_w(q; \theta) + c$, 

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where $y_i$ represents an exogenous and separable component of preferences for agent $i \in \{w, f\}$. In practice, $y_w$ may represent workers’ wages pinned down by an outside option whereas $y_f$ is the firm’s total revenue net of these wages.

When there is a regulator with preferences over efficiency and equality, these exogenous parameters will simply effect the water-level of the transfers. An increase (decrease) in $y_f$ or a decrease (increase) in $y_w$ will necessitate a higher (lower) transfer in all states. This does not effect the regulator’s ability to implement the first-best however, as the first best only depends on the state-dependence components of outcomes. Thus, we have the following proposition.

**Proposition 9** Assume a regulator is maximizing social welfare which has efficiency, equity and externality components. Any exogenous and separable components of utility which are state-independent and do not depend on quality, only affect the optimal mechanism by adjusting the default transfer. This does not impact implementability.

### E Application Derivations and Discussion

Assume that the firm can provide additional wage in order to compensate for the risk at the job by paying workers $c$.

$$U_w = WS(c, q; \theta) = w - (q - \theta)^2 + c$$
$$U_f = \Pi(c, q) = R - q^2 - c$$

The regulator wants to maximize

$$U_p = WS + \Pi - \beta(WS - \Pi)^2 + \gamma q$$

so that the regulator cares about the firm and worker surplus, the distribution and a term which captures an externality or social value associated with quality.

Summarizing:

- $w$: baseline pay independent of occupational risk
- $\theta$: captures the optimal level of safety for the consumer and affects the tradeoff between additional wages versus higher safety
- $R$: revenue of the firm net of baseline pay to worker
- $c$: compensation tied to safety concerns
- $q$: level of safety measures
- $G(\theta)$: Prior over the state. Throughout we will assume $\theta \sim U(0, 1)$
E.1 Regulator Problem

The regulator can choose a default \((q_d, c_d)\) and cannot prevent renegotiation. However, they can impose a minimum, \(q\) and maximum quality level, \(\overline{q}\). Without any constraints on the quality level we know that the firm and the consumer will negotiate until \(q = \frac{\theta}{2}\). This allows us to divvy up the state space into three intervals. We also know that the transfer will be the outcome of the renegotiation from the default and will be given by

\[
c_{\theta} = c(q_\theta, c_d, q_d; \theta) = c_d + (1 - \delta)(-q_d - \theta)^2 + (q_\theta - \theta)^2) - \delta(-q_d^2 + q_\theta^2)
\]

\[
c_{\theta} = c(q_\theta, c_d, q_d; \theta) = c_d + (1 - \delta)(q_\theta^2 - q_d^2 + 2\theta(q_d - q_\theta)) - \delta(-q_d^2 + q_\theta^2)
\]

\[
c_{\theta} = c(q_\theta, c_d, q_d; \theta) = c_d + (1 - 2\delta)q_\theta^2 - (1 - 2\delta)q_d^2 + 2(1 - \delta)\theta(q_d - q_\theta)
\]

**Binding minimum:** \(\theta < 2q \rightarrow q_\theta = q\)

**Unconstrained Interval:** \(2q < \theta < 2\overline{q} \rightarrow q_\theta = \frac{\theta}{2}\)

**Binding Maximum:** \(\theta > 2\overline{q} \rightarrow q_\theta = \overline{q}\)

E.1.1 Why Interval Delegation?

Alonso and Matouschek (2008) characterizes conditions under which interval delegation is optimal. Their conditions apply in the case of delegation to a single agent, and have to do with the difference between the agent and the principal’s optimal decisions.

A key object in their analysis is the **backward bias**, defined as

\[
T(\theta) = G(\theta)(q_\theta - E[q^*(z)|z \leq \theta])
\]

where \(q^*(z)\) is the regulator’s optimal quality choice conditional on bargaining. They show that if \(T''(\theta) > 0\) in the relevant range of \(\theta\), then the regulator will choose interval delegation.

**Proposition 10** (Alonso and Matouschek (2008), Proposition 2 (i)) Let \(Q^*\) be an optimal delegation set. Then if \(T'(\theta)\) is strictly convex then \(Q^*\) contains either no decision, one decision, or an interval of decisions.

We can apply this result in our example to confirm that the regulator would choose interval delegation. In our example, the backward bias is

\[
T(\theta) = \theta \left( \frac{\theta}{2} - \frac{1}{\theta} \int_0^\theta (q^*(z))dz \right) = \frac{\theta^2}{2} - \int_0^\theta q^*(z)dz
\]

and its second derivative is

\[
T''(\theta) = 1 - \frac{\partial q^*(\theta)}{\partial \theta}.
\]
Next we need to solve for \( q^*(\theta) \), the regulator’s optimal quality outcome conditional on the state. Taking the default as given, \( q^*(\theta) \) is defined by the problem

\[
q^*(\theta) = \arg \max_q \left[ w + R - (q - \theta)^2 - q^2 - \beta(-(q - \theta)^2 + q^2 + 2c)^2 + \gamma q \right].
\] (34)

The term \( c \) in the maximand above is in fact a function of \( q, \delta, \) and \( q_d \). In this set up, we are treating \( \delta \) and \( q_d \) as exogenous, and can rewrite \( c \) explicitly,

\[
c = c_d + (1 - 2\delta)q^2 - (1 - 2\delta)q_d^2 + 2(1 - \delta)\theta(q_d - q).
\]

Now plugging this expression for \( c \) into (34) and taking the first order condition, we get

\[
-4q^*(\theta) + 2\theta + \gamma - 2\beta \left( w - R + 2c_\theta - (q^*(\theta) - \theta)^2 + q^*(\theta)^2 \right) (2\theta + 4 [(1 - 2\delta)q^*(\theta) - \theta(1 - \delta)]) = 0.
\] (35)

To make this expression concrete, consider the simplest case when \( \delta = 0.5 \). In this case the first order condition (35) simplifies to

\[
q^*(\theta) = \frac{2\theta + \gamma}{4}.
\]

That is, the regulator’s optimal \( q \) is the agent-optimal \( q \) shifted by \( \frac{\gamma}{4} \). Substituting \( q^*(\theta) \) into the equation for the second derivative of the backward bias (33) yields

\[
T''(\theta) = \frac{1}{2}.
\]

By proposition 2 in Alonso and Matouschek (2008), the fact that \( T''(\theta) > 0 \) implies that the regulator’s optimal delegation set is either no decision, one decision or an interval.

Next consider the case where \( \delta = 0 \). In this case, the regulator’s first-order condition in (35) simplifies to

\[
-4q^*(\theta) + 2\theta + \gamma - 2\beta \left( w - R + 2c_\theta + 2q^*(\theta)\theta - \theta^2 \right) (4q^*(\theta) - 2\theta) = 0.
\]

Furthermore, note that the default transfer will always cancel the initial inequality such that we can consider \( w = R = 0 \) without loss of generality. Substituting in the transfer we get

\[
-4q^*(\theta) + 2\theta + \gamma - 2\beta \left( 2(c_d + q^*(\theta)^2 - q_d^2 + 2\theta(q_d - q^*(\theta))) + 2q^*(\theta)\theta - \theta^2 \right) (4q^*(\theta) - 2\theta) = 0
\]
Implicitly differentiating yields:

\[-4 \frac{\partial q^*(\theta)}{\partial \theta} + 2 - 2\beta \left( 4 \frac{\partial q^*(\theta)}{\partial \theta} - 2 \right) (2c_\theta + 2q^*(\theta)\theta - \theta^2) \]

\[-2\beta (4q^*(\theta) - 2\theta) \left( 4q^*(\theta) \frac{\partial q^*(\theta)}{\partial \theta} + 2(q_d - q^*(\theta)) - 2\theta \frac{\partial q^*(\theta)}{\partial \theta} \right) \]

Simplifying, yields

\[\frac{\partial q^*(\theta)}{\partial \theta} = \frac{1 + 2\beta (2c_\theta - \theta^2 + 2\theta q_d - 4q^*(\theta)(q_d - q^*(\theta)))}{2 + 4\beta (2c_\theta + 2q^*(\theta)\theta - \theta^2 + (2q^*(\theta) - \theta)^2)} \]

As long as this expression is less than 1, the second derivative of the backward bias in [33] will be positive. We can note a few circumstances under which this expression is less than one. First, when the equity parameter \( \beta \) is small, this expression is less than 1. Note that this also will be the case when the changes in equity are relatively small from figure 3 that the impact on inequity is lower in the middle than at the extremes which will make this condition more likely to hold.

A similar analysis can be undertaken for the case of \( \delta = 1 \).

### E.1.2 Solving the Regulator’s Problem

The regulator problem is then given by

\[
\max_{\{c_d, q_d, q_d^2\}} \int_{\frac{q_d}{2}}^{2q_d} \left( w + R - (\frac{q_d}{2} - \theta)^2 - \frac{q_d^2}{2} - \beta \left( w - R + 2c(q_d, q_d^2, \theta) - (\frac{q_d}{2} - \theta)^2 + \frac{q_d^2}{2} \right) + \gamma q_d \right) dG(\theta) + \\
\int_{\frac{q_d}{2}}^{2q_d} \left( w + R - \theta^2 - \beta \left( w - R + 2c(\theta/2, q_d, \theta) \right)^2 + \frac{\gamma \theta}{2} \right) dG(\theta) + \\
\int_{\frac{\theta - q_d}{2}}^{2(\frac{\theta - q_d}{2})} \left( w + R - (\frac{\theta - q_d}{2} - \frac{\theta^2}{2} - \beta \left( w - R + 2c(\frac{\theta - q_d}{2}, q_d, \theta) - \left( \frac{\theta - q_d}{2} \right)^2 + \frac{\theta^2}{2} \right) + \gamma \frac{\theta - q_d}{2} \right) dG(\theta)
\]

Subject to the constraints:

\[
\begin{align*}
2q_d & \geq \theta \\
2\bar{q} & \leq \theta \\
2q_d & \geq \bar{q} \\
\underline{q} & \leq q_d \leq \bar{q}
\end{align*}
\]

It is useful here to totally differentiate \( c(q_\theta, c_d, q_d; \theta) \)

\[dc_\theta = dc_d + 2 [(2\delta - 1)q_d + \theta (1 - \delta)] dq_d + 2 [(1 - 2\delta)q_\theta - \theta (1 - \delta)] dq_\theta \]
Now we can take first order conditions.

\[
\frac{\partial V}{\partial q} = \int_{\theta}^{2\theta} (-4\theta + 2\theta + \gamma - 2\beta (w - R + 2c_\theta - (q - \theta)^2 + q^2) (2\theta + 4 [(1 - 2\delta)q - \theta(1 - \delta)]) \ dG(\theta)
\]

\[
\frac{\partial V}{\partial \bar{q}} = \int_{2\theta}^{2\overline{\theta}} (-4\overline{\theta} + 2\theta + \gamma - 2\beta (w - R + 2c_\theta - \overline{q} - \theta)^2 + \overline{q}^2) (2\theta + 4 [(1 - 2\delta)\overline{q} - \theta(1 - \delta)]) \ dG(\theta)
\]

\[
\frac{\partial V}{\partial c_d} = 0 = \frac{w - R}{2} + \int_{\theta}^{2\theta} (c_d + (1 - 2\delta)q^2 - (1 - 2\delta)q_d^2 + 2(1 - \delta)\theta(q_d - q) - \frac{\theta^2}{2} + q\theta) \ dG(\theta) + \int_{2\theta}^{2\overline{\theta}} (c_d + (1 - 2\delta)\overline{q}^2 - (1 - 2\delta)q_d^2 + 2(1 - \delta)\theta(q_d - \overline{q}) - \frac{\theta^2}{2} + \overline{q}\theta) \ dG(\theta)
\]

\[
\frac{\partial V}{\partial q_d} = 0 = \int_{\theta}^{2\theta} (w - R + 2c_\theta - (q - \theta)^2 + q^2) [(2\delta - 1)q_d + \theta(1 - \delta)] \ dG(\theta) + \int_{2\theta}^{2\overline{\theta}} (w - R + 2c_\theta) [(2\delta - 1)q_d + \theta(1 - \delta)] \ dG(\theta) + \int_{\theta}^{\overline{\theta}} (w - R + 2c_\theta - (\overline{q} - \theta)^2 + \overline{q}^2) [(2\delta - 1)q_d + \theta(1 - \delta)] \ dG(\theta)
\]

E.2 Equal Bargaining $\delta = .5$

It is useful to start by considering the case where the firm and worker have equal bargaining positions. In this case they will split any surplus generated from renegotiation equally. Importantly, the regulator’s equality term aims to equate worker surplus and firm profits. Thus, the bargaining conditions are aligned with the regulator’s incentives as far as equity is concerned.

We also know that the regulator’s externality term favors high quality. Combined this means that the regulator would never want to implement a maximum quality level. However, it would implement a minimum quality level. When $\delta = .5$ the FOC’s simplify to

\[
\frac{\partial V}{\partial \bar{q}} = \int_{\theta}^{2\overline{\theta}} (-4\overline{\theta} + 2\theta + \gamma) \ dG(\theta)
\]
\[ \frac{\partial V}{\partial q} = \int_{\theta}^{q} (-4\theta + 2\theta + \gamma) dG(\theta) \]

\[ \frac{\partial V}{\partial c_d} = 0 = \frac{w - R}{2} + \int_{\theta}^{q} \left( c_d + \theta q_d - \frac{\theta^2}{2} \right) dG(\theta) \]

\[ \frac{\partial V}{\partial q_d} = 0 = \int_{\theta}^{q} \theta \left( w - R + 2 \left( c_d + \theta \left( q_d - \frac{\theta}{2} \right) \right) \right) dG(\theta) \]

Note that as expected there is no dependence on \( \beta \). We can also solve explicitly the regulator’s problem:

\[ q = \frac{\gamma}{2} \]

\[ q_d = \frac{1}{2} \]

\[ c_d = \frac{R - w}{2} - \mu_\theta q_d + \frac{\mu_\theta^2}{2} \]

Note that the term inside the integral for \( \frac{\partial V}{\partial q} \) is always positive and thus, the maximum is at a corner solution and thus, does not bind. We also see that \( q \) is increasing in \( \gamma \) as that is the only way to ensure a higher quality level when there is renegotiation. Lastly we have that the default transfer with our assumed distribution is \( c_d = \frac{R - w}{2} - \frac{1}{12} \) and \( q_d = \frac{1}{2} \). To interpret this we note that the default transfer’s first job is to equate the initial surplus \( R + w \) between the two parties. Then we see that the quality default is the expected optimal for the worker. Thus, the regulator is paying the worker who has state dependent preferences in terms of the quality whereas the firm is being paid in terms of a negative default transfer beyond the initial redistribution. Interestingly the presence of the minimum does not affect the default quality and transfer. This is because the only role of the defaults are to ensure equality. Since the two parties always equally divide the surplus, the realized outcomes do not affect equality, only the relationship between the default and the state.

It is interesting to consider an alternative distribution. Below are the results when \( g(\theta) = 1 + 2(\theta - .5) \) for \( \theta \in (0, 1) \). With this distribution we will now get a higher minimum quality level and a different default quality and transfer. Specifically,

\[ q = \frac{3\gamma}{4} \]
\[ q_d = \frac{1}{2} \mu_{\theta^2} - \frac{3}{5} \theta \]

Note that the default quality has gone up, the default transfer has gone down and the responsiveness to externalities has gone up. All of these make sense given that the benefit of a high default is higher now that the typical state is higher. Furthermore, we can compare the default quality to the expected worker optimal as before. The expected value of the state is now \( 2/3 \), which means that although the mean value increasing has pushed up the default quality, the skewed distribution has made it so that the default quality is no longer as high as the workers expected optimal.

### E.3 Firm Power \( \delta = 0 \)

The most interesting case and the case that gives us intuition for the realm where we may expect the regulator to be operating is when the firm has all of the bargaining power. From our discussion in implementation theory, we know that this is the state where the regulator is in the best position to implement something approximating first best because the worker is more sensitive to the true state.

Substituting \( \delta = 0 \) into the FOCs yields

\[
\frac{\partial V}{\partial \bar{q}} = \int_{\tilde{\theta}}^{2\bar{q}} (-4\bar{q} + 2\tilde{\theta} + \gamma - 2\beta (w - R + 2c_{\theta} - (\bar{q} - \theta)^2 + \bar{q}^2) (4\bar{q} - 2\tilde{\theta})) \, dG(\theta)
\]

\[
\frac{\partial V}{\partial \bar{q}} = \int_{\tilde{\theta}}^{\bar{q}} (-4\bar{q} + 2\tilde{\theta} + \gamma - 2\beta (w - R + 2c_{\theta} - (\bar{q} - \theta)^2 + \bar{q}^2) (4\bar{q} - 2\tilde{\theta})) \, dG(\theta)
\]

For the solver it is useful to rewrite these equations:

\[
\frac{\partial V}{\partial \bar{q}} = (2\bar{q}) \left( \gamma - 2\bar{q} - 4\beta \bar{q} \left( 2c_{\bar{q}} + \frac{8}{3} q_{d\bar{q}} - 2q_{d^2} + w - R \right) \right) = 0
\]

First thing to note is that for weakly positive \( \bar{q} \) and \( \gamma = 0 \), this equation holds when \( \beta = 2 \). You can also rewrite it defining \( d = 2\bar{q} \).

\[
\frac{\partial V}{\partial \bar{q}} = d \left( \gamma - d - 2\beta d \left( 2c_{\bar{d}} + \frac{4}{3} q_{d\bar{d}} - 2d^2 + w - R \right) \right) = 0
\]
\[
\frac{\partial V}{\partial q} = 0 = (1 - 2\bar{q})(1 + \gamma - 2\bar{q} + \frac{\beta}{3}(1 - 2\bar{q})(-3 + 12c_d + 4(4 - 3q_d)q_d + 4\bar{q}(4q_d - 3) + 6w - 6R))
\]

Similarly, defining \( \bar{d} = 1 - 2\bar{q} \)

\[
\frac{\partial V}{\partial \bar{q}} = 0 = \bar{d} \left( \gamma + \bar{d} + 2\beta\bar{d} \left( 2c_d - \frac{4}{3}q_d\bar{d} - 2q_d^2 + 4q_d - \frac{3}{2} + w - R \right) \right)
\]

We can solve these two explicitly in the case where \( \gamma = 0 \) and \( \bar{d} \) and \( d \) are weakly positive.

\[
d = \frac{3}{4q_d} \left( \frac{-1}{2\beta} - 2c_d + 2q_d^2 + w - R \right)
\]

\[
\bar{d} = \left( \frac{\frac{-1}{2\beta} - 2c_d + 2q_d^2 + w - R + 4q_d - \frac{3}{2}}{4q_d - 1} \right)
\]

We can also substitute in for \( c_d = \frac{R - w}{2} + \frac{3\mu_\theta}{4} + q_d^2 - 2q_d\mu_\theta \).

\[
d = \frac{\frac{-1}{2\beta} - \frac{3\mu_\theta}{2} + 4q_d\mu_\theta}{4q_d - 1}
\]

\[
\bar{d} = \left( \frac{\frac{-1}{2\beta} - \frac{3\mu_\theta}{2} + 4q_d(1 + \mu_\theta) - \frac{3}{2}}{4q_d - 1} \right)
\]

We can then differentiate these with respect to \( q_d \)

\[
d\bar{d} = \frac{16q_d\mu_\theta - \frac{4}{3} \left( \frac{-1}{2\beta} - \frac{3\mu_\theta}{2} + 4q_d\mu_\theta \right)}{(4q_d/3)^2}dq_d
\]

\[
d\bar{d} = \frac{4(q_d + \mu_\theta)(\frac{4}{3}q_d - 1) - \frac{4}{3} \left( \frac{-1}{2\beta} - \frac{3\mu_\theta}{2} + 4q_d(1 + \mu_\theta) - \frac{3}{2} \right)}{(\frac{4}{3}q_d - 1)^2}dq_d
\]

At \( \beta = 2, q_d = 3/8 \). These two equations simplify to

\[
d\bar{d} = 4dq_d
\]

\[
d\bar{d} = -7dq_d
\]
\[ \frac{\partial V}{\partial c_d} = 0 = \frac{w - R}{2} + \int_0^{2\pi} \left( c_d + q^2 - q_d^2 + 2\theta (q_d - \bar{q}) - \frac{\theta^2}{2} + q\theta \right) dG(\theta) + \int_{2\pi}^{4\pi} \left( c_d + \frac{\theta^2}{4} - q_d^2 + 2\theta \left( q_d - \frac{\theta}{2} \right) \right) dG(\theta) + \int_{4\pi}^{6\pi} \left( c_d + q^2 - q_d^2 + 2\theta (q_d - \bar{q}) - \frac{\theta^2}{2} + q\theta \right) dG(\theta) \]

Or

\[ \frac{\partial V}{\partial c_d} = 0 = \frac{w - R}{2} + c_d - \frac{1}{6} \left( 6(1 - q_d)q_d + \bar{q}(-3 + 6\bar{q} - 4q^2) + 4q_d^3 \right) \]

\[ \frac{\partial V}{\partial q_d} = 0 = \int_0^{2\pi} \left( w - R + 2c_d - (q - \theta)^2 + q^2 \right) [-q_d + \theta] dG(\theta) + \int_{2\pi}^{4\pi} \left( w - R + 2c_d \right) [-q_d + \theta] dG(\theta) + \int_{4\pi}^{6\pi} \left( w - R + 2c_d - (\bar{q} - \theta)^2 + \bar{q}^2 \right) [-q_d + \theta] dG(\theta) \]

or

\[ \frac{\partial V}{\partial q_d} = 0 = -3 + \left( c_d + \frac{w - R}{2} \right) \left( 12 - 24q_d \right) - 36q_d^2 + 24q_d^2 - 4q(2 - 3\bar{q} + 2\bar{q}^2) + 8q^4 + 4q_d (5 + \bar{q}(3 - 6\bar{q} + 4\bar{q}^2) - 4q^3) \]

Furthermore, we can substitute in the value for \( q_d \) to get:

\[ q_d = \frac{1 + 2\bar{q} - 8(1 - \bar{q})\bar{q}^3 + 8(1 - q)q^3}{4} \]

\[ 4dq_d = \left( 2 - 8(3 - 4\bar{q})\bar{q}^2 \right) d\bar{q} + 8 \left( 3 - 4q \right) \frac{2}{7} dq \]

As before it is useful to solve these FOCs for when there is neither a minimum nor maximum. For instance, in the limit as \( \gamma \to 0 \) and \( \beta < 2 \). In this case,

\[ c_d = \frac{R - w}{2} + \frac{3\mu_{\theta^2}}{4} + q_d^2 - 2q_d\mu_{\theta} = \frac{R - w}{2} + \frac{1}{64} \]

\[ q_d = \frac{3 \mu_{\theta^1} - \mu_{\theta^2} \mu_{\theta}}{8 \mu_{\theta^2} - \mu_{\theta} \mu_{\theta}} = \frac{3}{8} \]

Note that the default quality is lower when the workers have a worse bargaining
position. This because any renegotiation away from the default will result in higher surplus for the firm relative to the worker. Thus, in order to reduce inequality across states it is useful to reduce the extent of renegotiation and adjust the transfer.

Similarly, we can solve for \( q \) when \( \beta \to 0 \) resulting in \( q = \frac{\gamma}{2} \), which unsurprisingly is the same as in the equal bargaining case. As in either case the minimum is defined by efficiency and externality concerns and are independent of equality.

It is also useful to consider how the minimum adjusts with inequality. In order to gain some intuition consider we can evaluate \( \frac{\partial^2 V}{\partial q \partial \beta} \) at \( \beta = 0 \)

\[
\frac{\partial^2 V}{\partial q \partial \beta}\big|_{\beta=0} = -4q \left( 2c_d + \frac{8}{3}q_d - 2q_d^2 + w - R \right)
\]

We can substitute in the values for \( c_d \) and \( q_d \) to get

\[
\frac{\partial^2 V}{\partial q \partial \beta}\big|_{\beta=0} = -4q \left( \frac{3}{2} - \frac{3}{4} + q \right)
\]

This means that starting from \( q = 0 \), the minimum is increasing in \( \beta \). In general we expect that the interval over which the the firm and worker are able to choose quality is decreasing in concerns over equality. Note that with the firm making take it or leave it offers to the worker,

E.4 Worker Power \( \delta = 1 \)

Another special case is when the workers have all of the bargaining power. The difficulty here from the standpoint of the regulator is that the firm does not have state dependent preferences. This highlights the importance of state dependence as highlighted in the implementation discussion above. Thus, the default which is used to smooth the necessary transfer across states can no longer perform this function. We can see this directly in the first order conditions by plugging in \( \delta = 1 \).

\[
c_\theta = c(q_\theta, c_d, q_d; \theta) = c_d - q_\theta^2 + q_d^2
\]

Note that the transfer does not depend on the state except through the level of quality.

\[
\frac{\partial V}{\partial q} = \int_2^\varphi \left( -4q + 2q_\theta + \gamma - 2\beta \left( w - R + 2c_\theta - (q - \theta)^2 + q^2 \right) \right) dG(\theta)
\]

\[
\frac{\partial V}{\partial \varphi} = \int_{2\varphi}^\varphi \left( -4\varphi + 2q_\theta + \gamma - 2\beta \left( w - R + 2c_\theta - (\varphi - \theta)^2 + \varphi^2 \right) \right) dG(\theta)
\]
\[
\frac{\partial V}{\partial c_d} = 0 = \frac{w - R}{2} + \int_\theta^{2\theta} \left( c_d - \frac{q_d^2}{4} + q_d^2 - \frac{\theta^2}{2} + q\theta \right) dG(\theta) + \\
\int_\theta^{2\theta} \left( c_d - \frac{\theta^2}{4} + q_d^2 \right) dG(\theta) + \\
\int_{2\theta}^{3\theta} \left( c_d - \bar{q}^2 + q_d^2 - \frac{\theta^2}{2} + \bar{q}\theta \right) dG(\theta)
\]

\[
\frac{\partial V}{\partial q_d} = 0 = \int_\theta^{2\theta} (w - R + 2 \left( c_d - \frac{q_d^2}{4} + q_d^2 \right) - \theta^2 + 2q\theta) \left[ -q_d \right] dG(\theta) + \\
\int_\theta^{2\theta} (w - R + 2 \left( c_d - \frac{\theta^2}{4} + q_d^2 \right) \left[ -q_d \right] dG(\theta) + \\
\int_{2\theta}^{3\theta} (w - R + 2 \left( c_d - \bar{q}^2 + q_d^2 \right) - \theta^2 + 2\bar{q}\theta) \left[ -q_d \right] dG(\theta)
\]

Note that because \(q_d\) is just a constant we can eliminate it from the last expression which shows that when the workers have all of the bargaining power, the transfer and quality level are only jointly determined. We can show this by rewriting the last equation

\[
\frac{\partial V}{\partial q_d} = 0 = \frac{w - R}{2} + \int_\theta^{2\theta} \left( c_d - \frac{q_d^2}{4} + q_d^2 - \frac{\theta^2}{2} + q\theta \right) dG(\theta) + \\
\int_\theta^{2\theta} \left( c_d - \frac{\theta^2}{4} + q_d^2 \right) dG(\theta) + \\
\int_{2\theta}^{3\theta} \left( c_d - \bar{q}^2 + q_d^2 - \frac{\theta^2}{2} + \bar{q}\theta \right) dG(\theta)
\]

which is the same as the first order condition for \(c_d\). If the maximum and minimum are not binding this simply implies that \(\frac{R - w}{2} - c_d - q_d^2 = \frac{\mu_d}{4} = -\frac{1}{12}\), which is the expected losses that the workers will experience from the optimal level of quality. Thus, the firm will always receive \(\frac{R + w}{2} - \frac{1}{12}\) as will the workers in expectation. If the minimum is binding, the workers will be made better off relative to the firm in low states of the world and thus, the default will become more favorable to the firm. Similarly, if there is a maximum, then the maximum will make the firm relatively better off compared to the workers and thus, the default will be less favorable to the firm.

Furthermore, we can define the default value of the firm as \(F_d = -c_d - q_d^2\) and reconsider the regulator problem as choosing \(q, q, F_d\). Rewriting and simplifying the
FOCs:

\[
\frac{\partial V}{\partial q} = \int_2^q (\gamma + 4q \beta (w - R + 2(-F_d - q^2 + 2q \theta - \theta^2))) dG(\theta)
\]

\[
\frac{\partial V}{\partial q} = \int_{2q}^\pi (\gamma + 4q \beta (w - R + 2 (-F_d - q^2) - (\overline{q} - \theta)^2 + q^2)) dG(\theta)
\]

\[
\frac{\partial V}{\partial F_d} = 0 = \frac{w - R}{2} + \int_2^q (-F_d - \overline{q}^2 - \frac{\theta^2}{2} + q \theta) dG(\theta) + \int_2^{2q} (-F_d - \frac{\theta^2}{4}) dG(\theta) + \int_{2\overline{q}}^\pi (-F_d - \overline{q}^2 - \frac{\theta^2}{2} + \overline{q} \theta) dG(\theta)
\]

Solving for \(F_d\) yields:

\[
F_d = \frac{w - R}{2} - \frac{4}{3} \overline{q}^3 - \frac{2}{3} (\overline{q}^3 - q^3) + \frac{4}{3} \overline{q}^3 - \overline{q}^2 - \frac{1}{6} + \overline{q}/2
\]

It is important here to note that \(\frac{\partial F_d}{\partial q} < 0\) and \(\frac{\partial F_d}{\overline{q}} > 0\). These signs are intuitive when we consider how the worker’s utility changes in the range where either the minimum or maximum is binding. In either case, the worker’s utility is decreasing the tighter is the constraint because they get all of the surplus from renegotiation. Thus, when the minimum \(q\) raises the worker's position deteriorates which induces an optimal reduction in the firm surplus. Similarly when \(\overline{q}\) decreases, and thus, the constraint binds more tightly, the firm value \(F_d\) must decrease.

However, this immediately suggests that the maximum must never bind because we know that the worker’s utility is always below the firm’s in the high state. In the low state \(\theta = 0\), the worker receives its optimal quality as well as receiving the largest transfer from the firm. In the highest state, the firm is made the worst off from renegotiation which minimizes the value the workers receive from renegotiation. In this case the maximum can only increase inequality.

In order to see this we can look directly at the inequality term. We know that the
worker’s utility is given by $\frac{w+R}{2} - (q_\theta - \theta)^2 - F_d - q_\theta^2$. Meanwhile the firm receives $\frac{w+R}{2} + F_d$. The difference then is given by

$$Eq = W - F = - (q_\theta - \theta)^2 - 2F_d - q_\theta^2$$

With renegotiation, we can plug in $\theta/2$ and get

$$Eq = -\frac{\theta^2}{2} - 2F_d$$

This is a decreasing function of the state in the relevant range $\theta > 0$. Thus, in order to minimize the deviation it must be that $F_d > -\frac{\theta^2}{4}$, so that $Eq < 0$ when $\theta = \bar{\theta}$. Now consider decreasing $q_\theta$ where $\theta = \bar{\theta}$. In this case,

$$\frac{\partial Eq}{\partial q_\theta} = -2(q_\theta - \theta) - 2q_\theta$$

Note that this is positive when $q_\theta < \frac{\theta}{2}$. Thus, any decrease in the maximum will lead to a decrease in $Eq$ which given that $Eq$ is negative implies greater inequality. Thus, we know that $\bar{q} = .5$ in this setting.

Now we can solve for the minimum by substituting in $F_d = \frac{w-R}{2} - \frac{2}{3}q^3 - \frac{1}{12}$.

$$\frac{\partial V}{\partial q} = \int_{\theta}^{2\theta} \left( \begin{array}{c} -4q + 2\theta + \gamma \vspace{1em} + 4q_\theta \left( \frac{4}{3} q^3 + \frac{1}{6} - 2q^2 + 2q_\theta - \theta^2 \right) \end{array} \right) dG(\theta)$$

Note here that it is clear that losses due to efficiency will reduce the value of the minimum, the externality will push the minimum up and the equality term will also lead to greater minimums.

References

**ADP Research Institute**, “Illuminating the Shadow Workforce: Insights Into the Gig Workforce in Businesses,” Technical Report 2020.

**Aghion, Philippe, Mathias Dewatripont, and Patrick Rey**, “Renegotiation design with unverifiable information,” *Econometrica: Journal of the Econometric Society*, 1994, pp. 257–282.

**Alonso, Ricardo and Niko Matouschek**, “Optimal delegation,” *Review of Economic Studies*, 2008, 75 (1), 259–293.
Autor, David, David Dorn, Lawrence F Katz, Christina Patterson, and John Van Reenen, “The Fall of the Labor Share and the Rise of Superstar Firms,” *The Quarterly Journal of Economics*, 2020, 135 (2), 645–709.

Ayres, Ian and Robert Gertner, “Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules,” *Yale Law Journal*, 1989, 99 (1), 87–130.

Baron, David P and Roger B Myerson, “Regulating a monopolist with unknown costs,” *Econometrica: Journal of the Econometric Society*, 1982, pp. 911–930.

Benmelech, Efraim, Nittai K Bergman, and Hyunseob Kim, “Strong employers and weak employees: How does employer concentration affect wages?,” *Journal of Human Resources*, 2020, pp. 0119–10007R1.

Bhattarai, Abha, “Amazon boosts minimum wage to $15 for all workers following criticism,” *Washington Post*, 2018, October 2.

Bix, Brian, “Bargaining in the shadow of love: the enforcement of premarital agreements and how we think about marriage,” *William and Mary Law Review*, 1998, 40 (1), 145.

Chung, Tai-Yeong, “Incomplete contracts, specific investments, and risk sharing,” *Review of Economic Studies*, 1991, 58 (5), 1031–1042.

Easterbrook, Frank H and Daniel R Fischel, “Corporate Control Transactions,” *Yale Law Journal*, 1982, 91 (4), 698–737.

_ and _ , “The Corporate Contract,” *Columbia Law Review*, 1989, 89, 1416.

Farber, Henry S, Daniel Herbst, Ilyana Kuziemko, and Suresh Naidu, “Unions and inequality over the twentieth century: New evidence from survey data,” *The Quarterly Journal of Economics*, 2021, 136 (3), 1325–1385.

Galbraith, John Kenneth, *American Capitalism: The Concept of Countervailing Power*, Routledge, 1952.

Glaeser, Edward L and Andrei Shleifer, “A Reason for Quantity Regulation,” *American Economic Review*, 2001, 91 (2), 431–435.

Goetz, Charles J and Robert E Scott, “The mitigation principle: toward a general theory of contractual obligation,” *Virginia Law Review*, 1983, pp. 967–1024.

Green, Jerry R and Jean-Jacques Laffont, “Renegotiation and the form of efficient contracts,” *Annales d’Economie et de Statistique*, 1992, pp. 123–150.

Gruber, Jonathan, “Designing Benefits for Platform Workers,” Working Paper 29736, National Bureau of Economic Research February 2022.
Hart, Oliver and John Moore, “Incomplete contracts and renegotiation,” *Econometrica: Journal of the Econometric Society*, 1988, pp. 755–785.

Hermalin, Benjamin E and Michael L Katz, “Moral hazard and verifiability: The effects of renegotiation in agency,” *Econometrica: Journal of the Econometric Society*, 1991, pp. 1735–1753.

Hersch, Joni and Jennifer Bennett Shinall, “When equitable is not equal: experimental evidence on the division of marital assets in divorce,” *Review of Economics of the Household*, 2019, 18 (3), 655–682.

Holmström, Bengt, “On Incentives and Control in Organizations,” *Ph.D. Thesis, Stanford University*, 1977.

_ _, “On the Theory of Delegation,” in Marcel Boyer and Richard Kihlstrom, eds., *Bayesian Models in Economic Theory*, North-Holland 1984, p. 115–141.

Krishna, Vijay and John Morgan, “A model of expertise,” *The Quarterly Journal of Economics*, 2001, 116 (2), 747–775.

Laffont, Jean-Jacques and David Martimort, “Collusion and delegation,” *The Rand Journal of Economics*, 1998, pp. 280–305.

Martimort, David and Aggey Semenov, “The informational effects of competition and collusion in legislative politics,” *Journal of Public Economics*, 2008, 92 (7), 1541–1563.

Maskin, Eric, “Nash equilibrium and welfare optimality,” *Review of Economic Studies*, 1999, 66 (1), 23–38.

_ and John Moore, “Implementation and renegotiation,” *Review of Economic Studies*, 1999, pp. 39–56.

Mookherjee, Dilip, “Decentralization, hierarchies, and incentives: A mechanism design perspective,” *Journal of Economic Literature*, 2006, 44 (2), 367–390.

Moore, John and Rafael Repullo, “Subgame perfect implementation,” *Econometrica: Journal of the Econometric Society*, 1988, pp. 1191–1220.

Posner, Richard, *Economic Analysis of Law*, Little Brown and Company, 1986.

Rubinstein, Ariel and Asher Wolinsky, “Renegotiation-proof implementation and time preferences,” *The American Economic Review*, 1992, pp. 600–614.
Stewart, Andrew and Jim Stanford, “Regulating work in the gig economy: What are the options?,” The Economic and Labour Relations Review : ELRR, 2017, 28 (3), 420–437.

Summers, Lawrence and Anna Stansbury, “The Declining Worker Power Hypothesis: An explanation for the recent evolution of the American economy,” Brookings Papers on Economic Activity, 2020.

Tirole, Jean, “Hierarchies and bureaucracies: On the role of collusion in organizations,” Journal of Law and Economic Organization., 1986, 2, 181.