1. **Henry Ford’s five dollar day**  The pay hike could be explained by either moral hazard or adverse selection. Ford might have wanted workers to worry about losing their premium job at his factory, because they would work harder and refrain from shirking. Adverse selection could also explain the pay increase: by raising his wage Ford attracted a mixture of low and high quality workers, rather than low quality alone. **NOTE:** A wage that is set above the market-clearing wage for incentive reasons is sometimes called an **efficiency wage**.

2. **Sharecropping**

   a. He offers the agent a straight wage of \( w_1 \) *conditional on A working hard*. Since he can observe \( e \), he can condition the contract on effort. Since the contract is a straight wage, A bears no risk, so it does not matter if she is risk averse or not.

   b. If IR were loose then P could decrease \( w_F \) and hence decrease his expected cost of implementing \( e \) while still satisfying IC.

   c. 
   
   \[
   .5v(w_F) + .5v(w_S) - 40 \geq 8 \quad (IR)
   \]
   
   \[
   .5v(w_F) + .5v(w_S) - 40 \geq .9v(w_F) + .1v(w_S) \quad (IC)
   \]

   Or, after a little rearranging:

   \[
   v(w_S) \geq 96 - v(w_F) \quad (IR)
   \]

   \[
   v(w_S) \geq v(w_F) + 100 \quad (IC)
   \]

   d. \( E_y(e_0) = 9 + .1\alpha \) and \( E_y(e_1) = 5 + .5\alpha \). With risk neutrality, \( w_0 = 8 \) and \( w_1 = 48 \). Hence \( g(e_0) = .1\alpha + 1 \) and \( g(e_1) = .5\alpha - 43 \). The latter is larger than the former if \( \alpha > 110 \).

   e. The isocost lines have the equation \( .5w_F + .5w_S = K \), a constant. Or equivalently, \( w_S = K - w_F \). They are a series of parallel lines with slope -1. Notice the least cost one that intersects the double-crossed region coincides with the IR-binding line. So there are an infinite number of cost-minimizing contracts that implement \( e_1 \); the IC constraint is binding for only one of them.

   f. The profit maximizing rent is \( g(e_1) \) (that is, \( .5\alpha - 43 \)). This rent allows P to appropriate *all* the gains from trade. It is equivalent to the residual claimant contract:

   \[
   w_F = y_F - g(e_1)
   \]

   \[
   w_S = y_S - g(e_1),
   \]

   which is one of the cost-minimizing ways to implement \( e_1 \). In this context, renting his land is the same as “selling the business” to the agent. The intuition why renting
leads to efficiency is that A becomes fully responsible for the consequences of whatever action e she chooses; so, since she is risk neutral, in maximizing her expected utility, she will automatically choose the e that maximizes the gains from trade. The rental cost g(e1) is, after all, a sunk cost after the land is rented; so it does not affect her incentives.

g. Now w0 must satisfy: v(w) = 8; hence \[ w_0 = 2.25 \]. Similarly, w1 must satisfy \[ v(w) - 40 = 8 \]; hence \[ w_1 = 12.25 \]. Since \[ g(e_0) \equiv E_y(e_0) - w_0 \], \[ g(e_0) = .1\alpha + 6.75 \]; similarly, \[ g(e_1) = .5\alpha - 7.25 \]. The latter is larger than the former if \( \alpha > 35 \).

h. To see why IC must now also bind, suppose it is loose. Then, by decreasing the spread between \( w_S \) and \( w_F \) in such a way as to continue satisfying IR, the principal can decrease the risk premium he must pay the agent; i.e., he can decrease the expected cost of implementing \( e_1 \). [Notice that this argument does not apply when the agent is risk neutral because P does not have to pay her a risk premium to make her willing to bear the risk of an incentive contract.]

i. So, to minimize P’s cost find the point where the IR- and IC-binding lines in the FIGURE intersect: v(\( w_F \)) = -2 and v(\( w_S \)) = 98. Hence, \( C_1^* \equiv (w_F^*, w_S^*) = (1, 36) \), so \( c(e_1) = 18.5 \). This may be interpreted as a sharecropping agreement: The farmer is guaranteed a minimum wage of \( w_F \) plus a share \( \theta \equiv \frac{w_S - w_F}{y_S} \) of the crop if a good crop (i.e., \( y_S \)) occurs.

By contrast, to implement \( e_0 \) set \( w_F = w_S = w_0 \), that is offer a straight wage of 2.25. So \( c(e_0) = 2.25 \).

j. \[ \pi_P(C_1^*, e_1) = E_y(e_1) - c(e_1) = .5\alpha - 13.5 \]

So, to maximize his expected profit, P will choose to implement \( e_1 \) iff \( \alpha \geq 50.625 \). Comparing \( c(e_1) \) with \( w_1 \) we see that, to implement \( e_1 \), P must pay A a risk premium equal to 6.25. SEE FIGURE. This is not a benefit to A since she is risk averse and the 6.25 just compensates her for bearing the risk in the incentive contract (recall IR is binding). But it is a cost for P. If you think of the incentive contract as a burglar alarm which prevents A from wanting to steal some GFT from P by imposing a negative externality on P (i.e., choosing to deliver \( e_0 \)) then 6.25 is the cost of the burglar alarm. It is a deadweight loss to society, just like burglar alarms are a deadweight loss (a cost of protecting property rights).

It is no longer profit-maximizing to simply rent the land to A because then A would be bearing even more risk than under the optimal incentive contract; i.e., the risk premium (read: reduction in rent) that A would require to rent the land and bear all the risk of \( (y_F, y_S) \) would be so large that P is better off sharing the risk with A. NOTE: Please recall that for efficient risk sharing, P—who is risk neutral—must bear all the risk. Since the landlord is richer than the farmer, it’s reasonable to
suppose she’s less risk averse. We idealize this by saying she’s risk neutral.

**k.** \( \alpha \in (35, 50, 625) \). (If \( \alpha = 50, 625 \) then \( P \) is indifferent between implementing high or low effort.) For these values of \( \alpha \) the cost of the “burglar alarm” is so high relative to its benefit, that \( P \) is better off simply implementing \( e_0 \) (which does not require the “alarm” since there is nothing to steal). But the outcome is not Pareto optimal. The deadweight loss equals \( g(e_1) - g(e_0) \).

### 3. Good jobs and bad jobs

**a.** The nonnegativity constraint \( w_F \geq 0 \) is binding: The lowest isocost line intersecting the cross-hatched region AND satisfying \( w_F \geq 0 \) has equation \( w_F + w_S = 100 \). So, to implement high effort \( P \) sets \( w_F^* = 0 \), \( w_S^* = 100 \), which has expected cost \( c(e_1) = 50 \).

Notice under this contract \( IR \) is not binding since A’s expected utility is \( 10 > U = 8 \). There will be an “excess demand” for \( P \)’s manager job. Nevertheless, \( P \) will not be tempted by an applicant who says “pay me less than \( w_S^* = 100 \) if I succeed and I will still work hard for you” because \( P \) knows that for any \( w_S \) less than 100 it is no longer incentive compatible for A to work hard. The lesson to learn is that nonnegativity constraints can lead to **dual labor markets**, with some “good jobs,” like being a manager, and some “not so good jobs,” like being a worker without much discretion. [By contrast recall that, without nonnegativity constraints, \( IR \) is always binding.]

**b.** The nonnegativity constraint does not bind for implementing \( e_0 \), so \( c(e_0) = 8 \) still. \( P \) will implement \( e_1 \) iff \( \pi_P(C_1^*, e_1) \geq \pi_P(C_0^*, e_0) \), i.e., iff \( Ey(e_1) - c(e_1) \geq Ey(e_0) - c(e_0) \) or \( \alpha \geq 115 \). The outcome is efficient in this case since \( g(e_1) \) is achieved. But \( P \)’s slice of the pie is smaller by 2—he appropriates \( g(e_1) - 2 \),—while \( A \) now gets a slice of the pie equal to 2 (since \( IR \) is loose). So \( PB_p(e_1) < SB_p(e_1) \).

**c.** For \( \alpha \in (110, 115) \) the principal will implement \( e_0 \) even though \( g(e_1) > g(e_0) \)—so for efficiency he should implement \( e_1 \). The intuition is easy (and hopefully, by now, familiar): He switches to \( e_0 \) when his PB for implementing low effort > his PB from implementing high effort. In implementing low effort \( PB_p(e_0) = SB_p(e_1) \), i.e., he fully appropriates. But, as we saw above, in implementing high effort he creates a positive pecuniary benefit of 2 for whoever he hires. So, for \( \alpha \in (110, 115) \), there is a **profit reversal**: what is privately more profitable for the principal (namely, implementing \( e_0 \)) is socially less beneficial. Thus the link between Appropriation and Efficiency has made another appearance! See FIGURE below.

![Figure 1: Notice the profit reversal: \( PB_p(e_0) > PB_p(e_1) \), but \( g(e_1) > g(e_0) \). Also notice that there is an excess demand for the manager job when the expected wage equals 50, but \( P \) will not lower \( w_S \) for incentive reasons.](image)