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6 Appendix

6.1 Full insurance

We prove that under complete contracts the entrepreneur fully insures the supplier by offering $p^*(\gamma) = c(\gamma) + r$, $\forall \ \gamma \in [0,1]$. Suppose not; for the sake of generality, assume that for a set of states of nature A of measure $\mu_A > 0$, $p(\gamma) = c(\gamma) + r - a$ and for a set of states of nature B of measure $\mu_B > 0$, $p(\gamma) = c(\gamma) + r + b$.[1] In order for this structure of payments to be at least as good for the entrepreneur as the full-insurance one, it must be the case that

$$b \leq \left(\frac{\mu_A}{\mu_B}\right) a \tag{6.1}$$

We will evaluate equation 6.1 with equality - that is the highest payment conceivable - and see if it can satisfy supplier's IR, given by the following:

$$\int_{\gamma \in A} V\left(r - a\right)\, d\gamma + \int_{\gamma \in B} V\left(r + b\right)\, d\gamma + \int_{\gamma \in (AUB)^C} V\left(r\right)\, d\gamma \tag{6.2}$$

, which can be rewritten as:

$$\mu_A V\left(r - a\right) + \mu_B V\left(r + b\right) + (1 - \mu_A - \mu_B)V(r) \tag{6.3}$$

Inserting 6.1 with equality in 6.3 yields:

$$\mu_A V\left(r - a\right) + \mu_B V\left(r + \left(\frac{\mu_A}{\mu_B}\right) a\right) + (1 - \mu_A - \mu_B)V(r) < V(r) \tag{6.4}$$

, where the inequality follows from concavity of $V()$.

6.2 No courts: ex-ante transfer when the entrepreneur holds all the ex-post bargaining power

Entrepreneur chooses t^* so as to satisfy:

[1] So that supplier's IR is still potentially satisfied, since it was binding for the full-insurance structure of payments.

$$U_S(t^*) = \int_0^1 V\left(t^* - c(\gamma)\right) d\gamma = V(r) \tag{6.5}$$

By the concavity of $V()$ it follows that:

$$V(t^* - c_N) > \int_0^1 V\left(t^* - c(\gamma)\right)\, d\gamma \tag{6.6}$$

Substituting 6.6 into 6.5 gives:

$$V(t^* - c_N) > V(r)$$

Since $V()$ is increasing, we have:

$$t^* > r + c_N$$

6.3 Optimal Contract when Entrepreneur Holds Ex-post Bargaining Power

(a) Unconstrained Entrepreneur

Ignoring the entrepreneur's participation constraint, the optimal contract solves the following problem:

$$\max_{\{t,p\}} \; U_E(t,p)$$
$$\text{s.t.: } U_S(t,p) \geq V(r).$$

First order conditionss are as follows:

$$\begin{aligned} -1 + \lambda \left[\underline{\theta} V'(t+p-c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t+p-c(\gamma))d\gamma + \int_{\overline{\theta}}^{1} V'(t-c(\gamma))d\gamma \right] &= 0, \text{ and} \\ -\overline{\theta} + \lambda \left[\underline{\theta} V'(t+p-c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t+p-c(\gamma))d\gamma \right] &= 0, \end{aligned}$$

where λ is the multiplier on the constraint.

Solving for λ yields:

$$\overline{\theta} \left[\underline{\theta} V'\left(t+p-c_N\right) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(t+p-c(\gamma)\right) d\gamma + \int_{\overline{\theta}}^{1} V'(t-c(\gamma))d\gamma \right] =$$
$$\underline{\theta} V'\left(t+p-c_N\right) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(t+p-c(\gamma)\right) d\gamma.$$

Rearranging terms

$$\overline{\theta}\int_{\overline{\theta}}^{1} V'(t-c(\gamma))d\gamma = (1-\overline{\theta})\left[\underline{\theta}V'\left(t+p-c_N\right)+\int_{\underline{\theta}}^{\overline{\theta}} V'\left(t+p-c(\gamma)\right)d\gamma\right]. \tag{6.7}$$

It is hard to characterize in great details the general solution of this problem. Indeed, it might be the case that even the sign of p^* is undetermined. To see this, consider the case where $\overline{\theta} = \underline{\theta}$.

Then, after solving for λ, FOC's lead to

$$\underline{\theta}V'\left(t+p-c_N\right)+\int_{\underline{\theta}}^{1} V'(t-c(\gamma))d\gamma = V'\left(t+p-c_N\right).$$

Rearranging terms,

$$\int_{\underline{\theta}}^{1} V'(t-c(\gamma))d\gamma = (1-\underline{\theta})V'\left(t+p-c_N\right),$$

so that, if we assume that suppliers have decreasing absolute risk aversion [2], it follows from convexity of $V'(\cdot)$ that

$$V'(t-c_N) < V'\left(t+p-c_N\right),$$

which holds if and only if $p^* < 0$, since $V'(\cdot)$ is decreasing.

Now consider the other extreme hypothesis, $\overline{\theta} = 1$. Notice that, in analogy to the complete contracts framework, we have $t = 0$, since p is appropriated by the supplier in every state of nature.

Consider the binding supplier's participation constraint:

$$\underline{\theta}V\left(p-c_N\right)+\int_{\underline{\theta}}^{1} V(p-c(\gamma))d\gamma = V(r).$$

Concavity of $V(\cdot)$ gives

$$\int_{\underline{\theta}}^{1} V(p-c(\gamma))d\gamma < V(p-c_N), \tag{6.8}$$

, so that

$$(1+\underline{\theta})V(p-c_N) > V(r), \tag{6.9}$$

If $\underline{\theta} = 0$, it follows that $V(p-c_N) > V(r)$, which holds if and only if $p^* > r + c_N > 0$.

(b) Constrained Entrepreneur

The only difference in the relation to the case of the unconstrained entrepreneur here is that ex-ante investment is not at its optimal level. So

[2] A necessary condition is $V'''(\cdot) > 0$.

higher ex-ante transfers are associated with lower ex-ante investments, and we can write $e = a_i - t$.

Ignoring the entrepreneur's participation constraint, the contract design problem therefore is

$$\max_{\{t,p\}} U_E(t,p)$$
$$\text{s.t.: } U_S(t,p) \geq V(r),$$

where $U_E(t,p) = v_N - \overline{\theta}p + R(a_i - t) - w - a_i$. First order conditions are as follows:

$$-R'(a_i - t) + \lambda \left[\underline{\theta} V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))d\gamma + \int_{\overline{\theta}}^{1} V'(t - c(\gamma))d\gamma \right] = 0, \text{ and}$$
$$-\overline{\theta} + \lambda \left[\underline{\theta} V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))d\gamma \right] = 0.$$

Solving for λ and rearranging terms yields

$$\overline{\theta} \int_{\overline{\theta}}^{1} V'(t - c(\gamma))d\gamma = (R'(a_i - t) - \overline{\theta}) \left[\underline{\theta} V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))\, d\gamma \right].$$

Together with supplier's participation constraint ($U_S(t,p) = V(r)$), the expression above determines the optimal contract (t^*, p^*).

The only difference between this expression and the analogous expression for the unconstrained entrepreneur is the presence of the $(R'(a_i - t) - \overline{\theta})$ in the right-hand side, instead of $(1 - \overline{\theta})$. For a constrained individual, $R'(a_i - t) > 1$, so that $(R'(a_i - t) - \overline{\theta}) > (1 - \overline{\theta})$.

This means that, analyzing the expression above at the values for p and t that solve the problem for an unconstrained individual, we have that the right-hand side is larger than the left-hand side. So, in order to restore equality, t for the constrained individual has to be smaller than t for the unconstrained individual, while p has to be larger (this comes immediately from decreasing $V'(\cdot)$ and from the fact that the equality above has to hold at the optimum).

For a constrained individual, t and p play a double role. Differently from the case of the unconstrained entrepreneur, where they are chosen only taking into account the participation constraint and insurance considerations for the supplier, here their choice is also affected by the fact that ex-ante investments depend on the value of t. In order to reduce t to increase ex-ante investments, entrepreneurs have to compensate suppliers with a higher p. But since this moves suppliers away from the optimal insurance scheme, the expected value of the increase in p has to be larger than the expected value of the reduction in t. In other words, it is costly for entrepreneurs to reduce t in order to increase ex-ante investments. So, if the marginal entrepreneurs is constrained, and if the individual with initial wealth level $\widetilde{a}_i$ is indifferent between becoming an entrepreneur and a worker, all individuals with wealth $a_i > \widetilde{a}_i$ strictly prefer to be entrepreneurs.

Given t^* and p^* determined from the optimal contract problem, the marginal individual would be the one for which

$$v_N - \overline{\theta}p^* + R(\widetilde{a}_i - t^*) - \widetilde{a}_i = 2w.$$

The fraction of entrepreneurs in the population would be $\min\{1-G(\widetilde{a}_i), 1/2\}$, while the fraction of workers would be $\max\{G(\widetilde{a}_i), 1/2\}$. If less than half of the population become entrepreneurs, the expression above determines $\widetilde{a}_i$ from $v_N - \overline{\theta}p^* + R(\widetilde{a}_i - t^*) - \widetilde{a}_i = 2\underline{w}$. If half the population become entrepreneurs, than the wage rate adjust to guarantee the labor market equilibrium, with $v_N - \overline{\theta}p^* + R(G^{-1}(1/2) - t^*) - G^{-1}(1/2) = 2w$.

6.4 Optimal Contract when Supplier Holds Ex-post Bargaining Power

(a) Unconstrained Entrepreneur

When the supplier holds all the ex-post bargaining power, the entrepreneur's problem is to choose t and p to solve the following problem, ignoring his own participation constraint:

$$\max_{\{t,p\}} U_E(t,p)$$
$$\text{s.t.: } U_S(t,p) \geq V(r).$$

First order conditions are as follows:

$$-1 + \lambda\left[\underline{\theta}V'(t+p-c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t+p-c(\gamma))\,d\gamma + (1-\overline{\theta})V'(t+\Delta+R(e^*)-w-\underline{w})\right] = 0,$$

$$-\overline{\theta} + \lambda\left[\underline{\theta}V'(t+p-c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t+p-c(\gamma))\,d\gamma\right] = 0,$$

where λ is the multiplier on the supplier's participation constraint. Substituting for λ yields

$$\overline{\theta}V'\left(t+\Delta+R(e^*)-w-\underline{w}\right)=\underline{\theta}V'\left(t+p-c_N\right)+\int_{\underline{\theta}}^{\overline{\theta}}V'\left(t+p-c(\gamma)\right)d\gamma.$$

From decreasing absolute risk aversion (convexity of $V'(\cdot)$), it follows that

$$\int_{\underline{\theta}}^{\overline{\theta}}V'\left(t+p-c(\gamma)\right)d\gamma\geq(\overline{\theta}-\underline{\theta})V'\left(t+p-c_N\right).$$

Substitution into the previous expression leads to

$$V'\left(t+\Delta+R(e^*)-w-\underline{w}\right)\geq V'\left(t+p-c_N\right),$$

which, from concavity, implies that

$$p^*\geq v_N+R(e^*)-w-\underline{w}.$$

Entrepreneur's participation constraint can be written as

$$U_E(t,p)=\overline{\theta}(v_N+R(e^*)-p-w-\underline{w})+\underline{w}-t-e^*\geq w.$$

If $p^*=v_N+R(e^*)-w-\underline{w}$, then $U_E(t,p)=\underline{w}-t-e^*$, so that the entrepreneur's participation constraint cannot be satisfied for any $t>0$. The same thing holds for any $p^*>v_N+R(e^*)-w-\underline{w}$.

(b) Constrained Entrepreneur

When the entrepreneur does not have enough wealth to invest optimally, the contract design must take into account that higher ex-ante transfers affect the level of investment e, therefore reducing ex-post surplus.

In this scenario the optimal investment condition is $R'(e^*)=\frac{1}{\overline{\theta}}$, so constrained individuals are those for whom $R'(a_i-t)>\frac{1}{\overline{\theta}}$, or $a_i<R'^{-1}(\frac{1}{\overline{\theta}})+t$.

The constrained entrepreneur's problem is to choose t and p to solve the following problem:

$$\max_{\{t,p\}}U_E(t,p)$$
$$\text{s.t.: }U_S(t,p)\geq V(r)$$
$$a_i-R'^{-1}\left(\frac{1}{\overline{\theta}}\right)\leq t\leq a_i$$

, where $U_E(t,p)=\overline{\theta}(v_N+R(a_i-t)-p-w)+(1-\overline{\theta})\underline{w}-a_i$ and last constraint explicitly incorporates the fact that ex-ante transfers cannot be larger than the entrepreneur's wealth, and should not be smaller than the amount that would induce the entrepreneur to invest optimally (from his own perspective).[3] First order conditions for this problem are given by:

$$-\overline{\theta}R'(a_i - t) + \lambda[\underline{\theta}V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))\, d\gamma +$$
$$(1 - \overline{\theta})(1 - R'(a_i - t))V'(t + \Delta + R(a_i - t^*) - \underline{w} - w)] \gtreqless 0,$$

$$-\overline{\theta} + \lambda \left[\underline{\theta}V'(t^* + p^* - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t^* + p^* - c(\gamma))\, d\gamma\right] = 0,$$

where λ is the multiplier on the first (supplier participation) contraint. The inequality holds as $=$ for an interior, as $>$ when $t = a_i$, and as $<$ when $t = a_i - R'^{-1}(\frac{1}{\overline{\theta}})$.

Substituting for λ and looking for an interionr solution, one can write

$$\frac{1}{R'(a_i - t)} = \frac{\underline{\theta}V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))\, d\gamma}{\underline{\theta}V'(t + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'(t + p - c(\gamma))\, d\gamma + (1 - \overline{\theta})(1 - R'(a_i - t))V'(t + \Delta + R(a_i - t) - \underline{w} - w)}.$$

It is easy to see that an equality only holds if $t = a_i - R'^{-1}(1)$. Suppose not. With $R'(a_i - t) > 1$, the left-hand side of the expression is less than 1, while the right-hand side is necessarily greater than 1, so the equality cannot hold. Conversely, with $R'(a_i - t) < 1$, the left-hand side is greater than 1, while the right-hand side is necessarily less than 1. So the problem above will not have an internal solution, and the optimal contract will have t at its corner solution $t^* = a_i - R'^{-1}(\frac{1}{\overline{\theta}}) < 0$. It is as if suppliers wanted ex-ante to transfer additional resources to entrepreneurs, but they did not have instruments to enforce an investment level above $R'^{-1}(\frac{1}{\overline{\theta}})$.

The optimal contract involves a full subsidy from supplier to entrepreneur, so that the entrepreneur chooses his optimal level of ex-ante investment $(R'^{-1}(\frac{1}{\overline{\theta}}))$. Accordingly, p is chosen so as to just satisfy the supplier's partici-

[3]The supplier can never subsidize the ex-ante investment beyond the optimal investment level from the perspective of the entrepreneur, otherwise the latter would simply appropriate the additional ex-ante transfer. Since p and t do not affect the optimal choice of e from the perspective of the entrepreneur, they also cannot be used to enforce a higher level of investment.

pation constraint, so that p^* is implicitly determined from

$$\underline{\theta}V(a_i - R'^{-1}(1/\overline{\theta}) + p^* - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V\left(a_i - R'^{-1}(1/\overline{\theta}) + p^* - c(\gamma)\right) d\gamma +$$
$$(1-\overline{\theta})V(a_i - R'^{-1}(1/\overline{\theta}) + \Delta + R(R'^{-1}(1/\overline{\theta})) - \underline{w} - w) = V(r).$$

As the condition makes clear, for constrained entrepreneurs, the specific format of the contract will be a function of initial wealth, since in this case t is pinned down by the optimal level of investment and p is then set to guarantee that suppliers' participation constraint holds. From the expression above, one can show that the relationship between a_i and p for constrained entrepreneurs is given by

$$\left.\frac{\partial p}{\partial a_i}\right|_{constrained} = -\frac{\left[\begin{array}{c}\underline{\theta}V'(a_i - e^* + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(a_i - e^* + p - c(\gamma)\right) d\gamma + \\ (1-\overline{\theta})V'(a_i - e^* + \Delta + R(e^*) - \underline{w} - w)\end{array}\right]}{\underline{\theta}V'(a_i - e^* + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(a_i - e^* + p - c(\gamma)\right) d\gamma} < -1.$$

Benefits from entrepreneurship for constrained entrepreneurs are given by

$$\begin{aligned} U_E(t,p) &= \overline{\theta}(v_N + R(a_i - t) - p - w) + (1-\overline{\theta})\underline{w} - a_i \\ &= \overline{\theta}(v_N + R(e^*) - p - w) + (1-\overline{\theta})\underline{w} - a_i. \end{aligned}$$

So the effect of initial wealth on the gains from entrepreneurship in this case is

$$\begin{aligned} \left.\frac{\partial U_E(t,p)}{\partial a_i}\right|_{constrained} &= -\overline{\theta}\left.\frac{\partial p}{\partial a_i}\right|_{constrained} - 1 \\ &= -\frac{(1-\overline{\theta})\left[\begin{array}{c}\underline{\theta}V'(a_i - e^* + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(a_i - e^* + p - c(\gamma)\right) d\gamma - \\ \overline{\theta}V'(a_i - e^* + \Delta + R(e^*) - \underline{w} - w)\end{array}\right]}{\underline{\theta}V'(a_i - e^* + p - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V'\left(a_i - e^* + p - c(\gamma)\right) d\gamma}. \end{aligned}$$

When entrepreneurs are not constrained, so that the p and t are chosen to design the optimal contract without regard to optimal investment e^*, the term in brackets is zero (from the first order conditions of the optimal contract problem). In other words, when there are no credit constraints, or when the insurance motive is important enough that it induces a $-t$ large enough to guarantee the optimal investment, there will be no relationship between initial wealth and benefits from entrepreneurship.

But when entrepreneurs are constrained, t is determined to allow the optimal ex-ante investment level, and so the contract is not designed only based on insurance considerations. In this case, the numerator above is different from zero. In order for the suppliers' participation constraint to hold, a larger value for $-t$ implies a higher p. This is a further deviation from the ideal insurance design, imposed by the additional considerations taken into account in the choice of t (efficient investment level). This implies that p is larger and t is smaller (more negative) than in the ideal contract from the purely insurance perspective, so that the two first terms in brackets are smaller and the last term larger than they would otherwise be – since, as we have shown, $\frac{\partial p}{\partial a_i} > -1$, and since $V'()$ is decreasing. Therefore, the expression in brackets is negative and so $\left.\frac{\partial U_E(t,p)}{\partial a_i}\right|_{constrained} > 0$.

The intuition for this relationship is clear. From the perspective of suppliers, t and p are not interchangeable. In order to move t away from the ideal insurance value, the compensation in terms of increased p has to be larger than the initial change in t (from risk aversion). So, despite the fact that suppliers are always held at their outside option, it is increasingly expensive for entrepreneurs to demand higher anticipation of funds to finance the ex-ante investment. Therefore, individuals who are better able to finance their own investments end up with higher expected returns.

There are no upfront costs here ($t < 0$), so the equilibrium has half the individuals choosing entrepreneurship and half the individuals choosing salaried work. Still, if the marginal individual is constrained, typical entrepreneurs prefer strictly entrepreneurship and typical workers prefer strictly salaried work, with the indifference holding only for the marginal entrepreneur. The adjustment of wages guarantees that this equilibrium holds.[4]

Recalling that $G(\cdot)$ denotes the wealth distribution in the economy, p_m (p for the marginal entrepreneur) and w are determined from supplier's and entrepreneur's participation constraints:

$$\underline{\theta}V(G^{-1}(1/2) - e^* + p_m - c_N) + \int_{\underline{\theta}}^{\overline{\theta}} V\left(G^{-1}(1/2) - e^* + p_m - c(\gamma)\right) d\gamma +$$
$$(1-\overline{\theta})V(G^{-1}(1/2) - e^* + \Delta + R(e^*) - \underline{w} - w) = V(r), \text{ and}$$
$$\overline{\theta}(v_N + R(e^*) - p_m - w) + (1-\overline{\theta})\underline{w} - G^{-1}(1/2) = w,$$

[4]This implicitly assumes that the surplus generated by entrepreneurship is large enough. Since there is some efficiency loss when suppliers have to partly finance entrepreneurs' ex-ante investments, it is possible that this reduces entrepreneurship in the economy. This would be the case if the surplus from entrepreneurship was small enough that, once the efficiency loss takes place, the median individual experiences a loss from entrepreneurship, even when wages reach the lower bound $\underline{w}$.

where we already substituted [5] $t = G^{-1}(1/2) - e^* = G^{-1}(1/2) - R'^{-1}(1/\overline{\theta})$. So, equilibrium wages are given by $w = [\overline{\theta}(v_N + R(e^*) - p_m) + (1 - \overline{\theta})\underline{w} - G^{-1}(1/2)]/(1 + \overline{\theta})$.

6.5 Data

(a) Independent variables

Table 6.1: Variables' definition by year

Variable	1970	1980	1991	2000
male	VAR23 = 0	V501 = 1	V0301 = 1	V0401 = 1
age	VAR27	V606	V3072	V4752
urban	VAR4 = 0 or 1	V598 = 0	V1061 = 1 or 3	V1006 = 1
water	VAR12 = 1 or 2	V206 = 1 or 6	V0205 = 1 or 4	V0207 = 1
sewage	VAR13 = 1	V207 = 2	V0206 = 1	V0211 = 1
electricity	VAR14 = 1	V217 = 2 or 4	V0221 = 1 or 2	V0213 = 1
car	VAR19	V221	V0218	V0222
rooms	VAR20	V212	V0211	V0203
migrant	VAR32 < 8	V513 = 8	V0314 = 2 or 3	V0415 = 2

Water and sewage stand for access to the general network, irrespective of the presence of canalization. Electricity stands for access, irrespective of the presence of official measurement of consumption. Migrant status was attributed in 1970 only to the individuals that weren't born in that municipality but lived there for less than 10 years.

(b) Schooling

1970 schooling = 1 if (VAR38 = 1 and VAR37 = 1) or (VAR38 = 1 and VAR37 = 2);
schooling = 2 if (VAR38 = 1 and VAR37 = 3);
schooling = 3 if (VAR38 = 1 and VAR37 = 4);
schooling = 4 if (VAR38 = 1 and VAR37 = 5);
schooling = 4 if (VAR38 = 1 and VAR37 = 6);
schooling = 4 if (VAR38 = 1 and VAR37 = 7);
schooling = 5 if (VAR38 = 2 and VAR37 = 2);
schooling = 6 if (VAR38 = 2 and VAR37 = 3);
schooling = 7 if (VAR38 = 2 and VAR37 = 4);
schooling = 8 if (VAR38 = 2 and VAR37 = 5);
schooling = 8 if (VAR38 = 2 and VAR37 = 6);
schooling = 9 if (VAR38 = 3 and VAR37 = 2);

[5] Assuming the marginal individual is wealth-constrained.

schooling = 10 if (VAR38 = 3 and VAR37 = 3);
schooling = 11 if (VAR38 = 3 and VAR37 = 4);
schooling = 11 if (VAR38 = 3 and VAR37 = 7);
schooling = 12 if (VAR38 = 4 and VAR37 = 2);
schooling = 13 if (VAR38 = 4 and VAR37 = 3);
schooling = 14 if (VAR38 = 4 and VAR37 = 4);
schooling = 15 if (VAR38 = 4 and VAR37 = 5);
schooling = 16 if (VAR38 = 4 and VAR37 = 6).

1980 schooling = 1 if (VAR523 = 2 and VAR524 = 1) or (VAR523 = 4 and VAR524 = 1);
schooling = 2 if (VAR523 = 2 and VAR524 = 2) or (VAR523 = 4 and VAR524 = 2);
schooling = 3 if (VAR523 = 2 and VAR524 = 3) or (VAR523 = 4 and VAR524 = 3);
schooling = 4 if (VAR523 = 2 and VAR524 = 4) or (VAR523 = 4 and VAR524 = 4);
schooling = 4 if (VAR523 = 2 and VAR524 = 5);
schooling = 4 if (VAR523 = 2 and VAR524 = 9);

schooling = 5 if (VAR523 = 3 and VAR524 = 1) or (VAR523 = 4 and VAR524 = 5);
schooling = 6 if (VAR523 = 3 and VAR524 = 2) or (VAR523 = 4 and VAR524 = 6);
schooling = 7 if (VAR523 = 3 and VAR524 = 3) or (VAR523 = 4 and VAR524 = 7);
schooling = 8 if (VAR523 = 3 and VAR524 = 4) or (VAR523 = 3 and VAR524 = 5) or (VAR523 = 3 and VAR524 = 9) or (VAR523 = 4 and VAR524 = 8) or (VAR523 = 4 and VAR524 = 9);
schooling = 9 if (VAR523 = 5 and VAR524 = 1) or (VAR523 = 6 and VAR524 = 1);
schooling = 10 if (VAR523 = 5 and VAR524 = 2) or (VAR523 = 6 and VAR524 = 2);
schooling = 11 if (VAR523 = 5 and VAR524 = 3) or (VAR523 = 5 and VAR524 = 4) or (VAR523 = 5 and VAR524 = 9)— (VAR523 = 6 and VAR524 = 3) or (VAR523 = 6 and VAR524 = 4) or (VAR523 = 6 and VAR524 = 9);

schooling = 12 if (VAR523 = 7 and VAR524 = 1);
schooling = 13 if (VAR523 = 7 and VAR524 = 2);

schooling = 14 if (VAR523 = 7 and VAR524 = 3);
schooling = 15 if (VAR523 = 7 and VAR524 = 4);
schooling = 16 if (VAR523 = 7 and VAR524 = 5);
schooling = 17 if (VAR523 = 7 and VAR524 = 6).

1991 schooling = VAR3241;
schooling = 0 if (VAR3241 = 20 or VAR3241 = 30).

2000 schooling = VAR4300;
schooling = 0 if (VAR4300 = 20 or VAR4300 = 30).

(c) Dependent variables

1970 employer = 1 if VAR46 = 5;
self-employed = 1 if VAR46 = 3;
entrepreneur = employer + self-employed.

1980 employer = 1 if VAR533 = 7;
self-employed = 1 if VAR533 = 8;
entrepreneur = employer + self-employed.

1991 employer = 1 if VAR0349 = 10;
self-employed = 1 if VAR0349 = 9;
entrepreneur = employer + self-employed;

scale = 1 if VAR0351 = 1;
scale = 2 if (VAR0351 = 2 or VAR0351 = 3 or VAR0351 = 4);
scale2 = scale;
scale2 = 0 if (VAR0351 = 5 or self-employed = 1).

2000 employer = 1 if VAR0447 = 5;
self-employed = 1 if VAR0447 = 6;
entrepreneur = employer + self-employed;

scale = 1 if (VAR0449 = 1 or VAR0449 = 2);
scale = 2 if (VAR0449 = 3 or VAR0449 = 4 or VAR0449 = 5);
scale2 = scale;
scale2 = 0 if self-employed = 1.

(d) TPCs and JECs' variables

JEC JEC = 1 if year = 2000 and ((UF = RJ and date = 2000) or (UF = SP and date = 2000)).

TPC TPC = 1 if (year = 1991 and date $<$ year).

Placebo placebo = 1 if year = 1991 and ((UF = RJ and TPC $\geq$ 1996 and TPC $<$ 2000) or (UF = SP and TPC $\geq$ 1998 and TPC $<$ 2000));
placebo = 1 if year = 1980 and ((UF = RJ and TPC $<$ 1996) or (UF = SP and TPC $<$ 1998)).

JEC age JEC age = (year - 1998) if year = 2000 and TPC $\leq$ 1998 and UF = SP;
JEC age = (year - 1996) if year = 2000 and TPC $\leq$ 1996 and UF = RJ;
JEC age = (year - date) if year = 2000 and (TPC $>$ 1998 and TPC $\leq$ 2000) and UF = SP;
JEC age = (year - date) if year = 2000 and (TPC $>$ 1996 and TPC $\leq$ 2000) and UF = RJ.