Appendix A. Proof of Theorem 1

In this section we present the proof of theorem 1.

Theorem 1. *Let E_1 and E_2 be the set of solutions to Sys1 and Sys2 below.*

$$\max_{C1,C3,C5-C8,C10}(4) \tag{Sys1}$$

$$\max_{C1-C11}(4) \tag{Sys2}$$

We have

$$E1 = E2. \tag{Th}$$

Proof. We say that $v \in E_1$ is a solution that satisfies Sys1 and we write $v \vdash Sys1$. We first prove that all solutions of Sys2 are solutions to Sys1 ($E_1 \subseteq E_2$). Then we prove the other direction ($E_2 \subseteq E_1$).

Appendix A.1. Left: $E_1 \subseteq E_2$

We claim

$$\forall v \in E_1 . v \vdash C2, C4, C9. \tag{A.1}$$

We rewrite A.1 as

$$\neg\exists v \in E_1 . (v \nvdash C2) \vee (v \nvdash C4) \vee (v \nvdash C9), \tag{Th'}$$

and we show Th' case by case.

***Case:* $\neg\exists v \in E_1 . v \nvdash C2$.** Recall that C2 ensures that projects that are not selected in a quarter, have no resources allocated to them during that quarter. Assume $v \nvdash$C2, thus v is configured such that

$$\exists p, t . \boldsymbol{S}^v[p][t] = 0 \ \wedge \ \exists k . \boldsymbol{A}^v[t][p][k] > 0. \tag{A.2}$$

We construct the solution u exactly similar to v except for the following.

$$\forall p, t . \boldsymbol{S}^u[p][t] = 0 \ \wedge \ \forall k . \boldsymbol{A}^u[t][p][k] = 0. \tag{A.3}$$

We have $u \vdash C1, C3, C5 - C8, C10$. We also have $(4)^u > (4)^v$ since with u we reduce effort without increasing cost or reducing revenue. Thus $v \notin E_1$.

***Case:* $\neg\exists v \in E_1 . v \nvdash C4$.** Recall that C4 guarantees that we do not work on projects that are not selected. Assume $v \nvdash$C4, thus v is configured such that

$$\exists p . \boldsymbol{\gamma}^v[p] = 0 \ \wedge \ \sum_{t=1}^{T} \boldsymbol{S}^v[p][t] > 0 \tag{A.4}$$

This is equivalent to

$$\exists p, (\boldsymbol{\gamma}^v[p] = 0) \land (\exists t, \boldsymbol{S}^v[p][t] = 1) \tag{A.5}$$

We substitute for $\boldsymbol{S}^v$ with its implications using C1 to obtain

$$\begin{gathered}\exists p, (\boldsymbol{\gamma}^v[p] = 0) \land (\exists t, \forall j, \boldsymbol{B}^v[t][p][j] \geq \boldsymbol{W}^v[p][j]) \\ \land (\exists j, \boldsymbol{W}^v[p][j] > 0).\end{gathered} \tag{A.6}$$

We construct u that is exactly similar to v except for the following.

$$\forall p. \boldsymbol{\gamma}^v[p] = 0 \;\Rightarrow \forall t, j. \boldsymbol{B}^u[t][p][j] = 0. \tag{A.7}$$

We have $u \vdash C1, C3, C5 - C8, C10$. We also have $(4)^u > (4)^v$ since with u we reduce effort without increasing cost or reducing revenue. Thus $v \notin E_1$.

Case: $\neg \exists v \in E_1 . v \not\vdash C10$**.** Recall that C9 guarantees that if we are busy in one quarter, then there is at least one project selected in that quarter. Assume $v \not\vdash C9$, thus v is configured such that

$$\exists t, (\boldsymbol{b}^v[t] = 1) \land (\forall p, \boldsymbol{S}^v[p][t] = 0). \tag{A.8}$$

We construct u that is exactly similar to v except for the following.

$$\forall p, t. \boldsymbol{S}^u[p][t] = 0 \Rightarrow \boldsymbol{b}^u[t] = 0. \tag{A.9}$$

We have $u \vdash C1, C3, C5 - C8, C10$. We also have $(4)^u > (4)^v$ since with u we reduce cost without increasing effort or reducing revenue. Thus $v \notin E_1$. We have proved all cases of Th' and thus $E_1 \subseteq E_2$.

Appendix A.2. Right: $E_2 \subseteq E_1$

All solutions of Sys2 satisfy all constraints of Sys1 as they satisfy more constraints. We need to prove that they actually maximize (4). The three cases of $E_1 \subseteq E_2$ show that satisfying the constraints C2, C4, and C9 after satisfying all other constraints, reduces cost or effort monotonically without decreasing revenue. This concludes our proof. □