Appendix C

Decomposition of the Total PAC Transfer Payment Change into Price to Volume Effects

C.1 The Total Payment Change: Standard Transfer Payment

Define the change in total Medicare outlays for a DRG as the difference between pre-period and post-period spending:

(C-1) $\Delta E = PREPAY - POSTPAY$

where PREPAY = SA x DRGWT x N^{pre} and POSTPAY = SA x DRGWT x N^{post}, and SA = the hospital-specific standardized amount, DRGWT = the DRG relative weight, and N^{pre}, N^{post} = total DRG discharges before and after the introduction of the PAC transfer policy. To avoid confounding other PPS updates with the new PAC transfer policy, SA and DRGWT are assumed constant over time.

The post-period payments can be decomposed into per diems plus full DRG payments:

(C-2) $$POSTPAY = N^{post}\,[POSTPAY\,(\partial\theta) + POSTPAY\,(1-\partial)]$$

where ∂ = the share of discharges paid on per diem and $\theta = (\overline{LOS}^{pd} + 1)/GLOS =$ the average discount factor from full DRG payment on per diem PAC cases (see Appendix B.1 for proof). (The following analysis assumes all PAC transfer cases are paid on the standard "double per diem" system.) Formulas for the blended payment in three DRGs are presented in C.4. Eq. (C-2) decomposes post-payments into a ∂-weighted average of per diem and full DRG payments. Plugging (C-2) into (C-1)

(C-3) $$\Delta E = PREPAY - POSTPAY \times N^{post}[\partial\theta + (1-\partial)].$$

Substituting for PREPAY and POSTPAY,

(C-4) $$\Delta E = SA \times DRGWT\,[N^{pre} - N^{post}(\partial\theta + (1-\partial))]$$

(C-5) $$\Delta E = SA \times DRGWT\,[N^{pre} - N^{post}(1-\partial(1-\theta))].$$

By assuming a constant per case full DRG payment overtime, the change in Medicare outlays is expressed as the difference between pre- versus post-period discharges, the latter "devalued" by the extent of per diem discounting. Further assuming no change in total discharges, (C-5) simplifies to

(C-6) $$\Delta E = SA \times DRGWT \times N^{pre}[1-(1-\partial(1-\theta))]$$

or

(C-7) $\Delta E = SA \times DRGWT \times N^{pre}[\partial(1-\theta)] = PREPAY[\partial(1-\theta)].$

The bracketed term becomes the overall discount on pre-period payments in implementing the PAC transfer per diem policy.

C.2 The Price Effect: Standard Transfer Payment

The price effect is defined as the ex ante expected change in Medicare outlays and is based on the difference between actual and simulated pre-period outlays:

(C-8) PRICE EFFECT = PREPAY − PRESIM

where

(C-9) PRESIM = $N_{pd}^{pre} \times \overline{PD} + (N^{pre} - N_{pd}^{pre}) \times SA \times DRGWT,$

and $N_{pd}^{pre} =$ the number of discharges in the pre-period paid on a per diem basis. Simulated payments in (C-9) are decomposed into (a) per diem outlays and (b) full DRG outlays. The former are simulated as the product of the total number of pre-period discharges paid on per diem and the average per diem payment amount $(\overline{PD})$. The latter outlays are simply the number of discharges not paid on per diem times the full DRG payment.

Writing the average per diem as

(C-10) $\overline{PD} = SA \times DRGWT[\lambda],$

where $\lambda = (\overline{LOS}^{pd} + 1)/GLOS$ is the expected per diem discount factor and is based on pre-period lengths of stay and geometric mean stays. (See Appendix B for derivation of λ.) Substituting (C-10) and (C-9) into (C-8),

(C-11) $$PRICE\ EFFECT = N^{pre} \times SA \times DRGWT - N_{pd}^{pre} \times SA \times DRGWT[\lambda] - (N^{pre} - N_{pd}^{pre}) \times SA \times DRGWT.$$

Pulling out the common terms,

(C-12) $$PRICE\ EFFECT = N^{pre} \times SA \times DRGWT(1-1) - N_{pd}^{pre} \times SA \times DRGWT(\lambda - 1)$$

(C-13) $$PRICE\ EFFECT = -N_{pd}^{pre} \times SA \times DRGWT(\lambda - 1).$$

Next, multiplying and dividing (C-13) by $-N^{pre}$ gives

(C-14) $PRICE\ EFFECT = -N^{pre}[\alpha\ SA \times DRGWT(\lambda - 1)]$

where $\alpha = -N_{pd}^{pre} / -N^{pre} =$ share of PAC per diem discharges of total discharges in the pre-period. Rearranging (C-14) and multiplying through by -1 gives

(C-15) $PRICE\ EFFECT = SA \times DRGWT \times N^{pre}[\alpha(1-\lambda)].$

The term outside the brackets constitutes total Medicare pre-payments in the DRG while the bracketed term is the expected (simulated) price discount before any changes in either (a) the short-stay PAC transfer rate, α, or (b) the average length of stay of short-stay PAC patients expected to be paid on per diem. (1-λ) = the expected discount rate on short-stay PAC patients.

C.3 The (Behavioral) Volume Effect: Standard Transfer Payment

The behavioral volume effect is defined as the ex post response of providers to the decline in Medicare payment for short-stay patients discharged to PAC. It is calculated as a residual by subtracting the simulated price effect from the actual change in outlays, i.e., eq. (C-5) minus eq. (C-15):

(C-16) VOLUME EFFECT $= SA \times DRGWT[N^{pre} - N^{post}(1 - \partial(1-\theta))]$
$- SA \times DRGWT \times N^{pre}[\alpha(1-\lambda)].$

(C-17) $VOLUME\ EFFECT = SA \times DRGWT[N^{pre}(1-\alpha(1-\lambda)) - N^{post}(1-\partial(1-\theta))].$

Rearranging (C-17) and assuming no change in total discharges,

(C-18) $VOLUME\ EFFECT = SA \times DRGWT \times N^{pre}[\partial(1-\theta) - \alpha(1-\lambda)].$

(Eq. (C-18) is equivalent to subtracting (C-15) from (C-7) directly.) The bracketed offset term can be further rearranged to put changes in PAC discharge rates and short-stay lengths of stay together:

(C-19) $VOLUME\ EFFECT = SA \times DRGWT \times N^{pre}[\partial(\lambda-\theta) + (1-\lambda)(\partial - \alpha)].$

The volume offset factor is written as the change in lengths of short-stay PAC patients, (λ-θ), weighted by the post-period short-stay PAC rate, ∂, plus the change in PAC discharge rates, $(\partial - \alpha)$, weighted by the pre-period LOS discount factor, (1-λ).

For example, assume $\alpha = .3$, $\partial = .2$, $\lambda = .6$, and $\theta = .8$. These hypothetical parameters indicate that the PAC short-stay transfer rate fell 0.1 (=.2-.3) and that short-stay PAC lengths of stay, relative to the geo-mean, rose 0.2 (=.8-.6). Assuming no change in total discharges, the total change in Medicare outlays is calculated using (C-7) as total pre-payments times the overall discount factor, i.e.,

$$\text{TOTAL EFFECT} = \Delta\text{E} = [\partial(1-\theta)] = .2(1-.8) = .2(.2) = .04,$$

or a 4 percent reduction. The reduction is decomposed as

$$\text{PRICE EFFECT} = [\alpha(1-\lambda)] = .3(1-.6) = .3(.4) = .12$$

$$\begin{aligned}\text{VOLUME EFFECT} &= [\partial(\lambda-\theta)+(1-\lambda)(\partial-\alpha)] = .2(.6-.8)+(1-.6)(.2-.3)\\ &= .2(-.2)+(.4)(-.1)\\ &= -.04-.04 = -.08.\end{aligned}$$

Ex ante, expected payment reductions (due to the price effect) are 12 percent, but these have been offset by two, equally sized, volume responses of 4 percent each, resulting in net savings of only 4 percent.

C.4 Payments Effects: Blended Transfer Payment

For DRGs under blended transfer payment, all three payment effects are exactly halved. To see this, the total payment effect under blended payment can be written as

(C-20) $\Delta\text{E} = SA \times DRGWT[N^{pre} - N^{post}(\partial(.5+.5\theta)+(1-\partial))].$

(See Appendix B for per diem blended payment algorithm, (.5 + .5θ). Assuming, again, no change in total discharges, we have

(C-21) $\Delta\text{E} = SA \times DRGWT \times N^{pre}[1-\partial(.5+.5\theta)-(1-\partial)]$

or

(C-22) $\Delta\text{E} = SA \times DRGWT \times N^{pre}[.5\partial(1-\theta)]$,

which is half the standard payment algorithm for the same PAC transfer rate, ∂, and discount factor, (1-θ) (see eq.(C-7)). The price effect is similarly halved. Substituting the blended payment algorithm in for $\overline{PD}$ in (C-9), expanding, and converting N_{pd}^{pre} into a short-stay PAC rate gives

(C-23) $\text{PRICE EFFECT} = SA \times DRGWT \times N^{pre}[-\alpha(.5+.5\lambda)+\alpha]$

and

(C-24) $\text{PRICE EFFECT} = SA \times DRGWT \times N^{pre}[-.5\alpha(1-\lambda)].$

Subtracting (C-24) from (C-22), the residual volume effect naturally is also one-half what it is under the standard transfer payment policy:

(C-25) VOLUME EFFECT = $SA \times DRGWT \times N^{pre}[.5\partial(1-\theta)-.5\alpha(1-\lambda)]$.

Compare with (C-18). The halving of effects is intuitive in that the blended formula halves all per diems while still achieving full DRG payment at one day short of the geo-mean.