Scenario Simulation Model: Methodology

Supplement I to the Report:

Challenges and Alternatives for Employer Pay-or-Play Program Design: *An Implementation and Alternative Scenario Analysis of California's "Health Insurance Act of 2003" (SB 2)*

For the
California Health Care Foundation
and the
California Managed Risk Medical Insurance Board

Project Team Led by the
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Table of Contents

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Drs. Kanika Kapur and M. Susan Marquis of the RAND Corporation developed the database and estimation model, conducted the quantitative simulation analysis on the implications of SB 2 and alternative scenarios, and drafted this Supplement describing the simulation process, as well as Supplement H describing the data sources database development and Supplement A, setting out the results of the simulation. The lead organizations for the overall study were the Institute for Health Policy Solutions and the RAND Corporation. Rick Curtis, of the Institute for Health Policy Solutions, served as the project director. Please see the main report for a detailed discussion of the study process.

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Supplement I:

Scenario Simulation Model: Methodology

Background

The California Health Insurance Act of 2003 (also known as SB 2) adopted a "pay-or-play" mandate aimed at reducing the size of the state's uninsured population. This law required employers over a certain size to either: (a) "pay" a fee to the state so that their workers and, for employers with 200 or more workers, dependents could be covered through a State Health Purchasing Program established under the Act, or (b) "play" by directly providing health coverage for specified workers and dependents. Although SB 2 was overturned by a narrow margin in a November 2004 referendum, the passage of legislation intended to expand employment-based coverage provides a unique opportunity to assess and to evaluate the implementation issues and challenges presented by a "pay-or-play" program.

The Simulation Model

Our simulation model of employers' decisions to offer insurance or to pay a fee to participate in the state pool is based on the behavioral model that was employed by Goldman, Buchanan, and Keeler (2000) to examine the effect of Medical Savings Accounts on the insurance choices of employees in small businesses. Our model assumes that employers' insurance decisions are based on the preferences of their workers, so we start by determining worker preferences for the employer-offered plan and the pool plan. If the majority of workers within a firm prefer the employer-offered plan, the employer is assumed to offer health insurance. Alternatively, if the majority of workers prefer the pool plan, the employer will pay the fee to join the state pool.

Our simulation model can be broken down into the following steps:

1. Develop a model for workers' preferences among health plans.
2. Calculate premiums for available health plans.
3. Estimate out-of-pocket expenses for health services faced by workers under different plans.
4. Estimate the worker's preferred health plan.
5. Estimate firm's choice of offering own plan(s) vs. entering the pool.

The simulation model is applied to a database of employers and workers that we constructed from a variety of sources as described in Supplement H, "Database for Simulation Model." We divided our database into 4 samples of employers and the associated employees and carried out the simulation on each of the 4 samples. Our results present the average of the estimates from the 4 samples. We use the variability in estimates across samples to estimate the reliability of our results.

Step 1: Worker plan preferences

Model Structure

Following the model framework developed by Goldman, Buchanan, and Keeler, we assume that people choose plans to maximize expected utility, where we let Utility (U) depend on health (H) and consumption of non-health goods (C). If utility is separable in health and consumption, we can assume that:

$$U=U(H)+U(C).$$

The choice of insurance plans is made before sickness levels and health care spending are known. People are assumed to face a distribution of possible health care spending levels, and so will choose the insurance plan that will maximize the expected utility of health and consumption over this distribution. We assume that the expected utility of consumption depends on the mean or expected level of consumption and its variance:

$$EU(C) = E(C) - \tfrac{1}{2} r\, var(C),$$ where r is a measure of risk aversion.

The second term in this expression incorporates the notion that workers find uncertainty in consumption costly, and therefore the higher the variance of consumption, the lower the utility obtained from that consumption.

For a given insurance plan, once sickness and health spending levels are known, consumption (C) is constrained to be the amount that is left from wages (W) after paying for the insurance premium and out-of-pocket health care spending (OOP). Therefore, the expected value of C is:

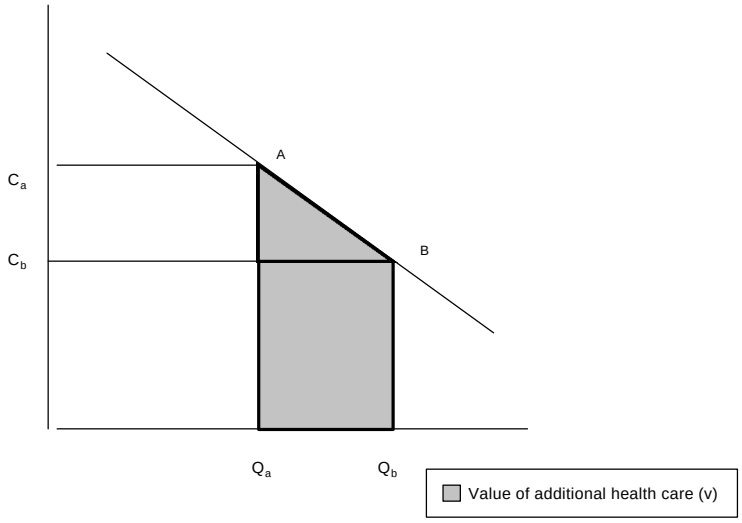
$$E(C) = (1-t)\, W - (1-e)*P - E(OOP),$$

where P is the premium for the plan, e is the share of the premium that the employer contributes, and 1-e is the share of the premium that the employee pays directly.[1]

We will measure the utility of health care in the amounts that the consumer is willing to pay for it, which we can do by using the demand curve to add up the value of marginal services. For example, if the consumer has a choice between a policy with coinsurance C_a and a more generous policy with coinsurance C_b, then the value of the additional services that will be consumed can be calculated as the increased area under the demand curve as the consumer moves from consuming Q_a to Q_b services. This is illustrated in Figure I-1. The area Q_aAB Q_b gives the value, V, of the additional care.

[1] If the worker participates in a Section 125 plan, the worker's out-of-pocket premium is paid in before-tax dollars and so the worker's premium is (1-t)* (1-e)* P. We were unable to find current data on participation in Section 125 plans and how the participation varies with worker characteristics to factor that into our model. Overall participation is only 7 percent, and this is unlikely to substantially bias our results; however these data are based on a 1997 survey, and participation may have risen since then.

Figure I-1. Demand for Health Services and Willingness to Pay



The worker will prefer plan a to plan b if $EU_a > EU_b$, or, given our assumptions above, if:

$$\{(1-t)(W_a - W_b)\} + V(a-b) + \{ (1-e_b)P(b) - (1-e_a)P(a)) \} + \{(E(OOP|b) - E(OOP|a) \} + \{1/2\ r\ (var\ (OOP|b) - var(OOP|a))\} > 0. \quad (1)$$

The first term is the difference in after tax-wages, accounting for the change in the wage due to the health insurance choice, as we discuss below. The second term represents the difference in the value of care. The third term is the difference in the worker's premium share. The fourth term is the difference in out-of-pocket spending for medical care. And the last term represents the difference in risk. In other words, the worker will prefer plan a to plan b if he/she perceives the family will be better off after taking into account the impact of the choice on after-tax wages, the difference in premium cost and out-of-pocket costs, the likely amount of health care consumed, and the financial risks remaining under the two policies.

The model focuses on the financial considerations in choosing a plan. However, non-financial considerations—such as freedom of choice of provider—may also factor into decisions. To incorporate this, we follow Goldman, Keeler and Buchanan in assuming that the value of the health services received in an HMO are worth 90 percent of the value of the same services received in other types of plans.

Wages

We assume that total compensation is fixed and that changes in the employer contributions will be reflected in the workers' wages. If employer contributions to health insurance are increased, money wages will fall (at least in the long run). While economists generally believe this to be the case, the evidence about how this generally occurs—that is, whether an individual worker's wages are adjusted based on the worker's choice or whether the adjustment is based on average employer contributions—is limited.[2] While adjustments may be made for different classes of workers based on readily observable characteristics, such as age, it seems implausible that incidence is fully worker specific within the firm. For our model, therefore, we assume that the adjustment is based on the average employer contribution and does not depend on the specific plan selected or the type of contract (e.g., single or family). Therefore, we calculate the change in wages based on the difference in the employer contribution per covered worker if the firm offered insurance compared to participating in the pool.

Marginal tax rates for each worker in our sample were measured using the NBER TAXSIM model, as described in the appendix entitled "Database for Simulation Model".

Difference in value of care

The difference in the value of care received in purchasing plan a or plan, b is given by[3],

$$V(a\text{-}b) = (Q_a - Q_b) * C_a + \tfrac{1}{2} (Q_a - Q_b) (C_b - C_a),$$

where the quantities (Q) depend on the elasticity of demand, and the consumer's share of cost depends on the plan benefits and actuarial value (see Figure 1 above). We assume an elasticity of -0.1, based on results from the RAND Health Insurance Experiment (Newhouse et al., 1993).

Step 2: Premiums

Generating medical expenditures

In order to set premiums, we generated a distribution of spending for each person in our database using the health care spending reported by the sample of all privately insured persons in the U.S. in the 1997 MEPS. For each person in the MEPS, we have their spending, their age, and their self-reported health status. We stratify the MEPS sample into 30 groups, based on 6 age categories and the 5 levels of reported health status. We randomly select a level of health care spending for respondents in the SIPP sample from the appropriate stratum. This is a measure of actual spending in one period. In order to obtain the distribution of spending for each person, we repeat this process 5 times to obtain 5 points of the distribution. In an earlier study, Actuarial Research Corporation (ARC) aged the health care spending reported by all privately insured

[2] Several studies have found evidence that wage adjustments do vary with the characteristics of the worker (Gruber 1995; Pauly and Herring 1999; Sheiner, 1999). However, a number of studies have failed to find robust estimates of the expected relationship between wages and health insurance (Jensen and Morrisey, 2001; Levy and Feldman, 2001; Simon 2001).

[3] This is a linear approximation of the change, because the demand curve may not be linear. However, we are looking at fairly small changes in cost-sharing, and so the approximation should not introduce much error.

respondents in the 1997 MEPS to the year 2002 using the CMS National Health Accounts as the benchmark. To account for changes in spending between 2002 and 2003, we inflated these estimates by 15 percent—the estimated increase in premiums in California over this period based on the 2002 and 2003 surveys of private employers in California done by the Kaiser Family Foundation and the Health Research and Educational Trust (KFF/HRET). These expenditures represent the distribution of spending for a typical plan. However, spending levels by those covered under a more generous policy would be expected to be somewhat greater, and spending levels by those under a less generous policy would be somewhat lower. We have adjusted spending to account for these demand effects assuming the elasticity of -0.1 we noted earlier. In addition, we account for lower spending in HMOs, by reducing spending under an HMO plan by 10 percent.

Setting premiums

Premiums are calculated separately for workers electing single coverage, workers electing two-party coverage, and those electing family coverage. The worker's choice of type of coverage is based on SB 2 requirements and current practice. SB 2 requires large businesses to cover workers' dependents. In medium businesses, SB 2 does not impose any mandates on dependent coverage. Therefore, we assume that workers will cover any dependents that they currently cover in their employer plan (see Supplement H, "Database for Simulation Model"). Premiums are set as the product of expected covered expenses for the group and a loading fee.

Expected covered expenses depend on the benefits of the plan and the expected spending of covered persons. Our constructed database, described in Supplement H, "Database for Simulation Model," characterizes each insurance plan that the employer currently offers by the actuarial value of the plan—the share of medical bills that the plan would cover. Insurance typically covers large medical bills more generously than small medical bills. Therefore, we have calculated the actuarial value of the plan benefits according to spending levels based on the quartiles of the distribution of spending in the entire population. That is, we have four actuarial values—one for each quartile—to characterize each plan offered.

Premiums for plans offered by employers

We set premiums for workers taking single coverage by calculating the plan payout for each of the five expenditure levels assigned to the worker, and then averaging for all workers in the group electing single coverage. We chose to restrict the calculation to workers electing single coverage to account for differences in the health risk of persons who choose single vs. family coverage.[4] The loading fee is assumed to be 10 percent.

We calculate premiums for two-party coverage (including worker and spouse or worker and one child) as twice the single coverage plan and premiums for family coverage as three times the single coverage plan. These multiples were based on ratios as measured in the Medical Expenditure Panel – Insurance Component for California in 2002. They are also consistent with

[4] In groups with no members taking single coverage, we set the single coverage premium based on all workers in the group.

multiples taken from price lists of insurers in California who sell coverage in the individual market.[5]

SB 2 includes rating reforms for medium employers (with 50-199 workers) that limit the premium variation to a range of from 85 to 115 percent of a standard risk. To incorporate these provisions in our simulation, we calculate the actuarially adjusted premiums for all medium businesses. We then trim actuarially adjusted premiums that fall below 85 percent of this average or exceed 115 percent of the average.

The pool fee

To measure the premium that would be charged for the pool (the fee), we initially set the premium as if those entering the pool are of average risk. That is, we calculate expected payout for the pool plan over all workers electing single coverage—after accounting for the adjustment factors that are assumed to be used in setting the fee—to determine the single premium for the pool. We then apply the multiples as described above to set two-party and family premiums. We simulate worker choices given these premiums and then recalculate the pool premiums based on expected payout for workers in businesses that actually participate. We iterate in this way until premiums for the pool change by less than 0.5 percent or until the pool fails to attract at least 1 percent of employers.[6] (More detail on how the premiums are set for the pool in the various scenarios is given below).

Out-of-pocket premium cost to workers

The premium cost to the workers depends on the nominal premium, measured as described above, and the employer contribution share. Current contribution rates for each plan offered by the employer were derived from the KFF/HRET survey, again as described in Supplement H, "Database for Simulation Model."

However, SB 2 includes two provisions that might alter these contribution amounts. First, contribution rates for single coverage must be at least 80%, and in large businesses the contribution rate for family coverage must also be at least 80%. The employer is required to offer at least one plan that meets these minimum contribution requirements. If the current offerings do not satisfy this requirement, we increased the contribution for the plan that would minimize the additional contribution amount that the employer would make for its worker population—given worker preferences among plans.

In addition, contribution amounts for low-wage workers are capped. For workers with low wages (below 200 percent of poverty for those with single coverage or a family of three, depending on whether coverage of dependents is required), the contribution is limited to 5 percent of wages. Again, the employer is required to offer one plan that caps the low-wage worker contribution, and we choose this to be the plan that would minimize the increased employer contribution.

[5] We used multiples rather than try to calculate the premiums based on expected payout within the group for workers choosing two party or family coverage because of sample sizes within the groups.

[6] We do not necessarily attribute a time dimension to this decision. Insurers will have better foresight about who will actually choose the plan than the simulators.

Step 3: Out-of pocket expenses and risk

With the five observations on the distribution of spending for each person given plan j, and the actuarial value of plan j for each quartile of spending, we calculate the expected out-of-pocket expenditures for each family and the variance of out-of-pocket spending for the family.[7] We assume a risk parameter of 0.00055. In 2003 dollars, this is consistent with the risk-aversion parameter estimated by Marquis and Holmer (1996) and used by Goldman et al. in their analysis of MSAs.

Step 4: Worker's preferred health plan

Worker eligibility for health insurance

SB 2 requires that all employees of medium and large businesses who work at least 100 hours per month and who have worked for the business for at least three months be provided with health insurance. Our model adopts these requirements.

Plans offered

Employers that currently offer insurance are assumed to have selected the set of plans to offer that best meets the needs of their employee population, and so are assumed to continue to offer that set of plans if they decide to offer insurance rather than participate in the pool. However, some employers will be required to substantially increase their contributions to coverage or to add a large number of additional employees to their plans. Some of these employers may respond by altering the benefits that they offer. We account for this by assuming that the employer introduces a new, minimum benefit plan, if doing so would decrease the employer contribution amounts relative to the expected aggregate contribution if the benefit package remains unchanged. The new benefit plan offered is assumed to be available to any employee who would prefer it, and to be the sole choice available to employees working fewer than 30 hours a week or with less than 6 months on the job. To account for the administrative costs of introducing a new plan, we assume that employers must realize a savings of greater than 20 percent in order to choose to introduce the new plan. The new minimum benefit plan is assumed to be one with characteristics that place it at the lowest 10^{th} percentile of the actuarial value distribution. It is equivalent to a plan with a $1,000 deductible, a 20 percent coinsurance rate, and a $5,000 out-of-pocket maximum. This minimum benefit plan is also assumed to be the plan that employers that do not currently offer health insurance would provide, if they choose to provide insurance rather than participate in the pool.

Pool plans and fee

We explore pool participation under various assumptions about the plan(s) offered, the fee, and employer contribution policies for dependent coverage for workers in businesses of fewer than 200 that enroll dependents.

[7] Some low-income workers may perceive that they would receive some public support for their medical expenditure liabilities if they incur very large medical bills, for example, uncompensated care. In such a case, their perceived out-of-pocket expenditures would be lower than our model assumes.

One pool offering that we explore is the same as the minimum benefit plan described above as the new plan offered by employers that experience large increases in costs. We also examine what happens when the pool plan is relatively generous. This is a plan design that is in the top 75th percentile of plans offered by private employers, when ranked on actuarial values. It is equivalent to a plan with a $100 deductible, 20% coinsurance, and a $1,250 out-of-pocket maximum.

We also examine a design that allows low-income families whose employers are in the pool to enroll in Healthy Families plans. They benefit from lower cost-sharing and from lower premiums that they must pay. We estimate the preference for these low-income families for the pool offering, the Healthy Families plan, or the employer plan. Actuarial values are assigned to the Healthy Families plans based on actuarial values for an HMO with a $5 per visit copayment for physician care, prescription drugs, and mental health care. As we do in evaluating other HMOs, as described above, we assume spending in Health Families plans is 90 percent of what it would be in actuarially equivalent PPOs, and the people value the restricted network at 90 percent of what they would a less restrictive network.

Fees paid by employers are assumed to be set on the basis of expected spending by those in the pool, plus a 10 percent administrative fee. As with private premiums, we set fees for those with single coverage, two-party coverage, and family coverage; and we use the same multiplicative factors for two-party and family coverage given above. As noted earlier, we initially set the fee as if those entering the pool are of average risk, after accounting for allowable adjustment factors. We then observe the actual cost for those entering the pool adjusting for allowable factors, reset the fee, and predict participation in the pool. Iteration continues until we reach a stable solution.

All of our fees allow for geographic adjustment. Our expenditure distributions are implicitly corrected for geography, because we draw from the same distribution of spending regardless of the workers location. Thus, calculating fees based on this adjusted distribution also implicitly allows for a geographic adjustment factor.

We also consider other adjusters including age and health status. We determined age adjusters by calculating average expected spending by subscriber age for each contract type. We used five subscriber age categories: under age 30, 30-40, 40-50, 50-60 and 60 or older. Within each contract type, we calculated adjusted spending for the population on which the fee is calculated based on the ratio of average spending for the subscriber age group to spending for the under-age-30 population with the same contract type. We then calculate adjusted premiums for the population expected to participate in the pool (the entire population to initiate the simulation and observed takers in subsequent rounds). The employer premium for each contract type is then the age-adjusted premium times an adjustment factor to account for the age of the employer's group. For each contract type, this is the sum of the percent of workers in the age group times the adjustment factor for age.

To introduce a health adjustment factor, we carry out a similar process by calculating factors for health rating based on age-adjusted spending. That is, we calculate marginal adjustments after taking into account age adjustments. Health ratings are based on self-reported health status, and

adjustments are calculated for those in excellent health vs. very good or good health vs. fair or poor health.

We also examine a pool design in which employer fees and worker contributions are based on payroll and wages. In this design, we do not need to iterate to a stable solution. Any shortfall in receipts, given those who are predicted to participate in the pool, is assumed to be subsidized by the public sector.

Worker's plan preference

We first calculate the preferred plan among those offered by the employer using equation 1. We then compare this plan to the plan offered by the pool to determine whether the worker prefers that the employer offer insurance or pay into the pool. Since there is substantial evidence of inertia in health plan choice, we introduce this by requiring that the utility of the pool plan be at least 10 percent higher than the utility of employer plan among workers who currently elect employer coverage. We use the strict inequality given in equation 1 to determine the preference of workers who are not now covered by an employer plan but will be so under SB 2.

Step 5: Firm's decision to offer insurance or to pay into the pool

The firm's decision is based on the preferences of a majority of workers. If the majority prefers the pool plan, the employer will pay the fee and participate in the pool. Otherwise the employer will provide insurance.

Evaluation of the Model

One measure of the validity of the model is how well it predicts what we know to be characteristics of the market. We therefore first applied the model to predict the actual choices made by workers in the private sector who currently elect coverage and compared our predictions to information about the distribution of choices. Employees are offered up to 4 health plans—an HMO, a PPO, a POS, and a conventional plan. The actual number and types of plans offered depend on the offers made by employers in our constructed database, described in Supplement H, "Scenario Simulation Model: Data Sources and Database Construction."

Table I-1 first compares the estimates of average premiums paid by employers for different plan types generated by our model and based on the KFF/HRET employer survey.[8] It also reports the coefficient of variation (C.V., the standard deviation divided by the mean) to demonstrate that the model matches the current reality fairly well on the distribution of premiums across businesses as well as the mean. The similarity between the distribution of premiums in our simulation and the market observed in the survey is further demonstrated in Table I-2.

[8] From our constructed database which reweights the KFF/HRET survey to match the counts of employers and employees in different size groups in the EDD database.

Table I-1. Comparison of average single coverage premiums by plan type from simulation model and employer survey

Source	HMO plans	PPO plans	POS plans	Conventional plans
Simulation model				
Mean ($ per year)	$2,916	$3,481	$3,370	$3,161
C.V.	0.4	0.5	0.5	0.4
Employer survey				
Mean ($ per year)	2698	3928	3257	3532
C.V.	0.4	0.4	0.3	0.5

Table I-2. Distribution of premiums paid by employers from simulation model and employer survey.

	Simulation Model	Employer Survey
Distribution of Single Premiums	($ per year)	
10^{th} percentile of employers	1806	2064
25^{th} percentile	2305	2424
Median	2959	3048
75^{th} percentile	3839	3864
90^{th} percentile	4620	4898

Table I-3 compares our predictions from the simulation model of the enrollment choices made by private sector workers who currently enroll in their own group plans with what we observe based on the employer-survey data. The simulation model accords very closely with actual choices.

Table I-3. Current enrollment choices of workers in medium and large businesses from simulation model and employer survey

Source	HMO plans	PPO plans	POS plans	Conventional plans
	(Percent of enrollees)			
Simulation model	44.6	33.2	20.6	1.6
Employer Survey	48.7	31.1	19.6	0.6

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