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Why Do Firms Offer Multiple Health Plans?

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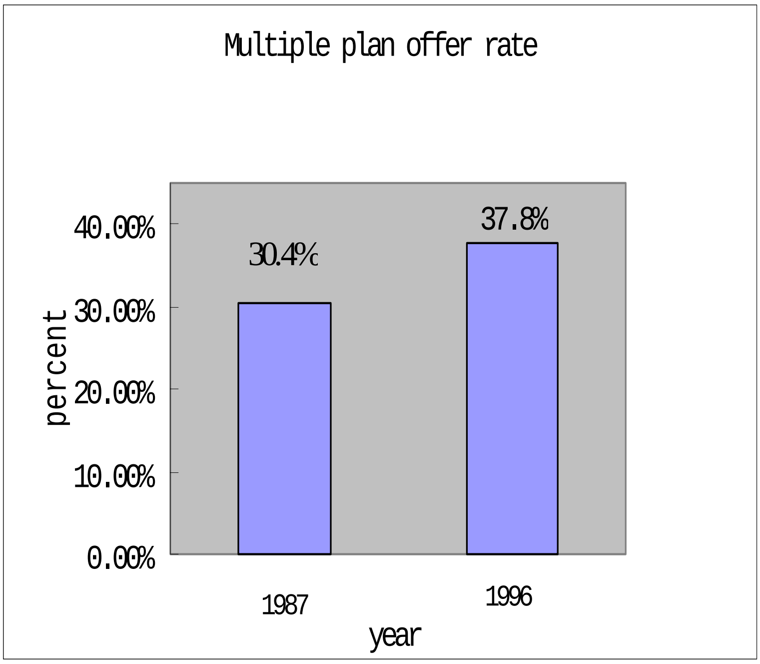
Abstract

Although health insurance coverage of workers fell during the 1980s and 1990s, the proportion of workers offered a choice of plans grew rapidly. We develop a model in which some private employers offer a single health insurance plan while others offer multiple plans. The existence of multiple plans not only reflects heterogeneous tastes but also allows firms to offer a relatively unattractive plan for free and a more attractive plan at a lower cost to those who find the more attractive one valuable. We calibrate the model to explain the change between 1987 and 1996 in the offer rate, proportion of workers offered a choice of plans, the take-up rate and the coverage rate. Our results suggest that the increased frequency with which firms offer a choice of health insurance plans reflects changes in the relative price of different plans and the increase in the proportion of skilled workers. These factors more than offset the decline in the tax wedge between employer- and employee-paid premiums.

Introduction

In the late 1980's and early 1990's there was a dramatic increase in the number of workers in firms that offer more than one employer-provided health insurance plan (see Figure 1 below). This change has received much less attention in the literature than other concurrent trends such as the decline in the fraction of workers covered by employer-provided health insurance (Farber and Levy, 2000), the increase in the proportion of those obtaining health insurance through their employer who contribute to the cost of the premium (Gruber and McKnight, 2002), the increase in number of workers in firms providing health insurance and the decline in the take-up rate (Farber and Levy, 2000).

Figure 1. Multiple-plan offer rate for job-based health insurance: 1987 and 1996



Data source:National Medical Expenditures Survey 1987,Medical Expenditure Panel Survey 1996

This paper addresses why firms offer multiple-plans and why offering multiple plans has become more common. We develop a model in which firms have access to two insurance plans. One plan is relatively inexpensive and is less generous. The other is more expensive and more generous. In equilibrium some firms offer both plans; others offer only one plan, and yet others offer neither to their workers. In addition, some firms provide the insurance for free while others require an employee contribution to the premium. In all cases where firms offer both plans, they provide the less generous plan for free and require an employee premium from those selecting the more generous plan.

Not surprisingly, firms offer multiple plans because their workers have heterogeneous tastes for health insurance. However, the mechanism by which worker heterogeneity generates multiple offering is more subtle than might be expected. Even when all workers in a firm fall into one of two groups: those who would be willing to cover the full cost of the more generous plan and those who would not even be willing to cover the cost of the less generous plan, the firm may still offer both plans. The reason is that by offering the less generous plan for free, the firm can offer the more generous plan at a lower premium without attracting to the more generous plan workers who put a low value on the health insurance.

Having developed the equilibrium model, we turn to the question of why offering multiple plans has become much more common. We calibrate the model for 1987 and 1996 using data from the National Medical Expenditure Survey and Medical Expenditure Panel Survey. Our estimates imply that the growth in offering of multiple plans reflects the growth in the number of workers who value health insurance highly and a decline in the cost of low cost plans relative to high cost plans. We estimate that the tax wedge between employee and employer premiums declined from 42% to 33% over that period which tended to reduce the frequency with which firms offer multiple plans. The calibration also addresses the rise in the overall offer rate and the decline in the take-up rate. The decline in the tax wedge more than accounts for both of these changes.

1 The intuitive argument

At first blush it may not seem surprising that firms offer multiple health insurance plans. After all, workers have heterogeneous tastes, and it seems natural that therefore firms would offer different health plans to appeal to different workers. However, firms have only a limited ability to discriminate among workers with respect to the plans that they offer. Therefore unless it requires a sufficiently high employee premium for more generous plans, all of the workers at a firm will choose the more generous plan even though they do not place much value on its additional benefits. If charging for health insurance were costless, then full efficiency could be achieved simply by setting the employee premium for each plan at its cost to the firm. However, the fact that few firms follow this policy suggests that employee premiums are inefficient, an assumption that will be built into our model. Full efficiency could also be achieved if workers were sorted across firms so that within each firm workers were homogeneous with respect to their taste for health insurance. As Pauly (1986) has pointed out, with perfect sorting, no firm would require an employee premium. Therefore, we examine a model in which sorting is imperfect. Levy (1998), Dranove, Baker and Spier, Gruber and McKnight and (implicitly) Bernard and Selden (2002) also examine insurance provision in models with imperfect sorting but do not endogenize the mismatching.

In our model, mismatching arises because production requires two different types of workers (low and high skill) with different distributions of willingness to pay for health insurance, and firms are compelled to offer health insurance in a nondiscriminatory fashion. Some high skill workers with high valuations of health insurance must be matched with low skill workers with low valuations. Despite the tax (or other) advantages of offering health insurance for free, if the low skill workers' valuations are sufficiently low, it is efficient (and profitable) for the firm to charge for health insurance.

Before addressing the intuition for the case where different types of health insurance are available, it is helpful to consider the case where only one type of health insurance is available on the market. We address this case in detail in Lang and Kang (2004) which focuses on the effects of tax policy on health insurance provision. With only one type of health insurance, firms in which both high skill and low skill workers place a high value on health insurance will offer it for free. Since all workers place a high value on health insurance, there is no point in deterring any worker from getting health insurance. These firms offer low wages but are desirable to workers who value health insurance highly. At the other end of the spectrum, firms with only workers who place a low value on health insurance will not provide insurance but will pay a high wage that makes them attractive to workers who do not particularly want health insurance. Finally, firms that attract the mismatched workers (high skill workers with high valuations of health insurance and low skill workers with low valuations) will require an employee premium that deters low skill workers from taking health insurance. They pay a compensating differential to low skill workers for not having health insurance and a compensating differential to high skill workers because they must pay part of their insurance premium costs.

When there are multiple plans, the intuition is similar. We assume that there are two plans that are ordered both by quality or generosity and by price. All workers prefer the more generous or good plan to the bad plan. However, some workers would be willing to pay more than the price differential between the plans in order to get the good plan while others would not. Moreover, some workers are not even willing to pay the cost of the bad plan. As before, the skilled and unskilled workers who place a high value on the good plan should be matched and receive the good insurance for free (while receiving a relatively low wage). And those who place a low value on health insurance will be matched and will work in firms that do not offer health insurance but will receive relatively high wages.

The matching of the remaining workers can be complicated. To see this consider what would happen if all skilled workers were willing to pay the cost of the good plan and no skilled worker were willing to pay the cost of even the bad plan. Then all workers will be mismatched, but the market will organize itself to minimize thc cost of this mismatching. For any firm there are six solutions: offer the good health insurance for free; offer the bad health insurance for free; do not offer health insurance; offer the good health insurance but require an employee premium; offer the bad health insurance but require an employee premium; offer the bad insurance for free but require an employee premium for the good insurance.

Each of these is an efficient solution in some settings. Although we will prove that not all can coexist in equilibrium, all can exist in some equilibrium. When high skill workers place high value on insurance and a high value on good insurance relative to bad insurance, then the efficient solution will involve offering good insurance. If low skill workers value good health insurance at almost its cost and value it a great deal more than bad insurance, it is very costly to deter them from purchasing the insurance. Since employee premiums are inefficient, this inefficiency would be large relative to the small inefficiency from having them receive the good insurance. Therefore in equilibrium firms in this situation offer the good health insurance for free. If low skill workers value bad health insurance almost at its cost but are not willing to pay much extra for good insurance, there is little inefficiency from providing them with bad insurance. Once they have been given bad insurance, the cost of deterring them from purchasing good insurance is small. Therefore the efficient solution is to provide bad insurance for free and to charge a premium for good insurance. Finally, if low skill workers place very little value on any health insurance, the cost of deterring them from buying good health insurance is small even when bad insurance is not available, and the efficient solution is to offer only the good insurance but to require an employee premium.

When high skill workers do not value good health insurance over bad insurance at much more than the price differential between the two, the efficient solution will generally be to provide them with the bad insurance. If the low skill workers value bad insurance at almost its cost, the solution is to provide the bad insurance for free. If they place a low value on even the bad insurance, the solution is to offer the bad insurance but to require an employee premium. Finally, if the valuation high skill workers put on insurance is not much greater than its cost and the cost of detering purchase by low skill workers sufficiently high, then the efficient solution is not to offer health insurance.

But then, what caused the multiple-plan offer rate to rise? From the intuition above, offering both plans is efficient when the inefficiency cost of employee premiums is high and when the relative cost of the bad plan is low. The advantage of offering multiple plans is that the employee premium for the good plan is lower than when only the good plan is offered. This also suggests that multiple plans will be favored when the number of high skill workers is large relative to the number of low skill workers. Over the period we study, the tax wedge declined which makes the rise of multiple plan offerings surprising. This suggests two other driving forces. The shifting technology towards higher skill concentration of US economy increased the proportion of skilled-worker in firms. In addition, there was a significant increase in HMO's over this period. One interpretation of the rise of HMO's is that they provided a mechanism for offering a better "less generous plan."

2 The Model

We assume there are two medical insurance plans (Good and expensive, Bad and inexpensive) available. The cost to employers of providing the bad health insurance to an employee is p_B, and p_G is cost of the good plan..

There are two types of workers 1 and 2, distinguished by the type of work they do, each with measure m_i. It may be helpful to think of these as skilled and unskilled workers or as white-collar and blue-collar workers. Worker type is exogenous.

Within each type, there is a distribution $F_i(b)$ of willingness to pay for the inexpensive health insurance where $0 < F_i(p_B) < 1$. F_i is continuous with $F_i' > 0$ everywhere in the support.

Further assume that

$$F_1(b) < F_2(b)$$

everywhere in the interior of the support. Thus the type 1 workers value health insurance more than the type 2 workers in a stochastic sense. We treat this difference in willingness to pay as exogenous. However, we think of type 1 workers as skilled workers and type 2 workers as unskilled workers. In this context, the difference in mean willingness to pay can be explained by differences in earnings.

Workers' willingness to pay for the good health insurance is vb and $0 < F_i(\frac{p_G}{v}) < 1$, $v > 1$.

Output is produced according to a production function that is homogeneous of degree one in the two types of workers, that is

$$q(L_1, L_2) = L_2 q(\frac{L_1}{L_2}, 1) \equiv L_2 q(\theta).$$

Firms pay p_G or p_B for each worker for whom they provide health insurance. If workers who get health insurance pay an employee premium, this is denoted by c_G or c_B. The cost to the worker is γc_G or γc_B, $\gamma > 1$. Formally we model γ as representing a tax wedge since the majority of workers do not participate in section 125 plans that allow such premiums to be paid on a pre-tax basis. However, we believe that treating γ as capturing the effects of adverse selection would have similar properties. Although wages may differ across firms, within a firm, wages may not be conditioned on whether or not an employee receives health insurance. The employee premium may not be conditioned on worker type.

Profit is given by

$$\pi = q(L_1, L_2) - \sum_{i\in L_1, j\in G,B} (w_1 + [p_j - c_j]H_i) - \sum_{i\in L_2, j\in G,B} (w_2 + [p_j - c_j]H_i)$$

where H_i equals 1 if the worker takes health insurance and 0 otherwise. Note $p = p_G$, $c = c_G$, for the good plan, p_B ,c_B for the inexpensive one.

Each worker's utility is given by

$$u_i = w_i + (([v - 1]g_i + 1)b_i - \gamma(c_B + g_i(c_G - c_B)))H_i$$

where g_i equals 1 if the worker has the good health insurance plan and 0 otherwise. This equation just says that a worker who receives bad insurance values it at $b_i - \gamma c_B$ and that a worker who receives good insurance values it at $vb_i - \gamma c_G$.

We model a market rather than a game. Therefore we define equilibrium in terms of prices and the allocation of workers to firms rather than in terms of worker and firm strategies.

Definition 1 *An equilibrium is a profile of compensation packages* $\{(w_1^A, w_2^A, c_G^A, c_B^A), (w_1^B, w_2^B, c_G^B, c_B^B), ...(w_1^K, w_2^K, c_G^K, c_B^K)\}$ *and an allocation of workers and firms such that*
1. All firms make zero-profit
2. No worker prefers to be employed at a firm with a different compensation package
3. All workers are employed
4. All workers have their preferred insurance status given the employee health insurance premium
5. The ratio of two types of workers in any firm maximizes profit at the firm given the compensation package and health insurance status of workers at the firm
6. There is no other compensation package that would simultaneously attract both type 1 and type 2 workers and make positive profit.

Note that because production is constant returns to scale, the size of individual firms is indeterminate.

Deriving the equilibrium is a tedious process of eliminating a variety of possibilities. We relegate all the technical details to the appendix. However, there are some points worth making. First, if all workers are getting health insurance, at least one plan must be offered for free. If not, it would be possible to lower the employee contrbution by x and the wage by γx, thereby increasing profit. Second, if workers of a given type are receiving the same insurance in two firms, their wages must differ by γ times the difference in their employee premium. Third, workers of a given type who are not receiving health insurance will earn more than those who are, and those receiving bad health insurance will earn more than those receiving good insurance.

It follows that all workers of a given type at a firm will all have the same health insurance status and that there will be a unique compensation vector associated with the insurance status of the workers at a firm.

Proposition 1 *In equilibrium there are only nine possible types of offers summarized by the health insurance status of the two types of workers. Denoting this status by XY where $X \in \{G, B, O\}$ is the insurance status of type 1's and $Y. \in \{G, B, O\}$ is the insurance status of type 2's, then firms must by of type GG, GB, GO, BG, BB, BO, OG, OB, or OO.*

Proof. see appendix ■

Since it is trivial to show that firms of type GG must exist in equilibrium, we denote the equilibrium compensation vector at GG firms as $(w_1, w_2, 0, \infty)$ where the first element is the wage paid to type 1 workers, the second is the wage paid to type 2 workers and the third and fourth elements are the employee premiums for good and bad insurance Note that any nonnegative employee premium for the bad insurance is an equilibrium which is identical in every important way to the one in which the employee premium for the bad insurance is infinite. We adopt the convention that the employee premium for any insurance not purchased at the firm in equilibrium is infinite. Any statements about uniqueness are subject to this caveat.

We use b_i^G to denote the value of b for the worker of type i who is just indifferent between working for a firm at which he obtains the good insurance and working for one at which he obtains the bad insurance. Similarly b_j^B denotes the value of b for the worker of type j who in equilibrium is indifferent between having no health insuarance and the bad insurance.

The table below summarizes the compensation cost associated with each offer type. To see how it is derived, begin with the case of GB firms. Since type 2 workers with $b = b_2^G$ must be indifferent between getting good and bad insurance, they must get a compensating wage differential of $(v-1)b_2^G$ for getting the bad insurance rather than the good insurance. Any bigger difference, and they would strictly prefer to working at a GB firm to working at a GG firm. With a smaller difference, they would prefer a GG firm. In order to deter type 2 workers from purchasing the good insurance, the employee premium must satisfy

$$\gamma c_G = (v-1)b_2^G$$

or

$$c_G = \frac{(v-1)b_2^G}{\gamma}.$$

Since type one workers purchase the good insurance they require a compensating differential of γc_G while the firms net cost is

$$(\gamma-1)c_G = \frac{(\gamma-1)}{\gamma}(v-1)b_2^G.$$

The remaining cases are derived in an analogous fashion. Further details of the derivation are given in the appendix.

TABLE 1 COMPENSATION COSTS		
Firm Type	Type 1 Compensation Cost	Type 2 Compensation Cost
GG	$w_1 + p_G$	$w_2 + p_G$
GO	$w_1 + p_G + \frac{\gamma-1}{\gamma} v b_2^B$	$w_2 + b_2^B + (v-1)b_2^G$
GB	$w_1 + p_G + \frac{\gamma-1}{\gamma}(v-1)b_2^G$	$w_2 + p_B + (v-1)b_2^G$
BG	$w_1 + p_B + (v-1)b_1^G$	$w_2 + p_G + \frac{\gamma-1}{\gamma}(v-1)b_1^G$
BB	$w_1 + p_B + (v-1)b_1^G$	$w_2 + p_B + (v-1)b_2^G$
BO	$w_1 + p_B + (v-1)b_1^G + \frac{\gamma-1}{\gamma} b_2^B$	$w_2 + b_2^B + (v-1)b_2^G$
OG	$w_1 + b_1^B + (v-1)b_1^G$	$w_2 + p_G + \frac{\gamma-1}{\gamma} v b_1^B$
OB	$w_1 + b_1^B + (v-1)b_1^G$	$w_2 + p_B + (v-1)b_2^G + \frac{\gamma-1}{\gamma} b_1^B$
OO	$w_1 + b_1^B + (v-1)b_1^G$	$w_2 + b_2^B + (v-1)b_2^G$

Of these the only combination that can be ruled out is OG, which would contradict our assumption that willingness to pay is greater in the sense of stochastic dominance among type 1's than among type 2's. However, the remaining eight compensation vectors cannot exist simultaneously in equilibrium. The theorem below shows the set of feasible combinations.

Proposition 2 *All equilibria must contain only a subset of one of two sets of offers. One set consists of type GG, GO, BB, BO, OO firms; the other consists of GG, GB, GO, BB, OB, OO firms.*

Proof. see appendix ■

The first set of equilibria is uninteresting from our perspective since no firm offers multiple plans. It is a straightforward extension of the equilibrium in Lang and Kang (2004) in which there is only one type of insurance. Type 2's are overinsured in the sense that the marginal type 2 receiving bad insurance values it at less than p_B and the marginal type 2 receiving good insurance values it at less than p_G. Type 1's are underinsured in the same sense. The main result of that paper goes through. Reducing the tax wedge γ increases efficiency but may increase or decrease health insurance coverage.

We therefore focus on the second equilibrium in which there are at most six types of firms (GG,GO, GB, BB, OB, OO). We can show that the full six-offer equilibrium does not exist if the ratio of the price of the good plan to the price of the bad plan (p_G/p_B) is greater than 2 and for realistic values of γ generally must be greater than 3.[1] Since we will not use a price ratio of this magnitude and since our experience suggests that the actual bound is tighter than the theoretical bound we have found, we will work with a five-offer variant of this equilibrium. The equilibrium of the form GG, GB, BB, OB, OO is ruled out by the restrictions on the distribution of tastes while GG, GO, BB, OB, OO does not have any firms offering multiple plans. Thus we focus on the equilibrium with five offers of the form GG, GB, GO, BB, OO. Also this is the only equilibrium that survives with the realistic parameters in our calibration.

2.1 The GG, GB, GO, BB, OO Equilibrium

Since type 2 workers do not care about the compensation of type 1 workers, GO and OO firms have the same compensation cost for type 2 workers. If all firms make zero profit, then GO and OO firms must also have the same compensation cost for type 1 workers. Similarly, GB and BB firms must have the same compensation costs for both types of worker. Finally we note that since GO and GB firms must pay a compensating differential to type 1 workers

[1] Details available from the authors on request.

that GG firms do not pay, the compensation cost for type 1 workers is lower and for type 2 workers higher in GG firms than in GB or GO firms.

We rely primarily on numerical results for this equilibrium since there are relatively few analytic results. However, we can show that the existence of the tax wedge leads to inefficiency. To see this, let q_i^j denote the compensation cost for type i workers in firms of type j. From the discussion in the previous paragraph

$$q_1^{BB} = q_1^{GB} > q_1^{GG}. \tag{1}$$

Using the information on compensation costs in table 2, this implies that

$$(v-1)b_1^G > p_G - p_B. \tag{2}$$

Similarly $q_2^{GB} < q_2^{GG}$ and therefore

$$(v-1)b_2^G < p_G - p_B. \tag{3}$$

Too few type 1's and too many type 2's get the good plan.

Since there are no OB firms, we know that

$$p_B + \frac{\gamma-1}{\gamma}b_1^B > b_2^B \tag{4}$$

and because there are no BO firms, we know that

$$p_B + \frac{\gamma-1}{\gamma}b_2^B > b_1^B. \tag{5}$$

Finally because both OO and BB firms exist

$$(p_B - b_1^B)(p_B - b_2^B) \leq 0 \tag{6}$$

with equality only when both terms in parentheses are zero. Thus there may be too many type 1's or too many type 2's without health insurance but not both.

3 Calibration

We calibrate the model using information from 1987 and 1996. The choice of dates is driven, in part, by the stability of the income tax system and the rapid growth of section 125 plans over this period. This makes it relatively easy to assume that the tax wedge was falling throughout the period. The choice is also driven in part by the availability of data. We obtain much of our data from the 1987 National Medical Expenditures Survey (NMES) and from the 1996 Medical Expenditures Panel Survey (MEPS).

To calibrate the model, we require a functional form for the production function and distributions for the willingness to pay for health insurance. We assume that the production function is CES. We have five zero profit conditions but only three first-order conditions because the compensation costs are the same for two pairs of firm types. In addition, we have two labor market equilibrium conditions. We require that the distribution of workers in different jobs be consistent with the distribution of tastes which adds four equations. Finally, we have the equations determining the employee contribution to premiums.

We thus have sixteen equations in the sixteen endogenous variables (2 wages (w), 3 ratios of high to low skill workers (θ), 5 $L's$, two employee premiums (c_{GB} and C_{GO}) and 4 cutoffs (b)). These equations are summarized in table 3.[2] There are sixteen endogenous variables given by w_1, w_2, L_{GG}, L_{GO}, L_{GB}, L_{BB}, L_{OO}, θ_{GG}, θ_{GO}, θ_{GB}, b_1^B, b_1^G, b_2^B, b_2^G, c_{GB} and c_{GO}.

[2] For details of the derivations see the calibration appendix.

TABLE 2 Calibration Equations	
Zero-Profit Conditions	
$GG : (a_1\theta_{GG}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G)\theta_{GG}-(w_2+p_G) = 0$	
$GO : (a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G+\frac{\gamma-1}{\gamma}vb_2^B)\theta_{GO}-(w_2+b_2^B+(v-1)b_2^G) = 0$	
$GB : (a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G)\theta_{GB}-(w_2+p_B+(v-1)b_2^G) = 0$	
$BB : (a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_B+(v-1)b_1^G)\theta_{GB}-(w_2+p_B+(v-1)b_2^G) = 0$	
$OO : (a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+b_1^B+(v-1)b_1^G)\theta_{GO}-(w_2+b_2^B+(v-1)b_2^G) = 0$	
1st Order Conditions	
GG	$a_1\theta_{GG}^{\rho-1}(a_1\theta_{GG}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G$
GG, OO	$a_1\theta_{GO}^{\rho-1}(a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}vb_2^B$
GB, BB	$a_1\theta_{GB}^{\rho-1}(a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G$
Labor Market Equilibrium	
Type 1's: $\theta_{GG}L_{GG}+\theta_{GO}L_{GO}+\theta_{GB}L_{GB}+\theta_{GB}L_{BB}+\theta_{GO}L_{OO}= m_1$	
Type 2's: $L_{GG}+L_{GO}+L_{GB}+L_{BB}+L_{OO}= m_2$	
Tastes/Worker Allocation	
Type 1, Good Plan	$\theta_{GG}L_{GG}+\theta_{GO}L_{GO}+\theta_{GB}L_{GB}= 1-F_1(b_1^G)$
Type 1, No Plan	$\theta_{GO}L_{OO}= F_1(b_1^B)$
Type 2, Good Plan	$L_{GG}= 1-F_2(b_2^G)$
Type 2, No Plan	$L_{GO}+L_{OO}= F_2(b_2^G)$
Employee Premiums	
In GB firms (for G)	$\gamma c_{GB}= (v-1)\, b_2^G$
In GO firms	$\gamma c_{GO}= b_2^B$

There are thirteen parameters which must be chosen in order to calibrate the model. We choose the values of these parameters in the following way.

TABLE 3 Calibration Parameters	
CES Production function parameters	a_1, a_2, ρ
Size of labor force	m_1, m_2
The cost of the good and bad health insurance plans	p_G, p_B
Distribution parameters	μ_1, μ_2, σ_1, σ_2
Tax wedge and taste difference for G/B plan	γ, v

- Production function parameters: a_1, a_2, ρ. We use $\rho = .8$ which we take from the literature on the elasticity of substitution between skilled and unskilled workers.[3] We derive a_1 and a_2 by imposing that the average wages for type 1 and type 2 workers equal the average earnings of skilled

[3] See for example Dougherty (1972). There are some recent studies (for example, Katz/Murphy 1992) that suggest an elasticity of substitution of around 1.4 between unskilled and skilled workers, thus implies $\rho = 0.29$. The results are similar when we use this value. Our conclusions are robust to a wide range for this parameter.

and unskilled workers with employer-provided health insurance and no employee contribution. We calculate these averages from the 1988 and 1997 March Current Population Surveys. The use of data on skilled and unskilled workers is intended to be suggestive. Worker type should not be understood as referring literally to skilled and unskilled workers.

- Size of labor force: m_1, m_2. m_2 is normalized to 1, and m_1 is equal to the ratio of skilled to unskilled workers in the labor force based on our calculations from the March Current Population Surveys.

- The cost of the good and bad health insurance plans: p_G, p_B. We use the 1987 National Medical Expenditures Survey (NMES) and the 1996 Medical Expenditures Panel Survey (MEPS) to estimate the average total premium for insurance obtained through employers We limit the sample to current private sector employees.[4] The ratio of p_G to p_B is estimated as part of the calibration exercise. We impose that the price of the bad plan rises at the rate of increase in the CPI for medical expenditures but allow the price of the good plan to rise faster or more slowly.

- Distribution parameters: μ_1, μ_2, σ_1, σ_2. We assume that the distribution of willingness to pay within each group is log-normal. We impose that the variances are constant across years and that the μ's increase by .562 to correspond to the 75.4% increase in the medical care component of the CPI over the period.

- Restrictions from health insurance data: From the NMES and MEPS, for private-sector workers, we obtain the offer rate, the take-up rate, the fraction of workers who are offered multiple plans and the average employee contribution among those making a contribution. We impose that our model match these values in each year.

These restrictions are sufficient to allow us to estimate the remaining parameters. Table 4 shows the values used in estimating the parameters. Details of our calculations and data sources are included in the data appendix. The column labelled "1996a" is based on data from the published 1996 MEPS which we believe to be most consistent with our NMES estimates for 1987. Our estimate of the offer rate is somewhat low relative to estimates elsewhere in the

[4] For 1987, we are unable to eliminate state and local government workers from the sample.

literature. Using the same data set (but different sample restrictions), Cooper and Schone (1997) estimate offer rates about five percentage points higher in both years. Using CPS data Farber and Levy also get higher offer rates but show a decline (about two percentage points) in the offer rate from 1988 to 1997.[5] Take-up rates from all three sources are similar for 1986 (1987 in Farber and Levy) but Farber and Levy show a somewhat smaller decline (about three percentage points) while Cooper and Schone show a much larger decline (eight percentage points). The net result of the differences is that our estimates show coverage as more or less constant over the period while the other two sources suggest an important drop in coverage. We focus on our estimates as inputs since these are less favorable to our model.[6]

However since there may be some concern that our results reflect some unusual aspect of our underlying coverage estimates, we also pursue a second strategy. We take the average of the estimated decline in the take-up rate from Cooper/Schone, Farber/Levy and our calculations (4.5 percentage points) and adjust our 1987 calculation by this change to get an estimate for 1996. We do the same for the offer rate for which we calculate a 1.3 percentage point increase. This results in about a two percentage point drop in the coverage rate over the period. These data assumptions are shown in the column labelled 1996b.

The only other source we found for the offering of multiple plans were the Kaiser/HRET surveys (Kaiser Family Foundation, 2003). This also shows a large increase in offerings of multiple plans over this period, going from 53% of covered workers in 1988 to 67% of covered workers in 1996. After adjusting for coverage, this is a slightly larger increase than in our data.

Before turning to the estimated parameters, we note that the data suggest very strong differences in the tastes of type 1 and type 2 workers. In our model, only workers in *GB* firms are offered multiple plans. Thus in 1996, 37.8% of workers are in these firms, and type 1 workers are getting good health insurance and type 2 workers are getting bad health insurance. Only type 2 workers in *GO* firms turn down health insurance. Since in 1996, 14.5% of the 70.3% of workers

[5] This refers to the offer rate at the individual level which is the product of the probability of being in a firm offering health insurance and the probability of being eligible for that insurance conditional on being in the firm.

[6] Bernard and Selden using the same data sets find a constant offer rate for their samples and a 2.7 percentage point decline in private coverage from all sources.

offered health insurance turn it down 10.2% of workers are type 2 workers in GO firms and are matched with type 1 workers getting good insurance. Since 54% of workers are type 2 workers, this means that if there were no substitutability among workers, 18.9% of all workers would be in GO firms. Finally, we know that 29.7% of workers are in OO firms in 1996. This leaves less than 14% of workers to allocate between GG and BB firms.

Thus, as a rough approximation, we know that at least half of type 2 workers are not willing to pay for even bad insurance and that no more than 14% and probably considerably less are willing to pay for good insurance. In contrast, at least 57% of type 1 workers and probably considerably more are willing to pay for good insurance. Thus we anticipate that our calibration will reveal a sharp difference in the willingness to pay of the two types and that this will be independent of our modeling decisions.

TABLE 4

KEY DATA USED IN CALIBRATION

	1987	1996a	1996b
Offered Insurance	67.5%	70.3%	68.8%
Offer Multiple Plans	30.4%	37.8%	37.1%
Take-Up Rate	87.8%	85.5%	83.3%
Average Premium	$1958	$3653	$3653
Average Employee Premium if>0	$617	$1188	$1188
Wage Type 1 Workers with Free HI	$32650	$47660	$47660
Wage Type 2 Workers with Free HI	$21690	$27670	$27670
ρ	0.8	0.8	0.8
Ratio of Type 1 to Type 2 Workers	0.751	0.874	0.874
Growth Rate of Mean Valuation of Insurance	0	75.4%	75.4%
Price Increase of Bad Plan Relative to 1987	0	75.4%	75.4%

3.1 Estimated Parameters

Table 5 gives the estimated parameters. The first two columns (labelled 1987a and 1996a) use our main data. The last two columns give the results using data showing a bigger drop in the take-up rate and a smaller increase in the offer rate, thereby creating a drop in the coverage rate over the period. We focus on the main results.

The results reveal a significant drop in γ between 1987 and 1996. If taken literally as a tax wedge, the implicit marginal tax rate fell from 42% to 33%. As measured by v, good insurance is valued at almost one and one half times the value accorded to bad insurance. The price ratio is about 1.58 in 1987 which is approximately the 75/25 differential both within single insurance plans and within family plans. This price ratio drops to 1.51 in 1996.

We estimate that in 1987, employees in *GO* firms paid $1,094 for their employer-provided insurance or a little over 40% of the total premium. In 1996, this estimate is 50%. Workers who purchased good insurance in *GB* firms paid $415 in 1987 or 43% of the price differential between the two insurances. This also rose to 50% in the later period.

As anticipated, the results suggest a strong dichotomy between type 1 and type 2 workers. The estimated distributions of willingness to pay for health insurance imply that almost no type 2 workers value health insurance at its cost. Only a tiny fraction of type 2 workers in the upper tail of the distribution would pay for even bad health insurance if required to pay its full price. In contrast, there is considerable variation in willingness to pay among type 1 workers. In each year, those with valuations no lower than about one standard deviation below the mean would pay the full price of good insurance. There is also a small group willing to pay the full price for bad health but not good health insurance.

If γ were equal to 1, almost all workers would be in *GO*, *BO* and *OO* firms with only minuscule numbers in *GG* and *BB* firms. Therefore, given the parameter estimates, the reason that type *GB* firms arise is not because there are type 2 workers willing to pay for bad insurance who must be mixed with type 1 workers willing to pay for good insurance. Instead some firms offer a *GB* combination because it is cheaper to give bad insurance for free than to charge the large employee premium required to deter type 2 workers from buying good health insurance when their only alternative is no insurance.

The tax wedge leads to considerable inefficiency. Using the 1996 results, type 1 workers who get bad health insurance would be willing to pay an additional amount of around $1,800 for good health insurance while the additional premium is only $1,460. Type 1 workers without health insurance would be willing to pay up to $5,270 for good health insurance which costs employers $4,370.

In contrast, since almost no type 2 workers are willing to pay for even bad insurance, we know that those receiving the insurance value it at less than its price. The 1996 estimates imply that very few type 2 workers get good health insurance, but those who do value it at as little as $3,550, almost $1,000 less than its cost. A very substantial fraction of type 2 workers get bad health insurance and value it at about $630 less than its cost.

The results using the "b" parameters are similar. We show a somewhat larger decline in the tax wedge. There is almost no variation in willingness to pay for insurance among type 2 workers while the variation among type 1 workers is larger than in the main set of estimates. However, overall the differences are modest. In the remainder of the paper, we restrict the analysis to the main set of estimates.

TABLE 5

ESTIMATED PARAMETERS FROM CALIBRATION

(all dollar figures are in thousands)

	1987(a)	1996(a)	1987(b)	1996(b)
γ	1.71	1.5	1.73	1.44
v	1.46	-	1.41	-
a_1	14.96	21.11	14.95	21.36
a_2	10.63	12.79	10.63	12.80
P_G	2.60	4.37	2.63	4.08
P_B	1.65	2.89	1.63	2.86
b_1^G	2.73	4.04	3.17	3.62
b_1^B	2.13	3.61	2.09	3.55
b_2^G	1.54	2.43	1.79	2.26
b_2^B	1.28	2.26	1.29	2.26
θ_{GG}	0.89	1.04	0.88	1.02
θ_{BB}	0.80	0.95	0.80	0.94
θ_{OO}	0.69	0.79	0.70	0.80
L_{GG}	*	0.04	*	0.09
L_{GB}	0.29	0.36	0.30	0.36
L_{BB}	0.22	0.09	0.22	0.01
L_{GO}	0.14	0.19	0.14	0.22
L_{OO}	0.34	0.31	0.34	0.33
μ_1	0.95	1.52	1.07	1.63
μ_2	0.25	0.81	0.25	0.82
σ_1	0.40	-	0.67	-
σ_2	0.04	-	0.0002	-
c_{GB}	0.41	0.74	0.43	0.65
c_{GO}	1.09	2.20	1.06	2.23
w_1	31.40	46.42	31.33	26.92
w_2	20.98	26.65	20.95	26.92

- Constrained to be the same in the two years

* Approximately zero

3.2 Understanding Changes in Multiple-Plan Offering and Take-up Rates

Since type 2 workers do not want to buy insurance, the issue for firms is, in a sense, to determine the least expensive way to provide insurance to type 1 workers. It may be least expensive simply to give everyone good insurance, to give all workers bad insurance so that those with a greater willingness to pay can purchase good insurance at a relatively modest premium or to require a relative high premium which discourages type 2 workers from getting insurance.

The results indicate that the trade-off is between the last two approaches, and they are close substitutes. Relatively modest changes in parameters can generate large offsetting shifts in the number of GB and GO firms. Thus we calculate that had γ equalled its 1996 value (1.50) in 1987 rather than the actual 1.71 and had no other parameters changed, GB firms would have been eliminated, and the economy would consist of only BB, GO and OO firms. Conversely, if the 1.71 value had held in 1996, the GO firms would have been eliminated.

Why then did the number of GB firms rise? We attribute this to the rise in the ratio of skilled workers to unskilled workers. As the number of workers who want health insurance rises, the model reveals a shift from GO to GB firms. Holding everything else constant at the 1987 rate but increasing the ratio of type 1 to type 2 workers from its 1987 to its 1996 rate eliminates the GO firms.

In essence, when type 2 workers do not place much value on insurance, the primary issue is whether it is cheaper to provide bad insurance to type 2 workers and provide good insurance to type 1 workers at a low price or whether it is cheaper not to provide the bad insurance and charge a high price for the good insurance. When the number of type 2 workers relative to type 1 workers is sufficiently high, it is cheaper to charge the high price. When the tax wedge is sufficiently high, it is cheaper to provide the bad insurance.

We can also get some sense of the importance that HMO's may have had by allowing v to decrease and examining the change in the equilibrium. We set v to 1.46 instead of 1.48 in 1996 and increase the μ's by $\ln(1.48/1.46)$ to keep the mean willingness to pay for the good plan constant. Overall, as measured in this way, there is a dramatic shift towards GB and BB firms and away from GG, GO and OO firms. It therefore increases the offer rate, the number of firms offering choice, and the take-up rate.

There are a few other comparative static experiments we can conduct:

- A decrease in the relative price of the bad insurance shifts workers from *GO* firms towards *GB* firms. Holding the premium for the good plan constant and increasing the prices of bad insurance increases the number of workers in *GB* firms dramatically and reduces the number of workers in *GO* firms accordingly.
- Increasing the productivity skilled relative to unskilled workers shifts workers from *GB* firms towards *GO* firms. Holding everything else constant and increasing a_1/a_2 decreases the number of workers in *GB* firms and increases the number of workers in *GO* firms. Table 6 summarizes the comparative experiments using the calibration.

TABLE 6		
comparative statics		
	Multi-Plan Offer Rate	Take-up Rate
Decrease in γ	down	down
Increase in m_1/m_2	up	up
Decrease in v	up	up
Increase in a_1/a_2	down	down
Decrease in p_B	up	up

3.3 Additional Tax Wedge Effects

As noted above, if γ equalled 1, almost all type 2 workers would have no health insurance. Type 1 workers would primarily receive good health insurance but some would choose bad health insurance and others no insurance. Thus the vast majority of firms would be *GO* firms but there would also be some *BO* and some *OO* firms. For simplicity we perform our comparative statics treating this as the exact equilibrium.

In contrast to the equilibrium when γ is greater than 1, the equilibrium when γ equals 1 is fully efficient. However, it is important to distinguish between the efficiency implications of lowering γ and the effect on insurance coverage. Based on the 1996 parameters, in the efficient equilibrium, a little over 80% of type 1 workers receive the good insurance for free, 6% get the bad insurance for free and the remainder are employed in firms not offering insurance. Thus while the offer rate would be over 80% if γ equalled 1, the coverage rate would fall to about 40% from about 60%. Using the 1987 parameters, when γ equals 1, virtually all workers are in either *GO* or *BO* firms. The drop in coverage from reducing γ to 1 is even greater based on the 1987 parameters than based on the 1996 parameters.

Lowering γ also benefits some workers at the expense of others. If γ equalled 1, in 1996, type 1 workers with good insurance would have earned $47,106 net of their payment of $4,370 for the full cost of insurance. This net wage exceeds the net wage of type 1 workers receiving the good insurance for free when γ is 1.50. However, the wage received by type 1 workers who do not get insurance declines. Moreover, type 2 workers are better off. They earn $30,359 which is a little over $300 more than the wage received by type 2 workers without health insurance in the original calibration.

The 1987 estimates are similar to those obtained using the 1996 parameters. Lowering γ to 1 continues to make the type 1 workers who want good health insurance better off. Type 1 workers receive a wage of $34,513 from which they pay $2,600 for good insurance. As with the 1996 estimates, this net wage exceeds the wage received by workers receiving insurance for free in the original calibration. The gross wage is less than the wage received by those who do not get insurance in the original calibration so that type 1 workers who do not get health insurance are worse off. Moreover, based on the 1987 parameters, the reduction in the tax wedge makes type 2 workers who do not get health insurance better off. The wage for type 2 workers without health insurance rises from $22,968 to $23,158.

4 Conclusion

We develop a model to account for the existence of multiple health insurance plans. We use this model to understand the channels which have led to an increase in the number of workers with access to multiple plans through their firms.

We believe that a number of important points arise from our analysis. First, the dichotomy between the multiple plan/fixed subsidy and the imperfect sorting explanations for employee contributions is false. In order to explain employee premiums, there most be imperfect sorting. However, firms with multiple plans are not necessarily more heterogeneous than firms with a single plan. Offering multiple plans can be a way to reduce the cost of deterring low-valuation employees from taking good insurance. This strategy may actually be more effective when tastes are not too heterogeneous. Thus in our model, type 2 workers in GB firms value health insurance more highly than do those in GO firms while there need not be any difference in the valuations of their type 1 employees.

Because offering multiple plans can be a strategy for reducing the cost of offering high-cost plans to workers who value them highly, multiple offering is very sensitive to a number of factors. These include the relative cost of different plans, the relative value workers put on different plans, the tax wedge between employer and employee premiums and the distribution of tastes for the different plans. Our calibration suggests that the decline in the tax wedge between 1987 and 1996 should have reduced the frequency with which workers were offered multiple plans but that this was more than offset by an increase in the fraction of workers from groups wanting high quality insurance and the decline in the relative cost of the low-cost plan (which we interpret as a rise in HMO's).

While we do not take the details of our calibration too seriously, we believe that it underscores an important message about tax policy and health insurance. The effects of tax policy on employer-provided health insurance are likely to be complex. The theoretical effect on the coverage rate of making employee premiums tax-deductible is unsigned, and there is good reason to believe that it lowers coverage. It also has large distributional effects. Such tax-deductibility is likely to increase coverage in high demand (and high income) groups and lower coverage in low income groups. It may also increase wages among workers receiving health insurance in these groups. While the policy is efficient, at least if we ignore the effect on government revenue, there are winners and losers.

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A Appendix

A.1 Data Appendix

1987

All health insurance data were obtained from the 1987 National Medical Expenditures Survey. We limited the sample to observations for which TYPEX=1 (the respondent is a worker), for which DATASRCE=1 (the record refers to health insurance potentially obtained through a non-federal employer). All estimates were weighted used POSTJOWT (the worker weight).

- Offer rate: Workers who worked in firms that offered insurance and were eligible for insurance were coded as having been offered insurance by their employer (EPROVINX=1 and ELIGX=1). Missing values of ELIGX due to nonresponse or invalid skips were dropped from the calculation.
- Take-up rate: Workers who held a plan through this employer (HELDOPT = 1 or 3) were coded as having insurance.
- Multiple plan offer rate: Workers who said they were offered two or more plans (CHOICE>1) and who either held insurance through this employer or were eligible for insurance through this employer were coded as having been offered multiple plans and were not coded as ineligible (ELIGX=2).
- Insurance premium: The mean total insurance premium is given by the mean of TOTPREXX.
- Employee contribution: The employer contribution is given by EMPCONXX. We calculated the employee contribution as the difference between TOTPREXX and EMPCONXX.
- Mean wages for workers with employer-provided health insurance and no employee contribution: These were obtained from the March 1988 Current Population Survey. We used total annual earnings. Skilled workers were defined as occupation codes occlyr<300 while unskilled workers were defined as occupation codes occlyr>300.

1996

All health insurance data were obtained from the 1996 Medical Expenditures Panel Survey. The following data are from the on-line published tables at http://www.meps.ahrq.gov/MEPSDATA/ic/1996/Index196.htm.

- Offer rate: The proportion of private sector employees in firms offering health insurance (Table I.B.2.c) multiplied by the proportion of private sector employees in firms offering health insurance who were eligible for insurance (Table I.B.2.a)
- Take-up rate: The proportion of private sector employees who were eligible for health insurance through their employer who were enrolled in health insurance at that establishment (Table I.B.2.a.(1))
- Multiple plan rate: The proportion of private sector employees working in establishments offering two or more plans (Table I.B.2.c) multiplied by the proportion of workers in the 1987 data set who worked in establishments offering two or more plans and who were eligible for insurance.

- Insurance premium: The average premium for a single plan (Table I.C.1) and the average premium for a family plan (Table I.D.1) weighted by the proportion of workers with health insurance who have a single plan (Table I.C.4)
- Employee contribution: The average employee contribution for a single plan (Table I.C.2) and the average premium for a family plan (Table I.D.2) given a positive contribution weighted by the proportion of workers with health insurance who have a single plan and make a positive contribution (Table I.C.4).

Mean wages for workers with employer-provided health insurance and no employee contribution were obtained from the March 1997 Current Population Survey.

A.2 Calibration Appendix

The GG, GB, GO, BB, OO Equilibrium

COMPENSATION COSTS		
Firm Type	Type 1 Compensation Cost	Type 2 Compensation Cost
GG	$w_1 + p_G$	$w_2 + p_G$
GO	$w_1 + p_G + \frac{\gamma-1}{\gamma} v b_2^B$	$w_2 + b_2^B + (v-1)b_2^G$
GB	$w_1 + p_G + \frac{\gamma-1}{\gamma}(v-1)b_2^G$	$w_2 + p_B + (v-1)b_2^G$
BB	$w_1 + p_B + (v-1)b_1^G$	$w_2 + p_B + (v-1)b_2^G$
OO	$w_1 + b_1^B + (v-1)b_1^G$	$w_2 + b_2^B + (v-1)b_2^G$

Denote $\theta_i = \frac{L_1^i}{L_2^i}$,If type B,E and F firms face the same cost of hiring type 2 , they must face the same cost of hiring type 1 workers. If not, they would not both make zero profit. It follows that

$$\theta_{GO} = \theta_{OO}$$

similarly,

$$\begin{aligned}
\theta_{BB} &= \theta_{GB} \\
p_G + \frac{\gamma-1}{\gamma} v b_2^B &= b_1^B + (v-1)b_1^G \\
p_B + (v-1)b_1^G &= p_G + \frac{\gamma-1}{\gamma}(v-1)b_2^G \\
q'_{GO} &= q'_{OO} \\
q'_{GB} &= q'_{BB}
\end{aligned}$$

Zero profit conditions for five types of firms:

$$(a_1\theta_{GG}^\rho + a_2^\rho)^{\frac{1}{\rho}} - (w_1 + p_G)\theta_{GG} - (w_2 + p_G) = 0 \tag{7}$$

$$(a_1\theta_{GO}^\rho + a_2^\rho)^{\frac{1}{\rho}} - \left(w_1 + p_G + \frac{\gamma-1}{\gamma} v b_2^B\right)\theta_{GO} - \left(w_2 + b_2^B + (v-1)b_2^G\right) = 0 \tag{8}$$

$$(a_1\theta_{GB}^\rho + a_2^\rho)^{\frac{1}{\rho}} - \left(w_1 + p_G + \frac{(\gamma-1)(v-1)b_2^G}{\gamma}\right)\theta_{GB} - \left(w_2 + p_B + (v-1)b_2^G\right) = 0 \tag{9}$$

$$(a_1\theta_{BB}^\rho + a_2^\rho)^{\frac{1}{\rho}} - \left(w_1 + p_B + (v-1)b_1^G\right)\theta_{BB} - \left(w_2 + p_B + (v-1)b_2^G\right) = 0 \tag{10}$$

$$(a_1\theta_{OO}^\rho + a_2^\rho)^{\frac{1}{\rho}} - \left(w_1 + b_1^B + (v-1)b_1^G\right)\theta_{OO} - \left(w_2 + b_2^B + (v-1)b_2^G\right) = 0 \tag{11}$$

Notice that the last two zero profit equations are redundant.

This leaves us with only three first-order-conditions which we express as

$$a_1\theta_{GG}^{\rho-1}(a_1\theta_{GG}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G \tag{12}$$
$$a_1\theta_{GO}^{\rho-1}(a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}vb_2^B \tag{13}$$
$$a_1\theta_{GB}^{\rho-1}(a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G. \tag{14}$$

Labor market equilibrium requires that

$$\theta_{GG}L_{GG}+\theta_{GO}L_{GO}+\theta_{GB}L_{GB}+\theta_{GB}L_{BB}+\theta_{GO}L_{OO}=m_1 \tag{15}$$
$$L_{GG}+L_{GO}+L_{GB}+L_{BB}+L_{OO}=m_2. \tag{16}$$

Finally, we require that the number of workers in the different jobs is consistent with the distribution of tastes. Therefore

$$F_1(b_1^B)m_1=\theta_{GO}L_{OO} \tag{17}$$
$$F_1(b_1^G)m_1=\theta_{GB}L_{BB}+\theta_{GO}L_{OO} \tag{18}$$
$$F_2(b_2^B)m_2=L_{GO}+L_{OO} \tag{19}$$
$$F_2(b_2^G)m_2=L_{GB}+L_{BB}+L_{GO}+L_{OO} \tag{20}$$

where F_i is the cdf of the willingness to pay for the bad plan among group i.

Making the appropriate substitutions gives us

$$(a_1\theta_{GG}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G)\theta_{GG}-(w_2+p_G)=0 \tag{21}$$
$$(a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G+\frac{\gamma-1}{\gamma}vb_2^B)\theta_{GO}-(w_2+b_2^B+(v-1)b_2^G)=0 \tag{22}$$
$$(a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1}{\rho}}-(w_1+p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G)\theta_{GB}-(w_2+p_B+(v-1)b_2^G)=0 \tag{23}$$
$$a_1\theta_{GG}^{\rho-1}(a_1\theta_{GG}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G \tag{24}$$
$$a_1\theta_{GO}^{\rho-1}(a_1\theta_{GO}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}vb_2^B \tag{25}$$
$$a_1\theta_{GB}^{\rho-1}(a_1\theta_{GB}^{\rho}+a_2^{\rho})^{\frac{1-\rho}{\rho}} = w_1+p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G \tag{26}$$
$$\theta_{GG}L_{GG}+\theta_{GO}L_{GO}+\theta_{GB}L_{GB}=1-F_1(b_1^G) \tag{27}$$
$$\theta_{GO}L_{OO}=F_1(b_1^B) \tag{28}$$
$$L_{GO}+L_{OO}=F_2(b_2^G) \tag{29}$$
$$L_{GG}=1-F_2(b_2^G) \tag{30}$$
$$\theta_{GG}L_{GG}+\theta_{GO}L_{GO}+\theta_{GB}L_{GB}+\theta_{GB}L_{BB}+\theta_{GO}L_{OO}=m_1 \tag{31}$$
$$L_{GG}+L_{GO}+L_{GB}+L_{BB}+L_{OO}=m_2 \tag{32}$$
$$p_G+\frac{\gamma-1}{\gamma}vb_2^B=b_1^B+(v-1)b_1^G \tag{33}$$
$$p_B+(v-1)b_1^G=p_G+\frac{\gamma-1}{\gamma}(v-1)b_2^G \tag{34}$$

Endogenous variables - $w_1, w_2, L_{GG}, L_{GO}, L_{GB}, L_{BB}, L_{OO}, \theta_{GG}, \theta_{GO}, \theta_{GB}, b_1^B, b_1^G, b_2^B, b_2^G$

A.3 Proofs Appendix

Proof of Proposition (1)

Lemma 1 *There cannot be an equilibrium in which all workers pay for health insurance.*

Proof. Suppose a firm offers $\{w_1, w_2, c_G, c_B\}$ with $c_i \geq 0$ with strict inequality for any insurance purchased by some employees. Suppose all workers take health insurance. An offer consisted of $\{w_1 - \gamma\Delta c, w_1 - \gamma\Delta c, c_G - \Delta c, c_B - \Delta c\}$, with $\Delta c > 0$ would attract the same workers and be more profitable. The same argument applies if $c_B = 0$ and all workers purchase the good health insurance. ■

Given the standard restrictions on production functions, it is an obvious corollary of this lemma that all firms in which all workers receive insurance must offer the same wages.

Lemma 2 *In equilibrium all workers of a given type at a firm all make the same decision regarding health insurance.*

Proof. At all firms at which $c_G^* = 0$, all workers will received the good insurance free. At all firms at which $c_G^* = \infty$,$c_B^* = 0$, all workers will received the less generous insurance free.

At all firms at which $c_G^* \neq 0$,$c_B^* = 0$ workers of a given type at that firm either all take or all refuse health insurance. Suppose not, some workers of type i pay c_G^* and receive the good insurance and some do not pay and only receive the bad one. Workers of type $j \neq i$ either all pay c_G^* or all do not pay c_G^*. If $c_G^* < p_G$, then setting $c_G = c_G^* + \Delta > c_G^*$, $w_j = w_j^* + \gamma\Delta$ for all types purchasing insurance, and $w_j = w_j^*$ for all types not purchasing the good health insurance and $w_i = w_i^* + \varepsilon$, $\gamma\Delta > \varepsilon > 0$, would attract all of the workers of type $j \neq i$ that the original firm attracted but only workers of type i who do not purchase insurance. For Δ and ε sufficiently small, this must be profitable. It is obvious for the case $c_G^* = \infty$,$c_B^* \neq 0$ where workers of a given type at a firm all make the same decision regarding health insurance. ■

Lemma 3 *In equilibrium there must be firms that offer insurance for free and there must be firms that do not offer insurance (or equivalently offer it at a price at which no worker will purchase it).*

Proof. Suppose not. Then either there are workers of both types who value health insurance at more than its cost and are not receiving it or there are workers of one type who value health insurance at more than its cost and workers of the other type are paying for their health insurance. A compensation vector which gives workers of types not getting health insurance a wage of $w_i - p - \varepsilon$ and workers of the type paying c, $w_j - \gamma c$ and provides health insurance for free will be profitable.

The proof of the second part parallels the first. ■

Proof. of Proposition (1)
>From the various lemmas, each type in each firm will have the same compensation vector, it is easy to see there will be only nine possible candidates(offers) exist in the equilibrium, denoted $GG, GO, GB, BB, BO, BG, OG, OB, OO$ firms. ■

Proof of Proposition (2)

We state without proof some results that parallel results for the case with only one type of insurance plan (Lang and Kang, 2004).

1. Type GO and OG firms cannot coexist.

2. Type BO and OB firms cannot coexist.
3. Type GB and BG firms cannot coexist.

Because of the restriction on the distribution of tastes, there cannot be equilibria in which

1. Type 1 workers only get the good insurance in GG firms but in which either OG or BG firms exist.
2. Type 2 workers only get no insurance in OO firms and OB or OG firms exist.

Lemma 4 *GO and BG firms cannot both exist in equilibrium.*

Proof. Let the cost of a type i worker at a firm of type abbe q_i^{ab}. Suppose that GG, GO,and BGfirms all exist. Offering BO will be profitable if $q_1^{BO} < q_1^{GO}$. We know that

$$q_1^{GO} = q_1^{GG} + \frac{(\gamma - 1)}{\gamma} v b_2^B \tag{35}$$

where $vb_2^b$is the highest value placed on good health insurance by any type 2 worker not getting health insurance since such workers would be willing to pay up to $\frac{vb_2^b}{\gamma}$and the firm must compensate type 1workers by vb_2^b for the added cost but gets $\frac{vb_2^b}{\gamma}$from each type 1 worker. An offer of BOwould cost

$$q_1^{BO} = q_1^{BG} + \frac{(\gamma - 1)}{\gamma} b_2^B \tag{36}$$

by the same logic. But since

$$q_2^{BG} > q_2^{GG} \tag{37}$$

we have

$$q_1^{BG} < q_1^{GG} \tag{38}$$

so that $q_1^{BO} < q_1^{GO}$and the deviation is profitable. ■

Lemma 5 *Firms offering GB and BO cannot both exist in equilibrium.*

Proof. Suppose that both exist. Then for GO not to be a profitable offer,

$$q_1^{GO} > q_1^{BO}. \tag{39}$$

Since

$$q_1^{GB} > q_1^{GO}, \tag{40}$$

we have

$$q_1^{GB} > q_1^{BO} \tag{41}$$

$$q_2^{BO} > q_2^{GB} \tag{42}$$

which implies that

$$b_2^B > p_B. \tag{43}$$

Now since

$$q_1^{BO} = q_1^{OO}, \tag{44}$$

we also have

$$b_1^B > p_B. \tag{45}$$

But if b_1^B and b_2^B are both greater than p_B, firm BB is more profitable than firm type OO which is a contradiction. ■

Proof. of Proposition (2)
>From the various lemmas, we know that there are only nine candidates for equilibrium offers, denoted $GG, GO, GB, BB, BO, BG, OG, OB, OO$. Type GO and OG firms cannot coexist, Type BO and OB firms cannot coexist, Type GB and BG firms cannot coexist. Thus we could sort the combination of them into eight subsets of equilibria. From lemmas above, we could eliminate six of them. For the remaining two sets, One set of equilibria consists of type GG, GO, BB, BO, OO firms, another one consists of GG, GB, GO, BB, OB, OO firms. ■