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ABSTRACT

It has long been suggested that trade unions take actions and favor public policies that reduce the quantity of labor so that union members might enjoy greater labor incomes. Can this explain the prevalence of generous public pension programs inducing retirement? I suggest not, by formalizing the monopoly unionism model and showing how labor's interest in reducing the quantity of labor cannot explain why the old are induced to retire rather than discouraging work among workers of all ages. Discouraging work of a subset of union workers introduces allocative inefficiencies without promoting the objectives of the monopoly union. And, unless the old have a disproportionate influence within the union, union interests cannot explain why public pension programs are so generous.

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A number of public policies – from income taxes to welfare programs – seem to discourage work. Perhaps this is unsurprising, since governments need to raise revenue, may want to assist the poor, and may want to discourage work in order to raise the return to labor. But governments do the most to discourage work among the old even to the point of (implicitly) taxing elderly labor income at 100% rates, and this is puzzling.

Can discouraging work among the elderly be understood as a relatively efficient way of reducing aggregate labor supply, and hence a means for raising the return to labor? I suggest not. I formalize the monopoly unionism model, and use it to derive the well-known result that it can be in labor's interest to reduce the quantity of labor. But, as compared to discouraging work among workers of all ages, inducing retirement is an inferior method of reducing labor supply. And, unless the old have a disproportionate influence within the union, union interests cannot explain why young workers would bear the burden of retirement subsidy programs.

Section I reviews some of the regularities of public pension programs: they encourage retirement, they implicitly tax elderly work at the highest *rates*, and they use taxes on young workers to finance pension benefits. Moreover, public pensions like these have existed for decades, and in a variety of different economies. Section II builds a mathematical model of a monopoly union facing a demand curve for the labor services of its members, showing how public pension policies are much inferior to other strategies for reducing the supply of labor. Sections III and IV extend the model to the cases when some union labor is more complementary with nonunion factors than others and when union density varies with age. I conclude with a comparison of the monopoly unionism model to some other positive theories of publicly induced retirement.

I. An Overview of Retirement-Inducing Policies Around the World

There is a growing literature comparing public pension systems and their retirement incentives across countries and over time. I report some of the main results from that literature.

The purpose of my report is not to conduct a detailed statistical analysis, but merely to highlight the empirical regularities relevant to a theory of unions and publicly induced retirement. The most conspicuous, and theoretically most relevant, regularity is that implicit earnings tax *rates* are highest for the elderly.

I.A Public Policies Encourage Retirement

As of 1995, over 100 countries had public pension programs.[1] Among the 88 of those countries reporting to the U.S. Social Security Administration sufficient detail of their public pension benefit formulas, 75% pay pension benefits in such a way as to discourage work by its elderly citizens. The most typical means by which benefit formulas induced retirement is remarkably transparent: retirement is a necessary condition for receiving public pension benefits, and no credit is given to those who decide to retire later and collect benefits for fewer years. Other countries had more complicated benefit formulas extending some less-than-actuariarily fair credits to those who delay retirement, or allowing employed elderly to collect partial benefits, or both (the case for U.S. Social Security for elderly aged 65-69). But the more complicated formulas have much the same effect as the simple one: elderly labor income is implicitly taxed.

At least in higher income countries, the rates of implicit taxation are enormous. Although an exact calculation of marginal tax rates is complicated due to nonlinearities and other details of benefit formulas, the reason for the high rates is simple: the elderly must retire to obtain full benefits and full benefits are typically a very large fraction of the earnings enjoyed if one does not retire. Gruber and Wise (1999, Table 1, based on even more detailed computations of their coauthors) attempt to quantify the rates of implicit taxation for 11 countries. According to their calculations for the early 1990's, the "typical" implicit tax rate for "someone of retirement age" ranges from roughly 20% for Japan, U.S., and Canada, to more than 80% for Belgium and the Netherlands.[2]

[1]Data in this paragraph are reported and described in more detail by Mulligan and Sala-i-Martin (1999a,b) and Sala-i-Martin (1996).

[2]Gruber and Wise point out that, in any one country, marginal implicit rates vary with earnings, age, calendar year, and other variables. For a person of age *t* in the early 1990's, where *t* is between the early retirement age (age 60 in 9 of the 11 countries they study) and 69, they

Another way to appreciate the quantitative significance of the implicit taxation of elderly labor income by public pension programs is to notice the prevalence of 100%(!) marginal tax rates. Mulligan (1998) discusses in some detail a number of examples, including U.S. Social Security benefit formulas between 1939 and 1971, under which retirees lost *all* of their Social Security benefit if their earnings exceeded a rather low earnings limit by even one dollar. Other American examples of 100% marginal tax rates can be found prior to the Social Security Act in U.S. state administered Old Age Assistance programs, which typically implicitly taxed earnings at a 100 percent rate (Joint Committee 1966, pp. 26-27). Spain has one of several international examples, where their elderly are not allowed to collect a government pension if they earn any labor income at all (Boldrin et al 1997 p. 16, SSA 1997 p. 330) and those benefits are typically close to or more than what the pensioner would have earned after taxes (Boldrin et al 1997).

Perhaps these implicit taxes are not distortionary, because they are not enforced or because other government regulations prohibit people from changing their behavior in response to them? There are two reasons to be skeptical of such a claim. First, Gruber and Wise (1999) show that retirement *behavior* is highly correlated across countries and across age groups with the measured incentives. Second, the stated purpose of the implicit tax provision is often to discourage retirement (Sala-i-Martin 1996; Gruber and Wise 1999, p. 31).

Pensions are not the only public programs encouraging retirement. "Disability insurance" and "unemployment insurance" programs "essentially provide early retirement benefits before the official social security early retirement age" (Gruber and Wise 1999, p. 9) in many countries. Tax-favoring company pensions, mandatory defined benefit company pensions, and public health insurance are some other government policies that may substantially induce retirement.

I.B Marginal (Implicit + Explicit) Tax Rates are Highest for the Old

Perhaps it is unsurprising that public policies discourage work, since governments need to

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compute for a worker of median earnings the present value of public pension benefits foregone by delaying retirement one year, and express it as a fraction of earnings (after income and payroll taxes) for that year, a fraction τ_t which can be interpreted as an implicit tax rate. They sum τ_t between the early retirement age and $t = 69$, and I divide their sum by the number of years in the sum (10 years are in the sum for 9 of the 11 countries they study) to arrive at the "typical" implicit tax rate for "someone of retirement age" reported in the text.

raise revenue, or may want to assist the poor. But another feature of public pension programs, and government policy in general, is that elderly work is discouraged more than young work. Hence, while payroll tax rates are paid by young and old workers and can be large in many countries – more than 10% in the U.S. and nearly 50% in Egypt, Italy, and the Netherlands – public pension benefit formulas in many countries substantially reduce the incentive to work beyond its reduction due to payroll and income taxation.

Income taxes, payroll taxes, and public pension benefits are not the only public policies discouraging work. Minimum wages, unemployment compensation, welfare payments, workweek restrictions, on other policies have the effect of discouraging work, and a full analysis of public policy and work incentives would include detailed calculations of the effects of these programs. However, two observations strongly suggest that, taken together, the various public policies tax elderly labor income at much higher marginal rates. First of all, a number of these programs – such as unemployment and welfare – affect work incentives for both elderly and young people. Often unemployment and welfare payments are most generous for the elderly, and implicitly tax elderly labor earnings at higher rates. Indeed, the unemployment insurance programs in Belgium, Finland, and other countries are hard to distinguish from public pension programs in terms of their intergenerational incidence and their age profile of marginal tax rates.[3] Second, it seems that, because of public pension programs, the prevalence of 100% and near 100% marginal tax rates is much higher among the elderly than among the young (as a consequence of tax and other policies) and, as a result, work is so much more prevalent among the young.

I.C Young Workers Pay for Public Pensions

Public retirement funds are almost always paid for by the young. It is rare for a country to have a fully-funded program (Mulligan and Sala-i-Martin 1999), so that most Social Security programs redistribute from younger generations to older ones. In fact, the cross-cohort redistribution is much more important than redistribution in any other dimension by these programs (e.g., Auerbach et al 1992, Auerbach et al 1999, Jensen and Raffelhuschen 1997, Hagemann and John 1997, House Committee 1996 table 1-50).

[3]For international examples, see SSA (1995) and Gruber and Wise (1999). Leimer (1998, pp. 16-17) reports results for the American DI program.

I.D Pensions Designed this Way Have Existed for Many Decades

For decades, Social Security benefit formulas have implicitly taxed labor income of the elderly. To prove this, I construct a data set for the years 1958 and 1975 like Mulligan and Sala-i-Martin's (1999a) 1995 data based on SSA reports (SSA, various issues). It was somewhat more common internationally in 1958 and 1975 for benefit formulas to induce retirement with the simpler formula making retirement a necessary condition for receiving public pension benefits (eg., the U.S. did so in 1958, but not in 1995). Delayed retirement credits and gradual phaseout of benefits with earnings were more common in 1995, so it might be said that retirement was induced more dramatically in 1958 and 1975. However, the size of the benefit foregone by the elderly worker has grown over time relative to what a retiree would have earned, so in this sense benefit formulas induce retirement more in recent years. More research is required to determine exactly how the incentive to retire has changed over the years in various countries, but it is clear that public pension benefits have for decades provided an important incentive to retire.

I.E Pensions Designed this Way can be Found in Countries of Various Sizes and under Various Forms of Organized Labor

Sala-i-Martin (1996) has shown how social security benefit formulas encourage retirement in countries as varied as the Bahamas, Belgium, Egypt, Japan, the Netherlands, and the United States. It is relevant for the monopoly unionism model how these incentives vary with (a) the size of the economy (a proxy for the elasticity of demand for domestic labor) and (b) the importance of organized labor. The Gruber-Wise tax rate calculations suggest that retirement incentives are largest in relatively small economies like Belgium and the Netherlands, and *relatively* small in larger economies like those of Germany and the United States. There may be a correlation across high income countries between retirement incentives and the importance of national unions (both union importance and implicit tax rates are relatively low in the United States while both are relatively high in Belgium), although high implicit tax rates are found in countries with average or less than average union importance (eg., Netherlands) and relatively low implicit rates found in countries with important unions (eg., Sweden).[4]

[4]I measure "union importance" by the fraction of the population that is a member of a union (OECD 1991), and the importance of centralized bargaining (the indices reported by

II. Optimal Age-Employment Policy for a Monopoly Union

Consider an economy where output is produced according to a constant returns production function $F\left((1-\alpha)L_y, \alpha L_o, K\right)$ with three inputs (each with positive marginal products): young union labor $(1-\alpha)L_y$, old union labor αL_o, and nonunion inputs K. Nonunion inputs include capital and nonunion labor of various types, but disaggregating the nonunion inputs is not of particular interest here. α is the fraction of union membership that is old; total union membership is normalized to 1. The union cares about the utility u_y of a representative young union member, the utility u_o of a representative old union member according to the quasiconcave "welfare function" W:[5]

$$W\left(\alpha u_o(c_o, L_o), (1-\alpha) u_y(c_y, L_y), \alpha\right)$$

where c_i is the average consumption of a union member of type i ($i = o,y$). W is increasing in its first two arguments and includes as special cases the utilitarian objective ($W = \alpha u_o + (1-\alpha)u_y$), and welfare functions that weight one age group more heavily than another. The utility functions u_y and u_o can be different for young and old workers.

Summers et al 1993, Data Appendix Table I). Sweden is highly unionized on both measures, and the U.S. much less unionized on both. Belgium has a relatively high percentage unionized, and is slightly above average on the collective bargaining scale. Netherlands is well below average in terms of union density and slightly below average in terms of the centralized bargaining indices.

[5]The utility functions u_y and u_o have the usual properties: increasing in consumption, decreasing in labor, and concave. For simplicity, I do not explicitly model age, income, or preference heterogeneity *among* the young or *among* the old. The main lessons of the analysis would obtain in models complicated in such dimensions. The reader can interpret age heterogeneity in this simple model, say, by letting u_o denote the present discounted utility enjoyed between age 50 and death, and L_o as the fraction of years worked between age 50 and death. "Publicly induced retirement" means that public policy does more to reduce the fraction of time worked at age 50 than before age 50. The reader can interpret preference heterogeneity together with more "realistic" discrete individual labor supply decisions as does Mulligan (1999): u_o is the utility of a representative old person and L_o is the fraction of old people who work. Under this interpretation, "publicly induced retirement" means that public policy does more to reduce the fraction people aged 50+ who work.

Since the purpose of this paper is to show how various *government* policies benefit labor, the relevant concept of a "union" is the group of labor that is represented by coordinated pressure on government. The "union" might literally be a national union such as the AFL-CIO, or a national collective bargaining unit, or all labor (eg., because a national union feels that in political affairs it should represent the interest of all workers including nonmembers). I prefer the "all labor" interpretation of "union" and hereafter refer to the union as "labor". I point out that, although the various interpretations might be quite different for the American labor market, they are quite similar in a number of European countries. Furthermore, my results are consistent with a union objective that puts different weights on the utility of various types of workers (eg., putting less weight on nonmembers).

II.A Optimal Policy with Lump Sum Taxation of Nonunion Factors

Suppose for a moment that labor had complete control over the allocation of inputs and outputs in the economy. The allocation optimal from labor's point of view solves:

$$\max_{c_y, c_o, L_y, L_o} W\Big(\alpha u_o(c_o, L_o), (1-\alpha) u_y(c_y, L_y), \alpha\Big)$$

$$\text{s.t.} \quad \alpha c_o + (1-\alpha) c_y \le F\Big((1-\alpha) L_y, \alpha L_o, K\Big)$$

$$L_o, L_y \ge 0$$

For the moment, I assume that the optimal allocation is labor is strictly positive for both types of workers. Two of the first order conditions for this problem equate a union member's marginal rate of substitution (*MRS*) to the marginal product of labor:

$$MRS_i \equiv \frac{-\partial u_i / \partial L}{\partial u_i / \partial c} = \frac{\partial F}{\partial(\alpha_i L_i)} \equiv w_i \qquad i = y, o$$

where I have defined w_i to be the marginal product of type *i* union labor. In words, the optimal policy from labor's point of view does not discourage work (ie, drive a wedge between the marginal product and *MRS*) for *any* of its members.

In effect, labor's goals are achieved by levying lump sum taxes on nonunion members (eg., nonunion workers, owners of capital) and paying lump sum subsidies to union members, without driving a wedge between *MRS* and marginal product of labor for union members.[6] Of course, it follows that the "lump sum tax" model is inconsistent with a wedge between *MRS* and marginal product that is larger for old workers and thereby cannot explain why public policy induces retirement.

If zero labor were optimal for one or both types of workers, then there could be a difference between *MRS* and marginal product for those workers with $L = 0$. However, the MRS *exceeds* the marginal product of labor for such allocations, and it cannot be said that the optimal policy discourages work except via a wealth effect.

II.B Optimal Monopoly Unionism – Production Weakly Separable in Labor

Some (eg., Leontief 1946, Freeman and Medoff 1984, MaCurdy and Pencavel 1986) have suggested that unions do achieve their objectives in labor-management negotiations without significantly distorting the supply of labor. And perhaps unions can do the same in the political negotiations that generate public policy. But, for the sake of argument and with the hope of explaining why public policy induces retirement, let us suppose otherwise. In particular, suppose that the division of output among union and nonunion factors is determined under competitive conditions. Euler's Theorem provides a convenient analytical characterization:

$$F\left((1-\alpha)L_y, \alpha L_o, K\right) = [\, w_y (1-\alpha) L_y + w_o \alpha L_o \,] + \frac{\partial F}{\partial K} K \qquad (1)$$

where the term in square brackets is labor compensation and the last term is compensation of nonunion factors.

[6]If leisure is a normal good, policy will decrease the labor supply of union members, but this is only a wealth effect.

That "compensation is determined under competitive conditions" means that nonunion factors must be paid $K\partial F/\partial K$. Even so, the union may want to decrease the quantity of labor so as to reduce $\partial F/\partial K$ and compensation to nonunion factors. The is seen most easily in the case that output is a weakly separable function of labor and nonunion inputs:

$$\text{output} = F\Big(L((1-\alpha)L_y, \alpha L_o), K\Big) \tag{2}$$

in other words, "aggregate" labor is a well-defined input to the production process although the aggregator function L need not be linear. It is important to note that the production function (2) is consistent with different productivity for old and young workers, any degree of substitutability between old and young workers (including perfect substitution), and with any degree of substitutability between union and nonunion factors (including perfect substitution).

Assuming constant returns in (L,K),[7] Euler's equation becomes:

$$F\Big(L((1-\alpha)L_y, \alpha L_o), K\Big) = G(L)\,L + \frac{\partial F}{\partial K}K \tag{3}$$

The monopoly union allocates consumption and work among its members to solve:[8]

$$\begin{aligned} \max_{c_y, c_o, L_y, L_o, L} \; & W\Big(\alpha u_o(c_o, L_o), (1-\alpha)u_y(c_y, L_y), \alpha\Big) \\ \text{s.t.} \quad & \alpha c_o + (1-\alpha)c_y \le L\,G(L) \\ & L = L\Big(\alpha L_o, (1-\alpha)L_y\Big) \end{aligned} \tag{4}$$

[7]which implies that the labor aggregation function L is homothetic.

[8]For simplicity, it is assumed that none of the union members own any of the nonunion input K. The result of this paper – that the marginal tax labor income rates that are optimal from the perspective of a monopoly union should not depend on age – does not depend on this assumption.

where G is the marginal product of L ($\partial F/\partial L$). Notice above that solutions to the problem (4) depend only on the production technology through the "inverse labor demand function" $G(L)$. Hence, the results derived from (4) apply to any other model of the labor market that has a labor demand schedule taken as given by the monopoly union. One relevant example of such a model might be an open economy model where the inverse of $G(L)$ is the demand for domestic labor by domestic and foreign producers.

For the moment, I assume that the optimal allocation of labor is strictly positive for both types of workers. Two of the first order conditions for the problem (4) relate a union member's marginal rate of substitution (*MRS*) to the marginal product of labor (see below for a discussion of the convexity of the maximization problem (4)):

$$MRS_i \equiv \frac{-\partial u_i/\partial L}{\partial u_i/\partial c} = G(L)\frac{\partial L}{\partial(\alpha_i L_i)}\left(\frac{\partial[L\,G(L)]/\partial L}{G(L)}\right) \equiv w_i(1-\tau) \qquad i = y, o \tag{5}$$

The allocation optimal from labor's point of view drives a wedge ($1-\tau$) between each union worker's *MRS* and his marginal product. Furthermore the optimal wedge has $\tau = 1/\varepsilon$, where ε is the elasticity of labor demand.[9] This is the well-known policy (Dunlop 1944; Lewis 1963, p. 32; Rees 1989, p. 67) of the monopoly union: reducing the supply of labor increases the return to labor and can make labor better off, even as it reduces efficiency and payments to other factors. Labor might implement such an allocation by enforcing work shift rules, by lobbying government to limit entry into union occupations and industries, or by lobbying government to finance transfer payments to workers that are funded with labor income taxes.

What is relevant for my study of retirement, however, is that *the optimal wedge is the same (in percentage terms) for all types of union labor*. In other words, if the optimal policy from labor's point of view involves reducing its young member's incentive to work by τ percent, then the

[9]When the demand for labor is derived from a production function like (2), the optimal wedge has $\tau = 1/\varepsilon = \frac{\partial \ln w_o}{\partial \ln K} = \frac{\partial \ln w_y}{\partial \ln K}$. This interpretation is useful for comparison with later results for non-weakly-separable production functions.

optimal policy involves the same τ percent reduction in elderly incentives to work. Notice that my derivation is perfectly consistent with:

- different labor supply elasticities for young and old
- different derived labor demand elasticities for young and old
- any degree of substitution in production between old and young workers
- any degree of substitution in production between labor and nonunion factors
- a welfare function that weights old and young workers differently

Since the labor aggregator function L is homothetic, my derivation does assume that the aggregate output elasticity of demand is the same for old and young labor. It seems that this is a rather weak assumption, since it implies that the relative demand for young and old workers is independent of the size of the economy. The weak separability assumption is more restrictive, and is relaxed in Section III below.

It is important to notice that the optimal wedge is the same for young and old labor even when young and old have very different labor supply elasticities. This implies that the optimal policy may involve a greater change in the *quantity* of one age group's labor input because the group supplying labor more elastically will respond more to a given marginal tax rate. Hence, the puzzle for the monopoly unionism model is not that the old work less, but that the old are discouraged most from working.

(4) may not be a globally convex maximization problem. However, for fixed L, it is convex in the choice variables c_o, c_y, L_o, and L_y. Hence, first order conditions describe the allocation of labor and consumption between old and young even if they do not fully characterize the aggregate quantity of labor L. It is the optimal allocation of consumption and labor – the equation of MRS_y / w_y and MRS_o / w_o – that is of primary concern for my study of publicly induced retirement.

If zero labor were optimal for one type of worker,[10] say the old, then there could be a difference between MRS_o and w_o. However, the MRS *exceeds* the marginal product of labor for such allocations, and it cannot be said that the optimal policy discourages work except via a wealth effect. It might even be the case that the optimal policy could be implemented with a relatively high

[10]If the utility functions u_y and u_o satisfied Inada conditions, then it would not be optimal for both types of workers to supply zero labor, because no worker could afford to consume.

(or relatively low) marginal labor income tax for the old, but that is only because the old labor supply decision is a "corner solution" and the same allocation would result if the old were taxed at the same marginal rate as are the young.

Reminiscent of Diamond and Mirrlees' (1971) result that a benevolent social planner optimally taxes intermediate inputs at a uniform rate, I find that the monopoly union optimally taxes its various labor inputs at a uniform rate. Why? Suppose that there were a larger wedge between MRS_i and w_i for older workers. Holding fixed L and thereby union and nonunion incomes, consumption can be reallocated to the old and leisure reallocated to the young in such a way to make both young and old better off. And, because L is held constant, there is no reason why nonunion factors would be worse off if the union moved in this way to equalize the implicit tax rates on young and old workers.

Our result can be graphically demonstrated in an Edgeworth box for the special case that $\alpha = ½$ and the labor aggregation function L is linear:

$$L = \frac{w_o}{G}\,\alpha\, L_o + \frac{w_y}{G}\,(1-\alpha)\, L_y$$

where the coefficients in the linear aggregator are computed according to the definition of the marginal labor products w_o and w_y, and are independent of L. The dimensions of the Edgeworth box are the available consumption $LG(L)$ and the efficiency units of labor L to be allocated between young and old. In the box we graph the indifference curves for young and old as a function of consumption and *efficiency units of labor*.[11] Since labor is a bad, these indifference curves slope up.

[11]Utility functions over consumption c and efficiency units λ are defined according to $\tilde{u}_i(c, \lambda) \equiv u_i\left(c, \frac{\lambda}{w_i}\right)$ $(i = o, y)$.

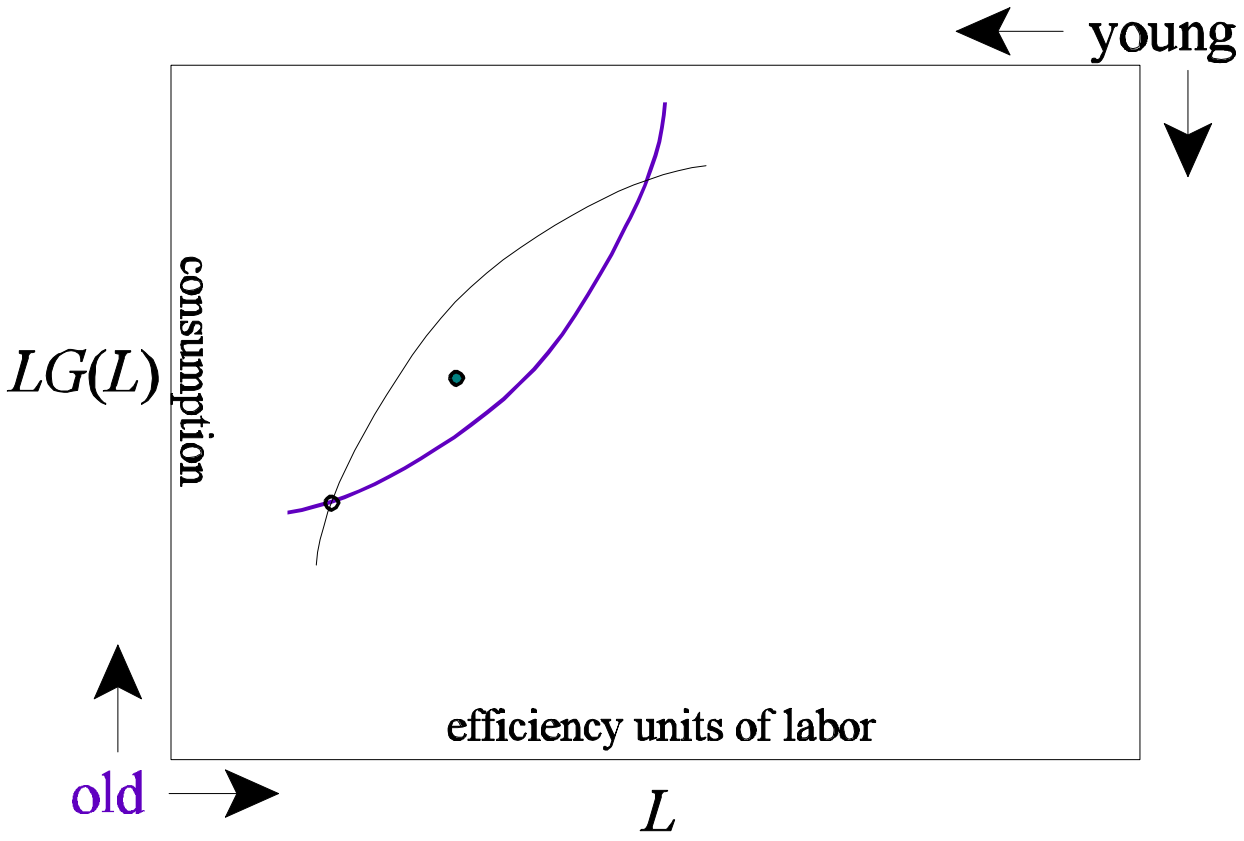

Figure 1 The Allocative Inefficiency of Publicly Induced Retirement

If there were a larger wedge between MRS_i and w_i for older workers, then older workers are willing to supply more efficiency units than are the young in order to gain a given increment to consumption, and young and old indifference curves cross as they do at the allocation denoted as a hollow circle in the Edgeworth box. Holding constant total efficiency units supplied L and total consumption of workers $LG(L)$, old workers can be made better off without hurting young workers or owners of nonlabor inputs by (a) reducing young labor input by δ efficiency units (δ small), (b) reducing young consumption by $\delta MRS_y / w_y$, (c) increasing old labor input by δ efficiency units, and (d) increasing old consumption by $\delta MRS_y / w_y$. (a) and (c) guarantee that total labor input L is held constant, while (b) and (d) guarantee that aggregate consumption is held constant. By

definition, a consumer of type *i* is willing to substitute consumption for efficiency units of labor at rate MRS_i/w_i, so (a) and (b) imply that the young are no worse off. The old would be no worse off if they received $\delta MRS_o/w_o$ more consumption, but (c) gives them $\delta MRS_y/w_y$ which is even better since $MRS_y/w_y > MRS_o/w_o$, at the hollow dot. The solid dot in the Edgeworth box is one such allocation that improves allocative efficiency without affecting aggregate consumption or aggregate labor input.

This proof should also make it clear that the efficiency gains of uniformly taxing young and old does not rely on my simplifying assumption that labor supply decisions are continuous. Suppose, for example, that individual labor supply could only be 0 or 1. The young are identical in every way except their reservation wages, as are the old. If old and young face different marginal tax rates $\tau_o > \tau_y$, then the marginal old worker has a smaller ratio of *MRS* to marginal product than does the marginal young worker. If a marginal young worker were removed from his job and replaced with w_y/w_o marginal old retirees, then nobody would be worse off (by definition of "marginal" and since *L* is held constant) and there would be $w_y(\tau_o-\tau_y)$ units of output not consumed by anybody, which could be divided between young and old union members making all better off.

The desirability of uniform marginal labor tax *rates* (rather than uniform marginal taxes) from the point of view of labor can also be understood in terms of Pigouvian taxes and subsidies. Additional work by some individual harms other workers since their compensation per unit labor declines with the aggregate quantity of labor, and the right labor income tax can internalize this effect into the individual's utility maximizing calculus. Notice that an individual's effect on the aggregate quantity of labor is proportional to his own marginal product; one hour worked by a more productive person has a larger positive effect on aggregate labor and a greater negative effect on the marginal product of labor. The optimal tax per hour is therefore proportional to each workers marginal product – the optimal tax per dollar earned is uniform across workers.

II.C "Lump of Labor" As a Special Case

Consider a special case of the production function (2):

$$F\Big(L((1-\alpha)L_y, \alpha L_o), K\Big) = \min\{(1-\alpha)L_y + \alpha L_o, K\}$$

What makes this case interesting is not its realism, but how it represents the occasionally popular view that there are a "fixed number of jobs" in the economy. In particular, the demand for labor is K and the demand for young labor is $(K - \alpha L_o)$; reducing old labor by one increases the demand for young labor by exactly one. Nonetheless, the Edgeworth box argument above is still valid – marginal tax rates that differ across types of labor are inefficient from labor's point of view because some of those having jobs value them less than those not having jobs.

II.D The Scope for Redistribution Among Union Factors

If the pretax compensation accruing to young workers were $w_y(1-\alpha)L_y$ and to old workers was $w_o\alpha L_o$ – as it would in a marketplace where compensation were competitively determined – lump sum taxes levied on young workers and paid to old workers (or vice versa) are needed to attain the solution to the problem (4). Since a person's age is easily observed and changed only by the passage of time, and used in benefit formulas by governments around the world, it seems that age-specific lump sum transfers are feasible. Age specific lump sum *taxes* may not be feasible in reality, since some of those in the age group being taxed may not be able to earn enough to pay the lump sum tax.[12] But the lack of lump sum taxes as a policy instrument cannot explain why publicly induced retirement deviates so far from the allocative efficiency achieved in the solution to the problem (4). I showed in Section I how marginal tax rates highest on the old, and they are the ones being subsidized! The marginal tax rates on the old could be equalized with those on the young by increasing young marginal tax rates, reducing old marginal tax rates and reducing the benefit paid to the old conditional on $L = 0$.

There is an easier way to describe how the monopoly union could Pareto-improve upon the way public policies around the world induce retirement: allow young and old workers to trade jobs with each other, without affecting their tax liabilities or benefit amounts, at relative price w_y/w_o. This is the kind of trade involved in moving from the hollow dot to the solid dot in Figure 1. Indeed,

[12]If it were difficult for tax authorities to separately attribute labor product to young and old, difficult to observe side payments between young and old workers, and distortionary taxation of the young were the only way to make an intergenerational transfer, then it may be desirable for elderly subsidies to also be distortionary but this reasoning cannot justify why marginal tax rates would be *greater* for the old.

one expects a union that operates at all efficiently to mediate some trades like this, and why monopoly unionism cannot explain the longtime political success of policies that place such a large and costly wedge between MRS_y/w_y and MRS_o/w_o.

III. Optimal Monopoly Unionism – Production Not Weakly Separable

To put it bluntly, because the model assumes that nonunion factors must be paid $K\partial F/\partial K$, the monopoly union's only option for stealing from the owners of nonunion factors is to raise wages and lower the marginal product of nonunion factors ("capital") by reducing the quantity of labor. I show in the previous section how, with a weakly separable production function, the efficient way of lowering the marginal product of capital and raising the marginal product of labor is to lower the quantity of old and young labor *together* so that MRS_y/w_y and MRS_o/w_o are equated. However, a wedge between MRS_y/w_y and MRS_o/w_o is optimal with a non-weakly-separable production function because the relative effect of the types of labor on the marginal product of capital differs from their relative marginal products w_o/w_y.

Without a weakly separable production function, the "demand for labor" is not well-defined and we must instead refer separately to the demand for young labor and the demand for old labor in the formulation of the union optimal program. (6) is that optimal program, and can be used to show how the more heavily taxed (at the margin) type of labor is more complementary with the nonunion factors and can be used more effectively to lower nonunion compensation and raise union compensation:

$$\max_{c_y, c_o, L_y, L_o} W\Big(\alpha u_o(c_o, L_o), (1-\alpha) u_y(c_y, L_y), \alpha\Big)$$
$$\text{s.t.} \quad \alpha c_o + (1-\alpha) c_y \le \alpha L_o w_o(\alpha L_o, (1-\alpha)L_y, K) + (1-\alpha) L_y w_y((1-\alpha)L_y, \alpha L_o, K) \tag{6}$$

where w_i the marginal product of L_i ($\partial F/\partial L_i$; $i = o,y$).

I assume that the optimal allocation of labor is strictly positive for both types of workers. Two of the first order conditions for the problem (6) relate a type i ($i = o,y$) union member's marginal rate of substitution (MRS_i) to the marginal product of labor:

$$MRS_i \equiv \frac{-\partial u_i / \partial L}{\partial u_i / \partial c} = w_i \left(1 - \frac{\partial \ln w_i}{\partial \ln K} \right) \qquad i = y, o \tag{7}$$

The allocation optimal from labor's point of view drives a wedge between each union worker's *MRS* and his marginal product. The wedge is different for young workers, with type *i*'s implicit marginal tax rate equal to $\frac{\partial \ln w_i}{\partial \ln K}$ – work is discouraged more for that factor whose compensation is increased (in percentage terms) more by the nonunion factors.

There is another interpretation of the optimal differential wedge for young and old workers. Young's Theorem implies that:

$$\frac{\partial \ln w_i}{\partial \ln K} = \frac{1}{w_i} \frac{\partial}{\partial (\alpha_i L_i)} \left(\frac{\partial F}{\partial K} K \right)$$

In other words, the more heavily taxed labor is that which, as a fraction of its marginal product, does the most to enhance nonunion compensation and the least to enhance union compensation. This fraction is the same for weakly separable production functions, which is why the optimal wedge is the same for young and old workers in that case.

Can non-weakly-separable production, together with monopoly unionism, explain why public policy discourages elderly work more than it discourages young work? There are three reasons to be skeptical of such an explanation. First, although stories might be told about complementarities between capital and old workers, there is little direct evidence that the wages of old workers are substantially more elastic to capital (equivalently, that capital income is substantially more sensitive to the quantity of old labor). Hamermesh (1993) reviews a number of studies of the demand for labor by demographic group that offer some indirect evidence. He suggests that (a) the demand for labor declines with skill, and (b) changes in the relative size of demographic groups does not have a quantitatively significant impact on the relative wages of those

groups. Point (a) may say something about the relative demand elasticities for old and young. But are the old more skilled than the young or less skilled?[13] Is an inelastic demand indicative of complementarity with capital? Point (b) suggests that any such difference between young and old would still be associated with a small effect of retirement on young wages.

Second, since some types of labor are "substitutes" with capital (ie, $\frac{\partial \ln w_i}{\partial \ln K} < 0$), this explanation implies that monopoly unions would promote public policies that subsidize (*at the margin*) some types of labor. The third and most important reason to doubt that such nonseparabilities are an important determinant of public policy is the fact that Social Security and other public policies have young workers, rather than old workers, paying for the vast bulk of the subsidies that discourage work among the elderly. In the non-weakly-separable model, the main reason why the old might be differentially taxed by the monopoly at the margin is the effect of an old worker's labor supply decision on *other old workers*.

Indeed, it may even be the case, as suggested by Kremer and Thomson (1998) that young and old workers are complements so that old workers work pay old retirees for not working and young workers for reducing their wage! This would be true even if the complementarity between young and old were weak and the complementarity between capital and old strong. Take the extreme: $F((1-\alpha)L_y, \min\{\alpha L_o, K\})$, with F_{12} positive but small. Lowering old labor below K means that old labor gets all of capital's income, and lowers the marginal product of young labor. Induced retirement tremendously benefits old labor, which is why it might be encouraged with a high marginal tax rate, but it harms young labor.

Perhaps publicly induced retirement paid for by the young can be understood as a monopoly union's combined response of nonseparabilities in production and excessive political power by the old (ie, that u_o receives more weight in the social welfare function W)? Powerful old might explain why young rather than old workers pay for induced retirement even though it is the old workers who enjoy the benefits of induced retirement (namely, high wages), but it also predicts that old *workers* would also enjoy substantial subsidies. It also leaves the power of the elderly unexplained.

[13]Most of the age studies surveyed by Hamermesh (1993) compare "young" workers with "middle aged" workers, not with elderly workers.

IV. What if Union Density Varies with Age?

Taken literally, my Edgeworth box and related arguments against differential marginal taxation by age presumes that the union represents both young and old workers. How do the predictions of the monopoly union model differ if union density varies with age?

The model (4) implies that old and young union members should face the same marginal tax rates. But should union workers and nonunion workers face the same marginal tax rates? There are two forces at work. First, nonunion workers contribute to the supply of labor and thereby affect the compensation of union labor, nonunion labor, and other nonunion factors ("capital"). Second, the union objective (4) does not include the utility of the nonunion members. We have already shown that uniform marginal taxation is optimal regardless of the relative weight enjoyed by the various types of labor in the welfare function, because distributional objectives are achieved in the optimal policy with lump sum taxes and transfers. So, if feasible, nonunion labor should be taxed at the same marginal rate as union labor and, in addition, pay lump sum taxes to finance lump sum transfers to union labor.[14]

In other words, optimal policy from the union's point of view has marginal tax rates that are uniform by age and union status, but lump sum taxes that vary by age and union status. If lump sum taxes cannot be levied on nonunion labor, then optimal income tax rates on nonunion labor could be higher, since they would serve the dual purpose of discouraging work and redistributing from nonunion labor to union labor. And, from the union's point of view, there is no reason for young nonunion labor to be taxed at different rates than old nonunion labor.

Suppose that it is feasible to vary lump sum taxes and marginal tax rates by age, but not by union status. Then there is another reason to levy lump sum taxes on one age group in order to finance lump sum transfers for the other – because age is a proxy for union status.[15] But even in this case, optimal marginal tax rates do not vary with age.

In summary, differential marginal tax rates by age are optimal only when neither lump sum taxation by age nor by union status is feasible. Even so, the purpose is to redistribute income from

[14]As derived in section II, the optimal marginal tax rate is zero if lump sum taxation of capital is feasible.

[15]Essentially, an age group's union density determines how an age group's representative utility enters the social welfare function (4).

those facing the high marginal tax rates to those facing the low rates. Hence, even if the old were less likely to be union members, the monopoly union model cannot simultaneously explain the high marginal tax rates for, and generous treatment of, the elderly by public pension programs.

V. Conclusions

Productive inefficiency – failure of marginal rates of substitution to be equated with marginal products – is the essence of the monopoly unionism model. But allocative inefficiency – failure of marginal rates of substitution to be equated for different union workers – is not. Because public pension programs impose positive and much higher *marginal* tax *rates* on the elderly, publicly induced retirement is a case of both productive and allocative inefficiency, and therefore not so easily explained by monopoly unionism.

While it does not seem that monopoly unionism can explain publicly induced retirement, I do not claim that unions do not or should not support publicly induced retirement. After all, many have argued that the *monopoly* union does not explain much union behavior. Freeman and Medoff (1984) suggest that, in negotiations with management and perhaps also in politics (see their Chapter 13), unions push for policies that enhance labor market efficiency. So, if induced retirement is efficiency enhancing as it is in the model economies of Diamond and Mirrlees (1978) or Sala-i-Martin (1996), union support of public policies that induce retirement might be understandable. Mulligan and Sala-i-Martin (1999a) suggest that retirement partly *explains* the political success of the elderly, and that unions might be understood as old-age lobbies supporting induced retirement and other subsidies for the elderly.

VI. Appendix: Monopoly Unionism with Habit Formation and Human Capital

The main text studies allocative efficiency in a static model, but the main implication that old and young labor should be taxed at uniform rates can be derived in dynamic models as well. The purpose of this appendix is to study allocative efficiency when the labor supply decision is a life cycle one because time worked might be habit forming, fatiguing, or facilitate the accumulation of human capital. I therefore abstract from, and leave to further research, other interesting dynamic issues such as the admittance of new members to the union, heterogeneity among union

members in desired savings rates, the effect of policy on the long run supply of nonunion factors, etc.

Time is indexed $t = 0, 1, 2, ..., \infty$. I assume that union membership is constant over time and across cohorts. The union objective is the discounted average utility of its current and future membership, and the discount factor β for union objective is the same as for each member's own utility function. In order to incorporate the possibility of habit formation in labor supply, I allow the utility of the date t old to depend on the labor supplied when young, in addition to consumption and labor supplied when old. This allows for the possibility of fatigue (more labor supply when young raises the marginal disutility of work when old), or habit formation (more labor supply when young lowers the marginal disutility of work when old) in utility. Utility functions can also vary across cohorts.

The union takes as given an aggregate demand for its labor L_t at each date t, the inverse of which is $G_t(L_t; L_{t-1}, L_{t-2}, ..., L_0)$. This is as in the static model, except that the union accounts for the possible effects of current labor supply of future labor demand. The aggregate quantity of labor is a function of young and old labor as in the static model, except that the contribution of an hour worked by old person i to aggregate labor depends on the amount he worked when young:

$$L_t = L_t\left(\sum_i L_{0,t}^i h(L_{y,t-1}^i), \sum_i L_{y,t}^i \right) \qquad \text{(A-1)}$$

where the first argument of the function L_t is aggregate date t old labor input, the second argument is aggregate date t young labor input, and the function h captures the effect of youth labor on old age productivity. This allows for the possibility of fatigue and/or human capital accumulation in production.

Labor's optimal allocation solves the problem:

$$\max_{\{c_{y,t},\, c_{o,t},\, L_{y,t},\, L_{o,t},\, L_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t \left[u_{o,t}(c_{o,t}, L_{o,t}, L_{y,t-1}) + u_{y,t}(c_{y,t}, L_{y,t}) \right]$$

$$\text{s.t.} \quad c_{o,t} + c_{y,t} \le L_t G_t(L_t; L_{t-1}, L_{t-2}, \ldots, L_0) \qquad \text{(A-2)}$$

$$L_t = L_t\left(L_{o,t}, h(L_{y,t-1}), L_{y,t}\right), \quad \text{all } t = 0, \ldots, \infty$$

$$L_{y,-1} \text{ given}$$

where I have normalized cohort size to one and, as in the static model, require the union to treat all members of the same cohort identically. Aggregate consumption by labor cannot exceed labor income period by period although, since current labor supply affects future labor demand, "aggregate savings" might be achieved by working more in the current period in order to enhance labor demand in future periods. I leave it to the reader to show that allowing for other forms of aggregate savings would not affect the optimality of uniform labor taxation.

As for the static model (4), the choice of aggregate labor L_t may not be a convex choice problem. However, with enough concavity in the utility functions and the function *h*, the allocation of labor between old and young for a given sequence $\{L_t\}$ is a convex problem. The first order conditions describing the allocation are:

$$MRS_{o,t} = w_{o,t}(1 - \tau_t)$$

$$MRS_{y,t} = w_{y,t}(1 - \tau_t) + w_{o,t+1}(1 - \tau_{t+1})\beta L_{o,t+1} \frac{\partial u_{o,t+1}/\partial c}{\partial u_{c,t}/\partial c} \qquad \text{(A-3)}$$

$$\text{all } t = 0, \ldots, \infty$$

where I have utilized the following definitions:

$$MRS_{o,t} \equiv -\frac{\partial u_{o,t}/\partial L_o}{\partial u_{o,t}/\partial c}, \quad MRS_{y,t} \equiv -\frac{\partial u_{c,t} + \beta \partial u_{o,t}/\partial L_y}{\partial u_{y,t}/\partial c} \qquad \text{(A-4)}$$

$$1 - \tau_t \equiv \frac{\mu_t}{\lambda_t G_t(L_t; \ldots)}$$

$$
\begin{aligned}
w_{o,t}(L_{y,t-1}) &\equiv G_t \frac{\partial L_t}{\partial (L_{o,t} h(L_{y,t-1}))} h(L_{y,t-1}) \\
w'_{o,t}(L_{y,t-1}) &\equiv G_t \frac{\partial L_t}{\partial (L_{o,t} h(L_{y,t-1}))} h'(L_{y,t-1})
\end{aligned}
\qquad \text{(A-5)}
$$

and where λ_t and μ_t are the Lagrange multipliers on the date t versions of the first and second constraints in the problem (A-2), respectively.

As compared to the corresponding conditions for the static model, there are two differences: (1) the young's marginal rate of labor-leisure substitution includes not only the current marginal disutility of youth leisure but also any old age marginal disutility of youth leisure, and (2) the price of youth leisure includes not only the after-tax date t marginal product of labor but also the discounted after-tax marginal effect of youth labor on old age labor product. However, even for this more complex dynamic economy, it is easy to show that the labor-optimal allocation can be decentralized with age-independent marginal labor income tax rates.

Decentralizing the Labor-Optimal Allocation

The basic claim in my paper is that the labor optimal allocation can be implemented with labor income taxes and transfers, and that the optimal marginal tax rates are independent of age. To prove this, consider a young individual making lifetime plans at date t for consumption and labor supply. He may receive lump sum transfers in the amount T_t ($T_t < 0$ if a lump sum tax) and anticipates his labor income being taxed at rates $\tau_{y,t}$ and $\tau_{o,t+1}$ when young and old, respectively. He recognizes that his youth labor supply affects his old wage rate according to the function $w_{o,t+1}(L_{y,t})$. Although aggregate borrowing and lending is not feasible, an individual young at date t may borrow or lend with other individuals in his cohort at a single interest rate. βR_t is the interest rate factor implied by this interest rate. The optimal life cycle plan for a date t individual therefore solves:

$$
\max_{c_{y,t}, c_{o,t+1}, L_{y,t}, L_{o,t+1}} \; u_{y,t}(c_{y,t}, L_{y,t}) + \beta u_{o,t+1}(c_{o,t+1}, L_{o,t+1}, L_{y,t})
$$

$$
\text{s.t.} \quad c_{y,t} + R_t c_{o,t+1} \le T_t + (1 - \tau_{y,t}) L_{y,t} w_{y,t} + R_t (1 - \tau_{o,t+1}) L_{o,t+1} w_{o,t+1}(L_{y,t})
$$

Among the first order conditions of the individual's problem (these are necessary for optimality with enough concavity in the utility functions and the function *h*):

$$MRS_{o,t+1} = w_{o,t+1}(1 - \tau_{o,t+1})$$
$$MRS_{y,t} = w_{y,t}(1 - \tau_{y,t}) + w_{o,t+1}(1 - \tau_{o,t+1})\beta L_{o,t+1}\frac{\partial u_{o,t+1}/\partial c}{\partial u_{c,t}/\partial c} \qquad \textbf{(A-6)}$$
$$\text{all } t = 0, \ldots, \infty$$

where I have used the same definitions (A-4). (A-5) is also used, but it is no longer a definition. (A-4) is instead an implication of pretax compensation's being competitively determined in an economy with labor product determined by (A-1). Notice that, from the perspective of an individual worker making his life cycle plan, the only dependence of his old age wage on his old age product is through the term *h*() because he neglects the effect of his decisions on the economy's marginal product of old labor (the first two terms on the right hand side of the equations (A-5)).

Comparing (A-3) and (A-6), we see that individual decisions are consistent with an optimal plan for the monopoly union only if marginal tax rates are independent of age:

$$\tau_{y,t} = \tau_t = \tau_{o,t}$$

In general, marginal tax rates must vary over time in order for individual decisions to be consistent with an optimal plan for the monopoly union.

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