

## Social Security

### I. Founding of Social Security

- A.** Poverty programs of various kinds extend well back into antiquity.
- i.** However, the history of national social insurance programs is much younger.
  - ii.** The first nationwide social security and public pension program was adopted in 1889 when Germany enacted an old age social insurance program.
    - These programs were adopted by a conservative coalition, in part, to undermine the opposition--eg for electoral purposes.
    - They attempted to remove or blunt a popular issue from the social democratic party's platform.
    - The first German programs were organized a lot like the present U.S. system and, like that in the U.S., it did not initially cover everyone.
  - iii.** Other countries in Europe adopted similar programs over the next twenty years.
    - For example, Great Britain adopted an Old Age Pensions Act in 1908 and Sweden adopted a similar program in 1913.
    - (Other accident programs and health insurance programs were also adopted in Europe, and for public employees in various US cities and states.)
    - Many of these programs were financed with taxes on labor income (or similar income based fees) and had benefits that varied with income, as the present U.S. system does.
    - In many cases, the tax was formally "paid" partly by workers and partly by their employers.
    - They were among the first ear-marked income taxes.
    - As in the case of Germany, the programs were usually adopted by right of center political coalitions, rather than left of center programs.
    - (Left of center coalitions had not at that time won enough votes to be the dominant party.)

- B.** In the US, the first proposal for a nationwide old age pension program legislation was introduced at about the same time--in 1909, but it did not pass
- i.** In 1915, Alaska adopted the first old age pension that was not challenged in the Supreme Court on grounds of constitutionality.
    - (Alaska was territory rather than a state at this time.)
    - Transfer programs were challenged and over turned on the basis of equal protection of the law in the period up to and into the great depression.
    - An "old age" pension program naturally treats old people different than young, and insofar as payments vary by income, they discriminate on the basis of income as well.
    - (At that time, laws were supposed to treat everyone in the same way, without respect to age, race or income.--although they did not always do so.)
  - ii.** In the US, the progressive movement attempted to pass various pension, accident, and health insurance programs at the state level, but most failed or were over turned by the Supreme Court.
    - "Self-financed" state sponsored insurance programs were, however, generally allowed.
    - State laws for workman's compensation were adopted by all but one state by 1929.
    - (Workman's compensation insures workers for injuries they receive while working.)
    - (In 1920, the American medial association declared its opposition to any compulsory medical insurance program.
  - iii.** In 1930, California and Wyoming adopted Old age pension laws.
- C.** On April 19, 1935, the social security bill (HR 7260) passed in the House 372 to 33 (25 not voting). On August 9, the bill cleared the Senate and went to the President Roosevelt for signing. On August 14, 19 President Roosevelt signs the bill, and social security becomes law.
- i.** The program has been amazingly stable. Although benefit levels and coverage has expanded through time, the basic structure of the program has not changed very much.
  - ii.** The programs initial conditions for qualifying for benefits were:
    - beneficiaries have to be more than 65 years of age

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- wages  $> 0$  earned in each of the five years before the age of 65 (totaling at least \$2000). [This would be about 36,000 dollars adjusted for inflation.]
  - Monthly benefits were 1/2% on the first \$3000 of income, plus 1/12% of next \$42,000, plus 1/24% on the remaining income.
  - (Note the declining replacement rates, which is still a property of the program.)
- iii. Taxes were initially paid at the rate of 1% each by employees and employers.
- It was to be increased to 3% each after 1950.
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  - However, the planned tax increases were reduced before they actually came into effect. Rates have, however, been slowly increasing during the ever since 1935. See below.
  - The current tax rate for social security is 6.2% each for employees and employers.
  - The current rates for Medicare are 1.45% each for employees and employers.
- iv. The social security act also includes provisions to encourage states to create unemployment insurance programs, through federal matching grants, partly funded by a 1% federal unemployment tax..
- This aspect of the program is neglected in this lecture, although it also was an important shift in public policy and at the time may have been the most important part of the program.
  - Life expectancy in 1900 was only 47 years for men at birth, so not too many folks were expected to reach the age at which they were eligible for benefits. (Women lived a couple of years longer.)
  - Life expectancy in 1940 was 62 years (for men at birth) and it is now 77 years for men and 81 years for women.
- D. Implementation of the Social Security program.
- i. Although the program was in large part motivated by the collapse in savings and wealth associated with the Great Depression of the 1930s, it did not come into effect immediately, but rather was phased in over a number of years.
- It included the national unemployment insurance program as well as the public pension (Old Age Insurance) program that came to be known as social security.
- The entire plan was not fully implemented until after the Great Depression was over.
  - Unemployment insurance was a joint state-federal program and states gradually signed up for it.
  - And, the public pension program (OAI) did not pay out benefits until 1940.
- ii. **Social Security (OAI) Trivia:** on June 2, 1936 the social security account number was created by the Social Security Board.
- (On August 17, 1936 an unemployed worker in Wisconsin received the first unemployment benefit under state law.)
  - On January 1, 1937, workers began to acquire credits toward old-age insurance benefits.
- iii. September 1937, the name Old Age Benefit Program was changed to the "Old Age Insurance Program." (OAI)
- **1939 survivors benefits added**, the social security program becomes the Old Age and Survivors Insurance (OASI).
  - (1939, Unemployment benefits became payable in 26 additional states bring the number of jurisdictions to 51 = 48 states + 2 territories + DC.)
- iv. **1940, first person receives a monthly old age benefit check, \$22.54.**
- v. In 1950 the social security tax was increased to 1.5% each for employees and employers.
- E. **1955 Disability provisions are added** and the program's official name changed to the **Old Age, Survivors and Disability Insurance, OASDI**, program--which is still its formal name.
- i. The wage base of the social security tax in 1955 was \$4200.
- 1956, Social security benefits become payable for women at age 62.
  - (1956, first computer goes into service at the Social Security Administration.)
  - A tax increase was implemented in January 1957, with tax rates increasing to 2.25% for employees and employers. (The self employed paid 3.375%).
  - For its first 40-50 years, social security was always barely self-sustaining. Reserves would be accumulated and then depleted by increases in benefits (and longevity).

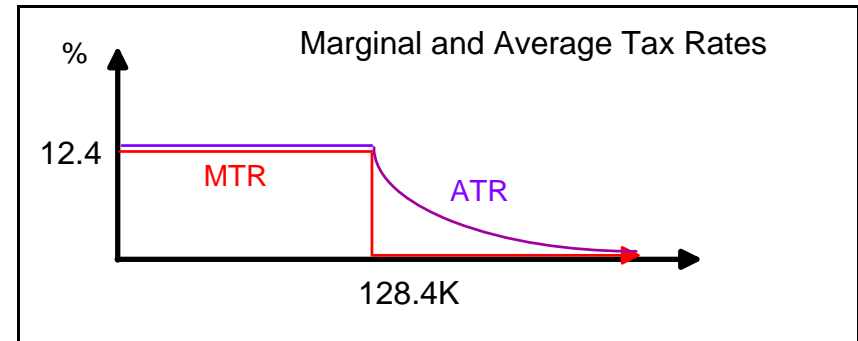
**F. Medicare Benefits Are Added to the OASDI program during the 1960s.**

- i. On June 30, the first bill to provide medical services for aged people not on public assistance but unable to meet their medical expenses was introduced in the Senate (S 3784).
- ii. September 1960, program of federal grants to states for venter medical care programs for aged people enacted. (Early form of Medicare.)
- iii. January 1966, States were authorized to set up medical assistance and medical assistance to the aged programs with the Federal Government to pay **50 to 80% of the costs**.
  - (Note that Medicare is initially done via matching grants.)
- iv. July 1, 1966, all persons over 65 were covered under the hospital insurance provisions of the new legislation.
  - Benefits for the voluntary medical insurance program begins (for other medical expenses).
  - Thus the Medicare program was initially a mix of central government, state government, and private insurance, which remains the case today.
  - (1967 the Freedom of Information Act became effective.)

**II. The Economics of the Social Security Program**

- A. The social security program has been a "pay as you go" system from its first days, with benefits paid from a flat tax on labor, "half" paid by labor and "half" by employers.
  - i. (See the Social Security Administration website for the general increase in those taxes during the past fifty years.)
  - ii. Of course the **actual distribution of the burden** of the social security varies with the slopes (elasticities) of the supply and demand curves for labor in the markets of interest.
    - Thus, in some markets all of the burden may be shifted to workers (employees), and in other labor markets the entire tax might be absorbed by firms.
    - (The supply and demand curves below show the case where the burden is shared more or less equally and a market where the burden is mostly shifted to labor.)

- B. Benefits have principally been tied to age (65) since the programs beginning, and the benefit schedule has always been "progressive" in the sense that the replacement rate falls as income rises for recipients.
  - Benefits have also been "indexed" so that inflation does not affect the purchasing power of the social security pension
  - In fact, benefits have been indexed to wages rather than prices, so the purchasing power of benefits actually tends to INCREASE through time.
  - (Wages generally increase faster than prices, because of productivity growth associated with increased in capital per labor and better education.)
- C. The tax schedule for social security benefits is "**digressive**," a flat tax on the first B dollars of labor income, but zero taxes on income above B. The upper bound on taxes is now 128,400. (Tax rates for the past 40 years have been pretty stable, but the tax base has gradually been expanded to increase tax revenue.)



- D. The combination of higher taxes and “rewards” for retirement tend to encourage persons to work fewer hours over the course of their lifetimes.
  - i. The pension itself tends to reduce incentives to save for retirement, because personal savings makes up less of one’s retirement income than it did in the days before social security. (Estimates vary on this, but Martin Feldstein and others find reductions of between 50 and 25%, which tends to reduce capital formation.)

- ii. A surprisingly large fraction of "baby boomers" are counting entirely on social security for their retirement income. The median person approach retirement has just 17K of savings, although the average is 163K.

### III. The Social Security Trust Fund: the "Lockbox"

- A. The social security's "trust fund" (reserve) was established in January 1940 as a separate account in the United States Treasury.
  - For the first forty years, benefits and tax rates were adjusted fairly frequently, with both benefits and tax rates increasing.
  - During this period, the trust fund had relatively small reserves and tax receipts generally exceeded expenditures by a small amount.
  - However, the program was often in a state of "crisis" in that promised benefits often grew faster than tax revenues, which required last minute tax increases.
- B. This changed shortly after 1981, when President Reagan promulgated Executive Order 12335 which established a Commission on Social Security Reform (aka: Greenspan Commission).
  - This commission was to make recommendations to assure the financial integrity of the social security program.
  - On January 20, 1983, the Commission sends its recommendations to the President and Congress.
- i. On April 20, 1983 President Reagan signed into law the social security amendments of 1983.
  - It raised the eligibility of retirement to 67 in two steps by 2027.
  - It raised social security tax rates for employees and employers
  - They rise to 7% in 1984 and then gradually to 7.65% in 1990. (15.3% in total, since employers and employees each "pay" this tax.)
  - It reauthorized inter trust fund borrowing among the social security trust funds.
  - It makes self-employed tax equal to the sum of the employer and employee shares. (The self employed had previously paid about three quarters of the total rate borne by salaried employees, see above.)
  - It made social security income taxable (*half of it*) for taxpayers earning more than 25K if single and 32K if married.

- ii. Overall, the Greenspan reforms adopted during president Reagan's term of office reforms increased taxes significantly and reduced benefits slightly (mostly through a very gradual increase in retirement age).
- iii. The social security program began accumulating huge "reserves" from that point onward.
  - In the next thirty years, the trust fund rose to more than 2.5 TRILLION dollars.
  - The reserves were held as US government bonds.
  - These were often formally kept in a large file cabinet in the social security administration (the true "lock box")
  - The reserves were, thus, "borrowed" from the Social Security Administration and used to pay for other federal government programs, such as defense spending, healthcare (medicaid), roads, grants to states and interest on the debt.
  - The treasury (e.g. tax payers) pay the social security administration interest on its debt holdings (about a 100 billion per year in 2012).
  - Unfortunately, as developed below, for the purposes of government finance, the existence of reserves held in government bonds is essentially **the same thing as not having any reserves at all !!!**
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#### C. Why the reserves do not really matter much as far as public finance is concerned.

- i. Fiscally, it turns out that the size of reserves does not really matter very much, although you would not know this from reading news accounts of Social Security's impending bankruptcy.
- ii. Note that **when the social security administration attempts to "cash in" its government bonds, the Congress or Treasury can do 3 things.**
- iii. It can raise taxes, it can borrow in the world market, and reduce expenditures on other government provided goods, services, and transfers.
- iv. **Now imagine what the government would have to do if there were no reserves.**
  - In order to make good on its promises, the Congress or treasury would have to:

- raise taxes
- borrow more on world markets
- or reduce other expenditures.

**v. In other words, exactly the same steps would have to be taken with reserves in the form of government bonds as without those reserves.**

- In reality, the social security tax surplus has been simply another source of tax revenue for ordinary (non social security) expenditures.
- If the trust fund had "cash" in a great vault instead of bonds, not much would be different.
- This would be cash that was not in circulation, and thus when brought out and given to retired folks, it would inject new money into the economy., generating inflation

**D.** The Medicare trust fund is much smaller (320 billion vs 2,677 billion in 2013), but is also entirely invested in government bonds and funded with an labor income based tax. Those surpluses were also used to pay for “ordinary” government services.

- Medicare is the government provided healthcare insurance for retired persons.
- Funding Medicare--given its cost trajectories is much more difficult than funding social security.

#### **IV. Social Security, Medicare, and Future Deficits**

- A.** Social Security and Medicare taxes reduced the deficits of the US government from the Reagan-Greenspan reforms to the present.
- B.** However, in the very near future those programs will begin to run deficits, that is pay out more in benefits than their earmarked tax systems produce in revenues.
- C.** At this point, they will be “cashing in” their bonds at the Treasury and the Congress will either have to raise taxes to pay for those redemptions, lower expenditures in other areas, or borrow on world bond markets.
- D.** **The fact that these programs will run deficits instead of surpluses means that the present deficit problems** (which may just now finally be being reduced) **will worsen** in the very near future even

if all other expenditure programs remain as they are under existing law (with the “sequesters”).

- From the 2013 social security report:

“Under current projections, the annual cost of Social Security benefits expressed as a share of workers’ **taxable earnings** will grow rapidly from 11.3 percent in 2007, the last pre-recession year, to roughly **17.0 percent** in 2037, and will then decline slightly before slowly increasing after 2050.

Cost displays a slightly different pattern when expressed as a share of GDP. Program cost equaled 4.2 percent of GDP in 2007, the last pre-recession year, and the Trustees project that cost will increase to 6.2 percent of GDP for 2036, then decline to about 6.0 percent of GDP by 2050, and thereafter rise slowly reaching 6.2 percent by 2087.” (See <http://www.ssa.gov/oact/trsum/>)

- The main parts of Medicare are funded in a similar way (HI and SMI, and also will run deficits in the very near future (indeed they are running deficits by some calculations right now):

• “the estimated 75-year actuarial deficit in the HI Trust Fund is 1.11 percent of taxable payroll ... However, the aging population and rising health care costs cause SMI projected costs to grow steadily from 2.0 percent of GDP in 2012 to approximately 3.3 percent of GDP in 2035, and then more slowly to 4.0 percent”

- E.** If social security benefits are not changed and taxes simply adjusted to keep up with expenditure tax rates would have to rise from about 12.6% today to around 17% in 2037.
- F.** Medicare deficits are normally projected to be much higher and projected tax rates would have to raise a good deal
- Keep in mind that these taxes are currently pretty flat and deduction free, and would be on top of the ordinary income tax and state sales and federal taxes.
  - Wages are about 66% of GDP so to raise 1% of gdp requires a 1.5% increase in tax rates (ignoring DWL).

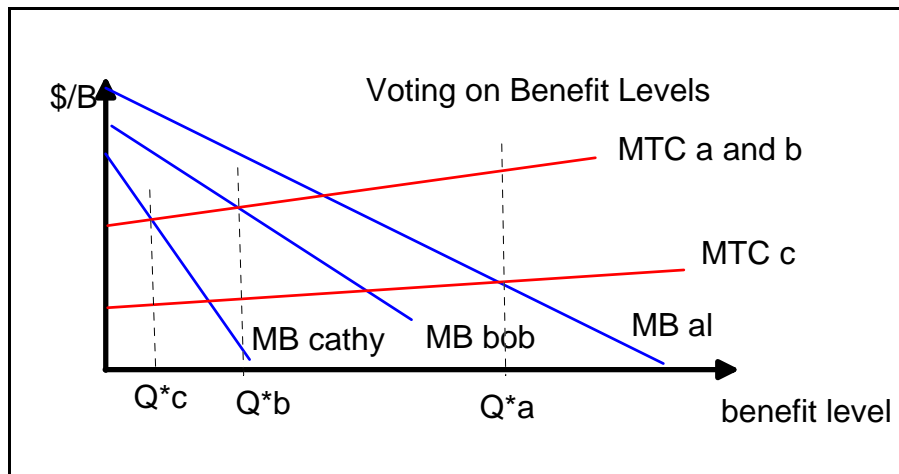
- Marginal tax rates in the US for middle class persons could thus be in the Swedish or Danish range of  $(20) + [17] + [6] = 43\%$  federal plus about 6% from state and local governments = 49%.
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- [How this is divided between employees and employers depends on the slopes of the supply and demand for labor curves.]
- (I have the above estimates of Social Security and Medicare expenditures and assumed that payroll taxes would continue to be used to fund most of Social Security and Medicare. The calculations also assume that other government spending remains the same fraction of GNP as the present one.)
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- Of course, the other part of the budget may well increase as well, which is the historical trend, which will imply that rates will be still higher.

## V. Future Reforms of the Social Security System

- A. The Reagan era reforms (1983) were the last major reform of the social security system.
- The increase in taxes allowed the program to provide the promised benefits to retired persons for the next twenty years, but did not completely solve the long term problems.
  - The **basic problems are demographic**:
    - Retired persons are living longer today than they did in 1950.
    - A very large group of persons (the baby boomers) are beginning to retire.
    - Families are having fewer children now than they did in the past, which reduces the number of tax payers relative to benefit recipients.
  - It bears noting that essentially all Western countries face similar problems with their current social security programs.
    - Indeed Europe and Japan have even more serious demographic problems than those faced by the United States.
    - And, many European countries have promised larger pensions at earlier ages for their aging populations.
- B. The imbalance between promised benefits and tax revenues is largest for the medicare program, because of the rapid growth in the cost of medical care experienced during the past several decades.
- Medical costs have been rising much faster than inflation for many years, as technological advances lead to more expensive “routine” treatments
  - As with heart bypass surgery, hip and other joint replacements, and advanced cancer treatments.
- C. The future imbalance between promised payments to retired folks and tax payments by those still working can be addressed in essentially three ways. (This is a simple matter of arithmetic, not rocket science or high finance.)
- Program benefits can be reduced: by reducing cash payments or delaying the age at which folks qualify for the program.
    - (Both these were done in the 1983 reforms.)
  - Program funding can be increased:
    - Tax rates can be increased to generate more revenue.
    - (This has historically been the main solution, as tax rates have increased from 2 to 15.3 percent over the past seventy years, including disability insurance. To this another 3% could be added for Medicare.)
    - The cap on eligible earnings could be eliminated.
    - New debt can be issued to pay for the benefits, which implicitly increases future tax obligations.
  - Some other way of funding the future benefits may be attempted.
    - If the trust fund held stocks or non governmental bonds, it would have, in effect, "socialized" the stock market as the social security program would own a substantial fraction of the resources in that market.
    - The use of "forced" savings accounts has similar effects, but insofar as ownership remains private, this reduces the "socialization" effect, but may also reduce benefits because it transfer the financial risk to those with the accounts. (There would no longer be a government guaranteed future retirement payment.)
    - Many countries have experimented with "b," the partial privatization of social security--including Sweden.

## VI. On the Politics of Reforming Social Security.

- A.** Social security is one of the most popular programs, even though not everyone gains from it to the same extent.
- B.** Given the current program, the older and poorer one is, the greater is the present (or present discounted value) of their net benefits (current taxes less future benefits)
- For this purpose, past taxes should be treated as sunk costs.
  - Given this, future tax payments fall with age. (Fewer working years remain)
  - Benefits are closer to being realized so their present discounted value is highest.
- C.** A simple median voter model of the demand for social security benefit levels given these taxes can be characterized with one of our net benefit maximizing diagrams.
- i.** Social security, like other insurance programs, is an essentially private good. It is not shareable and as one adds persons to it, more money is required to fund the benefits.
- ii.** The program should be thought of as a "governmentized" pure private good that is to be provided at more or less uniform levels. **i**



- iii.** As drawn, bob is the median voter and  $Q^*b$  will be the benefit level

- iv.** The difference in benefits among the three types of voters may be explained in a number of ways.
- They may reflect differences in age and income, expected longevity, or ideology.
  - Or, they may simply reflect differences in "replacement rates" for the individuals and diminishing marginal utility of income.
- v.** One interpretation of the relative position of the three curves is that Al is poorer and older than Bob or Cathy, and that Cathy is the youngest and richest and has a lower marginal tax price because her income is beyond the cutoff for payments into the system.
- vi.** Bob as the median voter is approximately median aged and has median income.
- vii.** The program will change only when median demands for benefits change.
- Changes may occur because the median voter becomes older, richer, or expects to live longer.
  - Changes may also occur because of changes in altruistic impulses or ideology of the median voter
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- viii.** (Notice that this diagram is an example of the "governmentization" of a pure private good developed earlier in the course.
- Social insurance has a "public" character because risks are shared under such systems, but they are mainly pure private goods.
  - Additional resources are required to provide the insurance benefit as persons are added to the insurance program. (That is, insurance reserve funds have to increase to account for the chance that the additional persons will qualify for the benefits.)
  - This effect is represented by the rising marginal tax cost curve in the diagram.
  - As benefits increase, reserves have to be proportionately increased, which requires proportionately higher marginal tax payments under the tax system used to fund social security.
  - (The same tends to be true of tax-financed health-care systems.)
- D.** Program deficits can also be analyzed using rational choice models.
- i.** They may reflect the expected longevity of the median voter.

- If Bob does not expect to be affected by the program deficits, he or she may prefer that deficits be run to provide larger benefits.
  - ii. As the median voter ages, the demand for social security benefits tends to increase rather than fall.
    - Older persons pay less additional tax for new benefits, because they will retire sooner than younger persons.
    - Younger persons, on the other hand, have a long period in which they will pay taxes, the financial return from which will vary by expected lifetime income.
    - Poorer young persons get a better return on their taxes than those expecting to be higher earners, because of the progressive nature of the benefit schedule.
  - iii. Reforms evidently require a younger median voter, the fear that the program will end--become bankrupt--or an increase in altruism that makes voters take account of the "big picture" problems associated with the program as it is now.
- E. Overall, it is difficult to see an obvious path to reform based on median voter interests, given their increasing age.
- i. This probably accounts for the lack of reform for the past ten years as it became clear that the program would run deficits and that the government bonds held in the "lockbox" does not really cover those deficits.
  - ii. *Discuss the above assumptions about voters. Do they make sense? What might make an older voter care about deficits? Are there other reforms that might lower the cost of health care of social security?*

## VII. Appendix: Medicare, another major program in deficit and in need of reform.

- A. The Medicare program established in the 1960s has also been expanding ever since its creation for demographic, technological, and political reasons.
- B. Currently hospital benefits are paid for by a payroll tax (part A) and currently is in deficit, as noted.
  - i. Part B is more or less paid for (out-patient) doctor's fees, lab tests, and so forth. It is paid from general tax revenue, rather than the payroll tax.

- ii. The remainder--and uncovered medical expenses--are paid through private "top up" insurance policies.
    - (In 1997, medicare recipients were made eligible to receive their benefits through a private HMO--in effect the government (tax payers) would pay for their HMO policies.)
- C. The demographic problems of Medicare programs are basically similar to those of social security programs because eligibility is based on age.
- i. However, the problems may be worse because health costs have been rising at rates far greater than inflation (or wages).
    - **Total medical expenditures** as a fraction of GDP have increased from about 3 percent of GDP in 1950 to about 12 percent in 2005 and to about 18 percent of GDP today.
    - (see the statistica website)
    - About half (medicaare and medicaid) are financed with tax dollars, the remainder is paid for with private insurance and out of pocket expenditures.
    - (This is roughly twice the fraction of GDP, more socialized healthcare systems cost in Sweden and Denmark.)
    - (Although there are some accounting differences in the way that the cost of health-care systems are calculated, it is not likely to be enough to account for the difference. Most of the difference is evidently a result of different educational requirements for healthcare personel and monopsony power on the part of the government.)
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  - ii. Part of the increase is driven by demographics.
    - Older persons generally require more health care than younger persons.
    - But, the increase is also partly a consequence of medical advances that have increased the capital and labor resources used in health care.
    - As the quality of a service increases, demand tends to increase as well.
    - It is also affected by increases in the menu of health care services available--which **are often more effective but more costly** than the ones that they replace.



- D.** Political support for Medicare and Medicaid tends to increase with age for the same reasons as social security.
- i.** Medicare is a program whose benefits are received only after retirement.
  - ii.** Medicaid is a program whose benefits are received only if one is poor enough.
  - iii.** Some people are old enough and poor enough to qualify for both.
    - They choose the program which provides the health-care benefits that they are most interested in--i. e. need the most.
  - iv.** Thus, support tends to increase as the median voter's age increases.
    - (Note the recent increase in Medicare benefits during a Republican governance. Part D, the prescription drug benefit, went into effect on January 1, 2006)
    - The largest increase in healthcare generated by "Obama care" is from an expansion of Medicaid, which raised the income level at which persons are eligible for that program and so increased the number of persons who use that insurance program.
    - (Medicaid is funded directly from federal and state general revenues, rather than having its own earmarked tax system.)
  - v.** Reducing the cost of taxpayer supported medical insurance, is more difficult to imagine than reforms of social security because electoral demand for all forms of medical insurance tends to increase as technology improves.
    - Thus, capping medical expenses or "bending the curve" tends to be politically very difficult to manage.
    - Nonetheless, there is some evidence that the rate of growth of health-care expenditures has diminished. (See the Kaiser foundation reports on per capital health-care expenditures.)
- E.** The Medicare system for retired persons depletes its "trust fund" several years ago.
- This is just another way of saying that the Medicare tax deficit (for part A) is presently being paid out of other funds or borrowed.
  - As discussed in the lock box section above, the lack of a "reserve fund" does not significantly affect Treasury's obligation to make good on promised benefit levels. So there has been no diminution of expenditures on Medicare.

- However, the fact that Medicare and Social Security are no longer providing surplus funds for the other parts of government spending implies that deficits are very likely to rise in the short and medium term if taxes are not increased or expenditures elsewhere as a fraction of GDP are not reduced.
- It is likely to turn out that deficits are the real problems associated with the end of the trust funds.

### **VIII. Appendix: Rational Choice, Time Discounting, and Political Support for Social Security.**

- A.** Once begun, the social security program has always been very popular with voters, especially older voters.
- B.** In 1975, Edgar Browning published a paper that explained why support for the program tends to be so strong and stable through time.
  - His analysis was based on an "overlapping generations model"
  - And relies upon some of ideas from finance, especially the idea of present discounted value.
- C.** To calculate and compare streams of benefits or costs that flow through time, most economists use a concept called "present discounted value."
- i.** The present value of a series of benefits and/or costs through time is the amount, **P**, that you could deposit in a bank at interest rate **r** and used to replicate the entire stream of future benefits or costs,  $F_1, F_2, F_3, \dots, F_T$ .
  - ii.** That is to say, if you deposit amount **P** today, you could go to the bank in year 1, and withdraw the amount ( $F_1$ ) a year later, return again in year 2, pull out the relevant amount for that year ( $F_2$ ) and so on...
- D.** All the **present discounted value formulas** can be calculated from the "compound interest" formula that you learned long ago in middle school or high school.
- $t$
  - Compound interest implies that if you put amount **P** into a bank today at interest rate **r**, that after **t** years, you will have amount  $F_t$  in the bank.
  - **where,  $F_t = P(1+r)^t$**

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- i. The calculation of present values asks a different question than addressed by the compound interest formula.
  - Suppose that you know  $F_t$  and want to know how large a deposit you would have to make today to have amount  $F$  in  $t$  years.
  - To answer that question we just solve the compound interest formula for  $P$ , given  $F_t$ .
  - So, the **present value of  $F_t$  is**  $P(t,r,F_t) = F_t/(1+r)^t$
- ii. It is the amount,  $P$ , that you could invest today at interest rate  $r$  which would generate  $F_t$  after  $t$  years.
  - (Note that  $r$  is entered into the formula as a fraction, e. g.  $4\%=.04$ )

E. To find the present discounted value of a series of amounts in the future  $F_1, F_2, F_3, \dots, F_T$ , one simply **adds up the present values for each of the future amounts.**

$$P = \sum_{t=0}^T (F_t/(1+r)^t)$$

- That is to say the present discounted value of any series of values is the sum of the individual present values of each element of the series.
- F. In cases where a constant value is received through time, e.g.  $F_t = F_{t+1} = F$ , a bit of algebra allows the above formula to be reduced to:
- - 
  - These formulae have many uses in ordinary personal finance.

G. Browning realized that they can also be used to calculate the present value of "Al's" tax payments for social security and the benefits they will receive.

- i. As an illustration of how this calculation might be done, suppose that Al pays an annual tax of \$10,000/year to the social security administration and plans to retire after 20 more years of work at age 62.
  - The present discounted value of this series of tax payments is:

$$(10,000) [ (1.05)^{20} - 1 ] / ( .05 (1.05)^{20} )$$

$$= (10,000)(12.4622) = \$124,622$$

- if the current interest rate is 5%/year.
- ii. Suppose that at that point, Al retires and collects social security benefits of 15,000/year for the next twenty years:
  - The present value of those benefits at Al's retirement is:

$$(15,000) [ (1.05)^{20} - 1 ] / ( .05 (1.05)^{20} )$$

$$= (15,000)(12.4622) = \$186,933$$

- if the current interest rate is 5%/year.
- iii. However, at age 42, those benefits do not start for 20 years then that amount (\$186,933) has to be discounted back to today:
  - Recall that  $P = F_T/(1+r)^T$ , so the present value of Al's future social security benefits when he-she is 42 is actually:

$$(\$186,933) / [1.05]^{20} = \$70,453.08$$

- iv. Since the present value of benefits is less than the present value of the costs, it implies that the rate of return on social security tax payments is less than 5%/year.
  - ( In other words, "Al" would be better off investing his or her OASDI payments in long term treasury bonds as 5% than investing them in the program.)
  - The **rate of return from this program** is personally greater than zero if and only if the sum of the benefits is larger than the sum of the costs (in constant dollars)--which is true in this case.
- v. [The **internal rate of return** earned on one's tax payments is the "r" (discount rate or interest rate) that sets the present value of benefits exactly equal to the present value of costs.]
  - Using a spread sheet program to search for the rates of return that sets the pv of benefits = pv of costs determines that Al earns approximately 2% per year on his or her tax payments to the Social Security Administration.

vi. Note that **the time to retirement is the main factor** in this illustration that determines whether a person's rate of return is greater than the discount rate or not.

- The implicit rate of return is increase as one approaches retirement age, other things being equal.
- Thus, a person of 25 does much worse under the program in present value terms than a 55 year old person.
- A young person has to pay a lot more taxes before retiring and their benefits are much further off in the future and so have a lower present value (because they are more "discounted").

H. Browning notes that in present value terms, self-interested voters would vote for the program only if they earn a good rate of return on their tax payments

i. That is to say, narrowly self interested voters support the program if and only if the present value of their retirement benefits is larger than the present value of their remaining tax payments.

ii. Sustained political support for social security in a democracy requires that the median voter favor the program.

iii. Note that the median voter in this case is approximately the voter of **median age and income**.

- The present value of the benefits realized by a middle aged voter of more or less median income is sufficient (or so Browning argued) to induce the median voter to favor the program.
- As people age, a new median voter arises every year, but since the median voter is about the same age as before, he or she still favors the program--even though they may have personally opposed the programs in previous years.
- (Congleton and Shugart 1990 show that the Browning model fits the data quite well for the US--although they also show that interest group models of social security also work quite well.)
- (It should be noted, however, that completely self-interested models of social security demand probably understate true demands because of altruistic and other goals voters may advance through social security programs.)

I. Browning and other public choice models of social security benefit levels also shed light on the kinds of reforms that are most likely to be adopted in the future.

- Clearly reforms must improve the present value of net benefits for a majority of the voters, given their expectations about the future of the program.
- Only a few countries have managed to find solutions to their social security dilemma thus far.
- (Perhaps surprisingly, Sweden has done so by partially privatizing and fully funding its public pension program.)