

# NBER Reporter

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

SPRING 1983

## Program Report

### Productivity and Technical Change

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For some time now, the main focus of NBER's Program in Productivity and Technical Change has been the role of research and development (R and D) expenditures in determining the rate of technological advance and subsequently influencing the growth in total factor productivity. Recently, most of our effort has been spent: (1) collecting, matching, and "cleaning" large data sets, both at the micro (firm) and at the macro (industry) level; (2) analyzing the newly available, detailed data on patenting by U.S. firms in an attempt to understand the potential utility of such data (that is, what do they measure, and what can they add to our understanding of the forces behind innovation and the reasons for the observed swings in rates of technological advance?); and (3) asking to what extent, if any, one can associate the recent slowdown in the growth of productivity with the earlier slowdown in the rate of growth of R and D expenditures in the United States. These questions represent only some of the many difficult issues that arise when we try to understand how, through what channels, and with what kind of lag, investments in R and D affect subsequent technological and productivity developments.

Our efforts in data construction involved developing a data base that covers most of the large U.S. manufacturing companies (based on their public 10-K reports) during the 1958-79 period. We then matched that data base with data acquired from the Patent Office on patents issued to *all* organizations between 1967 and 1979. We now have data on about 2600 firms in 1976, 1500 of which were reporting R and D expenditures and over 1000 of whom had received at least one patent. However, to follow the experience of particular firms over time

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This issue of the *Reporter* highlights the Bureau's Program in Productivity and Technical Change. Next, Alan Gustman discusses his work on structural retirement models. Then, Jerry Hausman describes his work on taxes and labor supply. After the quarterly Economic Outlook Survey are biographical sketches, news of NBER conferences, the Conference Calendar, and other NBER news and reports. The *Reporter* concludes with short summaries of recent NBER Working Papers.

with good, continuous data for a longer period (1972-79), eliminating major mergers and other data inconsistencies, the available sample falls to about 1300 firms of which about 700 have a continuous record of R and D expenditures. In addition to this micro data set, we also acquired the Penn-SRI-Census-based data on output, labor, capital, and material use at the four-digit SIC level, for 1958-76, which were cleaned and updated to 1978 at NBER by Wayne Gray and Frank Lichtenberg.

The first set of studies that used this data focused on the question of how good the available statistics are and what their relationship is to other variables of interest, such as R and D expenditures, the stock market valuation of the respective firms, and other productivity

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indicators. The studies show that the level of patenting is quite closely related to the level of R and D (cross-sectionally) and, moreover, that the observed relationship is not just the result of the large size difference across firms.<sup>1</sup> Pakes and Griliches, analyzing an earlier smaller sample, conclude that patents are in fact a good indicator of R and D effort, although better at describing longer-run differences across firms than short-run fluctuations within firms.<sup>2</sup>

Other studies have used the stock market value of a firm as a measure of its success, a measure that also reflects the level of its "intangible capital" and provides an implicit valuation of its research program. Griliches related the stock market value of a firm relative to the replacement value of its tangible assets (Tobin's *q*) to cumulated streams of its past R and D expenditures and the numbers of patents received.<sup>3</sup> Both the R and D and the patent constructs turned out to contribute significantly to the explanation of differences in firm valuation but implied rather implausible lag structures for both variables. On second thought, it became clear that the estimated effects should be interpreted as coming from the "unexpected" developments in R and D and patents, since all of the normally expected product of the R and D program is already incorporated in the value of the firm before its actual realization.

A consistent interpretation of such data was developed by Ariel Pakes who jointly analyzed the annual movements in R and D, patents, and the stock market rate of return.<sup>4</sup> In this interpretation, events occur (either demand shifts or technological breakthroughs) that change the expected value of a firm's research program. Such "shocks" induce simultaneous shifts in the market value of the firm, in its R and D program, and possibly also in the number of patents that it applies for. The same events will lead to further changes in the R and D and patent numbers but will not feed back into market returns that, as might be expected, cannot be predicted just from knowing a firm's past R and D and patenting history. Somewhat related results, using different variables (investment and sales instead of patents), were also obtained by Mairesse and Siu.<sup>5</sup> They found that R and D is affected strongly by demand shifts or fluctuations in sales that are not associated with fluctuations in the firm's market value. In future work, we expect to combine both of these approaches and to use the physical investment and sales data on one hand and

<sup>1</sup>J. Bound, C. Cummins, Z. Griliches, B. H. Hall, and A. Jaffe, "Who Does R and D and Who Patents?" *NBER Working Paper No. 908*, June 1982.

<sup>2</sup>A. Pakes and Z. Griliches, "Patents and R and D at the Firm Level: A First Look," *Economic Letters* 5, 1980, pp. 377-381.

<sup>3</sup>Z. Griliches, "Market Value, R and D, and Patents," *Economic Letters* 7, 1981, pp. 183-187.

<sup>4</sup>A. Pakes, "Patents, R and D, and the Stock Market Rate of Return," *NBER Working Paper No. 786*, October 1981.

<sup>5</sup>J. Mairesse and A. Siu, "An Extended Accelerator Model of R and D and Physical Investment," *NBER Working Paper No. 968*, August 1982.

the patent numbers on the other to try to disentangle demand shifts from changes in technological opportunity.

The work to date has not produced strong evidence for the notion that there is much extra information in the patent numbers variables, as far as standard production function and similar types of regressions are concerned, beyond that already present in the R and D measures. Griliches did find some independent significant role for patents in market value equations, but Pakes found no significant contribution to the explanation in the variation of stock market rates of return beyond that already captured by the R and D variables. Griliches, in his more recent work on production functions using a panel of 1154 firms covering the 1973–79 period, found that the patent data are a fair substitute for the R and D data. The patent data also help to deal with missing R and D numbers, but they do not have a significant independent contribution of their own. It seems that the annual fluctuations, and the small number for many firms, do not provide a clear picture of the firms' inventive activity. Thus, the patent data will have to be averaged over a larger number of years and attention limited to firms where patenting is common before we may be able to detect the longer-run message that might be hidden in the numbers.

Some insight into the economic value of patents may be gained from the work of Pakes and Schankerman who are examining the European data on patent renewal.<sup>6</sup> In Germany, for example, by the 18th year, the patent renewal fee rises to over \$850 a year, at which point 89 percent of the original patents have not been renewed. This implies that at that point only 11 percent of all patents were yielding annual expected revenues in excess of \$850. Patents that had been in force earlier must have had higher expected revenues that, however, depreciated rather fast and fell, ultimately, below the cutoff point. Pakes and Schankerman conclude both that the original distribution implied by these data is quite dispersed (that is, there are few very valuable patents and many that prove ultimately, and often quickly, to be of little value) and that the implied patent values appear to depreciate rather fast (at rates in excess of 25 percent per year).

Patent data may also prove useful in constructing measures of technological closeness or distance across firms and industries. This in turn may help to quantify the R and D spillovers phenomenon of benefits achieved by one firm from the research of others. It is impossible to trace such effects without imposing some underlying structure on them; there are too many actors in any field and too many dimensions in the industrial classification. An assumption that may prove helpful is that firms borrow (or steal) more from firms that are closer to them in their technological interests than from other firms. Adam Jaffe is using this idea and the detailed data on corporate patenting by patent class to construct two

different measures of firm closeness: one is based on the correlation of the patenting distributions of any two firms across all patent classes ("angular separation") and is symmetric between firms, while the second is based on the fraction of overlap in the range of patenting of any two firms and is asymmetric.<sup>7</sup> We intend to use such closeness measures to weight the research expenditures of other firms in constructing firm-specific indicators of "outside" research available for borrowing or stealing and to see if they can help to explain differences in the productivity of own research resources in different areas and industries.

The other major focus of our work has been the analysis of recent productivity trends at the firm and industry levels and the role of R and D, if any, in accounting for the recent productivity slowdown. A number of studies use an expanded production function framework for their analysis, adding a constructed R and D capital measure, or an R and D investment intensity variable, to the standard list of variables (capital, labor, and material input measures).<sup>8</sup> Three major conclusions emerge from these studies: (1) Investment in R and D does contribute significantly to the productivity growth. The estimated gross "excess" rates of return range from 20 to 40 percent. The observed changes in past R and D investment are too small, however, to account for much of the decline in the growth of productivity. (2) There is no strong evidence for a decline in the "fecundity" of R and D in the estimated elasticities or rates of return. If anything, the scattered evidence points in the opposite direction. (3) There is tremendous variance in productivity growth as conventionally measured, both at the individual firm and at the industry level, which is not accounted for by the kind of variables we have usually looked at.

There are a number of other studies being pursued by researchers associated with this program that we may mention only briefly here. For example, Schankerman and Nadiri have estimated a model of R and D investment and realization equations for actual and for multispan planned investment in R and D, using the McGraw-Hill firm data on R and D expectations.<sup>9</sup> They derive testable parameter restrictions for the rational, adaptive, and static expectations hypotheses and find that the pooled firm data strongly reject the rational and static expectations hypotheses and generally support adaptive expectations.

<sup>7</sup>A. Jaffe, "R and D Spillovers and Technological Proximity between Firms," unpublished paper, March 1982.

<sup>8</sup>Z. Griliches and J. Mairesse, "Productivity and R and D at the Firm Level," NBER Working Paper No. 826, December 1981; K. Clark and Z. Griliches, "Productivity Growth and R and D at the Business Level: Results from the PIMS Data Base," NBER Working Paper No. 916, June 1982; P. Cuneo and J. Mairesse, "Productivity and R and D at the Firm Level in French Manufacturing," NBER Working Paper No. 1068, January 1983; Z. Griliches and J. Mairesse, "Comparing Productivity Growth: An Exploration of French and U.S. Industrial Firm Data," European Economic Review 21, 1983.

<sup>9</sup>M. Schankerman and M. I. Nadiri, "Investment in R and D, Costs of Adjustment, and Expectations," NBER Working Paper No. 931, July 1982.

<sup>6</sup>A. Pakes and M. Schankerman, "The Rate of Obsolescence of Knowledge, Research Gestation Lags, and the Private Rate of Return to Research Resources," NBER Working Paper No. 346, May 1979.

Nadiri and Prucha have developed a discrete model of investment behavior that combines general nonstatic expectations with a general cost-of-adjustment technology.<sup>10</sup> They estimate a version of their theoretical model using pooled-firm, cross-section time series. Their results indicate a strong presence of adjustment costs and lead to a characterization of the dynamic paths of R and D and plant and equipment investment.

Bernstein and Nadiri explore the relationships between R and D and plant and equipment decisions and the financial structure of the firm, also using firm cross-section, time-series data. They find that the financial structure of the firm, as represented by the debt-equity ratio, significantly affects investment in both plant and equipment and R and D.<sup>11</sup> Investment in both is, however, fairly inelastic to the debt-equity ratio. The effect is stronger for plant and equipment than for R and D capital in the long run, while the elasticities of these two types of investments with respect to changes in the debt-equity ratio are similar in the short run.

Nadiri and Mohnen are studying the role of R and D in international comparisons of productivity growth.<sup>12</sup> Their decomposition of total factor productivity growth indicates that the slowdowns in demand growth and in technical change dominate the movements of productivity growth in the six countries studied. They also find that R and D contributes significantly to growth in total factor productivity. In another paper, Nadiri et al. construct a model of investment in two quasifixed assets and examine the effects of R and D investment on the growth rates of labor and total factor productivity.<sup>13</sup> They find significant effects of R and D on productivity in manufacturing in the six OECD countries they examine. However, the pattern of short- and long-run elasticities of inputs with respect to changes in input prices and output differ considerably among countries. They also find some evidence of biased technical change.

Nadiri and Wolff, using an input-output framework, study the spillover effects of R and D investment across different industries.<sup>14</sup> They estimate social and private rates of return and find that the social rate of return is higher and more significant than the private one. They also report that the social rate of return on privately

financed R and D investment exceeds that on government financed R and D. Their results suggest that in allocating government support for R and D, one should take into account a sector's "downstream" interindustry linkages. There is also significant interest in the appropriate measurement of capital and capital utilization in a world of changing energy and other prices. Robert J. Gordon, Ernst Berndt, and Nadiri and Morrison are pursuing work on these topics.<sup>15</sup>

A number of conferences and summer workshops relating to the research projects have been organized by the productivity program. A major conference on "R and D, Patents, and Productivity" was held at Lenox, Massachusetts, in October 1981 with proceedings to be published by the University of Chicago Press in 1984. Informal seminars were held in Cambridge during the summers of 1981 and 1982, and two special topics workshops are being planned for the NBER Summer Institute in 1983: "Investment, Capacity Utilization, and the Response to Energy Price Shocks" organized by Ernst Berndt, and "Technical Change and R and D Incentives" organized by Ariel Pakes. In addition, a small conference on "Econometric Studies of Industrial R and D" is being planned jointly by Griliches and Mairesse for September 1983 in Paris.

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<sup>15</sup>R. J. Gordon, "Energy Efficiency, User Cost Changes, and the Measurement of Durable Goods Prices," NBER Working Paper No. 408, November 1979; E. Berndt and M. A. Fuss, "Productivity Measurement Using Capital Asset Valuation to Adjust for Variations in Utilization," NBER Working Paper No. 895, May 1982.

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## Research Summaries

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### Structural Retirement Models

Alan L. Gustman

A full understanding of the retirement decision, and an analysis of its implications for related labor market policies, requires a structural model. Such a model must consider a number of factors. For example, what is the appropriate time frame for the analysis? Retirement clearly involves choices made in a life-cycle context. This suggests that a complete supply-side model of retirement should incorporate life-cycle elements, both in the preference function and in the budget constraint. Of course, further linkages over time are created by borrowing and lending activities.

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<sup>10</sup>M. I. Nadiri and I. Prucha, "Investment Anticipations, Adjustment Costs, Investment Decisions," mimeo, 1981; I. Prucha and M. I. Nadiri, "Formulation and Estimation of Dynamic Factor Demand Equations under Nonstatic Expectations: A Finite Horizon Model," NBER Technical Working Paper No. 26, October 1982.

<sup>11</sup>J. Bernstein and M. I. Nadiri, "Financing and Investment in Plant and Equipment and Research and Development," NBER Working Paper No. 1017, November 1982.

<sup>12</sup>M. I. Nadiri and P. Mohnen, "Sources of Total Factor Productivity Growth and the Composition of Its Recent Slowdown: An International Comparison," mimeo, 1982.

<sup>13</sup>M. I. Nadiri et al., "A Two Quasifixed Dynamic Factor Model: A Comparative Study of Effects of Research and Development Investment," mimeo, 1982.

<sup>14</sup>E. Wolff and M. I. Nadiri, "Spillover and Compositional Effects of R and D Investment," mimeo, 1982.

Second, exactly what are the relevant dimensions of labor market behavior that should be explained by such a model? Labor market activities in old age do not fall neatly into two categories—retired or not retired. Older people are frequently observed to retire partially—sometimes on a job they have held for many years, other times on a new job. A complete model of retirement not only will explain the probabilities of falling into each of these states—retired, not retired, partially retired on a job held while not retired, partially retired on a new job—but also will explain the flow from one state to another and the observed durations within each state.

Third, what does the opportunity set facing the individual look like? For many workers, there is a constraint that is commonly encountered on the main job and should be reflected in the specification of the opportunity set; namely, people may not be free to reduce their hours of work on their main job below full time. If they wish to retire partially, they may have to change jobs. However, wage offers for work when partially retired on a new job are likely to be lower than wage offers for work on the main job, not only because of differences in job-specific human capital but also because of differences in hours worked and their relation to setup costs, the expected nature of future job attachment, work effort required, and rewards for past work stemming from an implicit contract.

One last set of factors may influence the opportunity set for many workers. Pension plans and Social Security create a series of twists and turns in the budget line that reflect, among other things, the wage offers available to the individual, his work history, and age.

These various aspects of a structural model of retirement behavior have been explored in a series of papers that my coauthor, Tom Steinmeier, and I have written as a prelude to specifying and estimating a full structural model. Now we have also obtained parameter estimates for the structural model and are investigating the implications of these estimates for retirement policy. This work has been supported through grants from the Pension Office of the Department of Labor to NBER and to Dartmouth College, and from the ASPE Office of the Department of Health and Human Services to NBER.

The remainder of this research report provides a more detailed description of the separate elements we have incorporated into the structural retirement model and of the supporting evidence for the choices we have made. It also reports on the parameter estimates we have obtained, some implications for policy and, in the process, relates our findings to those of other studies of retirement behavior.

## Minimum Hours Constraints

A feature of potential importance to the specification of a structural retirement model is the constraint on employment conditions that limits the hours of work on the main job either to full time or to zero, with no opportunity for part-time work. If this constraint is common, an estimation procedure that ignores it is likely to

overestimate the within-period elasticity of substitution between income and leisure.<sup>1</sup> Moreover, if many older workers are not free on their main jobs to phase into retirement gradually, then part-time work outside of the main job becomes a more attractive option. Once that is the case, at least for constrained workers, there will be two wage offers that will need to be considered: pay for full-time work while not retired on the main job, and pay for work when partially retired off the main job. Accordingly, the minimum hours constraint, if it is binding, has important implications for the specification of the opportunity set facing the older worker.

There is some indirect evidence for the existence of a constraint requiring minimum hours. For example, of those workers who do partially retire, few are observed to retire partially on the job they held full time at age 55. Nor is partial retirement on the job held full time at 55 a relatively common occurrence even for those who are not forced off this job by poor health or financial incentives—that is, for those with no pension and who do not face mandatory retirement.<sup>2</sup> But the most persuasive evidence supporting a view that minimum hours constraints are common phenomena is direct survey evidence of both workers and firms. This evidence clearly indicates that, on their main jobs, most workers are not free to reduce hours of work below full time as they phase into retirement.<sup>3</sup>

## Retirement Outcomes

The evidence on constraints requiring minimum hours implies that a majority of workers do not have the option of choosing, at some fixed wage rate, how many hours to supply other than zero (full retirement) or full time. To work less than full time, they must leave their main job. In discrete terms, many workers have three alternative outcomes to choose from: (1) not retired on the main job (for example, still working at the job held at age 55); (2) partially retired outside the main job (that is, working part time on a nonmajor job); or (3) completely retired. Others who do not face the restraint

<sup>1</sup>A. L. Gustman and T. L. Steinmeier, "Minimum Wage Constraints and Retirement Behavior," *Contemporary Policy Issues*, a supplement to *Economic Inquiry*, forthcoming. The best-known of these structural models is developed in the pathbreaking work by R. H. Gordon and A. S. Blinder, "Market Wages, Reservation Wages, and Retirement," *Journal of Public Economics* 14, October 1980, pp. 245–276. Their paper assumes that hours of work are freely variable on the main job. Indeed, their model implies that in the absence of kinks in the budget line caused by retirement programs or mandatory retirement, all individuals should pass through a stage of partial retirement on their main jobs on the way to full retirement. However, their estimating procedure makes use only of information on age of full retirement, not of partial retirement or hours worked, complicating the nature of the bias created by ignoring the minimum hours constraint.

<sup>2</sup>Relevant evidence is presented in A. L. Gustman and T. L. Steinmeier, "Partial Retirement and Retirement Behavior," *NBER Working Paper No. 763*, September 1981, and *Industrial and Labor Relations Review*, forthcoming.

<sup>3</sup>For documentation and discussion of this evidence, see Gustman and Steinmeier, "Minimum Hours . . ."

requiring minimum hours can retire partially on their main jobs, with that choice (nonwage characteristics and financial incentives the same) dominating partial retirement outside the main job.

It should be recognized that there are different ways to define each of these categories of outcomes. One possibility is to use the worker's own response as to whether he is retired, partially retired, or not retired. Another is to base the definition of partial retirement on changes in hours of work and/or wages.<sup>4</sup> In some exploratory work, we chose to define partial retirement as being associated with a decline of 40 percent in hours and/or wages from the levels observed for full-time work on the job held at age 55.<sup>5</sup> There also is some question as to how one should define a "main job," and thus, for a person who is partially retired, whether or not he is partially retired on the main job. For example, as an alternative to defining the main job as the job held at 55, we have defined it as the last job held by an individual while reporting that he is not retired.

Obviously, the proportion of people falling into each alternative retirement category depends on which set of definitions is adopted. But more important is that, however partial retirement is defined, it is a commonly observed outcome. For those over 65, it is observed as often as is nonretirement. This finding calls into question the applicability of any structural model that would assume that older people work only full time or not at all.

Given the frequency with which partial retirement is observed, one might expect that findings based on retirement equations of the type that until recently have dominated the investigation of retirement behavior—that is, reduced-form retirement equations with dichotomous dependent variables covering the states of retired and not retired—would be sensitive to the classification of the partially retired as retired or not retired, a classification that, as has been noted, varies from study to study. We have investigated this issue and found some key parameter estimates are indeed sensitive to whether the partially retired are classified as retired or as not retired.<sup>6</sup>

Once it is recognized that the dependent retirement variable may involve three or four states, it is natural to investigate the flows among the states. Such an investigation indicates that the incidence of partial retirement is high in the sense that at least one-quarter to one-third of the oldest individuals in the Retirement History Survey are found to retire partially at some time

during their lives. But, although the incidence of partial retirement is relatively high, the duration is short, averaging just under three years.<sup>7</sup>

## Wage Equations and Compensation for Older Workers

An individual who faces a constraint requiring minimum hours and wishes to retire partially is likely to face a wage offer that is considerably lower than he could obtain if he worked full time on the main job and also is lower than he would earn if he were free to retire partially on his main job and chose to do so.<sup>8</sup> Studies of retirement, as well as of earnings or wages over the life cycle, typically fail to recognize that many individuals face two wage offers: one for full-time work on the main job, and one for reduced work in a partial retirement job. The equations describing the two wage offers are significantly different, and hence neither offer by itself fully captures the potential rewards for continued work. Further, the effects of pensions and Social Security (as indicated by the "deltas" that measure the change in present value of benefits if the individual chooses to continue working) depend on whether the continued work is in the main job or in a partial retirement job. Contrary to the effect of continued full-time work, which requires postponement of pension and Social Security receipt for the current year and subsequent readjustment in future years, partial retirement outside the main job may not affect pension benefits at all or may involve a very different effect of postponing or recomputing Social Security benefits than is obtained under the assumption of full-time work on the main job.<sup>9</sup> Yet this distinction is usually ignored in reduced-form and other retirement studies.

## The Structural Model

As suggested by the preceding discussion, the model we estimate includes a life-cycle utility function. The slope and convexity of indifference curves between consumption and leisure are assumed to differ among individuals, even among those with similar characteristics such as age, vintage, and health status.

No information on constraints requiring minimum

<sup>4</sup>Other studies have adopted different criteria for defining retirement. Examples include whether the number of hours worked falls below some level, or whether pension or Social Security benefits have been accepted.

<sup>5</sup>Gustman and Steinmeier, "Partial Retirement and Retirement Behavior." The empirical results reported, as well as our other results described in the remainder of this research summary, are based on data from the Retirement History Survey. The data pertain to white males who are not self-employed, covered in waves of the survey administered biennially from 1969 through 1975.

<sup>6</sup>Gustman and Steinmeier, "Partial Retirement and Retirement Behavior."

<sup>7</sup>A. L. Gustman and T. L. Steinmeier, "Retirement Flows," NBER Working Paper No. 1069, January 1983.

<sup>8</sup>A. L. Gustman and T. L. Steinmeier, "Partial Retirement and Wage Profiles of Older Workers," NBER Working Paper No. 1000, October 1982. It is important to distinguish wages from total compensation. As a result of incomplete actuarial adjustments, once the individual passes the age of early or normal retirement, the net reward for full-time work on the main job may fall well below the wage rate.

<sup>9</sup>In addition to the implications for retirement equations, for those interested in wage or earnings functions per se, we demonstrate in our wage profile paper that failing to distinguish between wages paid to the partially retired and to the not retired causes a sizable exaggeration of the decline with experience in the wage offer for work while not retired.

# Taxes and Labor Supply

Jerry A. Hausman

hours is available in the Retirement History Survey. Accordingly, the model assumes that all individuals are constrained, unless the individual is actually observed to retire partially on the main job. Separate wage offer curves are used for work on the main job and for work when partially retired. The influences on the budget constraint of income taxes, Social Security, and (for those who are covered) pension plans are taken into account.

The estimating strategy is to use information on the timing of transitions among full-time work, partial retirement, and full retirement to estimate the convexity of the indifference curves of various individuals and the rate at which the indifference curves are becoming steeper as the individuals become older. For an individual with a given full-time wage and a given partial retirement wage, there is a critical elasticity above which the individual will make the transition directly from full-time work to full retirement and below which he will go through a stage of partial retirement. However, some individuals do not partially retire even though the critical elasticity is quite low, while others do partially retire even though the critical elasticity is substantially higher for them. This suggests that not everyone has the same elasticity and leads us to characterize this elasticity as an individual characteristic drawn from a parameterized distribution.

With regard to the question of how rapidly the indifference curves are rotating with age, an important piece of evidence has already been mentioned. It is observed that although substantial numbers of individuals partially retire, most do so for only a relatively short period of time. There are two possible explanations for this. First, an individual may have just the right elasticity so that he partially retires for only a short period of time even though the indifference curves are rotating only relatively slowly. While this is a plausible explanation for isolated individuals, it is unlikely that almost all individuals who partially retire should have just the right elasticity so that their duration of partial retirement should be short. This leads us (and our estimation procedure) to an alternative explanation for the short duration of the partial retirement spells, namely, that the indifference curves are in fact rotating fairly rapidly.

In the estimating procedure, we allow for heterogeneity with respect both to the convexity of the indifference curves and to the aversion to work. Our initial estimates indicate that the median individual has a moderately convex set of indifference curves, with an elasticity of approximately 0.60. Further, the estimates indicate that the slope of the indifference curves is becoming steeper by about 30 percent per year. These results have important implications for the impact of potential policy changes or changes in institutional structures on retirement behavior. For instance, the effect of a change in pension or Social Security rules that halves the effective rate of compensation in later years (while leaving the overall lifetime income stream approximately unchanged) would be to reduce the age of retirement by approximately 2.7 years.

Over the past five years I have been involved in research that attempts to measure the effect of taxes on labor supply and economic welfare. Most previous work in labor supply has ignored taxes. This omission is potentially very important since the net aftertax wage of individuals is quite different from the observed market wage. Given the progressive nature of the U.S. tax system, it follows that the net wage depends on hours of work. Therefore, interesting problems of economic theory and econometrics are created by the nonlinearity of the budget sets arising from progressive taxes and by the problem of the joint determination of desired hours of work with net aftertax wages. Since over 75 percent of U.S. federal tax revenues are raised by the income and Social Security (FICA) taxes, the potential effects of taxation on labor supply and economic welfare are quite important.

Gary Burtless and I develop econometric techniques that account for the nonlinearity of the budget sets.<sup>1</sup> For the case of a convex budget set, which arises with progressive taxes, a traditional labor supply function can be used. Desired hours are a function of the net wages and "virtual incomes" that correspond to each segment of the budget set. (Segments of the budget set are defined by the appropriate brackets of the U.S. tax code. Virtual income is defined by the extension of a given budget segment back to the horizontal axis of zero labor supply.) For the case of a nonconvex budget set, which arises from fixed costs to working, transfer programs, and certain features of the tax system, more complicated procedures are necessary. Here a non-unique tangency of the indifference curves with the budget set can occur. Integration of the labor supply function to recover the underlying indirect utility function allows the most preferred point to be identified. Desired hours of work then follow from the utility-maximizing point.

The other nonstandard feature of the econometric models is a careful treatment of the stochastic components of the model. Truncated stochastic disturbances, caused by zero hours of work and distributions of preference for work, are both entered into the model. Each plays an empirically important role.

In addition to their use in evaluating the effects of the income tax and FICA, models of these types have been applied by a number of researchers to the following problems: (1) analysis of the negative income tax experiments; (2) investigation of the effects of AFDC on

<sup>1</sup>G. Burtless and J. Hausman, "The Effect of Taxes on Labor Supply: Evaluating the Gary NIT Experiment," *Journal of Political Economy* 86, 1978; J. Hausman, "The Econometrics of Labor Supply on Convex Budget Sets," *Economic Letters* 3, 1979; and "The Effect of Wages, Taxes, and Fixed Costs on Women's Labor Force Participation," *Journal of Public Economics* 14, 2, October 1980, pp. 161-194, and *NBER Reprint No. 144, February 1981*.

labor supply; (3) assessment of the effect of unemployment insurance on the duration of unemployment; and (4) studies of the effect of the earnings test on the labor supply of beneficiaries of Social Security. The resultant papers and other labor supply models that include taxes as well as applications of the labor supply model with taxes to other countries, are reviewed in "Taxes and Labor Supply."<sup>2</sup>

Income taxes, in principle, can cause people to work either more or less. Taxes lower the net wage and reduce the labor supply through the compensated substitution effect. But taxes also reduce income, causing people to consume less of all normal goods, including leisure. Thus taxation of labor income certainly can lead to either more work effort or less. Besides the direction of change in labor supply, we are also interested in the size of the effect.

I apply the labor supply model to a sample of husbands and wives in the Michigan Panel Study of Income Dynamics (PSID).<sup>3</sup> The first set of results measures the effect of taxes on the labor supply of both husbands and wives. In brief, these results show that the current tax system does significantly reduce labor supply. Husbands work about 8 percent less than they would in the absence of taxes. The reduction in work by wives is even greater because they generally face higher taxes than the husbands do. My results confirm the repeated finding of other studies that the tax-induced change in the net wage does not greatly affect the hours worked by husbands. But, unlike previous studies, my work finds an important income effect: for husbands, the uncompensated wage elasticity is estimated to be zero, while the mean income elasticity is estimated to be  $-.17$ . While the income and substitution effects approximately cancel, important implications arise for the efficiency of the tax system. In more recent work that uses panel data, the corresponding estimates are  $.03$  for the wage elasticity and  $-.14$  for the mean income elasticity. For wives, the estimated wage elasticity is  $.91$  while the income elasticity is about  $-.50$  for full-time working wives.<sup>4</sup>

I consider the effect on labor supply of tax cuts of 10 and 30 percent that correspond to recent legislation.<sup>5</sup>

<sup>2</sup>M. Kosters, "Effects of an Income Tax on Labor Supply," in A. Harberger and M. Bailey, eds., *The Taxation of Income Capital*, Washington, D.C., Brookings Institution, 1969; R. Hall, "Wages, Income, and Hours of Work in the U.S. Labor Force," in G. Cain and H. Watts, eds., *Income Maintenance and Labor Supply*, Chicago: Markham, 1973; H. Rosen, "Taxes in a Labor Supply Model with Joint Wage-Hours Determination," *Econometrica* 44, 1976; T. Wales and A. Woodland, "Labor Supply and Progressive Taxes," *Review of Economic Studies* 46, 1979; and J. Hausman, "Taxes and Labor Supply," NBER Working Paper No. 1102, March 1983.

<sup>3</sup>J. Hausman, "Labor Supply," in H. J. Aaron and J. A. Pechman, eds., *How Taxes Affect Economic Behavior*, Washington, D.C.: Brookings Institution, 1981, pp. 27-72, and NBER Reprint No. 245, February 1982.

<sup>4</sup>J. Hausman, "The Econometrics of Nonlinear Budget Sets," Fisher-Shultz lecture, Econometrics Society, delivered Dublin, 1982.

<sup>5</sup>J. Hausman, "Income and Payroll Tax Policy and Labor Supply," in L. H. Meyer, ed., *The Supply-Side Effects of Economics Policy*, St. Louis: Federal Reserve Bank of St. Louis, 1981.

Both types of tax cuts lead to increases in labor supply. Therefore, an estimated supply response is found. But the increase in supply is not nearly large enough to be self-financing. For the 10 percent tax reduction, estimated labor supply of males rises by 1.1 percent and tax revenue falls by 7.4 percent. For the 30 percent tax cut, labor supply increases by 2.7 percent while tax revenue falls by 22.6 percent. Similar results are found for wives, so that the recently enacted tax cuts lead to a substantial decrease in U.S. tax revenues.

To most noneconomists, the effect of taxation is most easily grasped through its effect on labor supply. The key question would be whether taxes increased or decreased labor supply, or perhaps had no effect at all. From an economist's perspective, the effect of taxes on labor supply is the most important part of the overall effect, but it omits an additional component: the effect of taxes on economic welfare. That extra component is the deadweight loss, or excess burden, of the tax.

The deadweight loss of a tax arises in the following manner. Suppose that the government levies a tax to raise revenue. Then suppose that it spends the revenue in an efficient and nondistortionary manner. That is, the government spends the money in a pattern desired by consumers or, even better, returns the revenues via a lump-sum subsidy. The cost of the tax at first glance might be thought to be zero. But the cost is not zero because the tax rates have caused individuals to change the amount they would work in their original (nontax) situation by altering their net aftertax wage. This distortion in relative prices leads to the deadweight loss of the tax. Economic theory demonstrates that the amount of deadweight loss rises as the *square* of the tax rate. Therefore, recent as well as proposed changes in the tax law can have important effects on the economic cost of income taxation.

The first component of a welfare measure is the effect of the tax on individual utility. Here the measure long used by economists has been some form of consumers' surplus. Consumers' surplus corresponds to the concept of how much money each individual would need to be given, after imposition of the tax, to be made as well off as he was in the no-tax situation. Measurement of consumers' surplus often is done by the size of a trapezoid under the individual's demand curve (the labor supply curve in this example). But I demonstrate that in the case of labor supply this method can be very inaccurate.<sup>6</sup> Instead the theoretically correct notion of either the compensating variation or equivalent variation should be used. These welfare measures are estimated from the expenditure function that corresponds to the labor supply function. Integration of the labor supply function leads to the calculation of an exact welfare measure. Once tax revenue is subtracted from the appropriate welfare measure, the economic cost, or deadweight loss, of the tax is found.

I estimate that mean deadweight loss as a proportion

<sup>6</sup>J. Hausman, "Exact Consumers' Surplus and Deadweight Loss," *American Economic Review* 71, 1981.



of the revenue raised is about 28 percent.<sup>7</sup> The deadweight loss calculation indicates that the current income tax system is a relatively high-cost means of raising tax revenues since one-quarter of every dollar of tax revenue raised is deadweight loss. The marginal cost of raising the tax revenue is even higher because of the relationship between the square of the tax rates and deadweight loss. The results differ greatly from the perceived wisdom in much of the public finance literature that the income tax provides a method of income redistribution and finance for government expenditure with very little economic cost. To the contrary, my results indicate that the costs may be substantial.

**TABLE 1**  
**Labor Supply and Deadweight Loss Effects**

Market Wage	DWL/Tax Revenue		DWL/Net Income		Change in Labor Supply
	Before	After	Before	After	
\$ 3.15	9.4%	6.8%	.8%	.4%	+1.3%
4.72	14.4%	10.9%	2.0%	1.1%	+1.6%
5.87	19.0%	14.5%	3.1%	1.8%	+2.7%
7.06	23.7%	17.9%	4.5%	2.5%	+3.1%
10.01	39.5%	29.5%	9.9%	5.3%	+4.6%

To consider the distribution effects on the recent tax changes, in Table 1 I divide the population into quintiles by their market wage (in 1975 dollars). Under the column DWL/Tax Revenue on the left-hand side, I give the value under the pre-1981 tax system and with the tax reductions. The same convention is used in the column for DWL/Net Income. First, note how the deadweight loss/tax revenue ratio increases rapidly with the market wage. This rapid increase arises from the progressivity of the tax system. Also, note that deadweight loss rises as a proportion of net income. Since the tax cuts are the same in percentage terms, the largest decreases in deadweight loss occur among those with the highest wages. Thus, the well-off have benefited most by the tax changes in terms of their economic welfare. Similar results are found for wives.<sup>8</sup> While tax

<sup>7</sup>J. Hausman, "Labor Supply."

<sup>8</sup>J. Hausman, "Income and Payroll Tax Policy . . ."

cuts such as those enacted will have supply-side effects and will increase economic growth, their effect on income redistribution and government expenditure needs to be kept in mind.

In Table 2, I consider an equal-yield linear income tax, or flat tax, for husbands. Note first that the tax rate begins at 14.6 percent with an exemption level of zero and rises to 20.7 percent with an exemption of \$4000 (in 1975 dollars). Each tax measure gives a substantial gain. Since tax revenues remain the same, the change in deadweight loss yields the welfare improvement. Even with the highest exemption level of \$4000, the deadweight loss falls by 49 percent from the current system.

Last, I look at the question of distribution. By considering the average tax rate for various exemption levels, one can see that either the \$2000 or \$4000 exemption is superior to the current tax system since the average (as well as the marginal) tax rate is lower at every tax bracket. The results are sensitive to various deductions and credits an individual taxpayer declares but yield the conclusion that approximately all taxpayers are made better off by this type of linear income tax system in terms of their labor supply. Lower-income groups can gain from lowering the top marginal tax rates. But part of this gain arises from the elimination of tax preference items. Most economists seem in favor of this significant broadening of the tax base. However, tax preference items, such as mortgage deduction, may be very difficult to eliminate. Furthermore, the redistributive aspect of the linear income tax is likely to encounter substantial opposition.

The analysis of other revisions to the income tax are possible: for example, the Bradley-Gephardt proposal of four tax brackets with a maximum rate of 28 percent. I discuss econometric techniques that can be utilized to calculate the labor supply and welfare aspects from other proposed income tax changes.<sup>9</sup> Analyses of this type are central to such tax simulation programs as the NBER TAXSIM model.

Important recent changes have occurred with income taxation: the 1981 tax cuts, tax bracket indexa-

<sup>9</sup>J. Hausman, "Stochastic Problems in the Simulation of Labor Supply," in M. Feldstein, ed., Behavioral Simulation Methods in Tax Policy Analysis, Chicago: University of Chicago Press, 1983, and NBER Working Paper No. 786, October 1981.

**TABLE 2**  
**Equal Yield Linear Income Tax with Exemption for Husbands**

Exemption Level	Tax Rate	Change in Deadweight Loss	Deadweight Loss/Tax Revenue	Change in Hours	Average Tax Rate at:			
					4000	8000	16000	24000
0	14.6%	-825.75	.071	+170.0	.146	.146	.146	.146
\$1000	15.4	-798.82	.083	+169.3	.116	.135	.144	.148
2000	16.9	-765.31	.098	+167.6	.085	.127	.148	.155
4000	20.7	-659.18	.145	+163.0	—	.104	.155	.172
pre 1981	IRS Code	—	.287	—	.119	.147	.173	.188

tion, a tax credit for working spouses, and proposed increases in FICA taxes. The economic effects of these changes may be quite important for economic growth and economic welfare. Models of labor supply are needed to analyze such changes because economic theory can make no definitive statements about the direction or magnitude of the effects of such changes. Empirical models of labor supply that incorporate taxes seem to be a useful tool in public finance to understand the likely effects on labor supply, deadweight loss, and government tax revenue of recent and proposed changes in the income tax.

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## Economic Outlook Survey

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### First Quarter 1983

Victor Zarnowitz

According to the median forecast from the February survey of professional economic forecasters taken by NBER and the American Statistical Association, total output of the economy will grow at annual rates varying between 2.8 and 4.5 percent from quarter to quarter in 1983 and is likely to gain about 4 percent between 1983 and 1984. The expectations of a continuing expansion have firmed up considerably since the previous (December 1982) survey. Inflation rates will rise appreciably in the near future but should average no more than 4 to 5 percent in the current year and the next, in terms of both the GNP implicit price deflator (IPD) and the consumer price index (CPI). Industrial production will grow at about double the rate of total output, corporate profits after taxes nearly twice as fast as GNP in current dollars. However, the total unemployment rate will still average 9.4 percent in 1984.

#### Real Growth Prospects

As reported by 38 survey correspondents, the mean probabilities attached to the alternative outcomes for year-to-year changes in real GNP are as follows:

Percent range	1982-83	1983-84
4.0 or more	15	53
2.0 to 3.9	46	31
Less than 2.0	39	16

The mean forecasts implied by these predictive probability distributions are 2.6 and 3.8 percent for 1982-83 and 1983-84, respectively. They are close to, but gen-

erally a little higher than, the averages of the corresponding point predictions.

Between 1982:4 and 1983:4, GNP in 1972 dollars will rise 3.8 percent according to the median forecast for the NBER-ASA group. This is higher than the 3.1 percent rise predicted by the President's Council of Economic Advisers in December-January and lower than the revised 4.7 percent just issued by the same source.

Only seven respondents place the chances as high as 20 to 50 percent that the recovery will abort in the near future. The median probability is 10 percent that real GNP would decline in any quarter during the year ahead.

#### Inflation and Interest Rates

For the year-to-year changes in IPD, the mean probabilities reported by the 38 forecasters are summed up in the accompanying tabulation:

Percent range	1982-83	1983-84
6.0 or more	15	34
4.0 to 5.9	62	47
Less than 4.0	23	19

The implicit mean forecasts are 4.9 percent for 1982-83 and 5.5 percent for 1983-84, again somewhat higher than the group averages of the corresponding point predictions.

The annual rates of increase in CPI will rise from 4.1 percent in 1982:2 to 5.0 percent in 1984:1. On the average, inflation in terms of CPI will be 4.1 percent in 1983 and 5.2 percent in 1984.

The median forecasts for the 3-month Treasury bill rate show a low point of 7.5 percent in 1983:2 and a gradual rise to 8.0 percent in 1984:1. The annual figures are 7.8 percent for 1983 and 8.0 percent for 1984 (the actual for 1982 was 10.7 percent).

The yields on new high-grade corporate bonds are predicted to vary narrowly between 11.3 and 11.5 percent in the four quarters 1983:2-1984:1, and to average 11.5 and 11.2 percent in 1983 and 1984, respectively (the actual figure for 1982 was 14.7 percent). In sum, these forecasts imply some reductions in the *real* interest rates (both short- and long-term), but as a consequence of higher inflation rather than lower nominal interest rates.

#### Gains in Industrial Production and Corporate Profits

The index of industrial production (1967 = 100) will rise 8 percent from 137 in 1983:1 to 148 in 1984:1. This suggests a substantial recovery in manufacturing, the largest component of this index (which also includes mining and utilities). The projected year-to-year changes are 1.7 percent for 1982-83 and 7.8 percent for 1983-84.

Corporate profits after taxes are expected to reach an annual rate of \$146 billion in 1984:1, a gain of 20 percent from the depressed level of 1983:1. The median predictions of profit changes in 1982-83 and 1983-84 are 11.5 percent and 19.4 percent, respectively.

## Projections of GNP and Other Economic Indicators, 1983-84

	Annual				
	1982 Actual	1983 Forecast	1984 Forecast	Percent Change	
				1982 to 1983	1983 to 1984
1. Gross National Product (\$ billions)	3057.5	3265.0	3578.0	6.8	9.6
2. GNP Implicit Price Deflator (1972 = 100)	207.2	216.7	228.1	4.6	5.3
3. GNP in Constant Dollars (billions of 1972 dollars)	1475.5	1503.1	1565.0	1.9	4.1
4. Unemployment Rate (percent)	9.7	10.2	9.4	0.5 <sup>1</sup>	-0.8 <sup>1</sup>
5. Corporate Profits After Taxes (\$ billions)	117.5	131.0	156.3	11.5	19.4
6. Nonresidential Fixed Investment (billions of 1972 dollars)	165.4	155.0	163.0	-6.3	5.2
7. New Private Housing Units Started (annual rate, millions)	1.1	1.5	1.6	38.5	11.9
8. Change in Business Inventories (billions of 1972 dollars)	-8.5	0.5	9.0	9.0 <sup>2</sup>	8.5 <sup>2</sup>
9. Treasury Bill Rate (3-month, percent)	10.7	7.8	8.0	-2.9 <sup>1</sup>	0.2 <sup>1</sup>
10. Consumer Price Index (annual rate)	6.1	4.1	5.2	-2.0 <sup>1</sup>	1.1 <sup>1</sup>

	Quarterly							Percent Change	
	1982 Q4 Actual	Q1	1983			1984 Q1	Q4 82 to Q4 83		
			Q2	Q3	Q4				
			Forecast						
1. Gross National Product (\$ billions)	3101.3	3160.0	3225.0	3297.0	3379.0	3460.0	9.0	9.5	
2. GNP Implicit Price Deflator (1972 = 100)	210.7	212.9	215.3	218.0	221.0	223.6	4.9	5.0	
3. GNP in Constant Dollars (billions of 1972 dollars)	1471.7	1485.0	1495.0	1510.0	1527.0	1541.0	3.8	3.8	
4. Unemployment Rate (percent)	10.7	10.5	10.3	10.1	10.0	9.8	-0.7 <sup>1</sup>	-0.7 <sup>1</sup>	
5. Corporate Profits After Taxes (\$ billions)	119.4	122.0	127.2	135.0	142.0	145.7	18.9	19.4	
6. Nonresidential Fixed Investment (billions of 1972 dollars)	159.6	156.0	154.6	154.3	156.0	159.9	-2.3	2.5	
7. New Private Housing Units Started (annual rate, millions)	1.3	1.4	1.4	1.5	1.5	1.6	22.9	18.5	
8. Change in Business Inventories (billions of 1972 dollars)	-17.7	-5.0	0.9	2.9	5.0	7.0	22.7 <sup>2</sup>	12.0 <sup>2</sup>	
9. Treasury Bill Rate (3-month, percent)	7.9	7.9	7.5	7.6	7.9	8.0	0.0 <sup>1</sup>	0.1 <sup>1</sup>	
10. Consumer Price Index (annual rate)	0.8	2.9	4.1	4.3	4.6	5.0	3.8 <sup>1</sup>	2.1 <sup>1</sup>	

SOURCE: National Bureau of Economic Research and American Statistical Association, Business Outlook Survey, March 1983. The figures on each line are medians of thirty-eight individual forecasts.

<sup>1</sup>Change in rate, in percentage points.

<sup>2</sup>Change in billions of dollars.

### The Recovery in Consumption and Housing

Consumption expenditures in constant dollars will gain 3.4 percent in the year ahead (through 1984:1), accounting for almost all of the rise in total real GNP. The median predictions of the percentage changes in 1982-83 and 1983-84 are 2.9 and 3.5.

New private housing starts will reach 1.6 million units (annual rate) in 1984:1, 18.5 percent above the 1983:1 level. Residential fixed investment in constant dollars will gain about 2.1 percent in the same period.

### The Weakest Sectors

Nonresidential fixed investment in billions of 1972 dollars will decline from 160 in 1982:4 to 154 in 1983:3, then regain the level of 160 in 1984:1. It will fall 6.3 percent in 1982-83 but rise 5.2 percent in 1983-84.

The process of inventory liquidation will continue through 1983:1. Later the changes in business inventories are expected to turn positive but they are generally seen as small or moderate.

Net exports of goods and services, at \$19 billion (1972 dollars, annual rate), will be much smaller in 1983 than in the already weak year 1982 (when they amounted to \$30 billion). Most forecasters do not expect them to improve much in 1984.

The state and local government purchases are to remain nearly stable at their recent level of \$175 billions of 1972 dollars. Federal government purchases, on the other hand, will rise about 5 percent in 1982-83 and slightly more than 3 percent both in 1983:1-1984:1 and in 1983-84.

The consensus is still strong that unemployment will decline, but slowly. The median forecast for 1984:1 is 9.8 percent, down from the 10.7 percent peak in 1982:4.

## Assumptions

Forecasters generally expect the recently enacted tax legislation to come into effect as scheduled. Most assume a buildup of defense outlays in the 7-10 percent range; some scale it down to 4-6 percent. M2 growth of 7-11 percent is frequently quoted. Energy prices are seen by most as stable or decreasing. A growing minority (16 respondents) anticipate that the dollar will weaken during the period covered in the survey.

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*This report summarizes a quarterly survey of predictions by about fifty business, academic, and government economists who are professionally engaged in forecasting and are members of the Business and Economics Statistics Section of the American Statistical Association. Victor Zarnowitz of the Graduate School of Business of the University of Chicago and NBER, assisted by Douglas Phillips of NBER, was responsible for tabulating and evaluating this survey.*

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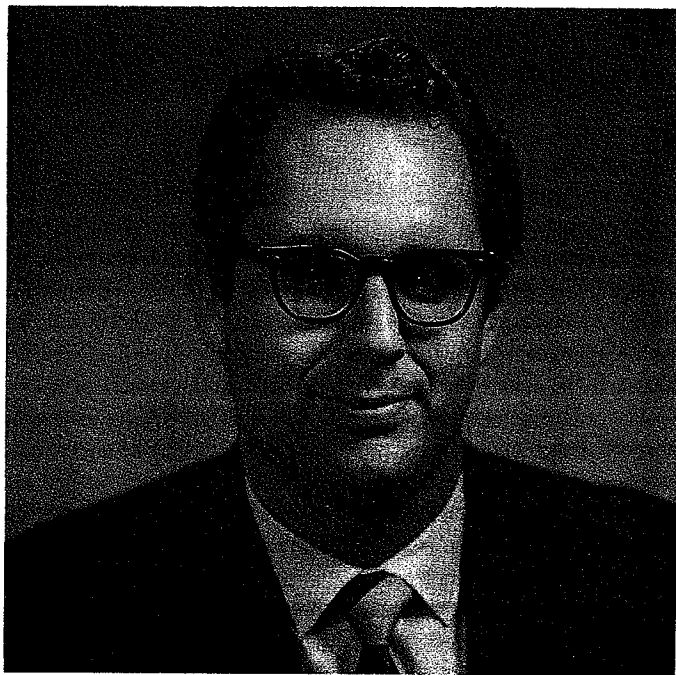
## NBER Profiles

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### Alan L. Gustman

NBER Research Associate Alan L. Gustman, professor of economics at Dartmouth College, is a member of the Bureau's Program in Labor Studies. Gustman, who holds a B.A. from City College of New York and a Ph.D. from the University of Michigan, has been on the Dartmouth economics faculty since 1969. He has taught economics of education, labor economics, and a number of economic theory courses.

Gustman took a one-year break from teaching in 1976 to become Special Assistant for Economic Affairs, U.S. Department of Labor. He has also served as a



consultant to the U.S. Department of Health, Education and Welfare, in 1978-80; the U.S. Department of Labor, in 1976, 1979-81, and at present; and the U.S. Department of Education, from 1980-83. Gustman has had published a number of journal articles, particularly in the areas of labor economics and the economics of education.

Gustman and his wife, Janice, have three children: Sam, Evelyn, and Mara. When he is neither teaching nor writing, Gustman jogs regularly, and plays golf occasionally, invariably losing by at least ten strokes to 14-year-old Sam.

### Jerry A. Hausman

NBER Research Associate Jerry A. Hausman has been a member of the Bureau's programs in labor studies, taxation, and pensions since 1979. He received a B.A. in economic history (summa cum laude) from Brown University in 1968 and a Ph.D. in economics from Oxford University in 1973.



Hausman joined the economics department of MIT as an assistant professor in 1973. He was promoted to associate professor in 1976 and to professor of economics in 1979. Hausman's research and teaching interests include econometrics, public finance, and applied macroeconomics.

In addition to having written numerous journal articles on those subjects, Hausman serves as an associate editor of the *Journal of Public Economics*, *Econometrica*, and the *Bell Journal of Economics*. He was also named a Fellow of the Econometric Society in 1979 and received that group's Frisch Medal in 1980. This academic year (1982-83), Hausman is a visiting professor in the economics department at Harvard University.

Hausman, his wife Margaretta, and their children, Nicholas and Claire, live in an eighteenth-century house in Milton (MA). His hobbies include tennis, squash, sailing, and "stock market speculation."

## U.S. Corporate Capital Structures

An NBER Conference on Corporate Capital Structures in the United States was held on January 6 and 7 in Palm Beach, Florida. The conference was part of the Bureau's research project on "The Changing Roles of Debt and Equity in Financing U.S. Capital Formation," sponsored by the American Council on Life Insurance. The two-day agenda was:

### CONFERENCE SESSION I

Chairman: Benjamin M. Friedman, Harvard University and NBER

Robert A. Taggart, Northwestern University and NBER, "Secular Patterns in the Financing of U.S. Corporations" (NBER Working Paper No. 810)

Discussant: John Lintner, Harvard University

John H. Ciccolo, Jr., Boston College and NBER, "Changes in the Balance Sheet of the U.S. Manufacturing Sector, 1926-77" (NBER Working Paper No. 702)

Discussant: Franco Modigliani, MIT

Patric H. Hendershott, Ohio State University and NBER, and Roger Huang, "Debt and Equity Yields, 1926-80"

Discussant: Jess Yawitz, Washington University

### CONFERENCE SESSION II

Chairman: Zvi Bodie, Boston University and NBER

Scott Mason, Philip Jones, and Eric Rosenfeld, Harvard University, "Contingent Claims Analysis of Corporate Capital Structures"

Discussant: Fischer Black, MIT and NBER

Wayne Mikkelsen, Dartmouth College, "Capital Structure Change and Decreases in Stockholders' Wealth"

Discussant: Michael Jensen, University of Rochester

### CONFERENCE SESSION III

Chairman: David F. Bradford, Princeton University and NBER

Zvi Bodie, Alex Kane, Boston University, and Robert McDonald, Boston University and NBER, "Inflation and the Role of Bonds in Investor Portfolios" (NBER Working Paper No. 1091)

Discussant: Martin Gruber, New York University

Benjamin M. Friedman, "The Substitutability of Debt and Equity Securities"

Discussant: Gary Smith, Pomona College

Alan J. Auerbach, Harvard University and NBER, "Real Determinants of Corporate Leverage"

Discussant: Roger H. Gordon, Bell Labs and NBER

### CONFERENCE SESSION IV

Chairman: Benjamin M. Friedman

Michael Spence, Harvard University, "Capital Structure and the Corporation's Product Market Environment"

Discussant: John Scott, Dartmouth College

Michael Long, Federal Home Loan Bank Board, and Ileen Malitz, Georgetown University, "Investment Patterns and Financial Leverage"

Discussant: Stewart C. Myers, MIT and NBER

Taggart's paper begins by noting that it is frequently argued that the use of debt financing by corporations has increased dramatically in recent years, but that such discussions have been hampered by the lack of a unified theoretical framework. In his paper, Taggart attempts to develop such a framework using existing corporate finance theory and some extensions thereof. His theory is then used to interpret available data on aggregate corporate financing patterns over the course of the twentieth century.

Taggart finds that corporations' use of debt has undeniably increased in the post-World War II period. Nevertheless, the relative corporate debt level was unusually low in the 1940s and current debt levels are not unprecedented when viewed in the context of the entire century. The tax system, in conjunction with inflation, has probably played an important role in the postwar increases in corporate debt, but these factors appear insufficient to explain longer-term trends. He argues, then, that supplies of competing securities, such as federal government bonds, as well as the secular development of the financial intermediary system, may also be important determinants of long-run corporate financing patterns.

Ciccolo's paper documents trends in the sources and use of funds, market valuations, and rates of return for a sample of U.S. manufacturing firms during the half-century ending in 1977. The major objective of the paper is to construct economic balance sheet relationships based on market valuations rather than on the more familiar book values used for accounting purposes.

Among the more interesting long-term trends highlighted in Ciccolo's analysis is that the widely recognized increase in debt in manufacturing firms' capitalization has come primarily at the expense of preferred stock. A second interesting point is the contrast between the sharp fall in common equity values in 1929-32, which was entirely reversed by 1936, and the even sharper post-1968 decline, which was not reversed by 1977 nor, for that matter, by 1981.

The study by Hendershott and Huang begins with an examination of the data for the 1926-80 period on returns earned on Treasury bills, long-term Treasury and corporate bonds, and corporate equities. The authors identify relationships among the returns, and between them and inflation and the business cycle. They then turn to an econometric explanation of four returns: (1) the one-month Treasury bill rate; one-month ex post returns on (2) corporate bonds and on (3) equities; and (4) the new-issue, long-term Treasury coupon rate.

Two general themes are supported by the authors' econometric work: First, the Livingston survey data—on both expected inflation and expected industrial production growth—are useful in explaining financial returns. Second, real interest rates are positively related to real economic activity.

The paper by Mason, Jones, and Rosenfeld seeks to apply and test the Contingent Claims Analysis, for almost a decade the premier model of how value is allocated among claimants on firms. The empirical validity of the model still remains an open question, though. There has been no known test of the model in its presumably most important application, namely the valuation of debt and equity in typical corporate capital structures. In addition to being of academic interest, such a test has significant practical implications: if it can be established that the model predicts actual market prices, then it can be used to price new and untraded claims and to infer firm values from prices of such traded claims as equity. In their paper, the three authors present evidence of how well a model that makes the usual assumptions in the literature does in predicting market prices for claims in standard capital structures. The results suggest that the usual assumption list requires modification before it can serve as a basis for valuing corporate claims.

Mikkelsen's paper presents a cross-sectional analysis of the relationship between the reactions of common stock prices to announcements of convertible security calls and to variables that represent possible determinants of changes in the wealth of common stockholders. The variables are measures of the following effects of calls of convertible securities: (1) the change in interest expense tax shields; (2) the potential redistribution of wealth from common stockholders to preferred stockholders and debt holders; (3) the decrease in the value of conversion privileges held by convertible security holders; (4) the relative increase in shares outstanding; and (5) the change in earnings per share. Mikkelsen finds a significant relationship only between the measure of the reduction in interest expense tax shields and the stock price response to call announcements. The apparent corporate tax effect is consistent with some combination of effects caused by: (1) a reduction in interest expense tax shields; and (2) unfavorable information about the calling firm's value or earnings prospects conveyed by a call of convertible securities. The evidence is consistent with theories of capital structure that imply that optimal financial leverage depends on earnings prospects and is also consistent with theories that imply that reductions in leverage convey negative information about firm value.

The paper by Bodie, Kane, and McDonald explores both theoretically and empirically the role of nominal bonds of various maturities in investor portfolios in the United States. One of its principal goals is to determine whether an investor who is constrained to limit his investment in bonds to a single portfolio of money-fixed debt instruments will suffer a serious welfare loss. The authors' interest in this question stems from the obser-

vation that many private retirement savings plans limit a participant's investment choices to two types: a common stock fund and a money-fixed bond fund of a particular maturity. A second goal is to study the desirability and feasibility of introducing a market for index bonds (that is, an asset offering a fixed real rate of return) in the U.S. capital markets.

The main results of the paper are: (1) There can be a substantial loss in welfare for participants in savings plans offering a choice of only two funds: a diversified stock fund and an intermediate-term bond fund. Most of this loss can be eliminated by introducing a money market fund as a third option. (2) The capital market is probably not large enough to justify the costs of such an innovation, however. The major reason for the small gain is that one-month bills, with their small variance of real returns, are an effective substitute for index bonds.

Friedman's paper sets out to determine the extent to which people, on average, regard debt and equity securities as either close or distant substitutes in their investment portfolios. Friedman first uses the theory of portfolio selection, together with the observed risk properties of debt and equity investments in the United States during 1960–80, to calculate how investors would have behaved in this regard if they had correctly understood the nature of the risks they faced. He then uses data on the U.S. household sector's aggregate holdings of financial assets to estimate how investors actually behaved during this period. The differences between the imputed optimal behavior and the estimated actual behavior are striking. Friedman's explanation for this divergence is that investors in fact did not accurately perceive the full nature of the risks associated with debt and equity securities. He shows that the relevant part of the risk structure changed sharply between the 1960s and the 1970s and argues that investors probably required some time to realize that they were operating in a new investment environment.

The purpose of Auerbach's paper is to examine, using firm-level panel data, the relationship between real and financial decisions by corporations, in part to determine the extent to which the various biases of the U.S. corporate tax offset or reinforce each other. Auerbach's results suggest that patterns of real and financial behavior are generally consistent with predictions of various capital structure models (for example, bankruptcy cost, agency cost, limited tax shield) but that there is no obvious offset on the financial side to the tax bias against investment in structures.

Spence's paper, which uses data on four-digit industries, including financial structure and diversification of corporations' product markets, explores the hypothesis that the variance in capital structures increases as competitive pressure from the product markets declines. There is limited evidence in the data for this type of effect. The paper also attempts to determine the direct link between product market position and either financial performance or the corporations' financial structure. Here the explanatory power of product market conditions, diversifications, and profitability is quite large.

Finally, the paper analyzes the extent to which competitive position in product markets and product market attributes determine rates of return.

Finally, the study by Long and Malitz investigates the influence of the types of investment opportunities facing a firm on its choice of capital structure. It is shown that the more discretionary investment opportunities a firm faces, the lower is its financial leverage. Inclusion of other possible determinants of capital structure, such as availability of internal funds, tax effects, and risk, while significant, do not affect the importance of discretionary investment. The evidence supports: (1) the existence of a moral hazard problem, which inversely relates risky debt and discretionary investment choice; and (2) a desire by most firms to use sources of internal funds prior to entering the capital market.

In addition to the conference participants already named, others attending were: Carliss Baldwin and Jay Light, Harvard University; Harry C. DeAngelo, Rochester University; Stephen Goldfeld, Princeton University and NBER; Robert Hamada, University of Chicago; David G. Hartman, executive director, NBER; Edward J. Kane, Ohio State University and NBER; John H. Makin, IMF and NBER; Robert C. Merton, MIT and NBER; Steve Ross, Yale University; Michael Rothschild, University of Wisconsin and NBER; Paul Wachtel, New York University and NBER; and Kenneth Wright, American Council on Life Insurance.

## Strategic Behavior and Trade Policy

As part of the Project on Trade Policy, Competitive-ness, and Capital Mobility in the World Economy, NBER sponsored a conference on "Strategic Behavior and Trade Policy" in Princeton, New Jersey, on March 17-18. The conference brought together policymakers and economists studying international trade and industrial organization; their discussion focused on approaches to modeling that involve strategic behavior.

The two-day agenda was:

Introductory Remarks: William H. Branson, NBER Program Director, International Studies, and Princeton University

### SESSION I

Chair: William H. Branson

Avner Shaked and John Sutton, London School of Economics, "Natural Oligopolies and International Trade"

Discussant: Kenneth Judd, Northwestern University  
Janusz Ordover, New York University, and Robert Willig, Princeton University, "Perspectives on Horizontal Mergers"

Discussant: Barbara Spencer, Boston College and NBER

David R. Macdonald, Office of the U.S. Trade Representative, "A Washington Perspective on Strategic Behavior and Trade Policy"

Commentator: Gary N. Horlick, U.S. Department of Commerce

### SESSION II

Chair: Paul R. Krugman, Council of Economic Advisers  
Elhanan Helpman, Tel Aviv University, "A Theory of Multinational Corporations and the Structure of Foreign Trade"

Discussant: Avinash Dixit, Princeton University

Jonathan Eaton, Yale University and NBER, "Product Quality, Reputation, and Direct Foreign Investment"

Discussant: James Markusen, University of Western Ontario

### SESSION III

Chair: Gene M. Grossman, Princeton University and NBER

Barry J. Eichengreen, Harvard University and NBER, "The Simple Analytics of Dumping"

Discussant: Wilfred Ethier, University of Pennsylvania

Panel: Avinash Dixit, Paul R. Krugman, and Robert Willig, "Where This All Leads Us"

The first paper, by Shaked and Sutton, focuses on vertical product differentiation: the way in which products are differentiated by quality. In a market where such quality differences exist, there may be an upper bound on the number of firms that can survive at a non-cooperative price equilibrium; such a possibility is called "natural oligopoly." Shaked and Sutton show that this outcome is associated with those high technology industries where the main burden of quality improvement falls on fixed (R and D) costs, rather than on variable (labor and materials) costs.

The implications of this for trade theory are: (1) The opening of trade in the short run (where product specifications are fixed) will be associated with the exit of certain low-quality producers. Consumers benefit by having access to higher-quality products at lower prices. (2) In the long run, the limitation on the number of viable firms ensures that those that survive enjoy enhanced returns to marginal improvements in product quality. The main impact of trade lies in the appearance of higher-quality products; this contrasts with the conventional view derived from the "horizontal differentiation" paradigm, which associates gains from trade with an increased variety of products. (3) Equilibrium in such models is asymmetric; it may be more attractive to be host to the high-quality producer, for example, where market equilibrium involves two firms producing at different quality levels. This raises a series of strategic issues concerned with the choice of alternative industrial policies.

The second paper, by Ordover and Willig, presents methods of analyzing the welfare effects of horizontal international mergers. In the final session of the first day, Macdonald discussed "A Washington Perspective

on Strategic Behavior and Trade Policy." His presentation was followed by a comment from Horlick and a lively group discussion of the issues involved.

The second day began with a discussion of a paper by Helpman. In order to deal with the role of multinational corporations in the structure of foreign trade, Helpman's paper develops a formal theory of horizontally integrated multiproduct firms on the basis of product differentiation and monopolistic competition. This theory is embedded in a general equilibrium trade model so that its implications for trade patterns may be observed. The result is a trade structure in which there is intersectoral, intraindustry, and intrafirm trade. Apart from the determinants of the trade patterns, Helpman shows how the volume of trade and the share of intrafirm trade respond to cross-country differences in factor endowments.

The paper by Eaton develops a model of firm product quality in an international trading environment with some features similar to less developed countries (LDCs) that may make it difficult for exporting firms to establish a reputation for quality. The problem may be especially acute in the case of labor-intensive manufactures, in which these countries have a comparative advantage from a purely technological perspective. This situation indicates a motive for direct foreign investment: firms from developed countries with established reputations for quality may locate production in LDCs to take advantage of the lower costs of production. Establishing internationally enforceable warranties could provide an alternative means of reducing trade distortions arising from unverifiable product quality.

Eichengreen's paper develops a number of theoretical models to be used to analyze dumping. Its two sections are devoted to the two alternative definitions of dumping: as price discrimination in international trade and as sales below variable production costs. The first section develops a series of models that provide a systematic explanation for dumping as price discrimination. In these models, dumping can be understood as a consequence of oligopolistic rivalry in imperfectly competitive, segmented markets. Dumping as entry deterrence is shown to be a special case of this general phenomenon. The second section develops a pair of models that can be used to analyze dumping as sales below apparent variable costs of production. Firms face an intertemporal pricing problem resulting from the existence of extra costs of adjusting the level of production or of acquiring additional customers. In these models, firms equate shadow marginal revenue with shadow marginal cost, but shadow revenues and costs can differ from apparent revenues and costs, giving firms' pricing policies the appearance of dumping.

The conference ended with a panel discussion by Dixit, Krugman, and Willig on future lines of research.

In addition to the aforementioned participants, others attending the conference were: Robert E. Baldwin and J. David Richardson, University of Wisconsin and NBER; Thomas Bayard, Ford Foundation; James Brander, Queen's University and NBER; Timothy Bresnahan and

Carl Shapiro, Stanford University; Jorge de Macedo, Princeton University and NBER; Nicholas Economides and Robert Feenstra, Columbia University; Joseph Farrell, MIT; William Finan, Department of Commerce; Robert Hodrick, Carnegie-Mellon University and NBER; Michael Katz, Princeton University; Carole Kittl and Rolf R. Peikarz, National Science Foundation; Al Klevorick, Yale University; Irving B. Kravis and Richard C. Marston, University of Pennsylvania and NBER; Robert E. Lipsey, Queens College and NBER; Martin McGuire, University of Maryland; Richard Portes, University of London and NBER; Herman Quirnbach, Rand Corporation; Pablo Spiller, University of Pennsylvania; and Lars E. O. Svensson, University of Stockholm.

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## Conference Calendar

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Each *Reporter* will include a calendar of upcoming conferences and other meetings that are of interest to large numbers of economists (especially in academia) or to smaller groups of economists concentrated in certain fields (such as labor, taxation, finance). The calendar is primarily intended to assist those who plan conferences and meetings, to avoid conflicts. **All activities listed should be considered to be "by invitation only," except where indicated otherwise in footnotes.**

Organizations wishing to have meetings listed in the Conference Calendar should send information, comparable to that given below, to Conference Calendar, National Bureau of Economic Research, 1050 Massachusetts Avenue, Cambridge, MA 02138. Please also provide a short (fewer than fifty words) description of the meetings for use in determining whether listings are appropriate for inclusion. The deadline for receipt of material to be included in the Summer 1983 issue of the *Reporter* is June 15. If you have any questions about procedures for submitting materials for the calendar, please call Kirsten Foss at (617) 868-3900.

### May 5-6, 1983

Program Meeting: Financial Markets and Monetary Economics, NBER

### May 6-7, 1983

Economics of Trade Unions, NBER

### May 17-18, 1983

Spring Symposium, National Tax Association\*

### May 23-27, 1983

Interlaken Seminar on Analysis and Ideology, University of Rochester

### May 31-June 3, 1983

Konstanz Conference on Monetary Theory and Monetary Policy, University of Rochester

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\*Open conference, subject to rules of the sponsoring organization.



**June 9-10, 1983**

Annual Meeting, International Association of Energy Economists

**June 10-11, 1983**

Conference on Political Economy, Carnegie-Mellon University

**June 27-28, 1983**

International Seminar on Macroeconomics, NBER

**July 6-8, 1983**

Conference on Macroeconomics, NBER

**July 20-24, 1983**

Annual Conference, Western Economic Association

**July 31-August 3, 1983**

Annual Meeting, American Agricultural Economics Association

**August 11-12, 1983**

Minority Youth Unemployment, NBER

**August 15-18, 1983**

Annual Meeting, American Statistical Association\*

**August 18-20, 1983**

Conference on Productivity in Health, NBER

**September 1983**

First Quarter Century of Cliometrics, NBER

**September 15-16, 1983**

Panel on Economic Activity, Brookings Institution

**September 21-24, 1983**

16th (CIRET) Conference, Centre for International Research on Economic Tendency Surveys

**September 27-30, 1983**

Annual Conference, National Association of Business Economists\*

**October 2-6, 1983**

Annual Conference, National Tax Association\*

**October 14-15, 1983**

The Economics of the U.S. Retirement Income System, NBER

**October 21-22, 1983**

Policy Options for Catastrophic Personal Injury, Hoover Institution

**December 7-10, 1983**

Income and Wealth: Horizontal Equity, Uncertainty, and Measures of Well-Being, NBER

**December 28-30, 1983**

Annual Conference, American Economic Association\*

**January 4-7, 1984**

Global Implications of Trade Patterns of Asia, NBER

**March 16-17, 1984**

Public Pensions, NBER

**March 22-24, 1984**

Income and Wealth: Long-Term Factors in American Economic Growth, NBER

**March 22-25, 1984**

Business Cycle Conference, NBER

**June 24-28, 1984**

Annual Meeting, Western Economic Association

**August 5-8, 1984**

Annual Meeting, American Agricultural Economics Association

**August 13-16, 1984**

Annual Meeting, American Statistical Association\*

**October 25-29, 1984**

Annual Conference, National Tax Association\*

**December 28-30, 1984**

Annual Conference, American Economic Association\*

**August 4-7, 1985**

Annual Meeting, American Agricultural Economics Association

**August 12-15, 1985**

Annual Meeting, American Statistical Association\*

**December 28-30, 1985**

Annual Conference, American Economic Association\*

**July 27-31, 1986**

Annual Meeting, American Agricultural Economics Association

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## Bureau News

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### Tax Economists Meet in Cambridge

On January 13 and 14, members and guests of NBER's Program in Taxation met in Cambridge to discuss recent work. The agenda for the meeting, chaired by NBER Program Director David F. Bradford of Princeton University, was

Hal R. Varian, University of Michigan, "Models of Rent-Seeking Behavior"

Discussant: Albert Kyle, Princeton University and NBER

Jerry A. Hausman, MIT and NBER, "The Econometrics of Nonlinear Budget Sets"

Discussant: James M. Poterba, MIT and NBER

Charles E. McLure, Jr., Hoover Institution and NBER, update on state corporate income tax research

Peter Mieszkowski, Rice University and NBER, and John Morgan, Rice University, "The Effects of Partial State Corporate Income Taxes on Multistate Corporations"

Discussant: Charles E. McLure, Jr.

Michael Katz, Princeton University, and Harvey S. Rosen, Princeton University and NBER, "Tax Analysis in an Oligopoly Model"

Discussant: John B. Shoven, Stanford University and NBER

Luncheon Speaker: J. Gregory Ballentine, U.S. Department of the Treasury

Alan J. Auerbach, Harvard University and NBER, and Laurence J. Kotlikoff, Yale University and NBER, "Investment versus Saving Incentives: The Size of the Bang for the Buck" (NBER Working Paper No. 1027)

Discussant: Roger H. Gordon, Bell Laboratories and NBER

Don Fullerton, Princeton University and NBER, update on the International Tax Comparison Project

Varian's study of rent-seeking behavior is concerned with the measurement of deadweight loss associated with various economic policies. The key insight involved is that when private benefits and costs are created by government policy in a market, resources in other markets will be devoted to an attempt to capture those benefits and escape the costs. Hence the conventional partial equilibrium measures of deadweight loss will typically understate the true deadweight burden of a given policy. This paper shows how one can use standard tools of multimarket, cost-benefit analysis to measure in principle the true deadweight loss resulting from such rent-seeking behavior.

Hausman's paper considers both the theoretical and the econometric issues that arise because nonconstant prices occur in many areas of public finance and regulation. To take account of the multiplicity of prices—for example, in labor supply with taxes, two-part tariffs, and electricity prices—models of demand behavior must be modified. Hausman also considers analogous problems such as the demand for durable goods and aggregate demand in the presence of nonconstant prices. In an empirical section he estimates a model of labor supply on five years of panel data and for each individual and considers the effect of taxes on both labor supply and economic welfare.

McLure discussed the characteristics of groups of affiliated firms that indicate that they should be treated as unitary businesses for purposes of state corporate income taxes. Besides substantial flows of products among members of the groups, McLure emphasized shared expenses, other economies of scale and scope, and other forms of economic interdependence that make it impossible to use separate accounting to isolate the profits of commonly controlled firms.

The paper by Mieszkowski and Morgan analyzes the incidence of a state corporate tax emphasizing the important effects of the tax law that arise from the way in which the profits of a multistate corporation are allocated to different states according to sales, wages, and property. The basic conclusion of the paper is that a corporate tax imposed by one state decreases the overall return to capital and increases commodity prices in the taxing state. Also, a partial corporate tax imposed by one state or group of states decreases wages in the taxing state.

Taxation is usually studied in models that postulate a perfectly competitive market structure or the polar op-

posite case of monopoly. In the paper by Katz and Rosen, the authors consider taxation when the market structure is the in-between case of oligopoly. They show that under quite reasonable conditions, the imposition of a tax can lead to an increase in industry profits.

According to Auerbach and Kotlikoff, the key difference between savings and investment incentives is their applicability to old as well as new capital. Investment incentives discriminate against old capital; savings incentives do not. This discrimination reduces the market value of old capital and, therefore, the economic resources of owners of the existing capital stock. The reduction in the resources and welfare of initial wealth holders under investment policies are similar, if not identical, to those arising from a one-time wealth tax.

In life-cycle economies, the remaining resources of the elderly are held primarily in the form of nonhuman wealth. The wealth tax generated by investment incentives therefore falls most heavily on the elderly. Since the elderly have a greater marginal propensity to consume than young and future generations do, this intergenerational redistribution of resources away from the elderly reduces current aggregate consumption. The reduction in the consumption of the elderly effectively finances the "crowding in" of investment and explains the extra "bang for the buck."

In the final presentation at the meeting, Fullerton summarized the now-completed work of NBER's international tax comparisons project. He described the common and consistent methodology that was used to study the combined effects of federal and state corporate taxes, local property taxes, and various personal tax systems in each country. Effective rates of tax were measured for marginal investments in different assets, located in different industries, financed in different ways, and owned by different groups. Results for Britain indicated low overall marginal effective tax rates but high dispersion of rates on different investments. Sweden and the United States were in the middle, while Germany was found to have high effective tax rates and low dispersion. Effects of inflation, suggested tax reforms, and alternative assumptions were also investigated.

The meeting was also attended by NBER researchers: Charles Clotfelter, Duke University; Stewart C. Myers, MIT; Joel Slemrod, University of Minnesota; Daniel Feenberg, and David G. Hartman. Harvard University Law School professors William Andrews, Stanley Surrey, and Alvin Warren also joined in the discussions, as did Christopher Chamley of Yale University and Daniel J. Frisch, Council of Economic Advisers.

## Program Meeting in Economic History

Members of NBER's Program in Development of the American Economy met in Cambridge on January 20-

22 to discuss their work with others in the field. The three-day agenda was:

#### WEALTH, CAPITAL, AND SAVINGS

Robert Gallman, University of North Carolina and NBER, "Capital Stock in the Nineteenth Century"

James R. Kearl and Clayne L. Pope, Brigham Young University and NBER, "The Distribution of Wealth and Income"

#### STRUCTURE OF INDUSTRY

John James, University of Virginia and NBER, "The Changing Structure of Industry"

#### LABOR FORCE AND MIGRATION

Thomas Weiss, University of Kansas and NBER, "Nineteenth-Century Labor Force Estimates"

Claudia Goldin, University of Pennsylvania and NBER, "Long-Term Trends in the Female Labor Force"

David Galenson, University of Chicago, "Internal Migration"

#### HEALTH, HEIGHTS, NUTRITION, MORTALITY, AND LABOR PRODUCTIVITY

Richard H. Steckel, Ohio State University and NBER, "Heights: The American Experience"

Roderick Floud, University of London and NBER, "Heights: The European Experience"

Kenneth W. Wachter, University of California, Berkeley, and NBER; Robert W. Fogel, University of Chicago and NBER; and T. James Trussell, Princeton University and NBER, "General Discussion of the Health, Heights, and Labor Productivity Project"

#### TECHNOLOGY AND WORK ORGANIZATION

Lance Davis, California Institute of Technology and NBER, and Robert Gallman, "Technical Change"

Stanley L. Engerman, University of Rochester and NBER, "Plantation Technology, Institutional Change, and Labor Organization"

Kenneth Sokoloff, University of California, Los Angeles, and NBER, "Early Industrialization in the American Northeast"

#### GOVERNMENT AND PUBLIC FINANCE

Robert A. Margo, University of Pennsylvania and NBER, "Public Finance of Black and White Schooling"

Richard Sylla, North Carolina State University, "The Evolving Functions of Federal, State, and Local Government"

Hugh Rockoff, Rutgers University, "Growth of Agencies"

Gallman's work focuses on estimating the capital stock and national income in the nineteenth century. His research on the capital stock, in both current and constant prices, will concentrate on one or two dates around 1800 and then on dates at ten-year intervals between 1840 and 1900. Gallman will produce national

income figures for ten-year intervals from 1839 to 1899, organized by narrow industrial sector.

Kearl and Pope's Utah income and wealth project is based on a sample of nineteenth-century households in that state for which observations on wealth, income, occupation, and residence have been collected at five- or ten-year intervals for as long as fifty years. The data set also contains linkages for brothers, fathers, and sons. Thus far their work has highlighted the positive effect of duration in the economy on household wealth or income, the high degree of economic mobility, and the importance of the path of occupation and residential choices on wealth.

For the near future, Kearl and Pope will focus on the effect of family on the distribution of income or wealth. Family effects will be measured through intergenerational correlations of income or wealth, inheritance patterns, and the extent of shared economic outcomes for brothers. The length of observation of the household will provide opportunity for studying the distributional effect of family-utilizing measures of permanent income, life-cycle changes in family effects, and both lagged and contemporaneous intergenerational relationships.

James's project investigates the growth of large firms and the development of concentrated national markets in the United States at the end of the nineteenth century—a dramatic change in the structure of manufacturing that indeed marked the emergence of the modern American economy. James examines the impact of technical progress on the range of increasing returns to scale and firm size by estimating translog cost functions by industry (based on Census of Manufacturing data). The estimated cost functions in turn allow measure of the extent of monopoly power over time. Using estimated demand and cost functions, James can simulate the impact of falling railroad rates on the extent of the market. He also plans to investigate the impact of falling transportation costs on firm organization and the degree of vertical integration across industries. Finally, James will study the American experience with cartels over this period—their stability and duration and their effects on later consolidations.

Weiss's project surveys the major time series on the nineteenth-century labor force, pointing out the chief similarities and discrepancies, and evaluating the figures. Existing labor force figures have a number of shortcomings: most cover only the period since 1870; also they are highly aggregated, lacking detail on state, regional, urban, and rural breakdowns, and other demographic characteristics. Female workers are counted inconsistently at various dates, and the industrial distributions of workers appear to be inaccurate, especially for the years before 1870.

Weiss proposes to construct a new series that will be more detailed and accurate. The first stage is to produce state-by-state estimates for 1870 to 1910 that contain detail on sex, age, residence, nativity, and marital status. This evidence may then be used to generate estimates of the participation rates for various demo-

graphic groups. Along with the population count for these groups in the antebellum years, estimates of the size of the labor force will be calculated.

Goldin is working toward a descriptive and analytical volume on the causes and consequences of economic change in the role of women from 1790 to 1980. Her study emphasizes labor force participation rates but also covers occupational structure, wages, nuptiality, fertility, education, differences by sex in occupations and wages, and work within the home. The central thesis is that changes in the economic role of women are explicable within a long-run framework of economic change. The increase of single women in the nineteenth-century labor force was primarily the result of the geographic diffusion of industry. The increase of married women in the labor force did not occur, however, until the second decade of the twentieth century. This change was largely the result of a shift in the structure of occupations within the economy, toward those that exacted only a small penalty for time away from work and for age itself, and for which the substantial educational advances from 1915 to 1930 yielded high returns.

Goldin's explanation for long-run change departs from the accepted theory that the substitution effect (that is, the increase in female labor force participation caused by increase in the female wage rate) alone accounts for the evolution of a market role for married women. All cohorts of white married women in the United States after 1890 experienced, over their lifetimes, rather large increases in labor force participation. Preliminary research indicates, as well, that individuals once in the labor force have typically remained in it for long periods.

Goldin also examines the origins of occupational segregation by sex. In manufacturing employment, where men and women occupied the same job, payment was invariably by the piece; but where payment was not for piecework, both in manufacturing and in other sectors, jobs were segregated by sex. Also, the ratio of female to male wages rose rapidly from about 1800 to 1860, but leveled off from about 1885, remaining around 0.60 since then.

Galenson's project analyzes long-run trends in internal migration within North America from the mid-seventeenth century to the end of the nineteenth century using micro level data. His research concerns a relatively neglected aspect of migratory behavior involving children typically departing from their parental homes and the historical variables that influenced the age of that departure. Some preliminary results obtained from a survey of the careers of nineteenth-century manufacturers in New England indicate that sons with living fathers and those who worked prior to leaving home (either within or outside the family) tended to remain at home longer than others, while sons whose first jobs were with relatives tended to leave earlier. These effects appear consistent with an economic analysis in which the family's retention of its children within the relevant range of ages is considered as a normal good. Galenson plans more work with data sets for other groups to provide a more comprehensive test of his analysis. This

larger project will also investigate many other aspects of both individual and family migratory behavior.

Steckel is working on two studies that explore the causes and consequences of height. One project retrieves and analyzes data from Ohio National Guard muster rolls for the late 1800s, census manuscript schedules, and death certificates; the other combines amnesty records collected during and after the Civil War in southern states with census manuscript schedules. Both projects seek to explain an individual's height in terms of socioeconomic characteristics of the family and county level environmental variables during his growing years, to estimate the contribution of height to labor productivity in agriculture, and to explain the time profile and regional differences in height. The Ohio project also investigates the effect of height on mortality rates.

In his work, Floud considers the nature of the inferences that are required in order to use measurements of the mean heights of military recruits to the British armed forces as indicative of the mean heights of the British working class between 1750 and 1900. His paper examines the nature of the recruitment process to the regular army and, for adolescent boys, to a naval charity, the Marine Society. Volunteers were rejected if they were unable to fulfill a minimum height standard, but techniques have been developed to adjust for the lack of observations in the lower tail of the height distribution (which is a normal curve). More troublesome is the possibility that observations are missing from the upper tail, as a result of the taller men in the population finding it easier to obtain civilian jobs and not being forced to turn to the army for a career. Data from the Marine Society do not show any evidence of such an effect and there are many grounds for rejecting it for adult recruits as well. Floud concludes that data from volunteers do indeed indicate changes in the heights of the civilian population and that they are therefore relevant to the solution of the longest-running single controversy in British economic history: the effects of industrialization on the British working class.

The work of Wachter et al. shows that estimation of average height, corrected for shortfall because of flexible minimum heights, is now in a very satisfactory state. He also shows that adopting a reduced-sample, maximum-likelihood approach to estimate the influence of covariates on height in the presence of shortfall is practicable. But it remains extremely important, Wachter notes, that histograms of height distributions, broken down by important covariates, be examined. Irregular histograms can produce instability in the covariate coefficient estimates. Diagnostic methods for recognizing interactions among status variables, height, and the probability of volunteering or being measured still need to be developed. Experience with the problem of potential "offer bias"—shortfall in the upper tail of the height distribution in response to labor demand in alternative employments—in the studies of the Marine Society emphasizes the value of background information on the recruitment process and its social and economic background.

Davis's project is designed to explore the possibility of using firm-level microeconomic data to examine questions of technical change. Since the primary focus of the work is the development of a usable methodology, the idea is to begin the study of a few industries with relatively simple technological characteristics and industries that had fairly long technical histories. Cotton textiles and railroads are two examples.

In the process of gathering the textile data, Davis stumbled on a very detailed record of the New Bedford whaling fleet—a fleet that accounted for nearly 90 percent of the total world “output” of whales from 1790 to 1925. In addition to the number and size of whales caught, the data include substantial technical information on the ships in question (size, rigging, speed, and age), the location of the whaling areas fished, the length of the voyage, and the name of the captain. Altogether there are usable data on 3665 voyages.

To support that data set, the ship lists for those same voyages are available. These lists (covering all 3665 voyages) include much information on the labor input. That information includes not only the number of crew but also “wage,” occupations, literacy, nativity, and some physical characteristics. Together, these two data sets allow Davis to examine productivity change in great detail. Knowing the composition of the capital stock at each point in time, he can analyze change in that stock under varying market and technical conditions. In the process, he should be able, for example, to separate technical change that originated in changing factor prices or in the availability of whales from that which could be termed “pure” or “neutral” change.

Engerman's project examines the role of technological and resource constraints in the adjustment to institutional change by studying the responses to the emancipation of slaves in the U.S. South and the British West Indies. Slavery ended in the British West Indies in 1834 and in the U.S. South in 1865, and in both cases the change in property rights in humans led to changes in the organization of labor as well as to declines in measured per capita income. There were differences in the magnitude of the initial decline, the pace of the subsequent recovery, and in the changing composition of output. These differences can be related to different changes in the quantity of labor input, to differences in world market conditions, and to differences in the technology of the crops produced. One important difference was that sugar, the principal crop of the West Indies, could be profitably produced only on large-scale units, while cotton, the main crop of the U.S. South, could be produced on farms of various sizes. Engerman's work uses data on the allocation of the labor force by size of farm and crops produced, before and after emancipation, as well as on differences in optimum scale by principal crop. He will examine the impact of changing labor input and will estimate the relative contributions of changing labor input and changes in the scale of production to the measured output movements. Finally, Engerman plans to study differences among the various British West Indies islands, as well as between the U.S. South and the West Indies, and to analyze the role of

the technological and resource constraints in influencing output level and composition.

Sokoloff's work focuses on the importance of women and children in U.S. industrialization during the first half of the nineteenth century. Evidence from 1820, 1832, and 1850 shows that the initial industrial expansion was characterized by firms altering their methods of production. Most manufacturing industries appear to have experienced significant increases in average establishment size and capital intensity. There were also substantial gains in labor productivity. But, one important feature of the early industrial labor force not fully recognized in the past was the quantitative importance of women and children. The data indicate that these groups of workers were disproportionately employed in firms operating at a larger scale. Given that the manufacturing sector was female- and child-intensive during this period, one factor contributing to the Northeast's leadership in industrial development may have been the relative abundance of those classes of workers in that region, as opposed to the South.

Margo's project examines the determinants of the racial division of public school resources in the U.S. South between 1880 and 1954. He is currently developing a model of school behavior that emphasizes such factors as the racial division of political power, the nature of school finance, the racial division of the school tax burden, the migration decisions of black households, race differences in the returns to schooling, and outside (southern) intervention (philanthropic aid, black protest activity, and court actions beginning in the 1940s). Early results for two states (Alabama and Louisiana) indicate that disfranchisement of blacks at the turn of the century contributed to an increased inequality in school expenditures between blacks and whites, and within the white population.

The main goal of Sylla's project is to make annual time-series estimates of state and local government spending and revenues from 1790 to the present. Sources of funds are broken down into various types of tax revenues, borrowing, and other income. Uses of funds are broken down into several functional classifications that illuminate the economic role of the state and local governments in different periods of American history.

The new data, with existing data on federal government revenue and spending, will allow a number of questions to be explored. What has been the rate of growth of government over time? What changes have occurred in the relative importance of different levels of government? How have revenue sources, tax systems, and the functional nature of governmental expenditures changed over time?

Rockoff's project is also concerned with the growth of the federal government. Two factors led to his decision to look at this issue. One, of course, is the current economic dilemma and the emphasis that has been placed on the growth of government as a potential factor in it. The other is the development of a new school of thought about the sources of the growth of government. Traditionally economists have stressed the growth of the demand for public goods in explanations. The

newer approach stresses internal factors such as the desire of administrators and strategically placed legislators to expand their empires.

Rockoff's approach will stress a disaggregation of the total spending figures. He hopes to follow a large set of agencies over the past century, measuring growth rates, and separating normal growth from growth that is the product of new functions. The sample will be chosen on the basis of several criteria including the availability of secondary works. By observing the distribution of relative agency growth rates over time and using qualitative evidence to explain the shape of that distribution, Rockoff hopes to reach a better judgment about the relative roles of internal and external pressures in the growth of the federal government.

In addition to those who made presentations, the following NBER researchers participated in the three-day meeting: Barry J. Eichengreen and Simon Kuznets, Harvard University; Laurence J. Kotlikoff, Yale University; Peter Temin, MIT; and David G. Hartman. Also attending were: Jerry Friedman, Henry Gemery, Georgia Villaflor, and Donghu Yang, all of Harvard University; and Douglass North, University of Washington.

## International Researchers Discuss Work

Members and guests of NBER's Program in International Studies met in Cambridge on March 14 to discuss recent research. The day's agenda was:

Robert P. Flood, University of Virginia and NBER, and Peter M. Garber, University of Rochester, "Collapsing Exchange Rate Regimes: Some Linear Examples"

Richard C. Marston, University of Pennsylvania and NBER, and Stephen Turnovsky, University of Illinois, "Imported Materials Prices, Wage Policy, and Macroeconomic Stabilization"

Rudiger Dornbusch, MIT and NBER, "Intergenerational and International Trade"

Willem H. Buiter, London School of Economics and NBER, and Jonathan Eaton, Yale University and NBER, "International Balance of Payments Financing and Adjustment"

The Flood/Garber paper presents both deterministic and stochastic models of the collapse of fixed exchange rate regimes. The deterministic case centers on two points. First, the authors determine the timing of a speculative attack on the fixed-rate regime. Second, they note that a speculative attack on fixed rates may be based on precisely the same arbitrary behavior that would render unstable a floating-rate regime.

The stochastic case centers on the determination of the forward discount under fixed rates. Flood and Garber find that a unit increase in domestic credit results in

a loss in international reserves larger than the increase in domestic credit.

The second paper, by Marston and Turnovsky, analyzes the effects of increases in the prices of imported materials on a small open economy. Such increases confront policymakers with a difficult set of choices involving real wages, employment, and real income. If real wages remain fixed in response to such price increases, whether because wages are indexed to the consumer price index or because they are linked to prices in negotiated settlements, costs are imposed on the economy. These costs include reductions in employment, GNP, and real income. Flexibility in the real wage, by contrast, may enable employment, and even real income, to remain constant in the face of such external shocks.

Real wage flexibility is difficult to achieve in practice. This paper shows, however, that two indexation rules can provide just the right degree of wage flexibility to stabilize employment. One rule ties nominal wages to a value-added deflator rather than the traditional consumer price index. The other rule, which is shown to be equivalent to the first, ties real wages to real GNP. Just how these rules would work in practice is suggested by the recent macroeconomic performance of Japan, which, after the second oil shock of 1979, kept its real wages in line with real GNP. Marston and Turnovsky also show how real income, as well as real labor income, can be stabilized by further reductions in the real wage large enough to raise employment. No country has pursued this more extreme policy, but the pattern of results in this case further reveals the nature of the trade-off between real wages and employment.

Dornbusch's paper studies international and intergenerational lending in an optimizing, overlapping-generations model in which a real government consol is the vehicle for intertemporal consumption smoothing. There is also a link in the model between future events and current short- and long-term interest rates.

The equilibrium short- and long-term interest rates are shown to depend on the timepath of income and of the existing stock of debt. In this context, Dornbusch shows that equilibrium long-term interest rates fluctuate more as households insist on intertemporal smoothing of their consumption profile. Specifically, an anticipated increase in future income will raise short-term interest rates in the present and lower them in the future. Long-term rates will rise in the present if the elasticity of intertemporal consumption substitution is less than one. Debt issue raises long-term interest rates and lowers steady-state welfare; this is implied by the fact that the equilibrium in the presence of long-term debt, because of the positive rate of interest, is socially inefficient.

When world trade in securities opens, a common rate of interest and asset price in the integrated capital market are established. The country with the high income/debt ratio will become a net lender. The country with a high interest rate must benefit from this opening of trade, but this is not necessarily the case in the country with a low interest rate. Dornbusch shows that here,

even taking into account intergenerational transfers, welfare may fall if the free trade price is close to the autarchy price.

Growth in income leads to international redistribution of welfare. Welfare increases in the growing country, but the fall in the equilibrium world rate of interest reduces welfare abroad. Conversely, debt issue in one country must reduce welfare there, given the increased taxes required to service the debt; but abroad, welfare will rise.

The final paper, by Buiter and Eaton, develops an intergenerational model to illustrate the interaction of national monetary policy and international reserves. The model is used to address several issues. First, the model identifies those characteristics that make a country likely to emerge as an issuer of reserves. Second, the authors consider the effects of holding reserves and issuing international reserves on the incentive to maintain a particular inflation rate. Third, they use the model to determine the costs and benefits of becoming an issuer of reserves. One result of the paper is that trade in assets that are denominated in the borrower's currency is likely to raise average world inflation. The opposite result emerges when assets are denominated in terms of the lender's currency.

Other participants at the program meeting were: Joshua Aizenman and David Papell, University of Pennsylvania and NBER; John F. O. Bilson and David A. Hsieh, University of Chicago and NBER; Program Director William H. Branson, Princeton University and NBER; Richard Clarida, Harvard University; Dale Henderson, Board of Governors of the Federal Reserve System; Richard Hodrick, Carnegie-Mellon University and NBER; Nancy P. Marion, Dartmouth College and NBER; and Lars E. O. Svensson, University of Stockholm.

## Economic Fluctuations Group Meets

NBER's Program of Research in Economic Fluctuations held a program meeting at Princeton University on March 17 and 18; the two-day agenda was:

Olivier J. Blanchard, Harvard University and NBER, "Rigid Relative Prices and Price Level Inertia"  
Discussant: John B. Taylor, Princeton University and NBER

Gary Fethke, University of Iowa, and Andrew Policano, Fordham University, "Determinants and Implications of Staggered-Wage Contracts"  
Discussant: Bennett T. Mc Callum, Carnegie-Mellon University and NBER

Martin Weitzman, MIT, "Some Macroeconomic Implications of Alternative Wage Systems"

Discussants: Robert J. Gordon, Northwestern University and NBER, and Jerry R. Green, Harvard University and NBER

Orley Ashenfelter, Princeton University, and James N. Brown, Princeton University and NBER, "Testing the Efficiency of Employment Contracts"  
Discussant: Robert E. Hall, Stanford University and NBER

Roger Kaufman and Geoffrey Woglom, Amherst College, "The Effects of Expectations on Union Wages"  
Discussant: Robert Solow, MIT

David Card, University of Chicago and NBER, "Indexation in Long-Term Labor Contracts: A Theoretical and Empirical Analysis"  
Discussant: Stanley Fischer, MIT and NBER

Panel discussion on indexing: Lawrence H. Summers, Council of Economic Advisers; Jo Anna Gray, Board of Governors of the Federal Reserve System; Stanley Fischer; Alan S. Blinder, Princeton University and NBER; and Costas Azariadis, University of Pennsylvania.

Blanchard develops a model in which prices are set at staggered dates. He then examines the relation between the rigidity of relative prices and the inertia of nominal prices. He shows that even if money is neutral in the long run, an increase in the money supply will affect relative prices, output, and employment in the short and medium runs. The adjustment of prices and wages to their new long-run levels tends to be slow if the elasticity of labor supply, or of output supply, is very large. If either of these elasticities is large, then prices and wages adjust by small steps, and nominal prices and wages exhibit inertia.

Starting from the optimizing behavior of individual agents, Fethke and Policano examine the determinants of contract length and the relative timing of contract negotiation dates across different sectors. The existence of staggered wage contracts leads to persistent effects of shocks and provides a mechanism by which monetary policy can affect output and employment. Fethke and Policano find that if all shocks in the economy are aggregate demand shocks, then all sectors will negotiate new contracts at the same dates. However, as sector-specific shocks increase in importance, then staggering of contract negotiation dates becomes a more likely outcome.

Weitzman examines the behavior of economic systems characterized by unconventional worker compensation schemes that allow individual firms to decrease unit labor costs by increasing production and lowering product prices. An important characteristic of such compensation schemes is that the economic system equilibrates with a positive excess demand for labor. Therefore, when the system is subjected to small contractionary shocks, the economy will not suffer any unemployment because small decreases in the demand for labor will fail to drive it below the supply of labor.

Ashenfelter and Brown test the efficiency of employment contracts of typographers by starting with the observation that efficiency requires the marginal rate of substitution between wages and labor to be the same for workers as for firms. In order to test this equality empirically, the authors present several alternative specifications of workers' utility functions and the demand conditions facing the firm. In general, the level of employment in this industry should be negatively related to the alternative wage for typographers and, for simple specifications of utility, should be unrelated to the own wage rate. However, in the estimated equations, the level of employment is significantly negatively related to the own wage rate; the alternative wage rate generally does not have the predicted negative effect although the probability of finding an alternative job does have a negative effect. On balance, these contracts do not appear to satisfy the efficiency criteria.

Kaufman and Woglom examine the effects of expectations of inflation and of future labor market conditions on negotiated wage changes. Expectations are proxied by commercial forecasts available at the time of negotiation, and the authors are careful to match up the length of the forecast horizon with the length of each contract. Expectations are found to have significant effects on expected wage growth for cost of living adjustment (COLA) contracts but not for non-COLA contracts. Specifically, for COLA contracts, inflationary expectations tend to raise expected wage growth about point for point. Also, the expected change in the unemployment rate over the life of the contract has a negative effect on expected wage growth.

Card characterizes the optimal degree of indexation in labor contracts. Workers and firms would want to index the nominal wage to the price of the output of the firm, the price level, the price of competing inputs, and the alternative wage that workers can obtain. If they index only to the price level, then optimal indexation will be less than full if there is negative covariance between the relative price and the price level, or between the real alternative wage and the price level, or positive covariance between the real price of other inputs and the price level. An examination of a cross-section of contracts over time provides some support for this hypothesis.

In addition to those named, other participants at the meeting were: Andrew B. Abel, Harvard University and NBER; Martin Baily, Brookings Institution and NBER; Gregory Chow, David Germany, Stephen Goldfeld (NBER), Peter R. Hartley, Dwight Jaffee, Albert S. (Pete) Kyle (NBER), all of Princeton University; Benjamin Eden, University of Iowa; and Anna J. Schwartz, NBER.

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#### The Effect of Ignoring Heteroscedasticity on Estimates of the Tobit Model

**Charles Brown and Robert Moffitt**  
Technical Working Paper No. 27  
January 1983  
JEL No. 211

We consider the sensitivity of the Tobit estimator to heteroscedasticity. Our single independent variable is a dummy variable whose coefficient is a difference between group means; the error variance also differs between groups. Heteroscedasticity biases the Tobit estimate of the two means in opposite directions, so the bias in estimating their difference can be significant. This bias is not monotonically related to the true difference and is greatly increased if the limit observations are not available. Perhaps surprisingly, the Tobit estimates are sometimes more severely biased than are OLS estimates.

#### Methods of Solution and Simulation for Dynamic Rational Expectations Models

**Olivier J. Blanchard**  
Technical Working Paper No. 28  
March 1983  
JEL Nos. 212, 213, 232

Many methods have been proposed for the solution and simulation of medium- or large-size models under

the assumption of rational expectations. The purpose of this paper is to present these methods and to show how and where each can be applied.

The methods fall into two groups. The first group can be used to solve for perfect foresight paths in nonlinear models. The second group can be used in linear models, to solve either for paths or processes followed by endogenous variables. All of the methods described here have been used in empirical applications, and computer algorithms are available for most of them.

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*Journal of Economic Literature* (JEL) subject codes, when available, are listed after the date of the Working Paper. Abstracts of all Working Papers issued since December 1982 are presented below. For previous Working Papers, see past issues of the *NBER Reporter*. The Working Papers are intended to make results of NBER research available to other economists in preliminary form, to encourage discussion and suggestions for revision before final publication. Working Papers are not reviewed by the Board of Directors of NBER.

#### Are Real Interest Rates Equal across Countries? An Empirical Investigation of International Parity Conditions

**Frederic S. Mishkin**  
Working Paper No. 1048  
December 1982  
JEL Nos. 400, 313, 134

The proposition that real rates are equal across countries is worth studying because it is central to our understanding of open-economy macroeconomics and because it is an important issue for policymakers. If it is true, then domestic monetary authorities have no control over their real rate relative to the world rate, limiting the impact of their stabilization policies. In addition, as Feldstein has pointed out, unless real rates can differ across countries, policies directed at increasing domestic savings cannot increase the rate of capital formation and hence productivity. The equality of real rates is also worth investigating because it is intimately linked to, and provides information on, the basic parity conditions featured so prominently in open-economy macro models.

This paper conducts empirical tests of the equality of real rates and other parity conditions across countries using euro rate data over the 1967:2 to 1979:2 sample period. The empirical evidence strongly rejects the hypothesis of the equality of real euro rates across countries. The joint hypotheses of uncovered interest parity and ex ante relative purchasing power parity (PPP), or the unbiasedness of forward rate forecasts and ex ante relative PPP, are also strongly rejected. Yet, independent tests of uncovered interest parity, the unbiasedness of forward rate forecasts, and ex ante relative PPP yield few rejections and high marginal significance levels. The evidence suggests that it is worth studying open-economy models that allow: (1) domestic real rates to differ from world rates, (2) time-varying risk premiums in the forward market, or (3) deviations from ex ante relative PPP. The evidence also leaves open the possibility for policymakers to exert some control over their domestic real rate relative to rates in the rest of the world. However, the evidence does not rule out the tendency for real rates across countries to equalize over time, and this is an important topic for future research.

### **Why Money Announcements Move Interest Rates: An Answer from the Foreign Exchange Market**

**Charles Engel and Jeffrey A. Frankel**  
Working Paper No. 1049  
December 1982

On a Friday when the Fed announces a money supply greater than had been anticipated, interest rates move up in response. Why? One explanation is that the market perceives the fluctuation in the money stock as an unintended deviation from the Fed's target growth rate that will be reversed in subsequent periods. The anticipation of this future tightening drives up interest rates today. A second explanation is that the market perceives the increase in the money supply as signaling a higher target growth rate. The expected future inflation rate rises, which is reflected in a higher nominal interest rate.

This paper offers grounds for choosing between the two possible explanations: evidence from the foreign exchange market. Under the first explanation (anticipated future tightening), one would expect the dollar to appreciate against foreign currencies. Under the second explanation (expected inflation), one would expect it to depreciate. We render these claims more concrete by a formal model, a generalization of the Dornbusch overshooting model. Then we use the mark/dollar rate to answer the question. We find a statistically significant tendency for the dollar to *appreciate* following positive money supply surprises. This supports the first explanation.

### **Macroeconomics after a Decade of Rational Expectations: Some Critical Issues**

**Bennett T. McCallum**  
Working Paper No. 1050  
December 1982  
JEL Nos. 023, 131, 311

The main section of this paper discusses competing theories of aggregate supply that currently are being utilized in macroeconomic models with rational expectations. I emphasize the distinction between flexible-price equilibrium models and models with nominal contracts and describe and contrast three models of the latter type. I argue that rejection of flexible-price equilibrium theories, as the evidence seems to warrant, does not require abandonment of the equilibrium *approach*. Also included are remarks on the present status of the rational expectations version of the natural-rate hypothesis.

The second section of the paper briefly discusses a few issues concerning the equilibrium approach and aggregate demand, with attention devoted to the overlapping-generations framework. The third section considers a recent attempt, involving the use of vector autoregression models, to denigrate the importance of the Lucas critique of traditional procedures for policy evaluation.

### **Do Asset-Demand Functions Optimize over the Mean and Variance of Real Returns? A Six-Currency Test**

**Charles Engel and Jeffrey A. Frankel**  
Working Paper No. 1051  
December 1982

Demands for international assets are functions of expected returns (on those assets). Optimal portfolio theory tells us that the coefficients in such relationships depend on the variance-covariance matrix of real returns. But previous estimates of the optimal portfolio: (1) assume that expected returns are constant, and (2) are not set up to test the hypothesis of mean-variance optimization. We use maximum-likelihood estimation to impose a constraint between the coefficients and the error variance-covariance matrix. For a portfolio of six currencies, we are able statistically to reject the constraint. Evidently investors are either not sophisticated enough to maximize a function of the mean and variance of end-of-period wealth, or they are too sophisticated to do so.

## **On the Monetization of Deficits**

**Alan S. Blinder**

Working Paper No. 1052

December 1982

Whether or not a deficit is monetized is often thought to have important macroeconomic ramifications. This paper is organized around two questions. The first is: Does monetization matter, or more specifically, for a given budget deficit, do nominal or real variables behave differently, depending on whether deficits are monetized or not? Virtually all macroeconomic models give an affirmative answer. After sorting out some theoretical issues that arise in a dynamic context, I present some new time-series evidence that suggests that monetization matters mostly for nominal variables.

The second question is: What factors determine how much monetization the Federal Reserve will do? After discussing some normative rules, I offer a game-theoretic argument to explain why a central bank may choose not to monetize deficits at all and may even contract bank reserves when the government raises its deficit. The empirical work turns up a surprisingly systematic link between budget deficits and growth in reserves. This relationship suggests that the Federal Reserve monetizes deficits less when inflation is high and when government purchases are growing rapidly.

## **The Accuracy of Individual and Group Forecasts from Business Outlook Surveys**

**Victor Zarnowitz**

Working Paper No. 1053

December 1982

This paper reports on a comprehensive study of the distributions of summary measures of error for a large collection of quarterly, multiperiod predictions of six variables representing inflation, real growth, unemployment, and percentage changes in nominal GNP and two of its more volatile components. The data come from surveys conducted since 1968 by the National Bureau of Economic Research and the American Statistical Association and cover more than 70 individuals (mostly economists, analysts, and executives from the corporate business and finance sectors) who are professionally engaged in forecasting the course of the U.S. economy. There is considerable differentiation among these forecasts, across the individuals, variables, and predictive horizons covered. Combining corresponding predictions from different sources can result in significant gains; thus the group mean forecasts are, on the average over time, more accurate than most of the corresponding sets of individual forecasts. But there is also a moderate degree of consistency in the relative performance of a sufficient number of the survey members, as evidenced in positive rank correlations among ratios of the individual to group root mean square errors.

## **Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression**

**Ben S. Bernanke**

Working Paper No. 1054

January 1983

JEL Nos. 042, 310

This paper examines the effects of the financial crisis of the 1930s on the path of aggregate output during that period. The approach is complementary to that of Friedman and Schwartz, who emphasized the monetary impact of the bank failures; it focuses on nonmonetary (primarily credit-related) aspects of the financial sector-output link and considers the problems of debtors as well as those of the banking system. I argue that the financial disruptions of 1930-33 reduced the efficiency of the credit allocation process and that the resulting higher cost and reduced availability of credit acted to depress aggregate demand. Evidence suggests that effects of this type can help explain the unusual length and depth of the Great Depression.

## **Youth Employment in the Seventies: The Changing Circumstances of Young Adults**

**David T. Ellwood and David A. Wise**

Working Paper No. 1055

January 1983

JEL Nos. 822, 824, 826

This paper examines the changing employment patterns for young men and women aged 16 to 24 over the 1970s and pays particular attention to the widening racial differences. Between 1970 and 1980 employment rates for both black men and women in this age range fell roughly 14 points relative to those of whites. Macroeconomic conditions, the reduction in the size of the military, changing schooling patterns, family structure, fertility patterns, and several public policies, are all examined in an attempt to understand the patterns of the 1970s.

The conclusion reached is that perhaps one-half of the diverging racial employment patterns can be "explained" by the variables we examine. For young men the most important forces appear to be the changing structure of the military, worsening macroeconomic conditions, and increased school enrollment among blacks. For women, the military is less important, of course, but shifts in family structure and fertility are rather important.

## **Petrodollars and the Differential Growth Performance of Industrial and Middle-Income Countries in the 1970s**

**Michael Bruno**

Working Paper No. 1056  
January 1983

This paper attempts to account for the differential growth performance of the industrial countries and the middle-income developing countries in the 1970s in terms of economic theory and some international cross-section comparisons. The theory of adjustment to supply price shocks in an individual country is coupled with the world equilibrium determination of capital flows and interest rates. The supply shocks suffered by the industrial countries during the first oil shock were compounded by relative real wage rigidity and contractionary macroeconomic response. The middle-income countries, at least initially, showed greater real wage flexibility and also followed a much more expansionary policy by borrowing the equivalent of the large OPEC surplus at very low or negative real interest rates. Their faster growth in output and productivity was attained at higher current account deficits and more accelerated inflation. At the time of the second oil shock this differential strategy could no longer be pursued by many of the middle-income countries as the real cost of foreign borrowing, as well as that of domestic labor, increased substantially.

## **On the Relevance or Irrelevance of Public Financial Policy**

**Joseph E. Stiglitz**

Working Paper No. 1057  
January 1983

This paper establishes conditions under which: (1) public financial policy has neither real nor inflationary effects; (2) it has inflationary but not real effects; and (3) it has only real effects. An increase in government debt (keeping real expenditures fixed), accompanied by a decrease in lump-sum taxes, has neither inflationary nor real effects (even in a stochastic environment) provided that there are no redistribution effects: the increase in the supply of government bonds gives rise to an exactly offsetting increase in demand for them. An increase in the interest rate paid on government debt will be associated with an increase in the rate of inflation, but there will be no real effects. A change in financial policy that preserves the mean rate of return on bonds has no effects if individuals are risk neutral and changes in the level of debt are offset by changes in lump-sum taxes/subsidies for the owners of bonds. Except in these special cases, changes in public financial policy will always have real effects.

The second part of the paper establishes that the optimal intertemporal redistribution scheme for risk can be implemented through financial policies that entail constant price levels. This result is established in the context of a life-cycle model with homogeneous individuals. It is shown, furthermore, that only a single financial instrument is required to implement the optimal policy; additional financial instruments are redundant. This redundancy result does not obtain with heterogeneous populations, however, if there are restrictions on the ability of the government to impose differential lump-sum taxes on different groups.

## **The Taxation of Income from Capital: A Comparative Study of the United States, United Kingdom, Sweden, and West Germany —The Theoretical Framework**

**Mervyn A. King and Don Fullerton**

Working Paper No. 1058  
January 1983  
JEL No. 320

This working paper is the second chapter of a book that compares taxes on income from capital in four countries. The analysis accounts for corporate, personal, and property taxes, and includes national, regional, and local level taxes. We describe statutory tax rates and other tax rules in each country and calculate overall effective marginal tax rates for different combinations of asset, industry, source of finance, and ownership categories.

This paper defines the methodological problems of estimating effective tax rates on income from capital, and it defines the limits of this analysis by pointing out areas that are excluded by this study. It sets out the parameters that need to be estimated for each country and describes other data requirements involving the amount of each capital asset located in each industry, financed by each source, and owned by each ownership category.

## **Rational Asset Price Bubbles**

**Behzad T. Diba and Herschel I. Grossman**

Working Paper No. 1059  
January 1983  
JEL No. 311

The solution to a linear model in which supply and/or demand depends on rational expectations of future prices can involve three parts, which we denote as the fundamental component, the deterministic bubble component, and the stochastic bubble component.

This paper explores the properties of these solution components, emphasizing the distinction between deterministic bubbles and stochastic bubbles, for a model of inflation and for a model of the evolution of price and quantity in the market for a storable commodity, such as gold. The analysis focuses on stochastic bubbles as a possibility peculiarly associated with models that involve rational expectations. In both the inflation model and the gold model, although the analysis points to no compelling reason to rule out rational stochastic bubbles a priori, conventional behavioral assumptions imply that any rational bubbles that arise, whether deterministic or stochastic, are explosive. The paper discusses problems of implementing econometric tests for the existence of rational bubbles and, as an alternative to these tests, suggests "diagnostic checking" of the stationarity properties of time series. Although these diagnostic checks do not constitute definitive hypothesis testing, we conjecture that they would provide strong evidence against rational bubbles outside the context of hyperinflation.

## **Measuring the Average Marginal Tax Rate from the Individual Income Tax**

**Robert J. Barro and Chaipat Sahasakul**

Working Paper No. 1060

January 1983

JEL No. 320

The economic effects of taxation depend on the configuration of marginal tax rates. We consider here the appropriate measure of a marginal tax rate for the federal individual income tax, which has a graduated-rate structure and allows for numerous legal and illegal deductions from total income. Our conclusion is that the explicit marginal rate from the tax schedule is the right concept for many purposes. Hence, we construct approximately weighted averages of these marginal tax rates for 1916-80.

When weighted by adjusted gross income, the arithmetic average of marginal tax rates is 5 percent in 1920, 2 percent in 1930, 6 percent in 1940, 20 percent in 1950, 23 percent in 1960, 24 percent in 1970, and 30 percent in 1980. We also discuss the dispersion of marginal tax rates and the behavior of both average tax rates and deductions from taxable income. One noteworthy result concerns the fraction of adjusted gross income that accrues to families that face a marginal tax rate of at least 35 percent; this fraction quadruples from 1964 to 1980.

## **Technical Problems in Social Experimentation: Cost versus Ease of Analysis**

**Jerry A. Hausman and David A. Wise**

Working Paper No. 1061

January 1983

JEL Nos. 211, 212

The goal of this paper is to set forth general guidelines that we believe would enhance the usefulness of future social experiments and to suggest ways to correct for the inherent limitations of such guidelines. Although the major motivation for an experiment is to overcome the limitations of structural econometric models, experimental designs have subverted this motivation in many instances. The primary advantages of randomized, controlled experiments were thus often lost.

The major complication in analyzing experiments has been that the endogenous sample selection and the procedure for treatment assignment typically selected participants and assigned them to control or treatment groups based partly on the response to a variable that the experiments were intended to measure. We propose that to overcome such difficulties, the goal of an experimental design should be (as nearly as possible) to allow analysis based on a simple analysis-of-variance model. Although complexities attendant to endogenous stratification can be avoided, one cannot avoid some of the inherent limitations of the experiments. Two major ones are self-determination of participation and self-selection out, through attrition. But one can correct for these problems with relative ease, we believe, if endogenous stratification is eliminated.

Finally, we propose a guiding principle: that the experiments should have as a first priority the precise estimation of a single or a small number of treatment effects.

## **Supplemental Social Insurance and the Health of the Poor**

**Paul J. Taubman and Robin C. Sickles**

Working Paper No. 1062

January 1983

JEL No. 913

In 1974 the federal government instituted Supplemental Social Insurance (SSI) for elderly welfare recipients and disabled individuals. The program distributed extra income and made people eligible for Medicaid

in all states except Arizona, which did not have Medicaid. We used subjective and objective health information in the Retirement History Survey (RHS) to examine the impact of the program. The RHS is a sample that began in 1969 and included heads of households who were 58 to 63 years old. The respondents or their widows were resurveyed every second year through 1977. Before 1974 those who subsequently received SSI were in much worse health than those who did not. After 1974 the differences in health were small and not statistically significant.

### **The Demand for International Reserves and Exchange-Rate Adjustments: The Case for LDCs, 1964-72**

**Sebastian Edwards**

Working Paper No. 1063

January 1983

JEL No. 431

This paper empirically investigates the relationship between the demand for international reserves and adjustments in exchange rates for a group of less developed countries (LDCs). I show that countries that have maintained a fixed exchange rate for a long period of time have a different demand function from countries that occasionally have used exchange-rate adjustments for correcting imbalances in payments. I also analyze the dynamics of the adjustment for both groups of countries. The results show that while both groups tend to eliminate reserve disequilibria quickly, those countries that have maintained a fixed rate tend to do it more slowly than countries that have occasionally devalued their currency. I also show that in the year prior to a devaluation, international reserves have been on average 30 percent below their short-run desired level. These results are important since they indicate that not all LDCs should be aggregated for prediction purposes. The results also have implications for the analysis of the adequacy of international reserves in LDCs.

### **Floating Exchange Rates, Expectations, and New Information**

**Sebastian Edwards**

Working Paper No. 1064

January 1983

JEL No. 431

This paper analyzes the relationships among forward exchange rates, future spot rates, and new information. I use a stochastic model of the determination

of exchange rates to show formally how unanticipated changes in the determinants of exchange rates (or "news") affect the spot rate. The empirical analysis indicates that "new information" plays an important role in explaining the forecasting error of the market, or the difference between the spot rate and the forward rate determined in the previous period.

### **The Short-Run Relation between Inflation and Growth in Latin America**

**Sebastian Edwards**

Working Paper No. 1065

January 1983

JEL No. 121

This paper investigates the relationship between monetary policy and growth in five Latin American countries (Brazil, Chile, Colombia, Mexico, and Peru). The analysis focuses on the effects of expected and unexpected monetary growth on output and explicitly incorporates the relationship between fiscal deficits and money creation in these countries. I explicitly introduce considerations of an open economy into the analysis.

Contrary to previous findings (Hanson, 1980), the results obtained in this paper indicate that these countries exhibit very different behavior with respect to the relationship between unexpected money and growth: while no evidence was found of a positive relation between monetary policy (expected or unexpected) and growth for Brazil and Chile, a positive relationship was found between *unexpected* monetary policy and growth for Colombia, Mexico, and Peru.

### **Modeling Deviations from Purchasing Power Parity (PPP)**

**Joshua Aizenman**

Working Paper No. 1066

January 1983

The volatility of the exchange rate under floating rates can be interpreted in terms of approaches that allow for short-term price rigidity and in terms of models that consider the magnification effect of new information. This paper combines the two approaches into a unified framework, where the degree to which prices are rigid is determined endogenously. I show that the variance of percentage deviations from PPP has an upper bound and that the relationship between the variance of deviations from PPP and the aggregate variability is not monotonic. Allowing for a short-run Phillips curve with optimal indexation, I also demonstrate that a higher price flexibility will reduce both deviations from PPP and output volatility.

## **Monetary Policy: Domestic Targets and International Constraints**

**Jacob A. Frenkel**  
Working Paper No. 1067  
January 1983  
JEL Nos. 310, 430

This paper argues that macroeconomic policies for open economies differ, in fundamentally important ways, from the corresponding policies for closed economies. The openness of the economy imposes constraints on the effectiveness and proper conduct of macroeconomic policies and it also provides policymakers with information that may be exploited usefully in the design of policy. The discussion in this paper focuses on the dependence of monetary policy on the constraints and the information that are provided by the external sector. Section I briefly summarizes the characteristics of the international constraints on monetary policy. Section II deals with intervention in the foreign exchange market and its relation to monetary policy. In this context, I draw the distinction between sterilized and nonsterilized interventions and examine the implications of the various forms of interventions for the effectiveness of monetary policy. Finally, Section III addresses the question of the role that exchange rates should play in the design of monetary policy. I argue that data from the market for foreign exchange in combination with data on interest rates can provide the monetary authorities with useful information on money market conditions and thereby can contribute to the improved conduct of monetary policy.

## **Productivity and R and D at the Firm Level in French Manufacturing**

**Philippe Cuneo and Jacques Mairesse**  
Working Paper No. 1068  
January 1983  
JEL No. 620

In a companion study to that of Griliches and Mairesse for the United States, we have investigated the relationships among output, labor, physical capital, and R and D capital during the 1972-77 period for a sample of 182 firms in the French manufacturing industries that perform R and D. Our results are quite comparable to those obtained for the United States. The relationship between firm productivity and R and D appears both strong and robust in the cross-sectional dimension of the data; it is less so in the time dimension. However, the within-firm estimates are still significant and of a likely order of magnitude. In this respect, they are more satisfactory than the U.S. ones. We show that this is largely the result of a better measurement of the

variables: (1) we can use a value-added measure of output instead of sales (or equivalently that we include materials among the factors of the production function); (2) we can correct the measures of labor, physical capital, and output for the double counting or the expensing-out of the labor, capital, and materials components of R and D expenditures.

## **Retirement Flows**

**Alan L. Gustman and Thomas L. Steinmeier**  
Working Paper No. 1069  
January 1983  
JEL No. 800

This paper considers labor market flows of older workers among the states of nonretirement, partial retirement, and full retirement. Statistics are presented that describe entry, exit, and continuation rates for each state by age, duration dependence, and "reverse flows." One important finding, which has implications for the structure of utility functions embedded in lifecycle retirement models, is the relatively high incidence but short duration of partial retirement. These implications are discussed.

## **Rational Expectations and Macroeconomic Forecasts**

**Victor Zarnowitz**  
Working Paper No. 1070  
January 1983  
JEL No. 132

This paper presents extensive results of testing for bias and serially correlated errors of quarterly, multiperiod predictions from surveys conducted since 1968 by the National Bureau of Economic Research and the American Statistical Association. The tests of the joint null hypothesis, that the regressions of actual on predicted values have zero intercepts and unitary slope coefficients, are very unfavorable to the expectations of inflation, but they show the forecasts of several other variables in a much better light generally. There have been strong tendencies for the forecasters in this period to underestimate inflation and overestimate real growth. Considerable attention is given to the effects of the sample size—the issue of the power of the tests—and also to the extent and role of autocorrelations among the residual errors from these regressions.

Rationality, in the sense of efficient use of relevant information, implies the absence of systematic elements in series of errors from the forecasters' own predictions, measured strictly in the form in which such

errors could have been known at the time of the forecast. The frequencies of significant autocorrelations among errors so measured may vary greatly across the forecasts for different variables, being very high for inflation, high for inventory investment and the unemployment rate, and much lower for most of the predictions of the other variables covered (rates of change in nominal and real GNP and expenditures on consumer durables). The corresponding tests for the group mean forecasts show much less evidence of serially correlated ex ante errors, except for inflation.

## **Is Optimism Good in a Keynesian Economy?**

**Torsten Persson and Lars E. O. Svensson**

Working Paper No. 1071

January 1983

JEL Nos. 411, 441

Assume that an economy is in a state of Keynesian unemployment. Since production is determined by demand, there are bootstraps (multiple) equilibriums. Then, the more optimistic about the future agents are, the higher will be their demand today and hence the higher current production will be. In that limited sense, optimism is good. But assume that when the future arrives, the optimism turns out to have been unwarranted, which forces a downward adjustment. Was this unwarranted optimism good?

We analyze this question using a general equilibrium model of a small open economy where the sequence of adjustment and readjustment is modeled as two successive equilibriums. The question of whether optimism is good is posed in terms of an explicit (ex post) welfare evaluation.

We find that if the future is Walrasian, the future multiplier is unity, whereas the present multiplier is larger than unity. Then optimism increases ex post welfare. If the future has Keynesian unemployment, optimism still increases ex post welfare, as long as the present multiplier is larger than the future one. A necessary and sufficient condition for this is presented.

## **The Relationship between Diet, Parents' Fatness, and Obesity in Children and Adolescents**

**Douglas Coate**

Working Paper No. 1072

January 1983

JEL No. 913

This paper presents empirical evidence on the determinants of obesity in youth in the United States, with

particular emphasis on isolating the effects of diet and parents' fatness. The result show that parents' fatness has statistically important impacts on skinfold growth among children and adolescents. Diets between obese and nonobese youth, however, do not differ substantially. Evidence that youth with fatter parents are able to produce more skinfold or adipose tissue from given calorie intakes includes: (1) the significant and relatively large parents' fatness (skinfold) effects in the youth skinfold equations; (2) the larger calorie coefficients in the skinfold equation for 10-16-year-old youths with fat mothers as compared to 10-16-year-olds with mothers around average; and (3) the significant and relatively large parents' fatness effects in the youth obesity probability equations. The probability models show that if either of the parents of a 10-16-year-old is obese, the probability of the 10-16-year-old being obese is .2 holding constant age, race, sex, and calorie consumption. If both parents are obese, the probability of the 10-16-year-old being obese is .4. The data set is the Ten State Nutrition Survey, 1968-70.

## **The Taxation of Income from Capital: A Comparative Study of the United States, United Kingdom, Sweden, and West Germany —Comparisons of Effective Tax Rates**

**Mervyn A. King and Don Fullerton**

Working Paper No. 1073

February 1983

JEL No. 320

This paper is Chapter 7 of a book to be published for NBER by the University of Chicago Press. The point of the book is to compare taxes on income from capital in four countries, accounting for corporate, personal, and property taxes, and including national, regional, and local level taxes. We describe statutory tax rates and other tax rules in each country and calculate overall effective marginal tax rates for different combinations of asset, industry, source of finance, and ownership categories.

This chapter compares effective tax rates in the four countries for different assets, industries, sources of finance, and ownership categories. Differences in overall effective tax rates among countries are attributed to differences in rates of inflation, actual depreciation, tax parameters, or differences in the amount of capital in each combination. For each country, we plot the effect of inflation on overall tax rates, and we plot the distribution of different effective tax rates at a given rate of inflation. Further, we investigate the sensitivity of our results to assumptions about inflation and interest rates.



## **World Equilibrium with Oil Price Increases: An Intertemporal Analysis**

**Nancy Peregrin Marion and Lars E. O. Svensson**

Working Paper No. 1074

February 1983

JEL Nos. 411, 431, 441

This paper examines the effect of OPEC price increases on the welfare of a group of oil-importing industrial countries. It also studies how taxes or subsidies on oil imports or capital flows could alter the group's welfare. The analysis is conducted using a general equilibrium model that describes the behavior of two actors, OPEC and the oil-importing bloc called Industria. The analysis is explicitly intertemporal and takes into account endogenous changes in saving, investment, and employment.

We show that Industria's welfare is affected not only by direct oil terms-of-trade effects but also by changes in the world rate of interest (intertemporal terms-of-trade effects) and, for rigid wages, changes in employment. Thus Industria gains from the intertemporal terms-of-trade effect if it is a net borrower and the world rate of interest falls. We give precise conditions for whether the world rate of interest falls or rises.

We also show that Industria may gain from subsidizing oil imports rather than taxing them, in particular if wages are rigid, and that it may gain from restricting international capital mobility.

## **International Capital Movements under Uncertainty**

**Gene M. Grossman and Assaf Razin**

Working Paper No. 1075

February 1983

JEL Nos. 411, 441

In this paper, we analyze the determinants of international movements of physical capital in a model with uncertainty and international trade in goods and securities. In our model, the world allocation of capital is governed, to some extent, by the asset preferences of risk-averse consumer-investors. In a one-good variant in the spirit of the MacDougall model, we find that relative abundance of factors, relative size of the labor force, and relative riskiness of production have separate but interrelated influences on the direction of equilibrium capital movements. These same factors remain important in a two-good version with Heckscher-Ohlin production structure. In this case, the direction of physical capital flow is determinate (unlike in a world of certainty) and may hinge on the identity of the factor that is used intensively in the industry with random technology.

## **Planning the Consumption Goods Market: Preliminary Disequilibrium Estimates for Poland, 1955-80**

**Richard Portes et al.**

Working Paper No. 1076

February 1983

This paper specifies and estimates a four-equation disequilibrium model of the consumption goods market in a centrally planned economy (CPE). The data are from Poland for the period 1955-80, but the analysis is more general and will be applied to other CPEs as soon as the appropriate data sets are complete. The work reported here is based on papers by Portes and Winter and Charemza and Quandt. Portes-Winter applied to each of four CPEs a discrete-switching disequilibrium model with a household demand equation for consumption goods, a planners' supply equation, and a "min" condition stating that the observed quantity transacted is the lesser of the quantities demanded and supplied. Charemza-Quandt considered how an equation for the adjustment of planned quantities could be integrated into a CPE model with fixed prices and without the usual price adjustment equation. They made plan formation endogenous and permitted the resulting plan variables to enter the equations determining demand and supply. This paper implements the Charemza-Quandt proposal in the Portes-Winter context. It uses a unique new data set of time series for plans for the major macroeconomic variables in Poland and other CPEs. The overall framework is applicable to any large organization that plans economic variables.

## **Money, Real Interest Rates, and Output: A Reinterpretation of Postwar U.S. Data**

**Robert B. Litterman and Laurence Weiss**

Working Paper No. 1077

February 1983

This paper reexamines both monthly and quarterly U.S. postwar data to investigate whether the observed comovements among money, real interest rates, prices, and output are compatible with the money/real interest/output link suggested by existing monetary theories of output, including both Keynesian and equilibrium models. The major empirical findings are:

(1) In both monthly and quarterly data, we cannot reject the hypothesis that the ex ante real rate is exogenous, or Granger-causally prior in the context of a four-variable system that contains money, prices, nominal interest rates, and industrial production.

(2) In quarterly data, there is significantly more information contained in either the levels of expected inflation or the innovation of this variable for predicting future output, given current and lagged output, than in any other variable examined (money, actual inflation, nominal interest rates, or ex ante real rates). The effect of an inflation innovation on future output is unambiguously negative.

The first result casts strong doubt on the empirical importance of existing monetary theories of output, which imply that money should have a causal role on the ex ante real rates. The second result appears incompatible with most demand-driven models of output.

In light of these results, we propose an alternative structural model that can account for the major dynamic interactions among the variables. This model has two central features: (1) output is unaffected by money supply; and (2) the money supply process is motivated by short-run price stability.

### **Deficits, Crowding Out, and Inflation: The Simple Analytics**

**Willem H. Buiter**

Working Paper No. 1078

February 1983

JEL No. 300

This paper studies the relationship between public sector financial deficits, crowding out of public sector capital formation, and inflation in a number of small, classical macroeconomic models. This amounts to reworking some of the government budget constraint literature by including capacity constraints, flexible prices, and rational expectations. After considering some simple "money-only" and "money-capital" models, I devote most of the paper to the analysis of a continuous-time representation of the "money-bonds-capital" model of Sargent and Wallace. I note that the conventionally measured deficit is likely to be a poor indicator both of the "eventual monetization" implied by the fiscal stance and of the long-run financial crowding-out pressure it represents. A better measure would be the inflation-and-real-growth-corrected, cyclically adjusted ("permanent") government current account deficit as a proportion of national income.

I also suggest that the Sargent-Wallace "paradox"—in the variable-velocity model, lower monetary growth may now mean higher inflation now and in the future—has its counterpart in the possibility that lower money growth now may give lower inflation now and in the future. In the constant-velocity model the Sargent-Wallace findings are confirmed when the real interest rate is made endogenous.

### **Rules, Discretion, and Reputation in a Model of Monetary Policy**

**Robert J. Barro and David B. Gordon**

Working Paper No. 1079

February 1983

JEL Nos. 311, 321

In a discretionary regime the monetary authority can print more money and create more inflation than people expect. But, although these inflation surprises can have some benefits, they cannot rise systematically in equilibrium when people understand the policymaker's incentives and form their expectations accordingly. Because the policymaker has the power to create inflation shocks ex post, the equilibrium growth rates of money and prices turn out to be higher than otherwise. Therefore, enforced commitments (rules) for monetary behavior can improve matters. Given the repeated interaction between the policymaker and the private agents, it is possible that reputational forces can substitute for formal rules. This paper develops an example of reputational equilibrium where the outcomes turn out to be weighted averages of those from discretion and those from the ideal rule. In particular, the rates of inflation and monetary growth look more like those under discretion when the discount rate is high.

### **A General Equilibrium Simulation Study of Subsidies to Municipal Expenditures**

**Roger H. Gordon and Joel Slemrod**

Working Paper No. 1080

February 1983

JEL No. 324

In the United States, local government expenditures are heavily subsidized through a variety of sources. This paper explores theoretically and then simulates empirically the effects of eliminating either of two federal subsidies encouraging local government expenditures: (1) income tax deductibility of local tax payments, and (2) the tax exempt status of interest on municipal bonds.

We find that eliminating the deductibility of local taxes raises the utility of all income groups, and of homeowners as well as of renters. Making interest on municipal bonds taxable, however, substantially hurts the very rich, who lose a tax shelter, and may hurt the very poor, who pay more for municipal services. While most people gain, the net gain is very small.

## **Demand Variability, Supply Shocks, and the Output-Inflation Trade-Off**

**Richard T. Froyen and Roger N. Waud**  
Working Paper No. 1081  
February 1983  
JEL Nos. 023, 026

This paper examines the shift in the relation between the inflation rate and the rate of growth of real output that has occurred in the United States over the past three decades and attempts to assess the relative importance of three possible lines of explanation: (1) the new classical view of the output-inflation trade-off, initially specified by Lucas; (2) the effect of supply-side shocks, such as energy prices; and (3) the effect of inflation variability on the natural rate of real output, as hypothesized by Milton Friedman. The paper concludes that the second and third explanations seem to have played significant roles in the observed shift from a positive to a negative correlation between the rate of inflation and the rate of real output growth, but that the first explanation did not.

## **Asset Substitutability and the Impact of Federal Deficits**

**V. Vance Roley**  
Working Paper No. 1082  
February 1983  
JEL Nos. 313, 311

This paper examines the role of asset substitutability in determining the impact of debt-financed federal deficits. I first discuss the issues in the context of a simple analytical model in which financial assets are disaggregated into money, federal debt, and corporate bonds. In this model, depending on the degree of substitutability among financial assets, a range of outcomes associated with a change in the federal deficit is possible. Next, I examine empirically the issue of asset substitutability in a disaggregated structural model of the Treasury security, corporate bond, and equity markets. Using this model, I examine the implications of larger debt-financed federal deficits in a series of simulation experiments.

## **Deficits and Intergenerational Welfare in Open Economies**

**Torsten Persson**  
Working Paper No. 1083  
February 1983

This paper deals with public debt in open economies, extending Diamond's overlapping-generations

model to deal with a small open economy as well as an international equilibrium of two large economies. It focuses on the intergenerational welfare redistributions caused by an increase in the public debt triggered by a period of government budget deficit and shows that these effects are markedly different in open and closed economies. I also analyze the interplay between the deficits in the government budget and the current account and show how a single period with a deficit in the government budget can be followed by a sequence of periods with a deficit in the current account.

## **Money, Credit Restraints, and Economic Activity**

**Alan S. Blinder and Joseph E. Stiglitz**  
Working Paper No. 1084  
March 1983  
JEL No. 310

When government expenditures exceed current tax revenues, the resulting deficit must be financed either by issuing bonds, which imply obligations to levy future taxes, or by creating high-powered money. The choice between money and bonds is often thought to be of great moment for both real and nominal variables: that is, monetary policy matters.

There is by now a wide empirical consensus that monetary policy has effects on such real variables as output and employment. But there is far less agreement about why this is so. The purpose of this paper is to take issue with some currently fashionable views of why money has real effects and to suggest a new theory, or rather resurrect an old one—the loanable funds theory—to give it new, improved microfoundations.

## **Length of Service and the Operation of Internal Labor Markets**

**Katharine G. Abraham and James L. Medoff**  
Working Paper No. 1085  
March 1983

This paper presents a summary of recently collected evidence on the role played by length of service in the operation of internal labor markets. We argue that the data are inconsistent with the human capital model of the experience-earnings and experience-layoff relationships. The paper concludes by asserting that if we are ever to fully understand the role of service, then new data are needed.

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## **Length of Service, Terminations, and the Nature of the Employment Relationship**

**Katharine G. Abraham and James L. Medoff**  
Working Paper No. 1086  
March 1983

This paper presents new survey evidence that relative protection against job loss grows with length of service, *independent of the net value of more senior workers to the firm*. This protection makes good sense given that, at most companies, employees appear to earn less than their marginal product in the early part of their tenure and more than their marginal product in the latter part. Without job protection policies for senior employees, the firm would have an incentive to terminate them when their "spot" earnings rose above their "spot" marginal product. In particular, we find that a very large percentage (over 95 percent) of union members on hourly wages, outside of agriculture and construction, are covered by protective policies for senior workers; a somewhat smaller, but still substantial, percentage (about 85 percent) of comparable non-union hourly workers also have some protection against job loss in their senior years. The paper briefly discusses the potential reasons for these findings.

## **Currency Inconvertibility, Portfolio Balance, and Relative Prices**

**Jorge Braga de Macedo**  
Working Paper No. 1087  
March 1983  
JEL No. 431

This paper analyzes regimes of currency inconvertibility in the framework of a simple general equilibrium model. In the model, an officially traded good, a smuggled good, and a nontraded good are produced and consumed by residents who hold both domestic and foreign currency in their portfolios. Stability requires that the effect of relative prices on the demand for traded and nontraded goods dominates their effect on asset demands; a once-and-for-all devaluation does not change the currency substitution ratio. To the extent that the monetary authorities wish to change the currency composition of private financial wealth, a crawling peg is the appropriate instrument. The direction of change depends on the nature of expectations about relative asset returns. Under perfect foresight, an increase in the rate of crawl increases the currency substitution ratio; whereas, if expectations are static, an increase in the rate of crawl reduces it.

## **Tax Analysis in an Oligopoly Model**

**Michael L. Katz and Harvey S. Rosen**  
Working Paper No. 1088  
March 1983  
JEL No. 320

In this paper we analyze taxation using the conjectural variations model of oligopoly. We demonstrate the way in which the incidence of a tax depends upon the pattern of firm interaction. The results obtained have important implications for the controversy surrounding the question of whether a tax on corporate income can be overshifted. We also study normative aspects of taxation. The focus here is on the errors that can arise in calculations of excess burden when incorrect assumptions on market structure are made.

## **Optimal Price and Inventory Adjustment in an Open Economy Model of the Business Cycle**

**Robert P. Flood and Robert J. Hodrick**  
Working Paper No. 1089  
March 1983  
JEL No. 431

This paper develops an open economy macroeconomic model that can be used to interpret the observed fluctuations in output, inventories, prices, and exchange rates in the medium-sized economies of the world. The model is consistent with the major empirical regularities that have been discovered in studies of business cycles as closed economy phenomena and in empirical studies of prices and exchange rates. The empirical regularities are: (1) changes in the nominal money supply cause fluctuations in real output; (2) deviations of output from a "natural rate" show persistence; (3) exchange rates are more volatile than nominal prices of goods; and (4) depreciations of the currency coincide with deteriorations of the terms of trade. A controversial aspect of the model is that only unperceived money has real effects. The channel through which these effects arise involves a misperception by rational maximizing firms of the true demand that they will face after having set prices. The firms learn about their environment from equilibrium asset prices, and the dynamics of the model reflect the optimal response of inventory-holding firms rather than ad hoc price dynamics.

## **The Structure of Expectations of the Weekly Money Supply Announcement**

**Thomas Urich and Paul Wachtel**

Working Paper No. 1090

March 1983

JEL No. 311

This paper examines the structure of expectations of the weekly money supply announcement in the late 1970s. The data used are from a weekly telephone survey of money market participants. The rationality and structure of expectations are explored with the data organized in three ways: (1) the mean response to each weekly survey; (2) the pooled sample of individual responses; and (3) time series of responses by each individual in the survey. The paper also investigates the effect of data aggregation on rationality tests. The structure of the expectations data is also examined and it is found that both strong regressive influences and adaptive learning characterize the data.

## **Inflation and the Role of Bonds in Investor Portfolios**

**Zvi Bodie, Alex Kane, and Robert McDonald**

Working Paper No. 1091

March 1983

JEL No. 520

This paper explores both theoretically and empirically the role of nominal bonds of various maturities in investor portfolios in the United States. One of its principal goals is to determine whether an investor who is constrained to limit his investment in bonds to a single portfolio of money-fixed debt instruments will suffer a serious welfare loss. Our interest in this question stems in part from the observation that many employer-sponsored savings plans limit a participant's investment choices to two types: a common stock fund and a money-fixed bond fund of a particular maturity. A second goal is to study the desirability and feasibility of introducing a market for index bonds (that is, an asset offering a riskless real rate of return) in the U.S. capital markets.

The theoretical framework is Merton's (1971) continuous-time model of consumption and portfolio choice. Our measure of the welfare gain or loss from a given change in the investor's opportunity set is the increment to current wealth needed to completely offset the effect of the change. A novel feature of our empirical approach is the method of deriving equilibrium risk premiums on the various asset classes. We employ the

variance-covariance matrix of real rates of return estimated from historical data in combination with "reasonable" assumptions about net asset supplies and the economywide average degree of risk aversion to derive numerical values for these risk premiums. This procedure allows us to circumvent the formidable estimation problems associated with using historical means, which are negative during some subperiods.

Our main results are: (1) There can be a substantial loss in welfare for participants in savings plans offering a choice of only two funds: a diversified stock fund and an intermediate-term bond fund. Most of this loss can be eliminated by introducing as a third option a money market fund. (2) The potential welfare gain from the introduction of private index bonds in the U.S. capital market is probably not large enough to justify the costs of innovation. The major reason for the small gain is that one-month bills with their small variance of real returns are an effective substitute for index bonds.

## **A Skeptical Note on the New Econometrics**

**Alan S. Blinder**

Working Paper No. 1092

March 1983

JEL No. 210

One suggestion for coping with the Lucas critique of applied econometric approach is to estimate the taste and technology parameters that presumably underlie supply and demand curves. Proponents of this approach generally interpret economywide data on prices and quantities as the results of optimization problems solved by representative consumers and firms. Theoretical first-order conditions (normally linear) for interior solutions are then used to convert observed data into estimates of the taste and technology parameters of representative agents.

This brief paper points to a hazard in this type of research. Specifically, the new style of econometrics can lead to serious error if the economywide data are not in fact generated by interior optimums of representative agents but rather come from aggregating over agents that behave quite differently.

In an example where the marketwide demand curve is smooth even though each individual's demand function is a step function, the procedures of the new econometrics are shown to lead to grievous errors even though all consumers optimize and the econometrician is assumed to know the precise form of the utility function. It is argued that this example is quite generally applicable and that the simpler procedures of "old-fashioned" econometrics may be less hazardous.

## **Causality and Innovations between Fertility and Infant Mortality**

**Tadashi Yamada**

Working Paper No. 1093

March 1983

JEL No. 913

This paper uses time-series methodology to study the sign and direction of causality between two demographic variables—the fertility rate and the infant mortality rate. The paper shows that a fall in fertility will decrease infant mortality below its normal level and that fertility and infant mortality are not mutually independent but are jointly determined. Therefore, this paper suggests that, when one constructs a model of the relationship between fertility and infant mortality, one should estimate a fertility equation in which infant mortality is an endogenous variable in a simultaneous equations system and vice-versa.

## **Some Aspects of the Taxation of Capital Gains**

**Joseph E. Stiglitz**

Working Paper No. 1094

March 1983

JEL No. 323

Analysis of the effects of capital gains taxation requires a careful modeling both of the details of the tax code and of the imperfections in the capital market. Under the standard assumptions concerning perfect capital markets and under the standard idealizations of the tax code, there are several strategies by which rational investors can avoid taxes on their capital income: these strategies leave individuals' consumption and bequests, in each state of nature and at each date, unchanged from what they would have been in the absence of taxes. Although certain detailed provisions of the tax code may limit the extent to which rational investors can avail themselves of these tax avoidance activities, there are ways, in a perfect capital market, by which the effects of these restrictions can be ameliorated. Accordingly, any analysis of the effects of capital taxation must focus on imperfect capital markets.

If individuals face limitations on the amounts that they can borrow and/or if there are limitations on short sales, then under some circumstances there is a locked-in effect (individuals do not sell securities that they would have sold in the absence of taxation). Under other circumstances, individuals are induced to sell

securities that they otherwise would have held, in order to take advantage of the asymmetric treatment of short-term losses and long-term gains. A policy of realizing gains as soon as they become eligible for long-term treatment dominates the policy of postponing the realization of capital gains, provided that the gains are not too large.

In this paper I construct a simple general equilibrium model within which I show that the taxation of capital gains may increase the volatility of asset prices and lead individuals not to trade when they otherwise would. While the analysis casts doubt on the significance of the welfare losses resulting from these exchange inefficiencies, there are circumstances in which the tax leads to production inefficiencies: for example, terminating projects at other than the socially optimal date.

Finally, I argue that the focus of some recent policy debates on the short-run revenue impact of a decrease in the tax rate on capital gains is misplaced: even when the short-run revenue impact is positive, consumption may increase (thus exacerbating inflationary pressures) and private savings may decrease (thus leading to a lower level of investment in the private sector). Moreover, there is some presumption that the long-run revenue impact is negative.

My analysis has some important implications for empirical research. In particular, it suggests that the impact of the tax is not adequately summarized by a single number, such as the "effective tax rate" representing the average ratio of tax payments to capital gains. Moreover, the impact of the tax cannot be assessed by looking only at reported capital gains and losses.

## **Unemployment and Insurance**

**Sherwin Rosen**

Working Paper No. 1095

March 1983

JEL Nos. 010, 820

This paper elaborates equilibrium properties of contract labor markets when cost barriers limit labor mobility in response to demand and productivity shifts. Unemployment is sustained because the marginal value of labor is not equated across all firms; however, the equilibrium contract optimally allocates a worker's time between market and nonmarket uses, given transactions cost-mobility constraints. Contracts provide full unemployment insurance for risks that are diversifiable by pooling among firms. Nondiversifiable (macro) risks are only partially shifted, largely through self-insurance (contingency saving). Increasing diversifiable risk has social value, similar to the value of an option.

Increasing nondiversifiable risk has negative value because it reduces lifetime consumption. The main empirical implication of contract theory is shown to be closely related to the permanent income hypothesis and establishes linkages between labor activities and consumption behavior. It is a theory of consumption rigidity rather than wage rigidity. Another empirical implication is that unemployment incidence is proportional to comparative advantage in nonmarket production. Layoffs are ordered by workers' relative productivity in nonmarket compared with market sectors. The theory is used to analyze some features of the U.S. employment system. Its empirical support is briefly reviewed.

### **Economic Incentives to Retire: A Qualitative Choice Approach**

**Olivia S. Mitchell and Gary S. Fields**  
Working Paper No. 1096  
March 1983

This paper addresses two questions: (1) Are older persons' retirement ages significantly affected by the opportunities for income from earnings, private pensions, and Social Security, and for leisure at alternative retirement ages? (2) How large are the estimated responses? Our approach to modeling the retirement problem is a forward-looking one, in which the explanatory variables include present discounted values of expected lifetime income from earnings, private pensions, and Social Security at *all future* retirement ages. Such data have been constructed using a unique archive on 390 workers covered by a large union pension plan. A previous paper (Fields and Mitchell, 1982) used these data to show that retirement ages are significantly associated with the present discounted value of income at age 80 and with the gain in income from deferring retirement. The current paper develops two different qualitative choice models of the retirement decision. We find: (1) retirement ages do indeed respond significantly to future income and leisure opportunities; (2) an ordered logit model is more suited to the data than is a multinomial logit model; and (3) the estimated responses to changes in future income opportunities differ across model specifications, where the preferred ordered logit model exhibits larger estimated responses.

### **Real and Financial Decisions of a Firm with Bankruptcy and Default: An Integration**

**Fumio Hayashi**  
Working Paper No. 1097  
March 1983  
JEL No. 520

This paper attempts to provide a framework for analyzing the interaction between real decisions (con-

cerning investment and factor inputs) and financial decisions (concerning debt and new share issues) of a corporation. The model carries a rich menu of tax rates and explicitly incorporates bankruptcy and default. The firm's multiperiod optimization problem is set up where real and financial decisions are simultaneously determined to maximize the value of the firm that is the market price of uncertain future dividends. The main results of the paper are: if the firm's aftertax profits are small relative to investment, the firm finances new investment by retentions and debt; if they are large relative to investment, financing additional investment is done through new shares of debt; in the intermediate case, additional investment is financed entirely by debt.

### **U.S. Antidumping Policies: The Case of Steel**

**Barry J. Eichengreen and Hans van der Ven**  
Working Paper No. 1098  
March 1983

This paper examines the controversy surrounding recent allegations that foreign producers are dumping steel products onto U.S. markets. The paper is in four sections, which take four quite distinct views of dumping and recent U.S. antidumping policies. Section I describes the evolution of U.S. antidumping policies, emphasizing the changing definition of dumping and the development of administrative procedures. Section II focuses on the application of these procedures to the international steel trade, taking as a case study the most noteworthy of recent innovations: the Trigger Price Mechanism (TPM) for steel. Section III considers models that can be used to analyze dumping. The models of most relevance to the practices currently at issue in the steel industry seem to us models of oligopolistic rivalry in imperfectly competitive, segmented markets. We develop a model designed to identify crucial factors upon which the incidence of dumping will depend: the number of firms producing for each national market, their costs, their market shares, and the extent to which they recognize and exploit their mutual dependence. Finally, in Section IV we calibrate these models to illustrate how the extent of dumping and the effects of the TPM depend on the model's parameters.

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