

George S. Tolley (1925–2021)

Glenn C. Blomquist, Richard V. Burkhauser and Donald S. Kenkel

Abstract

George Tolley's career demonstrates the value of using Chicago-style applied microeconomic principles to analyse the consequences of public policies. Initially, like his senior colleagues Theodore Schultz and D. Gale Johnson, he focused on agricultural issues. Later, as new national priorities emerged, George's pioneering research on amenities and city bigness helped shape modern urban economics. His early framing of urban pollution control in terms of the benefits of improved health, visibility, and other amenities is now part of environmental economics. George recognised the power of market forces but also the existence of nonmarket goods and externalities. For efficiency reasons, governments must intervene in otherwise competitive markets. However, his research often showed that markets still play a major role in the allocation of resources. In analysing proposed policies within a market context, George was instrumental in developing a Chicago approach. Throughout his career, he was also an extraordinarily generous mentor and funder of graduate students.

Keywords

Benefit-cost analysis; amenities; optimal city size; residential location; valuing health; evidence-based policy; Economic Research Service; rural poverty; mentor; environmental policy.

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38 (subject to change)

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1 Introduction¹

¹ In addition to launching each of our careers more than a few decades ago, we thank George Tolley for, over the summer of 2021 as we wrote this chapter, answering our questions, commenting on our earlier drafts, and enduring our interpretations of his

George S. Tolley was born 12 November 1925, in Washington, D.C. to Howard R. Tolley and Zora Frances Tolley. George's parents came from families with agricultural roots dating back to at least the middle of the nineteenth century. However, by the time George was born, Howard was a rising Washington-based statistician and administrator who contributed to and supervised the United States Department of Agriculture (USDA) statistical work that was primarily done at the Bureau of Agricultural Economics (BAE).

From this perspective, George was introduced to the economic and social issues of agriculture. George primarily went to schools in Georgetown at a time when they were attended by a mix of students from different socioeconomic classes, an experience that influenced his policy views later. In 1930, his father left the USDA to become the Director of the Giannini Foundation of Agricultural Economics at the University of California-Berkeley. George went to school in Berkeley for three years until his father was called back to Washington. Howard returned to the USDA and the greater administrative responsibilities and controversies that surrounded the implementation of the Agricultural Adjustment Act 1933. George attended American University in

career that may not have exactly matched his own. At age 95, George was living in Chicago and still writing when, after a brief illness, he died on 31 August 2021. He is survived by his wife Alice Welch Tolley, who has been a performing soprano and music teacher. His daughter, son-in-law, and two grandsons also reside in Chicago. We thank too our colleagues for reading previous drafts and prodding us to clarify and elaborate various points. They include Shoshana Grossbard, Bill Hoyt, Stephen Jenkins, Lala Ma, Casey Mulligan, Frank Scott, Bruce Seaman, and John Turner.

Washington, entered the service in 1944, and after his discharge, returned to complete his BS in Economics. These early experiences helped shape his ardent New Deal public policy views as he entered the graduate programme in Economics at the University of Chicago. He would continue to be committed to improving the economic well-being of small farmers and their descendants for the rest of his life. Yet, his perspective on how to do so would be forever changed by his emergence into the Chicago School of Economics in the 1950s and the transition of the US economy away from agriculture.

Section 2 below provides a review of George's family history and the effects of the twists and turns in his father's career on George's career choices and his *modus operandi*. Section 3 focuses on George's experiences as a graduate student in agricultural economics under Theodore Schultz and D. Gale Johnson. It includes as well the early influence of Milton Friedman and other members of the Chicago School on his initial publications as an Assistant Professor at the University. Section 4 marks his increasing independence as a scholar with respect to publication choices as a tenured Associate and Full Professor at North Carolina State University (NCSU) and his first hands-on experience in public policy at the USDA. The next three sections focus on the three primary fields of economic scholarship that George would turn to over the rest of his career following his return to Chicago. Section 5 focuses on his contributions to the nascent field of urban economics, Section 6 on his research in the emerging field of environmental economics, and Section 7 on his work in valuing health through benefit-cost analysis. Section 8 looks at George's other contributions in economics and public policy while at Chicago, including those since 2000, the year in which he became an Emeritus Professor. Section 9 reviews George's activities as a teacher and especially as a mentor to his graduate students at NCSU and Chicago. Section 10 summarises his

career achievements as a researcher, teacher, mentor and policy expert.

2 Tolley Family History

George's maternal great-grandfather, after serving as a soldier in the Civil War, cleared the land and homesteaded his acreage in rural Howard County, Indiana. His grandfather farmed 80 acres close to his father-in-law's farm and was a "country" public elementary school teacher.² George's father, Howard R. Tolley, born in 1889, was raised on that farm and by the age of 17 had graduated from high school, received teacher training at Marion Normal School, and was teaching in a one room country schoolhouse. During this time, he became acquainted with a teacher named Zora, who came from a family of musicians. They married, but not until after he finished college. With some support from his parents over the next six years, Howard graduated with a BA in Mathematics from Indiana University in 1910 and began teaching high school mathematics. A year later, he passed a civil service exam that landed him a job in Washington, D.C. as a "computer" mapping and charting at the US Coast and Geodetic Survey.

In 1915, Howard met W.J. Spellman, who was Chief of the Office of Farm Management (OFM) and was looking for someone with a statistical background and an interest in agriculture to work with him. When Howard discussed his use of least squares methods to reduce errors in measurement this led to a position at the USDA. The OFM under Spellman, and then George's father, emphasised the use of statistics for

² Information about George's father and his family is based on the "The Reminiscences of Howard R. Tolley", part of Columbia University Oral History Project (see H.R. Tolley 1956).

farm management. Howard Tolley's first publication "The Theory of Correlation as Applied to Farm-Survey Data on Fattening Baby Beef" is an example (H.R. Tolley 1917). This emphasis on statistics grew with the formation of the BAE and its focus on the application of economic principals to agricultural problems.

According to Fox (1986: 381–386):

The BAE during the 1920s was in a class by itself as a home for applied econometrics; the land grant universities shared some of its advantages. The size, economic organization, and political importance of US agriculture created a demand for comprehensible results that could be relied on (within carefully stated limits of applicability) by farmers and policy makers. These results were in the public domain, and they were supposed to reflect the state of the arts in the relevant basic sciences. Analogous conditions were not met during the 1920s in any agency, university department, or institute staffed by general economists.

As Deputy Chief of the BAE, George's father was adept at working with both institutionalists and marginalists within agricultural economics, something that fostered acceptance of the Bureau's analysis. However, increasingly he became focused on administrative issues and the balancing of the provision of the evidence for the evidenced-based policy his group was providing and the political forces surrounding those policies. In 1930, when he was offered a highly attractive leadership position as Director of the recently endowed Giannini Foundation of Agricultural Economics at the

University of California-Berkeley, he left the USDA³.

After three years of academia and life on the West Coast, Secretary of Agriculture Henry A. Wallace convinced Howard to return to work on implementing the new Agricultural Adjustment Act that was intended to increase agricultural prices (by restricting supply). In the thick of one of the most controversial of President Roosevelt's New Deal programmes, George's father, in his role as a self-taught agricultural economist, became further embroiled in the policy process with politically appointed administrators at the highest level at the USDA, emissaries from the White House, and private interest groups attempting to influence how USDA implemented this Act (see Kirkendall 1965). George's father returned to Berkeley in 1935, but a year later was called (out of a class he was teaching) personally by Wallace to help again after the Supreme Court declared the Act unconstitutional. By 1938, as it turned out, he had lost the confidence of Wallace and was moved over to head the old BAE which had a new (downgraded) mission to redesign the USDA in a more efficient way (see Gilbert 2016).

During the Second World War, George's father was asked by Wallace, who had become Vice President, to be a member of the United States committee that would organise a meeting of allied nations to determine the most effective way to get more and better food to war-damaged countries once the war was won. Howard became the Director of Economics and Statistics of the post-war Interim Committee of the Food and Agriculture Organization (FAO) of the United Nations. He resigned after two years,

³ Howard Tolley also taught classes in the graduate programme at Berkeley. Perhaps his most famous student was John Kenneth Galbraith. For an excellent review of the history of the Giannini Foundation, see Rausser (2006).

however, when a new Director was named, and the FAO was moving to Rome. George's father went to the Ford Foundation for three years, retired, and died in 1958.

The point of this history is to suggest why George Tolley, despite a commitment to public service and agriculture, did not pursue a civil service career at the USDA as did his father. Instead, he became an academic scholar who focused on agricultural economics initially and then moved to the emerging fields of urban, environmental, and other areas of applied microeconomics. George made this transition as people left farms and nonfarm areas became higher public policy priorities. His primary purpose was to provide analysis and evidence for public policy and yet remain outside the tumultuous political world in which policy makers live.

3 Graduate Student and Assistant Professor At Chicago

George S. Tolley, like his father, had an aptitude for mathematics and statistics. Also, as a young man, in part based on his father's example, George had a commitment to public service and an appreciation for the importance of government policies on agriculture. Based on his father's experience, however, he was reluctant to pursue a career in the civil service or in agricultural economics. In 1944, during his second year at American University, he entered the Army, but instead of serving in the infantry after basic training, his maths skills resulted in an assignment for advanced training at Pennsylvania State University. George took intense courses in mathematics and electrical engineering, and on his own, a mail correspondence course in economics supervised by Kenneth Boulding, who had studied at the University of Chicago in the 1930s. He was discharged in 1946, and for the first time, was interested in pursuing

economics. As a result, he returned to American to complete his BS degree in 1947 with a new major in economics.⁴

While in the Army, a visit to a friend from high school days, who had relocated to the city of Chicago, led him to eventually apply to the University of Chicago graduate programme in Economics. When he arrived on campus, George was still undecided about his field of study and under whom to study. What he found was a department chaired (1946–1961) by Theodore Schultz, who had already initiated educational reforms that emphasised the workshop system as a forum to facilitate research interaction between faculty and graduate students. He also found Milton Friedman, a future teacher and colleague, who was the dominant intellectual force in the emerging second Chicago School of Economics.

However, he also discovered a department that included faculty from the Cowles Commission for Research in Economics and its emphasis on mathematical, general equilibrium theory, econometrics, and Keynesian macroeconomics.⁵ George, the new student, took full advantage of this diversity by taking courses from Cowles economists

⁴ Much of the information about George's background is based on "George S. Tolley: From Agricultural to Resource, Urban, and Health Economics at the University of Chicago", an oral history with interviews conducted by Paul Burnett in 2018 (see Tolley 2020). Information also comes from our personal communication with George.

⁵ For a discussion of the Cowles Foundation and the factors influencing its exit from the University of Chicago, see "The Cowles Commission and Foundation for Research in Economics", by Robert W. Dimand (2020) and the chapter by Dimand in the current volume.

such as Jacob Marschak, Tjalling Koopmans and later Kenneth Arrow as well as from the rest of the Department, including Friedman. In addition, he benefited from study with fellow graduate students Donald Fort, who had a talent for applied econometrics and went on to RAND Corporation, and Robert Gustafson, who was adept at translating mathematical terms into economic meaning and went on to the Department of Agricultural Economics at Michigan State University.

Despite George's reluctance to get into agricultural economics, when his "G.I. Bill" funding ran out, he accepted Theodore Schultz's offer of financial assistance. The research position was on Schultz's new Resources for the Future (RFF) grant from the Ford Foundation. He replaced Oz Brownlee. Brownlee was the researcher famous for writing, in 1943, the pamphlet at the center of the Iowa Butter-Margarine Controversy that led Schultz and Johnson to leave Iowa State University for the University of Chicago in the same year (see Seim 2008). George received an MA from Chicago in 1950. He officially received his PhD from Chicago in 1955 just after leaving for a faculty position in the Department of Economics at North Carolina State University (NCSU).

During the period 1950 to 1955, while completing his coursework and pursuing his dissertation topic, George attended various department workshops and was eventually offered an Assistant Professor position. This arrangement allowed him to continue to receive RFF funding together with teaching a course in the agriculture sequence and, with the blessing of Friedman, the Keynesian Economics course in the PhD programme. This happened as the Cowles Foundation was leaving Chicago for Yale in 1955.

While writing his dissertation directed by Johnson, George also published three peer-reviewed papers in the *Journal of Farm Economics*, now published as the *American Journal of Agricultural Economics* (see Tolley 1950, 1953 and Tolley and Harrell 1955). To give a flavor of this research, George and his co-author in “Management of Meat Inventories”, discuss a profit-maximizing model of the accumulation of seasonal inventories of frozen meat for sale later in the year. When making its decisions, the firm knows the current price of meat and storage costs but faces uncertainty about the price in the future when the inventories will be sold. The co-authors enumerated costs to develop an estimate of storage costs. They used data from 1921 to 1953 and found that the average seasonal price increase was substantially larger than estimated storage costs. But the historical variation in seasonal price changes meant that the firm still faced the risk of a financial loss from inventories in years with small price increases or decreases. They argued that an inventory model with a risk constraint is a better explanation of observed outcomes and suggested that futures contracts might develop to further spread the risk. George’s intellectual growth during this period at Chicago, both in the breadth of his research topics and in his ability to use his Chicago training to pursue them, was more fully revealed during his time at NCSU.

The primary paper from George’s dissertation was published in the *Journal of Farm Economics* and received the cash prize for excellence from the American Farm Economics Association (see Tolley 1957a). However, it was his conversations with Friedman and Arnold Harberger as well as Carl Christ, a person more associated with the Cowles Foundation approach to macroeconomics, that resulted in the publication of “Providing For Growth of the Money Supply” in the *Journal of Political Economy* in that same year (see Tolley 1957b). This paper pointed out that the failure to pay interest

on required bank reserves constituted a tax on money and hence an interference with the optimum quantity of money whose cost to produce is zero. Friedman endorsed the idea and in his book on monetary stability gave George credit for it (see Friedman 1958: 72).

4 North Carolina State University, the USDA, and the Emergence of New Interests

In all, George published 22 peer reviewed articles during his time at NCSU (1955–1966). Most were on traditional topics in agricultural economics published in agricultural economics journals, including 11 articles in the *Journal of Farm Economics*. However, they also included papers published in major general economics journals using agricultural data. For instance, his co-authored paper “Agriculture and the Secular Position of the US Economy”, in *Econometrica* (Tolley and Smidt 1964) used data on the agriculture sector in a two-sector growth model to predict economic growth over the next two decades. More importantly, during this time he broadened his interests in, as well as helped shape, what would become the fields of urban economics and environmental economics. He did so empirically, using the emerging tool of benefit-cost analysis (BCA) to provide evidence-based social science research to policy makers in the tradition of Theodore Schultz and the University of Chicago School.

For instance, his co-authored piece in the *Quarterly Journal of Economics*, “Optimal Water Allocation: The North Platte River” (Tolley and Hastings 1960) begins with the observation that river water is a scarce factor of production which is not traded in any organised market system. George and his co-author outline and use an approach to measure a demand schedule that shows the value of the water for irrigation and

electrical power generation at different points along the river. They conclude that the then-present allocation was close to the optimal allocation that maximises the water's economic value.

Likewise, his co-authored piece in the *American Economic Review*, "Extensions of Benefit-Cost Analysis" (Tolley and Harrell 1962) discusses an approach to measure the area under a demand schedule for the recreational services from, e.g. Yellowstone National Park. The article's starting point is that usually, 'market valuations are good measures of benefits from project outputs and of opportunities foregone due to project costs' (ibid.: 459). This statement of the usual methods for BCA is the same as what Arnold Harberger (1971) later referred to as the "basic postulates". In fact, Tolley and Harberger were close friends who talked often and influenced each other on matters related to project evaluation and what would become BCA. It was not long before Harberger's article in the *Journal of Economic Literature* laid out the principles for BCA (see Harberger 1971). George takes a bit of credit for getting Harberger interested in BCA (see Tolley 2020: 42). "Extensions of Benefit-Cost Analysis" includes a section titled "What To Do About Friction in Economic Evaluations" which argues that public goods sometimes can be produced out of "slack" in the rest of the economy. For example, if hired labour for a project reduces frictional unemployment, the salaries paid might substantially exceed the opportunity costs of foregone private sector production. The discussion of slack and other reasons that market valuations might not be accurate measures of benefits and costs foreshadows the analysis of distortions or wedges in the welfare expressions derived by Harberger (1971) or in Chetty's reformulation of Harberger's method as a sufficient statistics approach to welfare economics (Chetty 2009).

In 1965, George was offered a position as Director of the Economic Development Division of the Economic Research Service at the USDA. The ERS is the direct descendant of the BAE that Howard Tolley once led. At the time, the USDA was charged with providing data on the rural poor for President Johnson's new War on Poverty. The major public document (ERS 1966) coming from this effort provided evidence of the economic conditions of farm and nonfarm residents of rural America with an introductory chapter co-authored by George. It was the first systematic look at rural America, using individual record data from both the 1960 Census and the 1962 Consumer Expenditure Survey. It included original estimates of poverty in 1959 from the 1960 Census data and compared them with Office of Economic Opportunity estimates of poverty rates for 1964 using the 1965 Current Population Survey. Both estimates were based on what would eventually be referred to as the Official Poverty Measure in 1969 using then-newly developed poverty thresholds developed by Mollie Orshansky (1965a, b).

While at ERS, George accepted an offer of a Professorship from the University of Chicago; he remained at Chicago in that position until becoming Emeritus in 2000. His return to Chicago marked a change after, what for many others would be, a full, highly successful career in agricultural economics. Despite his shift into other research areas, he continued to analyse and advise in countries around the world on agricultural issues much as Theodore Schultz and D. Gale Johnson did. For instance, he did extensive work advising South Korean policy makers about the pricing of rice under the auspices of the US Agency for International Development (USAID) (see Tolley 2020: 85). He worked on agricultural pricing policies, urbanisation, and development with Vinod

Thomas, who wrote his dissertation under George at Chicago and has held vice president and director-general positions at the World Bank and Asian Development Bank (see Tolley et al. 1982 and Tolley and Thomas 1987). Additional policy analysis can be found in books on trade, agriculture, and development (Tolley and Zadrozny 1975) and on technical change and income distribution in Indian agriculture (Abler et al. 1994). George continued to travel to advise on agriculture and development until he became Professor Emeritus.

5 Contributions to Urban Economics

Upon his return to the University of Chicago, George Tolley continued to work in agricultural economics, but his interests had already begun to turn to urban economics. His analysis of productivity increases in agriculture showed that only higher skilled farm managers were able to make a good living, as the optimal size of farms grew together with the sophistication of their operations (see Tolley 1970). The Economic Research Service (1966) report written under George's auspices contained information and discussion of rural poverty and outmigration from agriculture by race. Lower skill and younger workers, many of whom were minorities, were migrating out of agriculture mostly to urban areas. Census data showed that the changes were massive. The number of farms declined by 21% between 1935 and 1950 and the number of farms in 1969, just 19 years later, was only 51% of the number in 1950. Farm population shrank and urban population grew. The percentage of the population living in metropolitan areas increased from 45% in 1930 to 56% in 1950 and to 69% in 1970.⁶ Tolley became more

⁶ Calculations are based on data found in US Bureau of Census (1969), Part 1, Table 5. Percentage in metro areas come from Hobbs and Stoops (2002), Table 3, Part C.

interested in where people chose to live and what rural migrants to cities were doing (see Tolley 2020: 57).

Towards the end of his time at NCSU, George did pivotal research on the crucial role that location-specific amenities play in urban residential choice; it appeared in the *Review of Economics and Statistics* soon after his return to Chicago (see Harris et al. 1968). This research was supported by NCSU and funded in part by RFF as was his research on natural resources in his early days at Chicago. The contribution of this article on residential location was to explain the influence of amenities on location choice and demonstrate that amenities matter in addition to travel savings in making work, school, and shopping trips. Residents of Raleigh, North Carolina, the city studied, were surveyed to get data on trips made and estimate actual travel costs. Travel savings were estimated as the difference between the hypothetical travel costs at the urban travel margin where travel costs are high (and land values are low) and actual travel costs experienced. Amenity values, values of location-specific goods, were estimated by subtracting travel savings and value of land at the margin from land values at various locations. Estimated amenity values were found to be comparable in size to travel savings value. Regressions of amenity values on demand characteristics indicated that amenity demand was highly responsive to income (see *ibid.*: 243–246). As the authors noted, disamenities also matter in that low-income households tended to live in negative amenity areas near the centre of the city to save on travel costs and avoid paying for amenities.

The massive movements from rural areas in the US to cities involved not only numbers, but race. Urban problems of poor housing, unemployment, crime, and discrimination

led to the Watts Uprising in Los Angeles in 1965 and major riots in Newark, Detroit, and other cities in the summer of 1967. After the assassination of Martin Luther King, Jr., violence erupted in 125 cities, including Chicago, during an intense April 1968 (see France-Pressé 2020). The National Advisory Commission on Civil Disorders (Kerner Commission) was established by President Johnson to investigate causes and recommend changes (see National Advisory Commission on Civil Disorders 2016). Addressing urban problems moved up the list of national priorities far above issues in agriculture that were dominant after the First World War and during the Great Depression. This world was different from the agriculturally focused public policy world of Howard Tolley. When George returned to Chicago during the turbulent late 1960s, urban problems had displaced farm problems as top priority issues demanding national attention. He experienced the unrest first-hand on the University of Chicago campus where fires and sirens from surrounding low-income neighborhoods were disruptive in many ways, including making it difficult for him and others to teach. The seriousness of the situation refocused campus life and George as part of it. He had been interested in former farmers from the rural South who had moved to inner city neighborhoods, learning that some of them were in fact nearby (see also Tolley 2020: 106).

Keenly aware of the problems, George analysed the effects of government policies on blacks (see Tolley 1971). He pointed to the advantages of controlling the money supply to contain inflation while pursuing tax and expenditure policies to help blacks, amongst whom unemployment was much higher than amongst whites. George noted that minimum wage policies and union activities hit blacks disproportionately hard, and described the forces at work with spatial separation of blacks and with sorting that

produced racially homogeneous communities and limited income redistribution. George called for more objective evaluation of expenditure programmes with a role for the Office of Management and Budget (OMB) to mitigate discretionary decisions that tended to work against blacks. He highlighted some of the most productive expenditures leading to better opportunities for blacks, particularly spending on general primary and secondary education accompanied by programmes that improved learning at home (see Tolley 1971: 312–313). George’s approach was typical of the Chicago School in that he considered policies regardless of whether they were thought of as related to race, analysed the economic forces involved, and provided assessments of policies that warranted attention from policy makers.

Both George and D. Gale Johnson recognised that public policy interest was shifting away from the domestic agricultural sector. In response, they changed their research focus. Johnson shifted his interest to agricultural and development issues, first in Russia and then in China, as well as to major administrative positions at Chicago, including Chair, Dean and Provost. As discussed above, while George continued to do some research in agriculture, he became one of the leaders in the emerging field of urban economics.

In the Department of Economics at Chicago, George developed a graduate course in urban economics and by the early 1970s had established the subject as an area in the graduate programme (see Tolley 2020: 106–107). Such offerings were rare in economics departments at the time. His approach was much in keeping with Chicago in that in analysing urban problems, he was drawing on the price theory of Knight, Viner, Friedman, Schultz, Stigler, and influenced by Johnson, Harberger, and Becker. George

was a member of the Inter-University Committee on Urban Economics, an integral part of the early development of urban economics as a field within economics. He became Director of the Center for Urban Studies at the University of Chicago and was named to the inaugural editorial board of the new *Journal of Urban Economics*, contributing to its first volume (see Tolley 1974). Other pioneers in urban economics on the board selected by editor Ed Mills included William Alonso, Richard Muth, Orley Ashenfelter, Dick Netzer, Brian J.L. Berry, Anthony Pascal, Edwin von Bijventer, Richard Quandt, Frank de Leeuw, Jerome Rothenberg, Irving Hoch, Eugene Smolensky, John Kain, Robert Solow, Lester Lave, Thomas Sowell, Peter Mieszkowski, Leon Moses, and A.A. Walters.

Among prominent urban issues was the concern that some American cities were growing too big. George made a fundamental contribution by providing a framework for thinking about optimal city sizes. In his article “The Welfare Economics of City Bigness” (Tolley 1974), he saw the size distribution of cities as the result of decisions made by individual workers about where to locate. Workers allocate themselves across cities so that the wage rate, equal to their value of marginal product, is the same. Money wages will tend to be higher in bigger cities because of greater commuting costs which increase the price of local goods such as housing and because of increasing negative externalities in bigger cities. With congestion increasing nonlinearly, the negative externality will tend to make big cities too big. As increased density and pollution damage increase nonlinearly, pollution externalities also will tend to make big cities too large. These tendencies, however, must be measured against the potentially sizeable gains of bigness due to economies of scale and agglomeration before a judgement can be made as to whether big cities are in fact too big.

Implications for city size with efficient environmental controls depend on the type of source. If it is air pollution from a local good such as home heating, then the city will tend to grow faster as compensation for the pollution disamenity decreases. If it is air pollution from a factory that produces a good traded in national or international markets, then the city will tend to grow more slowly or shrink because of higher production costs. This framework starts with market forces driving migration to cities and incorporates the specific features that yield insights into the problem at hand. In this sense, it carries on the Chicago approach George used in earlier work in agricultural economics.

This framework became part of standard urban economics analysis. One of the leading textbooks bases much of its presentation on the size distribution of urban areas on it (see Mills and Hamilton 1996: 400–403). Further implications of this framework for fiscal externalities and the spatial effects of uniform welfare payments and minimum wages along with estimates of externalities are found in *Urban Growth Policy in a Market Economy* (Tolley et al. 1979).

More recent work also draws on Tolley’s city bigness framework. Within it, salient developments have been the increasing agglomeration benefits of proximity for people in services industries that tend to favour bigger cities, but also increasing negative externalities, especially in congestion that tend to work against larger cities (see Glaeser 2010 and Kahn 2010). Within the city bigness framework, nonlinear negative externalities inherent in the Covid-19 pandemic and the emergence of significantly more working from home can be expected to slow the growth of big cities and spur

expansion in favoured, high-amenity locations (see Kahn forthcoming).

Analysis of city bigness made explicit the potential importance of externalities in an urban setting. George delved deeper, developing further the concept of amenities as location-specific goods for which individuals are willing to pay. A defining characteristic is that consumption is tied to place while the purchase of amenities is indirect through an explicit market, say, for housing or jobs. Another characteristic is that amenities are exogenous to individual choice and nonexcludable locally.

In their edited 1982 book, *The Economics of Urban Amenities*, Diamond and Tolley present an overall framework for urban amenities and analyses of specific amenities such as access to recreation areas and desirable views, and disamenities such as expressway noise and air pollution. This research looked at the influence of amenities on location, housing prices and rents.⁷ Sherwin Rosen's (1974) theory of implicit markets for product characteristics (amenities) traded explicitly in (housing) bundles provided a highly relevant approach for estimating values of amenities. As Timothy Bartik and V. Kerry Smith (1987: 1,286) note in the *Handbook of Regional and Urban Economics* in citing Diamond and Tolley's co-edited volume that focuses on demand for amenities, less attention has been given to amenity supply. A possible exception is Barton Smith's (1982) chapter in the Diamond and Tolley book, a piece that treats local racial composition as a neighborhood amenity and one that can change. It was especially timely and provocative. Using rich data for Houston, Texas, he found a

⁷ The Randall and Castle (1985) chapter in the *Handbook of Natural Resource and Energy Economics* places the important contributions of these studies in the context of land resources and land markets.

pattern of housing prices and consumption that suggests segregation caused by prejudice. White households pay more for housing, and housing in stable white, upper-middle income areas appreciate the most in value. White households overconsume housing and own houses more than they would without prejudice in order to secure the neighborhood they want, and black households underconsume housing and rent more than they would otherwise. An implication is that eliminating discriminatory practices in the housing market may increase housing opportunities for blacks, but segregation is still likely if prejudice exists. Policy that accounts for such behaviour based on amenity consumption while also producing socially desirable results can be complex.⁸

6 Contributions to Environmental Economics

With the inaugural Earth Day and creation of the US Environmental Protection Agency (EPA) in 1970, the demand for environmental action was growing. George Tolley was recruited by the National Science Foundation to analyse urban environmental problems using the Chicago area as the prime example (see Tolley 2020: 91). A critical aspect of the *Environmental Pollutants and the Urban Economy* grant that began in 1972 was its

⁸ Another strand of research on amenities was influenced by George Tolley, namely amenities as a motive for migration. Because amenities vary by location, changes in location can be motivated by changes in the demand for location-specific amenities. Migration can take place because of amenity demand as well as for better income and employment opportunities. Funded by external grants on which George was Principal or Co-Principal Investigator, postdoctorate Philip Graves and graduate students Michael Duffy, Ronald Krumm, and Peter Linneman all contributed to developing this amenity-based approach to migration. For an example, see Linneman and Graves (1983).

joint award to the Center for Urban Studies at the University of Chicago and the Energy and Environmental Systems Division at Argonne National Laboratory (see Cohen and Tolley 1976).

Argonne National Laboratory is in the suburban Chicago area and has had a long affiliation with the University of Chicago. This arrangement facilitated collaboration between economists and environmental engineers who could develop relevant spatial models of pollution dispersion and environmental quality. The initial focus was on air pollution and policy simulations based on air quality dispersion models. For example, analysis indicated positive net benefits of a ban on burning of coal in homes and businesses. Cohen and Tolley presented their findings at the American Association for the Advancement of Science meetings. George also served on the National Academy of Sciences Committee on the Costs and Benefits of Automobile Emissions Control. Amid this activity, he was a founding editor of the journal that is now *Resource and Energy Economics*.

A series of five books documents much of the research done during the time of the *Environmental Pollutants and the Urban Economy* grant. The purpose of the book series as stated in the Preface of the first volume *Environmental Policy: Elements of Environmental Analysis* (Tolley et al. 1981: xiii) was to make available, in useful form, knowledge and techniques to those concerned with formulating environmental policy and evaluating plans for compliance of federal, state, and local pollution-control policies. Experience with US, Illinois, and Chicago policies informed the knowledge and techniques presented. The best evidence from economists and environmental engineers is provided in an understandable way to facilitate the systematic, objective

analysis of proposed policy actions. This purpose captures the *raison d'être* of much of George's work as an economist, especially since the late 1960s. In this particular volume, a benefit-cost framework is presented, a how-to guide to writing an environmental impact statement is offered, rollback, Gaussian plume dispersion models, and mass balance are explained, basics of benefit and cost estimation are described, and evaluations of six specific environmental measures are summarised.

Volumes 2-5 apply this comprehensive, interdisciplinary framework to particular aspects of environmental policy. Volume 2, *Environmental Policy: Air Quality* (Tolley et al. 1982) deals with diverse benefits of cleaner air, local effects on health and property, regional effects of acid rain and visibility, costs of various policy options such as add-on devices and spatial adaptation, as well as policy studies of siting of fossil fuel power plants, and regulation of urban traffic. Volume 3, *Environmental Policy: Water Quality* (Tolley et al. 1983) begins with the observation that water issues can be distinguished from air issues because water use can be categorised by instream, aesthetic, and withdrawal. A model of biochemical oxygen demand in the DuPage River is developed in order to estimate costs of varying degrees of water quality control, to explore the effects of seasonality on water quality and costs, to consider combinations of controls that minimise wastewater treatment cost across the river system, and to estimate the impact of nonpoint sources of pollution. Volume 4, *Environmental Policy: Solid Wastes* (Tolley et al. 1985) offers chapters on demand for waste disposal sources, collection and disposal cost, environmental problems of solid waste management, recycling, regulation of hazardous waste disposal, and policy options. In Volume 5, *Environmental Policy: Recreation and Aesthetics* (Tolley and Vaughn 1987), external effects of noise, odour, and blight are analysed as generating external effects that are

local and often not controlled through federal regulation. Benefits of urban recreation are estimated using area property values and park visitation data.

During the 1970s, while George was developing what was a practical benefit-cost framework for dealing with pollution in the Chicago area with funding from the NSF, interest in economic analysis of social regulation more generally was growing. Quality of Life Reviews during President Nixon's administration, economic impact statements and activities of the Council on Wage and Price Stability during President Ford's administration, and the requirement for cost-effectiveness analysis along with the creation of the Office of Information and Regulatory Affairs within the OMB during President Carter's administration, all increased executive branch oversight of regulations using economic analysis. Interest in BCA grew further still when, in 1981, President Reagan issued Executive Order (EO) 12291 that required BCA of all major regulations where permissible by law (see Dudley 2020).⁹

In the 1980s, the EPA enlisted leading scholars through cooperative agreements to do research on topics such as benefit estimation using indirect or imputed market methods, determining willingness to pay for national water quality improvements, valuing changes in hazardous waste risks, and estimating and valuing morbidity in a policy context. In addition to George Tolley, the list of core researchers in environmental economics included Kevin Boyle, Trudy Cameron, Richard Carson, Lauraine Chestnut, Thomas Crocker, Maureen Cropper, William Desvousges, A. Myrick Freeman, III,

⁹ Presidents George H.W. Bush, Clinton, George W. Bush, Obama, and Trump have made modifications but have left the requirement for BCA intact (see Dudley 2020). To date, this appears to be the case for President Biden also.

Shelby Gerking, Raymond Kopp, Alan Krupnick, Paul Portney, Alan Randall, William Schulze, Jason Shogren, V. Kerry Smith and W. Kip Viscusi as well as others who made notable contributions (see US Environmental Protection Agency 2021). This action was crucial to the implementation of EO 12291.

George was the Principal Investigator at the University of Chicago on two large cooperative agreement grants with the EPA in the early and mid-1980s. For *Establishing and Valuing the Effects of Improved Visibility in Eastern United States*, he teamed up with contingent valuation pioneer Alan Randall and others to determine how changes in visibility influence behaviour and to measure the benefits of improvements in visibility in a region with a substantial share of population in urban areas (see Tolley et al. 1984).¹⁰ Previous work had concentrated on sparsely populated areas of the West of the US. The focus was on developing a visibility value function that would facilitate estimating the value of changes in visibility resulting from various policy alternatives. In addition, activity functions were estimated to establish how people were affected in the course of daily living and in special activities sensitive to visibility conditions.

Visibility was found to influence observable human behaviour and activities. A one-mile increase in visibility increases swimming pool attendance by 3% to 5% while a one-mile rise in visibility raises gate attendance at Chicago Cubs baseball games, decreases television viewing, and on net increases consumer surplus. Analysis of visitation to the observation deck of the Chicago Hancock Tower showed better visibility increased visitation and the consumer surplus estimates were comparable to

¹⁰ The second cooperative agreement was *Valuation of Reductions in Human Health Symptoms and Risks* (see Tolley et al. 1986). It is discussed in the next section.

estimates from contingent valuation bids for similar visibility changes. Results for analyses of view-oriented residences along Lakeshore Drive, air traffic at the three area airports, and motor vehicle accidents along with the estimates from recreation and tourism activities, all suggest that visibility influences behaviour and give credence to estimates of positive willingness to pay for improved visibility estimated using contingent valuation.

From the contingent valuation, one important result was that visibility programmes in the Chicago area, the area east of the Mississippi, and the Grand Canyon area are substitutes in that Chicagoans were willing to make trade-offs among programmes in the East and programmes in the West (see Tolley et al. 1984: 93). The implication is that if several collective goods are valued independently and the individual values are simply added to estimate the aggregate value, the value of the combined programme will be overestimated.

This ordering result generated controversy about the reliability of contingent valuation because estimated values depend on seemingly irrelevant context such as the order in which they are presented; for an example that appeared several years later, see Diamond and Hausman's 1994 *Journal of Economic Perspectives* article.¹¹ Yet, it also motivated further research that offered insight into the valuation of individual policies in a multi-policy context. Overlapping the EPA-funded research on visibility in the East was an EPA-funded project on holistic valuation of a portfolio of environmental changes that

¹¹ A leading benefit-cost textbook offers the view that the reliability issue is still undecided (see Boardman et al 2018: 440). A more recent review and assessment is more positive (see Hanley and Czajkowski 2019).

accounted for multi-policy contexts, a national aggregate benefit estimate (see Randall et al. 1984). Out of this related research came Hoehn and Randall's 1989 *American Economic Review* article that showed that too many proposals pass the benefit-cost test. It also produced Blomquist et al.'s 1988 *American Economic Review* article, that estimated amenity-based quality of life in urban areas across the US, based on values revealed in housing and labour markets.

Illustrative aggregation using the estimated visibility valuation function based on contingent values for several scenarios of visibility improvements yielded sizable benefits for the Eastern US, from \$2 billion to \$15 billion. The visibility grant report to the EPA attracted more attention than a typical grant report and had 97 Google Scholar citations as of 30 October 2021. Concern arose over technical issues in eliciting valuation trade-offs, portraying visibility as an aesthetic good, and willingness to pay for visibility, including values for cleaner air especially due to improved health. Visibility varies because of differences in humidity, but also because of differences in air pollution that can affect health. McClelland et al. (1993) addressed these concerns in further research for the EPA. This period was one of intense scrutiny of contingent valuation because of the large stakes in court cases related to the Exxon-Valdez oil spill in 1989 and the vital role of contingent valuation in natural resources damages assessment (see Portney 1994). To some extent, the controversy harks back to what George's father experienced during the New Deal when he was embroiled in the policy process of implementation of the Agricultural Adjustment Act in the 1930s. Both situations involved legal, political, and economic issues that were highly visible.

In addition to research and analysis at the national level, George was involved in

economic analysis of environmental policy in the State of Illinois. He served on the Program Committee of the Illinois Institute for Environmental Research during the early and mid-1970s. At the time, Illinois required economic evaluations of proposed environmental regulations and was unique among states in this respect (see Braden and Kolstad 1991). The Illinois Institute of Natural Resources (later part of the Department of Energy and Natural Resources) was the agency that conducted analyses of environmental proposals for use by the Illinois Pollution Control Board that promulgated environmental standards and regulations. George estimated the effects of Reasonably Available Control Technology (RACT) controls on air pollution in Illinois (see Tolley et al. 1981). When the Illinois Department of Energy and Natural Resources commissioned a review of the state-of-the-art in environmental assessment, George offered guidance to the state agency on how careful use of BCA can yield sensible environmental policy for the common good (see Hunter et al. 1982). When the next Illinois review was commissioned, Richard Carson (1991) in his chapter on constructed markets cited research from the EPA-funded research on visibility in the East as did Philip Graves (1991) in his chapter on aesthetics. In a chapter on environmental health effects, Maureen Cropper and A. Myrick Freeman (1991) cited research from the second large cooperative agreement George had with the EPA, *Valuation of Reductions in Human Health Symptoms and Risks* (see Tolley et al. 1986). To that research we now turn.

7 Valuing Health for Benefit-Cost Analysis

George's research in environmental economics led him to the important methodological question of how to place a monetary value on the health benefits of cleaner air. His

interest in BCA dated to the beginning of his career, when George, during his first stay at Chicago, worked with Theodore Schultz on the value of natural resources in Western states.¹² As in George's earlier studies of water resources and park services, he faced the question of how to value the health benefits of cleaner air because health is not explicitly traded in organised markets. By the early 1980s, when George began to work on the health valuation problem, the economics profession had developed several partial solutions. In his BCA of the development of the polio vaccine, Weisbrod (1971: 528) focused on what he called 'a subset of the varied but elusive benefits' – preventing the earnings losses and medical costs from premature mortality and morbidity. Measuring lost earnings and medical costs became known as the human capital or cost-of-illness approach to health valuation. Several articles argued that the value of premature mortality should instead be based on what people are willing to pay to reduce mortality risks (Schelling 1984; Mishan 1971). Early empirical estimates of the value of mortality risk reductions, summarised as the value of a statistical life, were far more than the lost earnings from premature mortality (Thaler and Rosen 1976). Less attention had been paid to developing more comprehensive estimates of the value of health that included the value of morbidity from common symptoms and serious illnesses.

George's work on health valuation resulted in two well-cited publications. The article

¹² George strongly preferred the term "benefit-cost analysis" over the alternative "cost-benefit analysis" (personal communication, 2021). Consistent with George's preference, Ward (2014) traces the "benefit-cost analysis" term back to the wording of the US Flood Control Act of 1936 and subsequent studies of water resource allocation. Ward suggests that the alternative wording that places costs before benefits can be traced to British studies of transportation infrastructure.

“Valuing Changes in Health Risks: A Comparison of Alternative Measures” (Berger et al. 1987) conducted theoretical and empirical comparisons of alternative approaches to health valuation. The edited volume *Valuing Health for Policy: An Economic Approach* (Tolley et al. 1994) expanded and elaborated the analysis. The first part of the book compared the conceptually correct measure of willingness to pay to alternative measures, including the cost-of-illness approach and the quality-adjusted life year (QALY) method used in cost-effectiveness analysis. The second part of the book discussed the development and results of a contingent valuation survey of common symptoms, the part examined possible approaches to valuing serious, life-threatening illnesses, while the book’s fourth part developed a set of estimates of health values and discussed their use in policy making. Throughout, the volume struck a balance between the desirability of conceptually correct measures of willingness to pay with the need for practical estimates for evidence-based policy.

Like his work on the value of visibility, George’s research on health valuation included contingent valuation/stated preference studies. A large body of econometric research examined observed behaviour that revealed individual preferences over mortality risks – like the Thaler and Rosen (1976) study of workers’ willingness to accept riskier jobs for higher wages. Most economists trust revealed preferences as more reliable than stated preferences, but in the 1980s (and to a lesser extent today) the field lacked many revealed preference studies of the value of morbidity. We (Blomquist and Kenkel) remember George saying he was being ‘dragged kicking and screaming’ into contingent valuation. Yet, he continued to defend the method, arguing that because regression coefficients from revealed preference studies are also not necessarily reliable, well-designed stated preference studies can provide valuable information (see also Tolley

2020: 245). In their review of the current state of the art of contingent valuation, Haab et al. (2020) argue that the best practices of contingent valuation are merging with discrete choice experiments, another stated preference method. Economists using discrete choice methods have developed methods to merge the stated preference data from their experiments with revealed preferences from market data; an example is the Nobel-prize winning economist Daniel McFadden's study of consumer choices of Medicare Part D insurance coverage for prescription drugs (Kesternich et al. 2013).

George's practical approach to health valuation was influential among both government and academic economists. The project *Valuation of Reductions in Human Health Symptoms and Risks* was partly funded through a cooperative agreement with the EPA, reflecting its interest in the value of better health from improved air quality (University of Chicago 1985–1986). The EPA and other agencies are required to complete benefit-cost analyses of federal regulations, originally under President Reagan's EO 12291 and continuing through the present under President Clinton's EO 12866 (see below). The OMB has reported that from 2006 through 2016, EPA regulations accounted for about three-quarters of the monetised benefits of all federal regulations, mainly reflecting the health benefits brought about by cleaner air (Office of Management and Budget 2019: 10). The economic approach that George helped develop is central to health valuation at the EPA and a range of other agencies that regulate health and safety. In 1996, the OMB issued a set of best practices for the economic evaluation of federal regulations under EO 12866.¹³ The document recommends the Tolley et al. (1994) volume as 'an

¹³ The 1996 best practices guideline was revised and replaced by Circular A-4 (Office of Management and Budget 2003), which provides the current set of guidelines for the BCA included in federal regulatory impact analysis.

excellent summary of methods to value reduction in morbidity and extensions to life expectancy' (Office of Management and Budget 1996). During the 1990s, the use of QALY-based cost-effectiveness analysis of health interventions was also becoming more common (Gold et al. 1996). George and his co-authors were early advocates of bridging cost-effectiveness analysis and BCA by monetising QALYs based on willingness to pay. In academic research, Cutler and Richardson (1999) and Murphy and Topel (2006) used the economic approach and monetised QALYs to estimate the value of increases in life expectancy over time; both studies cite Tolley et al. (1994).

George's interests in health economics and policy also led him to make interdisciplinary connections. Beginning in 1987, he was on the Board of the Center on Aging, Health and Society at the University of Chicago. Earlier, George had met Bernice Neugarten, a human development psychologist who was one of the first to specialise in research on ageing. George recalls a series of breakfast meetings where he tried to educate physicians about how economists think about health policy questions (Tolley 2020: 266). The policy examples in the last chapter in *Valuing Health for Policy: An Economic Approach* reflect these interactions. For example, the chapter discusses how to develop willingness to pay estimates of the value of the health benefits from hypothetical treatments for Alzheimer's disease. George was also a co-author on several papers that used the economic approach and were published in the medical journals *Psychiatric Services* and *Expert Opinion on Pharmacotherapy* (see Luchins et al. 2005 and Hanrahan et al. 2006 respectively).

8 Other Research and Public Policy Activities

George Tolley's contributions go beyond those described and discussed above. In the 1970s, well before the modern interest in the economics of ageing and concerns about the long-run funding of social security (Old-Age, Survivors, and Disability Insurance (OASDI)) by the mainstream economics profession, he participated in an NSF-funded multidisciplinary project headed by Robert J. Havighurst and Bernice Neugarten on *Social Policy, Social Ethics, and the Aging Society* (1976) that included a chapter on federal economic policy toward the elderly (Tolley and Burkhauser 1976). They subsequently held a conference and edited a multidisciplinary volume (Tolley and Burkhauser 1977a) that offered chapters supporting the current OASDI system and chapters calling for fundamental policy reforms. Among the latter was one that provided a first framework for disentangling the annuity and distributional effects of social security and, using this framework, proposed policy changes that would better integrate the OASDI programme into the then-newly initiated Supplemental Security Income program (implemented in 1974) and the nascent Earned Income Tax Credit programme (Tolley and Burkhauser 1977b).

George was also a consultant to the World Bank and USAID more than a dozen times during the 1970s, 1980s, and 1990s. He published a book on the economics of research and development (see Tolley et al. 1985) and advised on housing reform in China for the World Bank as China moved to privatise urban housing in an attempt to address overcrowding, poor maintenance, and long waiting lists. This latter analysis focused on issues such as the consequences of housing tied to place of employment and administratively set, low (subsidised) rents and wages. Low rents kept the incentive to buy and own but low wages hindered the ability to purchase and own. This along with weak financial instruments for home purchase and lingering doubts about the property

rights of ownership in China obstructed achieving a stated policy goal of privatisation of urban housing (see Tolley 1991). In 1995, George was a Visiting Lecturer at Nankai University, China, and advised on measuring and understanding the motivating forces behind the rural-to-urban migration within the country. He continued to study China into the 2000s as he met with others who shared his interest at the University of Chicago.

In addition to these international activities, George served as the chief witness on postal mail volumes, rates, and classifications for the US Postal Service before the Postal Rate Commission. Since 2000, his interest and expertise in energy economics led him to explore the future of hydrogen and nuclear as sources of energy and resulted in several monographs for the US Department of Energy. As President of RCF Economic and Financial Consulting, Inc., he continued to offer expert analysis as recently as 2016. This included measuring housing discrimination in zoning regulations, effects on property values of spent nuclear fuel storage, and electricity cost comparisons across alternative fuel sources and technologies.

Most recently, he returned to a long-standing interest in finance and published *Information Costs & The Economics of Asset Pricing* (see Tolley and Nielson 2020). In this monograph, George and his co-author extend a standard mean-variance expected utility model to include the effort that investors devote to acquiring information about the securities in their portfolio. The investor chooses the optimum number of securities by balancing the gains from additional diversification with the costs of acquiring more information. This approach has some parallels with Sims' (2006) work on rational inattention, although it does not include his distinction between useful and non-useful

information. George and his co-author discuss some of the model's implications for asset pricing and macroeconomics.

9 George Tolley As Teacher and Mentor

George Tolley was a generous mentor. He directed 69 PhD dissertations as committee chair, one each year in his 12 years at NCSU and 57 after he returned to the University of Chicago in 1966 and before becoming Emeritus in 2000. He was tireless and met with graduate students at all hours. Lines outside his office probably showed he gave more time than was deserved, and definitely showed he gave more time than was scheduled. His influence was immense.¹⁴

A search (30 October 2021) through Google Scholar of Chicago dissertation authors matching dissertation titles with similar titles of articles by the same author showed that 24 articles were published based, in part, on these dissertations. The articles appear in general journals such as the *American Economic Review*, *Journal of Political Economy*, *International Economic Review*, and the *Quarterly Journal of Economics*, and area journals such as the *American Journal of Agricultural Economics*, *Journal of Environmental Economics and Management*, *Journal of Human Resources*, and *Journal of Urban Economics*. Among these articles based on dissertations, 14 have been cited more than 50 times. Eight have more than 100 citations including: J.V. Henderson, “The Sizes and Types of Cities”, *American Economic Review* (1974); B.A. Smith, “The

¹⁴ For a complete list of dissertations, see Blomquist (2002). In the interest of full disclosure, note that the three authors of this chapter about Tolley are on that list. We are grateful for his guidance early on and inspiration throughout our careers.

Supply of Urban Housing”,’ *Quarterly Journal of Economics* (1976); R.V. Burkhauser, “The Pension Acceptance Decision of Older Workers”, *Journal of Human Resources* (1979); G.C. Blomquist, “Value of Life Saving: Implications of Consumption Activity”, *Journal of Political Economy* (1979); D.B. Diamond, Jr., “Income and Residential Location: Muth Revisited”, *Urban Studies* (1980); P. Linneman, “The Demand for Residence Site Characteristics”, *Journal of Urban Economics* (1981); D.S. Kenkel, “The Demand for Preventive Medical Care”, *Applied Economics* (1994); and Y-C Chuang, “Learning by Doing, the Technology Gap, and Growth”, *International Economic Review* (1998). In addition, R.J. Krumm, “Neighborhood Amenities: An Economic Analysis” *Journal of Urban Economics* (1980) has more than 50 citations and was written while Krumm was completing his dissertation under George. All articles are sole authored. Credit goes to the authors, of course, but Tolley’s influence is extended through them and their work.

George also collaborated with dissertation students and former dissertation students, a partnership that resulted in joint publications. He authored or edited books with Glenn Blomquist, Richard Burkhauser, James Hodge, Donald Kenkel, Ronald Krumm, Mark Nielson, James Oehmke, William Shear, and Vinod Thomas. He co-authored articles with Glenn Blomquist, Donald Kenkel, Ronald Krumm, Tracy Miller, and Ardith Spence and co-authored chapters in books with Glenn Blomquist, Richard Burkhauser, John Crihfield, Douglas Diamond, Donald Haurin, Barton Smith and Vinod Thomas. In addition to directing dissertation publications from which students got full credit and publishing other work jointly with current and former students, with large grants from the NSF, EPA, and other sources, he helped finance graduate school for an amazing number of students at Chicago. For that support too, many are grateful.

10 Conclusion

George Tolley's career was a testament to the value of using Chicago-style applied microeconomic principles to predict and evaluate the consequences of public policies. Around the time he moved back to the University of Chicago in the late 1960s, George shifted his research from agricultural economics to help found modern urban economics. In the 1970s and 1980s and throughout the rest of his career, he continued to use economics to study cutting-edge problems in urbanisation, environmental quality, health, and ageing. George would make important and early contributions to what was usually a small body of economic research on a policy problem, and then move on to another emerging area. His approach to these problems defied the popularised simplification of the Chicago School's approach. He clearly recognised the power of market forces, but from his early work on the allocation of water in the West of the US to his later work on urban amenities, visibility, and health, George also studied nonmarket goods and externalities and the appropriate government policies in response. He readily acknowledged that for efficiency reasons governments are required to intervene in otherwise competitive markets, but his analyses often showed that markets still play a major role in the allocation of resources. Policy makers must take into consideration how their policy treatments will affect both suppliers and demanders. Failure to consider behaviour in the form of market responses can easily produce unfortunate, unintended policy outcomes.

Perhaps more important, when you get closer to the real world of policy advising, it is essential that policy advisers separate government intervention arguments for efficiency

reasons from interventions for income distributional reasons in their interactions with policy makers. While income redistribution is a legitimate objective of government, it is nonetheless important to make arguments for redistribution recognising that often there are efficiency versus redistributive trade-offs; and to do it empirically, not simply theoretically. George demonstrated that preferences for nonmarket goods such as location-specific amenities matter and that policy which ignores implicit markets for them is likely to generate disappointing outcomes. These issues were highlighted in his demonstration that nominally “fair” national minimum wages or redistribution expenditures have spatially differential effects because of differences in the cost of living in cities of different sizes and in rural areas. In analysing proposed policies within a market context, George was instrumental in developing a Chicago approach to these policies.

It is interesting to speculate about a hypothetical conversation about public policy between George and his father Howard. A farmer’s son and school teacher, Howard was a rising statistician/administrator at the USDA when George was born in 1925. He made his mark developing applied econometrics at the BAE. However, as an administrator, his vision for the implementation of the Agricultural Adjustment Act was grounded in a belief that the collective actions of voluntary councils of farmers backed by the scientific knowledge provided to them by academics and the support of enlightened government bureaucrats and elected officials could combine in co-operatives to overcome the market forces of the 1930s. The failure of that vision never changed Howard Tolley’s New Deal hopes, but his frustrations are clearly displayed in his personal history written in the 1950s.

His father's experiences helped shape George Tolley's ardent New Deal public policy views entering the graduate programme in Economics at Chicago. But the frustrations of his father's career in government and the experiences of Theodore Schultz and D. Gale Johnson at Iowa State University showed him the value of doing his research at arm's length from the political side of public policy. George, in turn, taught his many graduate students by example, to block out the politics and keep doing your best competent and honest analysis toward the goal of improved public policy. George would continue to be committed to improving the economic well-being of small farmers and their descendants who moved to the city for the rest of his life. Yet, his perspective on how to do so and where to do it would be forever changed by his emergence into the Chicago School of Economics in the 1950s.

References

Main Works by George S. Tolley

Abler, D.G., G.S. Tolley and G.K. Kripanani (1994). *Technical Change & Income Distribution in Indian Agriculture*. Boulder, CO: Westview Press.

Berger, M.C., G.C. Blomquist, D.S. Kenkel and G.S. Tolley (1987). 'Valuing Changes in Health Risks: A Comparison of Alternative Measures'. *Southern Economic Journal*, 53(4): 967–984.

Cohen, A.S. and G.S. Tolley (1976). *Environmental Pollutants and the Urban Economy*. Phase I, June 1972–October 1975. University of Chicago and Argonne National Laboratory Final Report on National Science Foundation Research Applied to National Needs (RANN) Under Contract Numbers AG-352 and GI 32989A2.

Diamond, D.B., Jr. and G.S. Tolley (eds) (1982). *The Economics of Urban Amenities*. New York, NY: Academic Press.

Hanrahan, P., D.J. Luchins, R. Fabian and G.S. Tolley (2006). 'A Cost-Effectiveness of Atypical Antipsychotic Medications Versus Conventional Medication'. *Expert Opinion on Pharmacotherapy*, 7(13): 1,749–1,758.

Harris, R.N.S., G.S. Tolley and C. Harrell (1968). 'The Residence Site Choice'. *Review of Economics and Statistics*, 50(2): 241–247.

Hunter, A.P., Jr., G.S. Tolley and R. Fabian (1982). 'Benefit-Cost Analysis and the Common Sense of Environmental Policy.' Chapter 5 in D. Swartzman, R.A. Liroff and K.G. Croke (eds) *Cost-Benefit Analysis and Environmental Regulations: Politics, Ethics, and Methods*. Washington, D.C.: The Conservation Foundation: 87–105.

Johnson, W.E. and G.S. Tolley (1968). 'The Supply of Farm Operators'. *Econometrica*, 36(2): 365–382.

Luchins, D., I. Chiriac, P. Hanrahan, M. Goldman, R. Fabian and G.S. Tolley (2005). 'Economic Grand Rounds: Allocating Funds for Medications and Psychosocial Interventions: How Consumers Would Divide the Pie'. *Psychiatric Services*, 56(7): 799–801.

Tolley, G.S. (1950). 'Short Run Demand and Supply in the Hog Market'. *Journal of Farm Economics*, 32(4): 624–643.

Tolley, G.S. (1953). 'Minimizing Grain Storage Costs'. *Journal of Farm Economics*, 35(4): 530–543.

Tolley, G.S. (1957a). 'Labor Market Efficiency for Agricultural Processing'. *Journal of Farm Economics*, 39(3): 695–713.

Tolley, G.S. (1957b). 'Providing For Growth of the Money Supply'. *Journal of Political Economy*, 65(6): 465–485.

Tolley, G.S. (1970). 'Management Entry into US Agriculture'. *American Journal of Agricultural Economics*, 52(4): 485–493.

Tolley, G.S. (1971). 'Effects of Government Policies on Employment Opportunities for Blacks'. *American Journal of Agricultural Economics*, 53(2): 308–315.

Tolley, G.S. (1974). 'The Welfare Economics of City Bigness'. *Journal of Urban Economics*, 1(3): 324–345.

Tolley, G.S. (1991). *Urban Housing Reform in China: An Economic Analysis*. Washington, D.C.: World Bank Discussion Paper.

Tolley, G.S. (2020). 'George S. Tolley: From Agricultural to Resource, Urban, and Health Economics at the University of Chicago'. Conducted by P. Burnett in 2018, Oral History Center, The Bancroft Library, University of California, Berkeley. Available at: https://digitalassets.lib.berkeley.edu/roho/ucb/text/tolley_george_2020.pdf.

Tolley, G.S., L. Babcock, M. Berger, A. Bilotti, G. Blomquist, M. Brien, R. Fabian, G. Fishelson, C. Kahn, A. Kelly, D. Kenkel, R. Krumm, T. Miller, R. Ohsfeldt, S. Rosen, W. Webb, W. Wilson and M. Zelder (1986). *Valuation of Reductions in Human Health Symptoms and Risks*. Report to Office of Policy Analysis, Environmental Protection Agency Under USEPA Grant #CR-811053-01-0. Washington, D.C.: US Environmental Protection Agency.

Tolley, G.S. and R.V. Burkhauser (1976). 'Federal Economic Policy Toward the Elderly'. In R.J. Havighurst and B. Neugarten (eds) *Social Policy, Social Ethics, and the Aging Society*. NSF/RA 76-000247. Washington, D.C.: Committee on Human Development, University of Chicago: 45–53.

Tolley, G.S. and R.V. Burkhauser (eds) (1977a). *Income Support Policies for the Aged*. Boston, MA: Ballinger.

Tolley, G.S. and R.V. Burkhauser (1977b). 'Integrating Social Security into an Incomes

Policy'. Chapter 3 in G.S. Tolley and R.V. Burkhauser (eds) *Income Support Policies for the Aged*. Boston, MA: Ballinger: 71–82.

Tolley, G.S. and A.S. Cohen (1976). 'Air Pollution and Urban Land-Use Policy'. *Journal of Environmental Economics and Management*, 2(4): 247–254.

Tolley, G.S. and R.W. Gieseeman (1963). 'Consumer Demand Explained by Measurable Utility Changes'. *Econometrica*, 31(3): 499–513.

Tolley, G.S., P.E. Graves and G.C. Blomquist (eds) (1981). *Environmental Policy: Elements of Environmental Analysis*. Volume 1. Cambridge, MA: Ballinger Publishing Company.

Tolley, G.S., P.E. Graves and A.S. Cohen (eds) (1982). *Environmental Policy: Air Quality*. Volume 2. Cambridge, MA: Ballinger Publishing Company.

Tolley, G.S., P.E. Graves and J.L. Gardner (1979). *Urban Growth Policy in a Market Economy*. New York, NY: Academic Press.

Tolley, G.S., T.R. Guimond and S.T. Townsend (1981). *Effects of RACT II Environmental Controls in Illinois, R80-5*. Chicago: Illinois Institute of Natural Resources.

Tolley, G.S. and V.S. Hastings (1960). 'Optimal Water Allocation: The North Platte River'. *Quarterly Journal of Economics*, 74(2): 279–295.

Tolley, G.S., J. Havlicek and R. Fabian (eds) (1985). *Environmental Policy: Solid Wastes*. Volume 4. Cambridge, MA: Ballinger Publishing Co.

Tolley, G.S. and C. Harrell (1955). 'Management of Meat Inventories'. *Journal of Farm Economics*, 37(2): 252–269.

Tolley, G.S. and C. Harrell (1962). 'Extensions of Benefit-Cost Analysis'. *American Economic Review*, 52(2): 459–468.

Tolley, G.S., J.H. Hodge and J.F. Oehmke (eds) (1985). *The Economics of R&D Policy*. New York, NY: Frederick A. Praeger, Inc.

Tolley, G.S., D.S. Kenkel and R.G. Fabian (eds) (1994). *Valuing Health for Policy: An Economic Approach*. Chicago: University of Chicago Press.

Tolley, G.S. and M.L. Nielson (2020). *Information Costs & The Economics of Asset Pricing*. Chicago: Blackstone Co.

Tolley, G.S. and E. Olson (1971). 'The Interdependence Between Income and Education'. *Journal of Political Economy*, 79(3): 460–480.

Tolley, G.S., A. Randall, G. Blomquist, R. Fabian, G. Fishelson, A. Frankel, J. Hoehn, R. Krumm, E. Mensah and T. Smith (1984). *Establishing and Valuing the Effects of Improved Visibility in Eastern United States*. Final Report on USEPA Grant #807768-01-0.

Tolley, G.S. and S. Smidt (1964). 'Agriculture and the Secular Position of the US Economy'. *Econometrica*, 32(4): 554–575.

Tolley, G.S. and V. Thomas (eds) (1987). *The Economics of Urbanization and Urban Policies in Developing Countries*. Washington, D.C.: World Bank.

Tolley, G.S., V. Thomas and C.M. Wong (1982). *Agricultural Price Policies and the Developing Countries*. Baltimore, MD: John Hopkins University Press.

Tolley, G.S. and R.J. Vaughan (1987). *Environmental Policy: Recreation and Aesthetics*. Volume 5. Cambridge, MA: Ballinger Publishing Co.

Tolley, G.S., Y. Wang and R.G. Fletcher (1969). 'Re-examination of the Time Series Evidence on Food Demand'. *Econometrica*, 37(4): 695–705.

Tolley, G.S. and J.D. Wilman (1977). 'The Foreign Dependence Question'. *Journal of Political Economy*, 85(2): 323–347.

Tolley, G.S., D. Yaron and G.C. Blomquist (eds) (1983). *Environmental Policy: Water Quality*. Volume 3. Cambridge, MA: Ballinger Publishing Company.

Tolley, G.S. and P.A. Zdrozny (eds) (1975). *Trade, Agriculture and Development*.

Cambridge, MA: Ballinger Publishing Company.

Other Works Referred To

Bartik, T.J. and V.K. Smith (1987). 'Urban Amenities and Public Policy'. Chapter 31 in E.S. Mills (ed.) *Handbook of Regional and Urban Economics*. Volume 2. New York, NY: North-Holland: 1,207–1,254.

Blomquist, G.C. (1979). 'Value of Life Saving: Implications of Consumption Activity'. *Journal of Political Economy*, 87(3): 540–558.

Blomquist, G.C. (2002). 'Economist and Editor George S. Tolley: A Special Issue in His Honor'. *Resource and Energy Economics*, 24(1–2): 3–11.

Blomquist, G.C., M.C. Berger and J.P. Hoehn (1988). 'New Estimates of Quality of Life in Urban Areas'. *American Economic Review*, 78(1): 89–107.

Boardman, A.E., D.H. Greenberg, A.R. Vining and D.L. Weimer (2018). *Cost-Benefit Analysis: Concepts and Practice*. Fifth edition. Cambridge: Cambridge University Press.

Braden, J.B. and C.D. Kolstad (eds) (1991). *Measuring the Demand for Environmental Quality*. Amsterdam: North-Holland.

Burkhauser, R.V. (1979). 'The Pension Acceptance Decision of Older Workers'. *Journal of Human Resources*, 14(1): 63–75.

Carson, R.T. (1991). 'Constructed Markets'. Chapter V in J.B. Braden and C.D. Kolstad (eds) *Measuring the Demand for Environmental Quality*. Amsterdam: North-Holland: 121–162.

Chetty, R. (2009). 'Sufficient Statistics for Welfare Analysis: A Bridge Between Structural and Reduced-Form Methods'. *Annual Review of Economics*, 1(1): 451–488.

- Chuang, Y-C. (1998). 'Learning by Doing, the Technology Gap, and Growth'. *International Economic Review*, 39(3): 697–721.
- Cropper, M.L. and A.M. Freeman, III (1991). 'Environmental Health Effects'. Chapter VI in J.B. Braden and C.D. Kolstad (eds) *Measuring the Demand for Environmental Quality*. Amsterdam: North-Holland: 165–211.
- Cutler, D. and E. Richardson (1999). 'Your Money and Your Life: The Value of Health and What Affects It'. Chapter 5 in A.M. Garber (ed.) *Frontiers in Health Policy Research*. Volume 2. Cambridge, MA: MIT Press: 99–132.
- Diamond, D.B., Jr. (1980). 'Income and Residential Location: Muth Revisited'. *Urban Studies*, 17(1): 1–12.
- Diamond, P.A. and J.A. Hausman (1994). 'Contingent Valuation: Is Some Number Better Than No Number?'. *Journal of Economic Perspectives*, 8(4): 45–64.
- Dimand, R.W. (2020). 'The Cowles Commission and Foundation for Research in Economics'. In M. Vernengo, E.P. Caldentey and B.J. Rosser, Jr. (eds) *The New Palgrave Dictionary of Economics*. Living Edition. London: Palgrave Macmillan. Available at: https://link.springer.com/referenceworkentry/10.1057/978-1-349-95121-5_3111-1.
- Dudley, S.E. (2020). 'Regulatory Oversight and Benefit-Cost Analysis: A Historical Perspective'. *Journal of Benefit-Cost Analysis*, 11(1): 62–70.
- Economic Research Service (1966). *Rural People in the American Economy*. Agriculture Economic Report 101, October. USDA.
- Fox, K.A. (1986). 'Agricultural Economists as World Leaders in Applied Econometrics, 1917–33'. *American Journal of Agricultural Economics*, 68(2): 381–386.
- France-Press, A. (2020). 'A Timeline of US Race Riots Since 1965'. Voice of America News, 20 May. Available at: <https://www.voanews.com/usa/timeline-us-race-riots->

1965.

Friedman, M. (1958). *A Program for Monetary Stability*. New York City: Fordham University Press.

Gilbert, J. (2016). *Planning Democracy: Agrarian Intellectuals and the Intended New Deal*. New Haven, Connecticut: Yale University Press.

Glaeser, E.L. (2010). 'Introduction'. In E.L. Glaeser (ed.) *Agglomeration Economics*. Chicago: University of Chicago Press: 1–14.

Gold, M.R, J.E. Siegel, L.B. Russell and M.C.Weinstein (1996). *Cost-Effectiveness Analysis in Health and Medicine*. First edition. Oxford: Oxford University Press.

Graves, P.E. (1991). 'Aesthetics'. Chapter VII in J.B. Braden and C.D. Kolstad (eds) *Measuring the Demand for Environmental Quality*. Amsterdam: North-Holland: 213–226.

Haab, T, L. Lewis and J. Whitehead (2020). 'State of the Art of Contingent Valuation'. *Oxford Research Encyclopedia of Environmental Science*. Available at: [https://oxfordre.com/environmentalscience/oso/viewentry/10.1093\\$002facrefore\\$002f9780199389414.001.0001\\$002facrefore-9780199389414-e-450;jsessionid=391F100409A72AE1B4FC0B0C087E19DE](https://oxfordre.com/environmentalscience/oso/viewentry/10.1093$002facrefore$002f9780199389414.001.0001$002facrefore-9780199389414-e-450;jsessionid=391F100409A72AE1B4FC0B0C087E19DE).

Hanley, N. and M. Czajkowski (2019). 'The Role of Stated Preference Valuation Methods in Understanding Choices and Informing Policy'. *Review of Environmental Economics and Policy*, 13(2): 248–266.

Harberger, A.C. (1971). 'Three Basic Postulates For Applied Welfare Economics: An Interpretive Essay'. *Journal of Economic Literature*, 9(3): 785–797.

Havighurst, R.J. and B. Neugarten (eds) (1976). *Social Policy, Social Ethics, and the Aging Society*. NSF/RA 76-000247. Washington, D.C.: Committee on Human Development, University of Chicago.

- Henderson, J.V. (1974). 'The Sizes and Types of Cities'. *American Economic Review*, 64(4): 640–656.
- Hobbs, F. and N. Stoops (2002). *Demographic Trends in the 20th Century: Census 2000 Special Reports*. Washington, D.C.: US Government Printing Office.
- Hoehn, J.P. and A. Randall (1989). 'Too Many Proposals Pass the Benefit Cost Test'. *American Economic Review*, 79(3): 544–551.
- Kahn, M.E. (2010). 'New Evidence on Trends in the Cost of Urban Agglomeration'. Chapter 11 in E. Glaeser (ed.) *Agglomeration Economics*. Chicago: University of Chicago Press: 339–354.
- Kahn, M.E. (forthcoming). *How Will Remote Work Reshape America's Cities*. Berkeley: University of California Press.
- Kenkel, D.S. (1994). 'The Demand for Preventive Medical Care'. *Applied Economics*, 26(4): 313–325.
- Kesternich, I., F. Heiss, D. McFadden and J. Winter (2013). 'Suit the Action to the Word, the Word to the Action: Hypothetical Choices and Real Decisions in Medicare Part D'. *Journal of Health Economics*, 32(6), 1,313–1,324.
- Kirkendall, R.S. (1965). 'Howard Tolley and Agricultural Planning in the 1930's.' *Agricultural History*, 39(1): 25–33.
- Krumm, R.J. (1980). 'Neighborhood Amenities: An Economic Analysis'. *Journal of Urban Economics*, 7(2): 208–224.
- Linneman, P. (1981). 'The Demand for Residence Site Characteristics'. *Journal of Urban Economics*, 9(2): 129–148.
- Linneman, P. and P.E. Graves (1983). 'Migration and Job Change: A Multinomial Approach'. *Journal of Urban Economics*, 14(3): 263–279.
- McClelland, G., W. Schulze, D. Waldman, D. Schenk, J. Irwin, T. Stewart, L. Deck and

M. Thayer (1993). *Innovative Approaches for Valuing Perceived Environmental Quality – Valuing Eastern Visibility: A Field Test of the Contingent Valuation Method*. Final Report on USEPA Grant #CR-815183. Washington, D.C.: US Environmental Protection Agency.

Mills, E.S. and B.W. Hamilton (1996). *Urban Economics*. Fifth edition. New York: Prentice Hall.

Mishan, E.J. (1971). ‘Evaluation of Life and Limb: A Theoretical Approach’. *Journal of Political Economy*, 79(4): 687–705.

Murphy, K. and R. Topel (2006). ‘The Value of Health and Longevity’. *Journal of Political Economy*, 114(5): 871–904.

National Advisory Commission on Civil Disorders (2016). *The Kerner Report*. Princeton, NJ: Princeton University Press.

Office of Management and Budget (1996). *Economic Analysis of Federal Regulations Under Executive Order 12866*. Available at: https://obamawhitehouse.archives.gov/omb/inforeg_riaguide/.

Office of Management and Budget (2003). ‘Circular A-4’. Available at: https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/.

Office of Management and Budget (2017). *2017 Report to Congress on the Benefits and Costs of Federal Regulations and Agency Compliance with the Unfunded Mandates Reform Act*. Available at: https://www.whitehouse.gov/wp-content/uploads/2019/12/2019-CATS-5885-REV_DOC-2017Cost_BenefitReport11_18_2019.docx.pdf.

Orshansky, M. (1965a). ‘Counting the Poor: Another Look at the Poverty Profile’. *Social Security Bulletin*, 28(1): 3–29.

Orshansky, M. (1965b). ‘Who’s Who Among the Poor: A Demographic View of

- Poverty'. *Social Security Bulletin*, 28(7): 3–32.
- Portney, P. (1994). 'The Contingent Valuation Debate: Why Economists Should Care'. *Journal of Economic Perspectives*, 8(4): 3–17.
- Randall, A., G.C. Blomquist, J.P. Hoehn and J.R. Stoll (1984). *National Aggregate Benefits of Air and Water Pollution Control*. Report to Benefits Staff, Environmental Protection Agency, Under CR 811 056-01-0. Washington, D.C.: US Environmental Protection Agency.
- Randall, A. and E.N. Castle (1985). 'Land Resources and Land Markets'. Chapter 13 in A.V. Kneese and J.L. Sweeney (eds) *Handbook of Natural Resource and Energy Economics*. Volume II. Amsterdam: North-Holland: 571–620.
- Rausser, G.C. (2006). 'The Giannini Foundation and the Welfare of California Agriculturists in a Changing State, Nation and World'. Originally Presented at the Giannini Foundation 75th Anniversary Symposium. Available at: https://escholarship.org/content/qt2q41m5jk/qt2q41m5jk_noSplash_859d87b9d79edee4be7b0054279ddcad.pdf?t=lnr64m.
- Rosen, S. (1974). 'Hedonic Prices and Implicit Markets: Product Differentiation in Perfect Competition'. *Journal of Political Economy*, 82(1): 34–55.
- Schelling, T.C. (1984). 'The Life You Save May Be Your Own'. Chapter 5 in T.C. Schelling, *Choice and Consequence*. Cambridge, MA: Harvard University Press: 113–146.
- Seim, D.L. (2008). 'The Butter-Margarine Controversy and "Two Cultures" at Iowa State College State College'. *The Annals of Iowa*, 67(1): 1–50.
- Sims, C.A. (2006). 'Rational Inattention: A Research Agenda'. Originally Presented at the Deutsche Bundesbank Spring Conference, 2005. Available at: sims.princeton.edu/yftp/RIplus/RatInattPlus.pdf.

Smith, B.A. (1976). 'The Supply of Urban Housing'. *Quarterly Journal of Economics*, 90(3): 389–405.

Smith, B.A. (1982). 'Racial Composition As A Neighborhood Amenity'. Chapter 8 in D.B. Diamond, Jr. and G.S. Tolley (eds) *The Economics of Urban Amenities*. New York, NY: Academic Press: 165–191.

Thaler, R. and S. Rosen (1976). 'The Value Of Saving A Life: Evidence From the Labor Market'. In N.E. Terleckyj (ed.) *Household Production and Consumption*. New York: National Bureau of Economic Research: 265–302.

Tolley, H.R. (1917). 'The Theory of Correlation as Applied to Farm-Survey Data on Fattening Baby Beef'. Washington, D.C.: US Department of Agriculture Bulletin 504.

Tolley, H.R. (1956). 'The Reminiscences of Howard R. Tolley'. Conducted by D. Albertson in Interviews 1951–1954, Columbia University Oral History Project, Columbia University Special Collections. Available at: https://digitalassets.lib.berkeley.edu/roho/ucb/text/tolley_howard_r_columbia_university_web.pdf.

University of Chicago (1985–1986). *Valuation of Reductions in Human Health Symptoms and Risks*. Volumes I–V. Paper No. EE-0092. Washington, D.C.: US Environmental Protection Agency. Available at: <https://www.epa.gov/environmental-economics/valuation-reductions-human-health-symptoms-and-risks-volumes-i-v-1985-1986>.

US Bureau of Census (1969). *Census of Agriculture, 1969*. Washington, D.C.: US Government Printing Office. Available at: <http://lib-usda-05.serverfarm.cornell.edu/usda/AgCensusImages/1969/02/02/564/1969-02-02-intro.pdf>.

US Environmental Protection Agency (2021). *Environmental Economics Research Inventory – NCEE EERI Series*. Available at: <https://www.epa.gov/environmental-economics/eeri-series>.

economics/environmental-economics-research-inventory-ncee-eeri-series.

Ward, W.A. (2014). 'Which Is It – Cost-Benefit Analysis, or Benefit-Cost Analysis?'.
The CBA Guru BLOG, March. Available at:

The CBA Guru BLOG, March. Available at:

[https://www.researchgate.net/publication/261323314_Which_is_it_-_Cost-](https://www.researchgate.net/publication/261323314_Which_is_it_-_Cost-Benefit_Analysis_or_Benefit-Cost_Analysis)

[Benefit_Analysis_or_Benefit-Cost_Analysis.](https://www.researchgate.net/publication/261323314_Which_is_it_-_Cost-Benefit_Analysis_or_Benefit-Cost_Analysis)

Weisbrod, B.A. (1971). 'Costs and Benefits of Medical Research: A Case Study of
Poliomyelitis'. *Journal of Political Economy*, 79(3): 527–544.