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The neoclassical production function as a relic of anti-George politics: Implications for ecological economics

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ABSTRACT

Widespread support for Henry George's land tax proposal prompted a backlash from wealthy landowners, who focused their political efforts on tax policy. The backlash corresponded chronologically with the development of neoclassical economics, and land barons became active in the establishment of academic economics institutions in the United States. Whereas the classical economists frequently referred to the factors of production as land, labor, and capital, neoclassical textbooks appearing in the 20th century increasingly ignored land and provided a production function, " $Y=f(K,L)$," in which capital and labor were the only factors explicitly identified. Neoclassical authors had several possible reasons for using a two-factor production function, but the political influence on neoclassical economics during its formative stages was conducive to avoiding reference to land when discussing factors of production. An emphasis on land would have invited scrutiny of land rents for tax purposes. Ecological economics has evolved as a response to the shortcomings of neoclassical economics in dealing with the environmental perils of economic growth. One of those shortcomings is the capital/labor production function which hides the importance of land and natural resources. Ecological economists have developed production functions that are more ecologically oriented, and one of them is explained herein.

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1. Henry George in the context of academic and American history

After approximately a century of classical economics, which was largely a European exercise, the "Marginalist Revolution" (roughly 1870–1874) spawned the transition to neoclassical economics. While classical economics had been known to its practitioners as "political economy," indicating the breadth of the genre, the marginalists (such as William Stanley Jevons and Leon Walras) honed in rapidly and mathematically upon microeconomics. They were most notably concerned with how supply, demand, and prices interact at the margin, and thus how the factors of production and consumer goods were allocated among producers and consumers, respectively. But the Marginalist Revolution was just the beginning of neoclassical economics, and it occurred in academia while political economy characterized the real world. In order for the scholars we generally classify as "economists" to warrant the adjective "neoclassical" as opposed to "classical," additional developments in economic thought were required.

One such development was precipitated by the prominence of Henry George, the American who wrote *Progress and Poverty* (first published in 1879; 1894 edition cited here). *Progress and Poverty* had a major impact on politics and political economy in North America and

Australia. For awhile, it also had a wave of followers in Europe, especially Great Britain and Ireland.

In a sense, what Karl Marx was to labor, Henry George was to land, and what Marx was to the capitalist, George was to the land baron. To Marx, the capitalist's extraction of wealth from the toils of the proletariat was the great injustice of capitalism. To George, the landlord's unearned wealth from rent, which inevitably rose as populations and businesses expanded, was the key source of society's ills. Marx stirred up communist revolutions. Seemingly the gentler soul, George called for a tax on land.

George argued that wealth consists of tangible goods, and an increase in these goods represents an increase in wealth. These goods are readily distinguished from land, because land cannot increase in quantity. As populations grow, land rents increase, but because the land itself does not grow, the common wealth does not increase. Instead, increasing rent simply amounts to an ever-widening maldistribution of wealth, which moves from the tenant (invariably a laborer) to the landlord. More money may be spent on land, but it is money earned by the toil of the laborer, then delivered into the unworked hands of the landlord.

George was far from the first to put the blame for poverty and social injustice on the unearned income of the landowner. For example, the physiocrats of 1760's France had identified the rent-taking of the "proprietary class" as one of the biggest of the French economy's flaws. Two things distinguished George, however. First, he wrote *Progress and Poverty* in a passionate style vaguely reminiscent of the *Communist*

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Manifesto. Unlike the atheistic Marx, however, George infused his rhetoric with Christianity. This was a potent mix among the protestant ethics of the American agricultural economy. For example, George (1894, p. 425) wrote:

“Can it be that the gifts of the Creator may be thus misappropriated with impunity? Is it a light thing that labour should be robbed of its earnings while greed rolls in wealth — that the many should want while the few are surfeited? Turn to history, and on every page may be read the lesson that such wrong never goes unpunished; that the nemesis that follows injustice never falters nor sleeps. Look around today. Can this state of things continue?... Nay; the pillars of the state are trembling even now, and the very foundations of society begin to quiver with pent-up forces that glow underneath. The struggle that must either revivify, or convulse in ruin, is near at hand, if it be not already begun.”

The second thing that distinguished George was when and where he wrote; i.e., the late-19th century American West. Railroad, timber, and cattle barons had amassed millions of acres, often by luck, trickery, and brute force. Meanwhile, in the East, land barons tended to be capitalists who invested much of their profits in land. For those who preferred to invest in land, the logic was probably based to some extent upon the realization that rents were sure to rise amidst the floodtide of European immigrants, while industrial profits were always at risk of a swipe from the market's invisible hand. Capitalism could be a stressful and highly competitive occupation; land lording required little more than buying the lands and collecting the rents.

Many of the immigrants had fled Europe because of oppressive landholding regimes in their native countries. Aristocracy, vestiges of feudalism, and Roman Catholic patronage had kept masses of Europeans in a state of peasantry. When ships set sail for the New World, the immigrants were ready for a new life. They did not want to settle for a new form of peasantry, and there were plenty of descendants of earlier immigrants already populating the United States with similar sentiments.

It is not so surprising, then, that when *Progress and Poverty* was published it ignited a powder keg of pent-up frustration. It is widely regarded as the best-selling economics book of all time (not including textbooks), and even as the best-selling non-fiction book of any kind during the 19th century (Wenzer and West, 2000). Many of George's ideas were rolled up into the Populist Movement during the latter decades of the 19th century.

Ideally, according to George, land and only land would be taxed — unimproved land to be more specific. It was not right to tax the wages of labor because workers earned their keep, and taxing wages would only discourage people from working. Nor was it right to tax capital or capital gains, because capital investment and entrepreneurialism helped make the economy more productive. Landlords, however, were collecting unearned money, and taxing them would serve justice. A substantial fringe benefit would be the discouraging of land speculation that often caused heartbreaking boom-and-bust cycles in the American West.

Taxing the landlord and the speculator made a lot of sense to a lot of people, and George's proposal bore a proportional amount of fruit. For example, property taxes became a major source of revenue for local governments in the United States, and the federal income tax targeted land rents early in the 20th century (Wenzer and West, 2000). George's fruit has been falling from the tree, however. Local property taxes are giving way to sales taxes, and the federal income tax has become more of a payroll tax. George's dream of a single tax on land never came close to fruition.

2. Opposition to George and the development of neoclassical economics

“Land, labor, and capital” had been identified as “the factors of economic production by a century's worth of classical economists. The

latter had quibbled over which factor was most important, and especially whether labor or capital added the most value in the production process, but none had doubted that each of the three were essential and unique. Yet, when we open an economics textbook today, we typically find that “ $Y=f(K,L)$,” in other words that the factors of production (Y) are simply capital (K) and labor (L).

This is not always the case, nor is the production function the only means of identifying land as a factor of production. For example, Nicholson (1975:127) noted that production entails capital, labor, raw materials, and “other variables affecting the production process.” In recent textbooks, environmental economists of neoclassical orientation (e.g., Tietenberg and Lewis, 2008) and even some economists not particularly known for environmental interests (e.g., Romer, 2001, Chapter 3) have helped to clarify the productive role of natural resources. Furthermore, in the primary literature, highly sophisticated work on the production function itself sometimes focuses on the role of land and natural resources (e.g., Zhengfei et al., 2006). Presumably these developments have stemmed partly, at least, from the critique of neoclassical economics provided by ecological economics. The question here is why land, as a basic and distinct factor of production, received so little attention for so long and is yet often absent from the production function found in standard neoclassical textbooks.

One of the simplest explanations for why land was lost from the typical production function is that it is impossible to show more than two factors in a textbook graph. If only two factors are used, they may be placed on two offset X -axes, with production on the Y -axis. The result is a pseudo-3-dimensional graph, a conical shape with variable shading intended to express how much production can be expected from various combinations of the two factors. With three or more factors, a production function becomes virtually impossible to represent graphically, thus making the relationships among factors more difficult for the student to envision. However, this doesn't explain why the two factors selected are invariably labor and capital instead of land and labor or land and capital. Furthermore, if this was the answer to why only two factors were used in the production function, one would expect the textbook to explain precisely that and to clarify that, in fact, there is one more primary factor called “land.” The typical textbook, however, provides little or no such explanation.

Another potential explanation for why land was lost from the typical production function is the industrialization of the European and American economies, which had run much of its course by the time neoclassical economics was born (Krausmann et al., 2008; Gordon, 2004, respectively). While it was easy for an 18th century physiocrat or a 19th century classical economist to witness the agricultural operations underpinning the economy, perhaps such was not the case for neoclassical economists of the 20th century, who were increasingly born and raised in urban areas far removed from the agricultural and extractive exigencies of economic growth, and increasingly focused their attentions on the manufacturing (and later the service) sectors.

The proposition here is that, while there may be multiple reasons for the lack of land in the neoclassical production function, one of the primary reasons is the anti-George backlash as manifested in academia. The fact that there was such a backlash, and that it manifested in academia, is well-documented by Mason Gaffney in *The Corruption of Economics* (1994). Gaffney, an economist at the University of California-Riverside, focuses on post-George political economy and the associated development of economic thought. He argues that a select group of American land barons established the dominant economics schools and departments in the United States, populating them with faculty who were anti-George.

Gaffney's thesis begins with a description of how influential George and the single tax movement had become, especially in the United States. He provides a laundry list of policies and political parties that were influenced by Georgist thinking to varying extent during the early decades of the 20th century. The Single Tax Party is the most obvious example, but Georgist philosophy was also melded

into the populist movement, progressive movement, and the original federal income tax law. Gaffney (1994, pp. 36–37) quotes the historian Eric Goldman who, writing about *Progress and Poverty* in 1956, said, “no other book came anywhere near comparable influence.”

Gaffney briefly summarizes George's teaching itself and what it would mean for American society if it was followed. From the standpoint of ecological economics, perhaps the most relevant point is that a single tax on land would strongly discourage the land speculation and urban sprawl that plagues the American environment today. The single tax would tend to keep the agricultural sectors in the most productive lands and the manufacturing and services in the most efficient locations.

Next, in dramatic fashion, Gaffney (1994, p. 46) provides his account of how neoclassical economics quickly evolved in response to George:

“As to the academic clerisy, George first suspected, and then impugned their motives. They were myrmidons of the rent-takers, using smoke and mirrors to addle, baffle, boggle, and dazzle the laity. He provoked, supplying motive for venomous reaction from those whom the shoe fits. The inevitable counterattack came to be called ‘neoclassical economics’... ‘Neoclassical’ was an inspired stroke of public relations, suggesting modernity with continuity of tradition. It is not, however, an accurate description. It was a radical paradigm shift. The task was to vandalize the stage Mill had set for George, torch the old furnishings, and reset the stage permanently in ways to discomfit George and frustrate future Georgists.”

Gaffney's analysis of neoclassical motives starts with those of John Bates Clark (1847–1938), one of the fathers of neoclassical economics, which after the Marginalist Revolution became an evermore American endeavor. Gaffney found 24 publications by Clark that were directed against George over a period of 28 years. While academic critique is often productive, Clark's critique of George seemed exaggerated and excessive. For example, Clark reviewed Alfred Marshall's *Principles of Economics* and, instead of focusing on Marshall's content, spent 26 pages attacking George's concept of land rent. Clark was particularly concerned with loosening the distinction between land and capital.

Clark's move to Columbia University in 1895 was put into a context of American political economy by Gaffney. Prior to his distinguished position at Columbia, Clark had been affiliated with small colleges such as Carleton, Amherst, and Smith. He had debated George in 1890 at Saratoga, New York, where he argued that capital “transmigrates” into land, breathing into the land a spirit of production. Meanwhile, the president of Columbia was Seth Low (1850–1916), a wealthy silk importer and landowner who in 1895 was preparing to run for mayor of New York against (among others) Henry George. Low hired Clark, who was also in high demand among other leading, anti-Georgist universities, including Johns Hopkins University, the University of Chicago, and Stanford University.

The move to Columbia allowed Clark to team up with Edwin R.A. Seligman (1861–1939), who had been Clark's ally at the Saratoga debate against George. Seligman was from a banking family and became chairman of the Economics Department at Columbia under Seth Low and then under the new president of Columbia, Nicholas Murray Butler. Butler was known for his close ties with J. P. Morgan and Wall Street, bringing money into the university and especially into the Economics Department. Columbia became the wealthiest university of the time, and the Economics Department went from two faculty members to more than 40 during the Butler/Seligman administration. The team of Clark and Seligman, supported by the wave of faculty hired by Butler, formed a powerful academic attack on the single-tax movement.

In their efforts to divert attention from land as a factor of production, Clark and Seligman found support from other figures at the front of the neoclassical transition. Most notable, for a time, was Francis Walker, the first president of the American Economic Association, president of the

Massachusetts Institute of Technology (MIT), and Director of the U.S. Census Bureau. Like Clark, Walker was an early and ardent debater of Henry George, although he later came to temper his disagreements with George (Whitaker, 1997).

As Gaffney noted, Clark and Seligman also found limited support from Phillip Henry Wicksteed (1844–1927) and Alfred Marshall (1842–1924). Actually, Walker, Wicksteed, and Marshall weighed in on both sides in various ways, but Clark and Seligman had many opportunities to pick and choose from the work of these esteemed colleagues in support of their anti-George agenda. George and his followers were at a major disadvantage in this regard. For one thing, Clark and Seligman outlived George by four decades. Furthermore, after *Progress and Poverty* was published George and his followers were constantly on the front lines of political battle, their message diluted by the many and sundry political issues, with little time to write economics textbooks or articles. Finally, Clark and Seligman had wealthy interests backing them, with all the attendant privileges (including the proliferation of faculty at Columbia University). They wrote the textbooks and suggested the tax codes long after George died, which was in the duress of the 1897 New York mayoral race (Schwartzman, 1997).

Another major figure in Gaffney's thesis is Richard T. Ely (1854–1943), educated at Columbia University, founder of the American Economic Association in 1885 and one of the most prolific economics authors of all time. Ely's name is not so strongly associated with the transition from classical to neoclassical economics. Instead, he charted the terrain of “land economics,” about which he wrote the seminal textbook *Outlines of Economics* (Ely, 1937). Ely's motivation for attacking George was broader than that of Clark and Seligman's. For starters, he was himself a highly successful land speculator. Later, when he established his Institute for Research in Land and Public Utility Economics in 1920, his major contributors were utilities, railways, building and loan associations, land companies, and bankers. Furthermore, Ely was influenced by the patronage of Daniel Coit Gilman (1831–1908), a prominent figure in the development of American academia (Flexner, 1946).

Gilman excelled at exploiting the Morrill Act of 1862. The Morrill Act granted vast areas of land to the states, which were then allowed to sell the land for the purposes of establishing agricultural and engineering universities. The smallest state grants were 90,000 acres, and over 70 “land-grant universities,” as they came to be called, were established pursuant to the Morrill Act.

Administering the Morrill Act land grants became a highly complex financial endeavor, with lands sometimes being used directly for university construction, but often managed as real estate for university income. In some cases, titles were transferred to private trusts, which would then manage the land in the interests of the university. In other words, in many cases administering the Morrill Act was hardly distinguishable from land speculation. Successful speculation often required long periods of “sitting” on the land without conducting any meaningful economic activity, and it was easy to sit as long as the land wasn't taxed. A lot of land and money was at stake, and many university administrators specialized in the Morrill Act. George's single tax would have threatened this entire subculture of academic administrators and the universities they worked for. Gilman was a Morrill Act expert at Yale, then Berkeley, where he became the first president of the University of California. He was driven out of Berkeley by agrarian political pressure that developed in response to the university's land grabs. The pressure was exacerbated by the journalism of Henry George, who was writing for the *San Francisco Daily Evening Post* in the 1870's (Gaffney, 1994, p. 84).

Gilman moved back east, becoming the first president of Johns Hopkins University, and then of the Carnegie Institute (Flexner, 1946, pp. 38–53). Under his tutelage, Johns Hopkins became the first major university to specialize in graduate studies. For nearly two decades beginning in 1876, Johns Hopkins produced nearly all the American Ph.

D.s in economics, laying the foundation for the economics profession in the United States. Eleven of these Ph.D.s became presidents of the American Economic Association. Gilman also hired Ely as his first economics professor, drawing him away from the University of Wisconsin (J. B. Clark and Francis A. Walker also eventually taught under Gilman at Johns Hopkins).

Ely returned to the University of Wisconsin in 1892, where he established the field of land economics and, in 1920, the Institute for Research in Land and Public Utility Economics. Ely remained an opponent of Georgist thought and politics. He did not attempt to excise land from the language of economics as Clark did, but denied that land was fundamentally distinct from capital. While Clark's work was spread far and wide in general economics, Ely's work became prominent in the more specialized yet substantial fields of agricultural, natural resources, and his own "land" economics. The result was that:

"Ever since, the economics profession has been poised on the balance of wonderful ambivalence. Official Clarkian theory says there is no such thing as land, but just in case there is, it is to be studied under the guidance of Ely, founder of the AEA [American Economic Association], in a separate, watertight compartment. Ely isn't so sure there is such a thing as land either, but whatever it is, it must be treated as private property, and taxed nominally if at all" (Gaffney, 1994, p. 91).

Gaffney's thesis is rounded out with developments at the University of Chicago, which would become the largest and most influential academic economics institution in the United States. His focus was on Frank Knight (1885–1972), part of an "apostolic succession" initiated by John D. Rockefeller, the quintessential land baron who established the university in 1892 (Gaffney, 1994, p. 117). Knight was an extremely influential figure in the early–middle stages of the development of neoclassical economics and is considered the father of the Chicago School (Kasper, 2002, pp. 7–22).

Knight is considered one of the greatest American economic thinkers and achieved much of his fame by dissecting the work of other economists and schools of thought. He was not an "American apologist" in the mold of John Bates Clark (Fonseca, 2007). He did argue, however, that land was indistinguishable from capital as a factor of production (Tideman and Plassman, 2004). In other words, there was no "rent" in the Georgist sense, only interest that accrued from the investment in capital. Again, this concept of land was used to oppose the single tax and land taxes in general. Knight's complicity in this academic movement culminated with "The Fallacies in the Single Tax" (Knight, 1953, p. 809).

It is impossible to ascertain precisely to what extent the capital theories of post-classical economics were developed in response to Henry George and the single tax movement. The evidence is compelling that George and the single tax had a greater effect on the life and ideas of John Bates Clark, for example, than on Frank Knight. There is little doubt, however, that the anti-George effects were significant in the aggregate: "The reasons for the abandonment of land as a unique or special factor in economic theory stem clearly from the negative reactions to Ricardian rent theory and its modifications by J. S. Mill and Marshall, but most strikingly to Henry George's proposal to tax away, in its entirety, the rent of land" (Ryan, 2002).

3. A moderating influence: Alfred Marshall

Gaffney's thesis is a major blow to neoclassical economics. It says that neoclassical economics, at least in the American tradition, was borne of a mixture of anti-George bias at best and academic deceit at worst. As Gaffney (1994, p. 29) stated, "Few people realize to what degree the founders of neoclassical economics changed the discipline

for the express purpose of deflecting George and frustrating future students seeking to follow his arguments."

To be more thorough, however, not all of the founders of neoclassical economics were as preoccupied with deflecting George as the American apologists. A good example is Alfred Marshall (1842–1924), whose magnum opus, *Principles of Economics*, was published in 1890. Marshall is best known for his contributions to microeconomics. He compiled the principles established by the early marginalists and added many original, insightful contributions. In a sense, he was the John Stuart Mill of microeconomics. Mill had synthesized the political economy of Smith, Malthus, and Ricardo; Marshall synthesized the microeconomics of Menger, Walras, and Jevons. However, Marshall was not interested solely in microeconomics. As with the classical economists, he was concerned with the wealth of nations, and observed:

"The gross real income of a country depends on (i) the number and average efficiency of the workers in it, (ii) the amount of its accumulated wealth, (iii) the extent, richness, and convenience of situation of its natural resources, (iv) the state of the arts of production, [and] (v) the state of public security and the assurance to industry and capital of the fruits of labor and abstinence" (quoted in Whitaker, 1975, p. 309).

In other words, Marshall recognized that land, labor, and capital were still the primary factors of production. He recognized as well the importance of technological progress and sound governance.

As with Mill and the classical economists, Marshall also recognized the importance of diverse perspectives and pluralistic methods to economic thought. Many scholars have described how, during the transition to neoclassical economics, a certain "physics envy" prompted economists to apply the mathematical rigor of Newtonian physics to economics at the expense of other perspectives and approaches (see, for example, Ormerod, 1997; Nadeau, 2003). To the extent physics envy was the rule of the day, Marshall was an exception. In the preface to the eighth edition of *Principles of Economics*, after decades of study and hindsight, he proclaimed, "The Mecca of the economist lies in economic biology rather than in economic dynamics" (Marshall, 1930).

4. Implications for ecological economics

Revisiting Gaffney's claim that "the founders of neoclassical economics changed the discipline for the express purpose of deflecting George and frustrating future students seeking to follow his arguments," there is a related frustration among ecological economists with the neoclassical production function. Ecological economics was borne out of the perception that neoclassical economics, or more accurately many of its practitioners, had failed to account, in a broad sense of the word, for the importance of ecology and the natural environment to the process of economic production (Røpke, 2004). A parallel perception is that neoclassical economists have failed to recognize the impacts of the economy on the environment, impacts that grow along with the economy. There is perhaps nothing more emblematic of that dual failure than the neoclassical production function.

Gaffney (1994:121) did not hone in on the production function as one of the theoretical casualties of the anti-George backlash, although he criticized the "Cobb–Douglas function" (i.e., $Y = f(K, L)$) as dealing "solely with relations of coexistence ignoring relations of sequence." In other words, his critique was centered not on the absence of land from the production function, but rather on a seemingly static relationship between the factors of production. Elsewhere, he used the phrase "production function" only once, in a footnote used to identify the Cobb–Douglas function. He also posited in the text that "Production economics, meanwhile, has evolved into manipulation of symbols purporting to represent quantities of labour and capital conceived as substitutes at a point in time. Micro theorists avoid

handling the sequential relationships, that labour produces capital and investment employs labour... Appreciation of land gets short shrift."

In a thesis of emphatically stated points, "short shrift" is an understatement and the production function itself is an overlooked manifestation of said shrift. Basic economics and introductory business courses are some of the most common courses in the American collegiate experience, and the production function is likely one of the most summarizing, heuristic formulae committed to American memory. The simple reinsertion of land, such that $Y=f(N, L, K)$ (where N represents the natural resources comprising land), would accomplish an equally prominent reminder that labor and capital are for naught in the absence of ecosystem goods and services. Such a reminder would have public policy implications far beyond the tax code, extending to environmental law and even to the macroeconomic policy goal of economic growth.

For conceptual and normative reasons, then, ecological and Geogist economics have a mutual concern in re-asserting the primacy of land as a factor of production. From a Geogist perspective, the logical and normative rationale may be summarized thusly:

"Instead of assuming that land and capital are indistinguishable, it is more appropriate to maintain the classical separation of factors of production into land, labor, and capital... Human beings, who own themselves and whose ownership is inalienable, are classified as 'labor.' Things that are not human beings but came into existence through human effort and are therefore owned by their producers are classified as 'capital.' Everything else is classified as 'land'" (Tideman and Plassman, 2004, pp. 387–388).

Meanwhile, one of the first bona fide textbooks in ecological economics, *Ecological Economics: Principles and Applications*, includes an ecologically economic production function, " $Q=F(N, K, L; r)$," in which land is recognized as comprising not only natural resources (r) but the ecological services of natural capital (N), such as agricultural pollination services provided by insects (Daly and Farley, 2003, p. 150). The semicolon in the production function indicates a complementary (as opposed to substitutive) relationship in which natural resources are transformed by labor, capital, and ecological services into the goods and services that are bought and sold in the market and therefore accounted for in measures of national production and income such as GDP.

Until an ecologically economic production function is widely adopted in economics textbooks and courses, it behooves transdisciplinary scholars concerned about conceptual rigor, environmental protection, and economic sustainability to recount, especially for students, the forces of political economy that shaped the development of our economics curriculum and one of its most influential heuristics: the neoclassical production function. Adequate recounting may help tomorrow's economist find the ecological path to Marshall's promised

"Mecca." Meanwhile, the work of ecological economists and Geogists will continue to increase in value as land becomes scarcer relative to labor and capital.

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References

- Daly, H.E., Farley, J., 2003. *Ecological Economics: Principles and Applications*. Island Press, Washington, DC. 450 pp.
- Ely, R.T., 1937. *Outlines of Economics*, 6th edition. Macmillan, New York. 1064 pp.
- Flexner, A.H., 1946. Daniel Coit Gilman: Creator of the American Type of University. Harcourt, Brace, New York. 173 pp.
- Fonseca, G.L., 2007. *The History of Economic Thought Website*. The New School for Social Research, New York. (<http://cepa.newschool.edu/het/home.htm>).
- Gaffney, M., 1994. *The Corruption of Economics*. Shephard-Walwyn, London, United Kingdom. 271 pp.
- George, H., 1894. *Progress and Poverty: An Inquiry into the Cause of Industrial Depressions and of Increase of Want with Increase of Wealth: The remedy*. William Reeves, London, UK.
- Gordon, J.S., 2004. *An Empire of Wealth: The Epic History of American Economic Power*. Harper Collins, New York. 460 pp.
- Kasper, S.D., 2002. *The Revival of Laissez-faire in American Macroeconomic Theory: A Case Study of the Pioneers*. Edward Elgar, Cheltenham, UK. 177 pp.
- Knight, F., 1953. The fallacies in the single tax. *The Freeman* 3, 809–811.
- Krausmann, F., Schandl, H., Siefert, R.P., 2008. Socio-ecological regime transitions in Austria and the United Kingdom. *Ecological Economics* 65 (1), 187–201.
- Marshall, A., 1930. *Principles of Economics*, Eight edition. MacMillan, London, U.K.
- Nadeau, R.L., 2003. *The Wealth of Nature: How Mainstream Economics has Failed the Environment*. Columbia University Press, New York. 253 pp.
- Nicholson, W., 1975. *Intermediate Microeconomics and Its Application*. Dryden Press, New York. 576 pp.
- Ormerod, P., 1997. *The Death of Economics*. John Wiley and Sons, New York. 230 pp.
- Romer, D., 2001. *Advanced Macroeconomics*, Second edition. McGraw-Hill, New York. 651 pp.
- Røpke, I., 2004. The early history of modern ecological economics. *Ecological Economics* 50 (3–4), 293–314.
- Ryan, C.K., 2002. Land as a factor of production. *American Journal of Economics and Sociology* 61 (5), 7–25.
- Schwartzman, J., 1997. The death of Henry George: scholar or statesman? *American Journal of Economics and Sociology* 56 (4), 391–405.
- Tideman, T.N., Plassman, F., 2004. Knight: nemesis from the Chicago School. *American Journal of Economics and Sociology* 63 (2), 381–409.
- Tietenberg, T., Lewis, L., 2008. *Environmental & Natural Resource Economics*, 8th edition. Addison-Wesley, Reading, Massachusetts. 688 pp.
- Wenzer, K.C., West, T.R., 2000. *The Forgotten Legacy of Henry George*. Emancipation Press, Waterbury, Connecticut. 142 pp.
- Whitaker, J.K., 1975. *The Early Economic Writings of Alfred Marshall, 1867–1890*, volume 1. MacMillan, London.
- Whitaker, J.K., 1997. Enemies or allies? Henry George and Francis Amasa Walker one century later. *Journal of Economic Literature* 35 (4), 1891–1915.
- Zhengfei, G., Lansink, A.O., van Ittersum, M., Wossink, A., 2006. Integrating agronomic principles into production function specification: a dichotomy of growth inputs and facilitating inputs. *American Journal of Agricultural Economics* 88 (1), 203–214.