contains a nonstandard monetary channel (from price deflation to higher ad-valorem-equivalent duties) and it abstracts entirely from total factor productivity shocks. Thus it is rather odd that Irwin cites Lucas (1994) and Cole and Ohanian (1999, 2007) in the context of debate on the macroeconomic impact of the tariff: these scholars are neither working with trade models nor do they examine tariff legislation.

Finally, there are a number of specific references to Crucini and Kahn (1996) worth clarifying. First, there is a typo: the impact on output when capital is held fixed in the steady-state of our model is –0.8 and –1.9 for the low and high tariff variation scenarios respectively (Crucini and Kahn 1996, table 5). On page 139, Irwin reports these as ranging from 0.8 percent loss of output to a 1.9 percent gain to output. More to the point, the fixed capital case was included in the paper as a pedagogic device to show the reader precisely why it is important to consider the capital accumulation channel. It is grossly misleading to hold capital fixed when assessing the actual impact of the tariff during the 1930s, a period in which investment basically collapsed. Second, the statement that 55 percent of U.S. imports were intermediate inputs, a much lower number than used in our calibration, is based upon Irwin's decision to classify imports based their industry classifications rather than their actual uses in the intermediate and final sectors of the economy. Nobel Laureate Wassily Leontief is the authoritative reference on this point. Leontief distributed U.S. imports across intermediate uses and final uses in his 1929 input–output tables and estimated 75 percent were intermediate inputs.

Despite these shortcomings, the book by Irwin is an important contribution to the continuing dialogue and debate on the role of the international commercial policy in the propagation of the Great Depression. The book is accessible to undergraduate economics majors and combined with the references it contains could quite readily be crafted into a very intriguing special topics course.

References

Crucini, Mario J. 1994. "Sources of Variation in Real Tariff Rates: The United States, 1900–1940." *American Economic Review*, 84(3): 732–43.

Crucini, Mario J., and James Kahn. 1996. "Tariffs and Aggregate Economic Activity: Lessons from the Great Depression." *Journal of Monetary Economics*, 38(3): 427–67.

Irwin, Douglas A., and Randall S. Kroszner. 1996. "Log-Rolling and Economic Interests in the Passage of the Smoot–Hawley Tariff." *Carnegie–Rochester Conference Series on Public Policy*, 45: 173–200.

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The Big Ditch: How America Took, Built, Ran, and Ultimately Gave Away the Panama Canal. By Noel Maurer and Carlos Yu. Princeton and Oxford: Princeton University Press, 2011. Pp. xv, 420. $35.00. ISBN 978–0–691–14738–3.

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By most scientific accounts, the Holocene age has ended and we are now in the midst of a relatively new age called the *Anthropocene*— the geological era when man has become a significant geological and morphological force on the earth. I would argue that one of the best examples of this new geological era is the project that led to "a land divided, the world united"—the Panama Canal. It is the economic history of this project that Noel Maurer and Carlos Yu document in their book *The Big Ditch: How America Took, Built, Ran, and Ultimately Gave Away the Panama Canal*. From the first proposal in 1529 for a way to cut across the isthmus to the current profitable operation of the canal by the *Autoridad del Canal de Panamá* (ACP), Maurer and Yu carefully document the economic incentives that drove the political decisions about the Panama Canal. While other books, such as the David McCullough book *The Path Between the Seas*, tell the history about the personalities and dreams behind the canal, Maurer and Yu's book gives us the unromantic, but nonetheless fascinating, economic facts behind the story.

Most of the conclusions of the book are consistent with my priors. I grew up in the American-run Panama Canal Zone during the 1960s and first half of the 1970s. My father had begun working there in 1942 as an electrician and my mother arrived just after WWII. I lived there my first fourteen years, and left in 1974 when my father retired. Everyone I knew in the Canal Zone was extremely proud to be part of running this engineering marvel, and the school curriculum regularly reinforced this pride. I also witnessed the less idealized aspects. Despite being quite young at the time, I still remember being confined to our house during the 1964 riots. In the late 1960s, my father became the operations supervisor of Miraflores Locks, and I recall his constant complaints about the mediocre upper-level management of the canal and the rising accident rate among ships. When the Carter–Torrijos Treaty was signed in 1977, all of the former Zonians we knew thought that it was a good idea, particularly since the United States no longer needed a two ocean navy and was not making any profits from the canal. Thus, while I think that McCullough's narrative best captures the romance, pride, and fascinating personalities of the imperialistic adventure, Maurer and Yu's array of economic statistics accord well for the most part with my personal experience about the more concrete economic aspects.

As they state in chapter 1, Maurer and Yu see their book as a case study of the economics of U.S. imperialism. The two central questions they seek to answer are: (1) Was the United States able to use its military, economic, and technological advantages to create economic gains from the endeavor and (2) Why did the United States then decide to withdraw from the endeavor three-quarters of a century later? In order to answer those questions, the authors present a panorama of facts and descriptions extending back to the sixteenth century. Overall, the book marshals evidence and arguments that provide convincing answers to both questions.

Chapters 2 and 3 cover the period before the building of the canal. They describe the numerous failed ideas, failed treaties, and failed attempts to create "a path between the seas" starting in 1529. I was surprised that this section did not begin with a world map (such as the one displayed later in chapter 5) showing the various trade routes and illustrating the tremendous savings of distance that could be accomplished by crossing the isthmus. The story of Panama is really the story of geography above all else, and it is only with such a map in mind that one understands the continual quest to build a route across this isthmus. Chapter 2 is filled with descriptions of ideas that were several centuries ahead of the technology required to implement them, as well as visionaries such as Humboldt, who knew the technology was not currently available but who had a surprisingly clear picture of what could be accomplished when it was. The chapter also describes the projects that were successful first steps, such as the Roman-style paved road built by the Spanish government in the 1520s using Nicaraguan slaves and the Panama Railroad built by American entrepreneurs in the early 1850s. Economic statistics for these first several centuries are hard to come by, but the authors make a good effort. While some of the statistics, such as the annual silver flows from Peru and the price of the stock of the Panama Railroad, are enlightening, others, such as the volume of the Nicaraguan–Panama slave trade, seem somewhat extraneous.

Maurer and Yu devote only seven pages to the tragedy of the French effort between 1877 and 1888. As Maurer and Yu briefly discuss, but which McCullough's book describes and documents in detail, the French effort was plagued by a different type of technology coming too late. By most accounts the French engineering technology was up to the task. What the French lacked was *medical knowledge*, in particular the knowledge that malaria and yellow fever were spread by mosquitoes. This lack of knowledge was a major source of the 22,000 deaths during the French effort.

In the middle of chapter 3, the narrative returns to the American interest in the canal. A major hypothesis of this chapter, as well as a continuing thread in later chapters, is that the United States used its military might to strike a deal that captured all of the rents and left Panama nothing. Tables 3.4, 3.5, and 3.6 compare the terms of the Hay–Bunau–Varilla treaty to those of the Wyse Concession between Colombia and French private interests, as well as other rejected treaties with Colombia and treaties with Nicaragua. Point by point, the Hay–Bunau–Varilla treaty is not unprecedented, but as a whole it did extract most of the rents for the United States. I am not sure how relevant the comparison is, however, because the comparison set consists of agreements between private interests and the Colombian government or agreements that were never approved by one or both of the governments involved.

Maurer and Yu's accounts of the various proposals and events starting in the early 1800s illustrate to me why the eventual deal under Theodore Roosevelt was not so surprising. While several European powers were potentially interested in building a crossing, all recognized the United States as the big player in the hemisphere. This deference to the United States (particularly by Great Britain) probably hurt Colombia's bargaining power. Similarly, the variety of serious proposals to build a canal in Nicaragua undercut Colombia's bargaining power. In the end, Colombia was ultimately hurt by the independence movement in Panama, whose leaders were so eager to break away from Colombia that they ended up with not much more than independence. Thus, while I agree with Maurer and Yu that U.S. military power played a role, the actual terms of the treaty may have been influenced by the ability of the United States to play off the variety of interests against each other. I think that basic bargaining theory goes far in explaining the outcome.

Chapter 4, which discusses the actual construction of the canal and set-up of the Canal Zone, repeatedly argues that the United States did not treat various groups, such as the Panamanian merchants, fairly. To understand the various decisions documented by Maurer and Yu, I think it is important to remember that, while the other efforts in Panama over the centuries used private investor funds, the Panama Canal was built and run with U.S. taxpayer dollars. I suspect that this fact explains much of the hard-headedness of the U.S. government in building and running the canal. Indeed, the numerous decisions summarized by Maurer and Yu support this view. For example, when Spanish workers started striking, the Canal Zone decided to replace them with workers from Barbados (p. 113). When the sudden influx of workers led to food shortages, sky-rocketing prices by Panamanian merchants, and subsequent malnourishment among the Barbadian workers, the U.S. government established the system of commissaries to guarantee an adequate supply of goods at low prices (p. 193). Particularly supportive of this view is the fact that the U.S. government also tried to protect itself from entrenched American interests. In particular, it voted against the plan to create a civil government in the Canal Zone with a permanent population of Americans with private property rights and instead voted in favor of Goethal's plan based on the premise that the Canal Zone should instead be "like a large corporate enterprise," dedicated to the "management of a great public work, and not the government of a local republic" (p. 102). Thus, it appears the U.S. government was just as worried about American vested interests interfering with the building and running of the canal as with foreign interests. Indeed, the civilians in the Canal Zone lived very much like the military—we rented our houses from the government, we shopped at government commissaries, and we could only live in the Canal Zone if we worked for the Panama Canal Company. My hypothesis that the U.S. government was single-minded in its goal to build and run a well-functioning canal explains why it did little to help the development of the Panamanian economy and did not try to be socially progressive with respect to racial issues during the early years of the canal. While shocking from a modern perspective, the U.S. treatment of foreign nationals of color was not very different from the U.S. segregation of the armed forces before Truman's order in 1948.

Whereas the first four chapters give moderately interesting background information, the book really takes off starting with chapter 5. Chapters 5 through 9 discuss the returns to the canal during the early days, how Panama was prevented from sharing in the returns to the canal, the declining value of the canal to the United States in the post–World War II period, the handover of the canal, and the experience under Panamanian management. Chapter 5 expands on Maurer and Yu's *Journal of Economic History* article about the impact of the Panama Canal from 1903 to 1937. Maurer and Yu use a variety of social savings and internal rate of return calculations to assess the savings from the Panama Canal. As their various calculations show, the Panama Canal yielded a very healthy social return. This chapter represents economic history at its best.

Did the U.S. Treasury benefit from these healthy social returns? Ironically, it did not. As documented by Maurer and Yu, the United States essentially distributed a significant part of the returns in the form of very low shipping tolls. While the initial Panama Canal Act of 1912 stipulated that there would be no tolls for intra-U.S. shipping, diplomatic pressure convinced

President Wilson to repeal the act and implement a policy that charged the same low tolls to all shipping, varying only by the tonnage and size of the ship. Moreover, it kept the nominal tolls constant for decades (p. 251).

A key point that Maurer and Yu seem to overlook is that the U.S. pricing system may have been closer to the socially efficient optimum than the later system adopted by Panama. Basic economic theory states that efficiency is achieved when price is set equal to marginal cost. Achieving efficiency in a natural monopoly such as the Panama Canal is more difficult because fixed costs cannot be covered. The standard policy response to a natural monopoly situation is average cost pricing. The statistics presented by Maurer and Yu in chapters 5, 6, and 7 suggest that perhaps such a pricing strategy may have guided the setting of tolls, since profit margins were near zero.

Chapter 7 nicely describes cumulating economic forces that made the decision to give back the canal much easier. Even from the beginning, the military costs of defending the canal were much higher than anyone had anticipated. After World War II, the Panama Canal played only a limited role in U.S. military ventures, so that even from a military perspective, the costs were beginning to exceed the benefits. In fact, Maurer and Yu describe how President Truman tried to give the Panama Canal to the United Nations in 1945 (p. 228). Their narrative clearly indicates that, while the United States was somewhat eager to relinquish the canal to an authority it trusted to run it, it did not trust Panama to do so because of its rather unstable politics. Thus, the United States was reluctantly stuck managing the canal through the 1950s, 1960s, and 1970s and was facing increasing costs of doing so. These costs were mainly from two sources: the constant rise in transfers to Panama used to placate the increasing aversion to the U.S. presence in Panama and the rising inefficiency of the Panama Canal management.

While Maurer and Yu have direct data showing the increase in transfers, their argument about the rising inefficiency is weak. Maurer and Yu repeatedly emphasize that the post–World War II U.S. experience had a declining profit margin because of rising costs, not low tolls. They argue that, after the handover, Panama turned the canal into a profitable operation because it was more efficient. I am not convinced by their argument. I believe their strongest evidence points to rising tolls, not necessarily falling costs, as the key source of the higher profitability under Panamanian management. Figure 8.4 (p. 309) shows that both revenue per ton and revenue per transit declined significantly in real terms from the 1930s to the mid-1970s under American management. In contrast, both real revenue per ton and per transit *doubled* from the mid-1990s to 2009 under Panamanian management. Thus, Maurer and Yu's own graphs clearly show that the *price* part of the price–cost margin jumped dramatically. The time pattern of these price increases matches very closely with the time pattern of the profit margins shown in figure 8.1 (p. 306)—note the small jump in both series just before 1980, the relatively flat part between 1980 and 1995, and the small hump followed by the dramatic increase after 1995.

But what about Maurer and Yu's various types of evidence for U.S. inefficiency? Their first exhibit is the fact that the chief executives of the Panama Canal company were typically military bureaucrats near the end of their careers. While this evidence is suggestive that perhaps the canal was not run by top talent, it is only indirectly indicative of lower efficiency. Moreover, they do not present comparable evidence that the Panamanian talent was better. The second piece of evidence is the number of accidents. As figure 7.6 (p. 252) shows, the number of accidents doubled between 1965 and 1975. (It would have been much more informative, though, if the graph had shown the accident *rate* rather than the *level* of accidents.) The rise in the number of accidents is clearly a sign of rising costs, and I know from personal experience that it put a lot of stress on the workforce. As pages 307–09 describe, the Panamanians brought the accident down significantly with a variety of measures, such as ending the practice of allowing two-way transits of the canal. Thus, this evidence is indeed supportive of better management by the Panamanians. However, it is difficult to believe that this was a major source of changes in costs. Finally, the third piece of evidence they present is the labor unrest among the American workers. Again, though, the effects on costs are never quantified. Thus, given the very direct evidence that the rise in profit margins under the

Panamanians matches almost perfectly with the rise in tolls and the lack of quantification of cost inefficiencies, I would argue that the most likely explanation for the rise in profitability under the Panamanians is that they set price to maximize profits, and did not engage in average cost pricing as the Americans apparently did. Thus, it does not make sense to draw conclusions about cost efficiencies from profit margins under the two regimes since the Americans had a different objective function.

Chapters 8 and 9 chronicle the negotiations leading up to the Torrijos–Carter Treaty, as well as the transition of control and the development of Panama as a result. A key theme in these, as well as earlier chapters, is the effect of world events and new transportation alternatives on the demand of the Panama Canal. There is much fascinating material in these chapters, including the huge increase in the demand for transits as a result of the oil discoveries in Alaska's Prudhoe Bay and the subsequent building of the trans-isthmian pipeline, the problems with Norriega until his ouster by American military forces in December 1989, and the hopeful burst of democracy after his removal.

Overall, this book represents a fascinating economic history of the Panama Canal and is a great compendium of economic data pertinent to the canal. It is also an important contribution to the economics of imperialism.

Postscript. I read much of this book on the plane last summer when I returned to Panama for the first time in thirty-seven years. I was delighted to see the obvious growth in living standards of the Panamanians (particularly evidenced in the booming malls serving the middle class) and the large number of high rises in Panama City. Our old American neighborhoods still stood, though with more colorfully painted houses and less manicured lawns. What was particularly rewarding was the visit to the Miraflores Locks, where my father had been operations supervisor. The ships still transited the locks like clockwork and the Panamanians were running the canal with the same obvious pride that we Americans had experienced. But as Maurer and Yu's book reminds us, the Panamanians should be ever mindful of the threat of competition from new transportation alternatives. Indeed, the Panama Canal may face the greatest competitive challenge of its history in the most recent event of the Anthropocene Age—the opening of the Northwest Passage.

References

Maurer, Noel, and Carlos Yu. 2008. "What T. R. Took: The Economic Impact of the Panama Canal, 1903–1937." *Journal of Economic History*, 68(3): 686–721.

McCullough, David. 1977. *The Path between the Seas: The Creation of the Panama Canal 1870–1914*. New York: Simon & Schuster.

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O Economic Development, Technological Change, and Growth

Understanding Growth and Poverty: Theory, Policy, and Empirics. By Raj Nallari and Breda Griffith. Washington, D.C.: World Bank, 2011. Pp. xxii, 498. $25.00, paper. ISBN 978–0–8213–6953–1. *JEL 2011–0774*

Understanding Growth and Poverty provides an accessible and up-to-date review of the knowledge accumulated on economic growth and poverty in the last decades. Raj Nallari and Breda Griffith achieve the difficult task of covering, in a nontechnical fashion, a very wide range of research and its policy implications. By not assuming any previous economics knowledge, the authors aim at reaching interested readers from policy circles, donor agencies, NGOs, etc. Even if there are some chapters that are redundant for the trained economist, the wealth of data presented when covering specific topics can provide an interesting first-perspective to economists who are outsiders to the topic. In addition, the reader will make acquaintance with some of the World Bank parlance (e.g., "growth diagnostics" coined from Ricardo Hausmann, Dani Rodrik, and Andrés Velasco 2008), and will learn the opinion of the World Bank regarding current growth and poverty debates (to the extent that the book is representative of it).

The book originated from a compilation of lecture notes used by learning programs of the World Bank. As the institution itself, this book touches upon a wide range of topics related to economic growth and poverty. The topics span from domestic policy to climate change, including institutions,