THE SMOOT-HAWLEY TARIFF: A QUANTITATIVE ASSESSMENT

Douglas A. Irwin*

Abstract—In the two years after the imposition of the Smoot–Hawley tariff in June 1930, the volume of U.S. imports fell over 40%. To what extent can this collapse of trade be attributed to the tariff itself versus other factors such as declining income or foreign retaliation? Partial and general equilibrium assessments indicate that the Smoot–Hawley tariff itself reduced imports by 4–8% (*ceteris paribus*), although the combination of specific duties and deflation further raised the effective tariff and reduced imports an additional 8–10%. A counterfactual simulation suggests that nearly a quarter of the observed 40% decline in imports can be attributed to the rise in the effective tariff (i.e., Smoot–Hawley plus deflation).

I. Introduction

The Smoot–Hawley tariff, enacted on the eve of the economic collapse of the early 1930s, will forever be associated with an outbreak of worldwide protectionism, the collapse of world trade, and the onset of the Great Depression. The subject of heated debate and controversy in the course of its passage through Congress during 1929–1930, the tariff became infamous as a result of the economic disasters that appeared in its wake. Smoot–Hawley has been blamed for cutting the volume of U.S. trade nearly in half within two years of its imposition. Smoot–Hawley has been blamed for poisoning international trade relations by triggering a wave of foreign tariff increases that put world commerce on a downward spiral.[1] Smoot–Hawley has even been blamed for turning a modest recession into the Great Depression, although others contend that it may have ameliorated rather than exacerbated the economic downturn.[2]

The debate over the economic consequences of the Smoot–Hawley tariff has continued to this day, mainly concentrating on its relationship to the Great Depression. Meltzer (1976), Gordon and Wilcox (1981), Saint-Etienne (1984), and others have speculated about the possible channels by which Smoot–Hawley aggravated the depression. The only two empirical studies of the macroeconomic effects of Smoot–Hawley focus on different channels by which the tariff affected aggregate output. Although these studies arrive at comparable magnitudes—which are small, relative to the depression itself—they differ as to the direction of the effect. Eichengreen (1989) argues that Smoot–Hawley provided a Keynesian-type stimulus that could have increased U.S. gross national product (GNP) by 2% even after taking foreign retaliation against U.S. exports into account. Crucini and Kahn (1996) argue that tariff-induced distortions to capital accumulation and foreign retaliation could have brought about a 2% decline in U.S. GNP.

If Smoot–Hawley did not play a major role in inhibiting or intensifying the Great Depression, which appears to be close to a consensus view among economic historians, it surely bears part of the responsibility for the collapse of trade in the early 1930s. Yet as Eichengreen (1986, p. 52) has noted, "[s]trikingly, there are just two empirical analyses of the impact of Smoot–Hawley on U.S. foreign trade, both completed within three years of the tariff's imposition." Given the methodological shortcomings of these early assessments, this paper aims to provide a more thorough analysis of the impact of the Smoot–Hawley tariff on U.S. trade and welfare, abstracting from the macroeconomic collapse. By separating out the impact of the tariff from that of the depression, this paper hopes to isolate the underlying magnitude of the Smoot–Hawley shock to international trade, and perhaps lead to further progress in answering the larger question of its relationship to the Great Depression.

This paper is organized as follows. Section II addresses the size of the Smoot–Hawley duties, disentangling two sources of the higher U.S. tariff in the early 1930s: the higher tariff rates legislated in the Smoot–Hawley act, and the deflation-induced increase in the *ad valorem* equivalent of the numerous specific duties in the tariff code. Then a partial equilibrium model of U.S. import demand is estimated and used to determine the degree to which the sharp decline in imports can be attributed to Smoot–Hawley. Section III evaluates Smoot–Hawley's effect on trade, resource allocation, and economic welfare in the context of an applied general equilibrium model of the U.S. economy based on Leontief's (1951) input–output matrix for 1929. Section IV summarizes the paper's main findings and describes some of their implications for the larger issue of understanding the mechanisms by which Smoot–Hawley may have had significant macroeconomic effects.

II. Smoot–Hawley in Partial Equilibrium

After a year and a half of working its way through Congress, the Smoot–Hawley tariff was finally imposed on June 18, 1930. Over the next two years, U.S. trade collapsed. As figure 1 illustrates, the volume of U.S. imports plummeted 41.2% between the second quarter of 1930 and its local trough in the third quarter of 1932.[3] (The volume of exports fell by almost exactly the same amount over the same period.) Isolating the role of Smoot–Hawley in bringing about this collapse of trade is complicated by the fact that, as figure 1 also shows, real GNP declined 29.8% during

Received for publication September 5, 1996. Revision accepted for publication May 19, 1997.

* Dartmouth College.

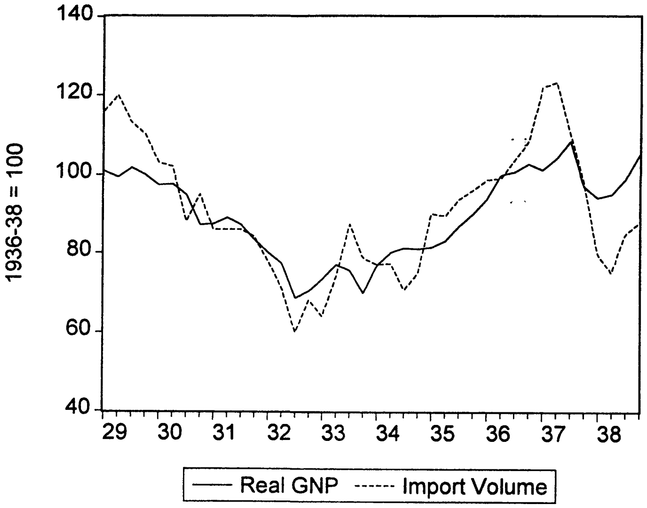
I thank Richard Clarida, Barry Eichengreen, Peter Klenow, Randy Kroszner, Jeffrey Williamson, two referees, and seminar participants at Harvard, the NBER, Georgetown, Colorado, Northwestern, Maryland, and Columbia for helpful comments.

[1] The League of Nations (1933, p. 193) stated that "the Hawley–Smoot tariff in the United States was the signal for an outburst of tariff-making activity in other countries, partly at least by way of reprisals."

[2] Contemporaries debated this proposition extensively, and this debate has continued. Meltzer (1976) argues that the tariff severely worsened the recession, whereas Eichengreen (1989) suggests it could have mitigated the economic downturn.

[3] All data sources are described in the appendix.

FIGURE 1.— REAL GNP AND IMPORT VOLUME, 1929–1938



this same period. Smoot–Hawley's contribution to this decline in imports can be obtained using partial equilibrium methods by estimating a U.S. import demand equation for this period and subjecting it to a counterfactual path for the tariff. The result will hinge upon how much Smoot–Hawley increased the average tariff and the price elasticity of U.S. import demand.

How much did the Smoot–Hawley tariff increase import duties? There is no straightforward answer because no simple, conceptually satisfactory measure of the "average tariff" exists. The simplest and most frequently used measure of the *ad valorem* equivalent "average tariff" is tariff revenue as a share of dutiable imports. This rose from 40.1% in the second half of 1929 to 47.1% in the second half of 1930, a 17.4% increase which, if taken as the average *ad valorem* tariff rate, translates (*ceteris paribus*) into a 5.0% increase in the relative price of imports, calculated as $(1 + t_1)/(1 + t_0)$. This tariff measure is biased downward because consumers substitute away from commodities subject to higher duties, giving them a lower weight in the index (with imports subject to a prohibitive tariff getting zero weight).[4]

To avoid these problems, the U.S. Tariff Commission calculated the average revenue effect of the 1930 duties using the 1928 volume and value of imports as weights. Table 1 shows this calculation, which indicates that the Smoot–Hawley tariff raised duties on average by 22.7%, bringing about a 5.8% increase in the relative price of imports, compared to the 1922 duty schedule. This fixed-weight estimate exceeds that given by the variable-weight "tariff revenue" measure and indicates the magnitude of the

TABLE 1.—COMPARABLE AD VALOREM EQUIVALENT RATES OF DUTY

Tariff Legislation	Average *ad valorem* Equivalent
Act of 1913	21.08
Act of 1922	34.61
Act of 1930	42.48

Source: U.S. Senate (1930).
Note: The equivalent *ad valorem* rates are calculated from the quantity and value of imports in the calendar year 1928.

substitution bias.[5] Because imports in the 1928 base year chosen by the Tariff Commission are influenced by the 1922 tariff, an alternative method of measuring the height of the tariff would be to avoid trade weights altogether. Lerdau (1957) constructed an annual "effective weighted tariff rate" for the years 1907–1946 using weights from the wholesale price index of the Bureau of Labor Statistics (BLS). This tariff index rises from 20.9% in 1929 to 25.3% in 1931, a 21% increase that translates into a 3.6% increase in the relative price of imports.

These tariff measures each have a different conceptual basis, but they yield comparable estimates of the change brought about by Smoot–Hawley: roughly a 20% increase in duties, on average, sufficient to bring about a 4–6% increase in the relative price of imports. However, the impact of the tariff in the early 1930s was not simply the increase in duties brought about by Smoot–Hawley. Many of the import duties were specific duties (a nominal dollar amount per imported quantity), not *ad valorem* rates (percentage of import value), and therefore the real burden of the tariff increased significantly between 1930 and 1932 when import (and domestic) prices plunged.[6] This increase in the effective height of the tariff was unrelated to the changes brought about by the Smoot–Hawley revision and would have occurred even if Smoot–Hawley had been rejected and the 1922 duties remained in place.

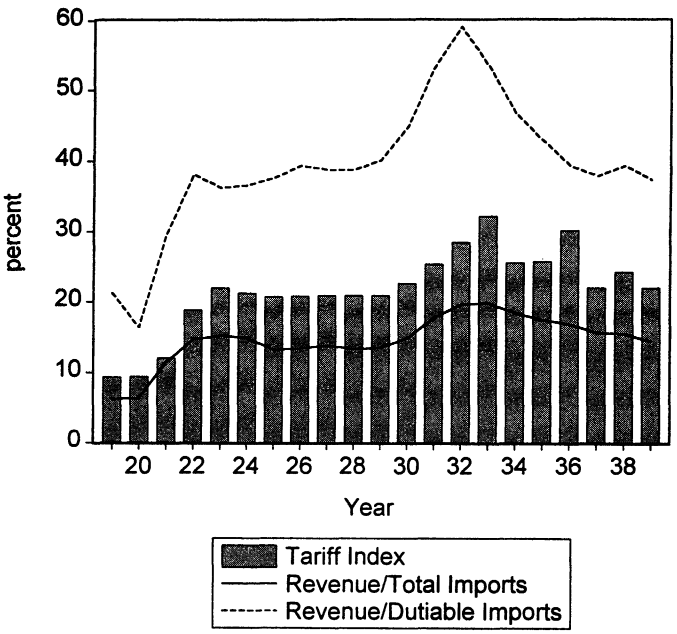
The price-level effect on the tariff is evident in figure 2, which plots several annual measures of the tariff series. All the series increase by roughly 20% between 1929 and 1930, but they also increase to a greater extent in 1931 and 1932. On a quarterly basis, for example, tariff revenue as a share of dutiable imports remains roughly constant at 47% from the second half of 1930 until mid-1931, then begins to rise, peaking at over 60% in the second half of 1932. (Lerdau's tariff index rises similarly from 25.3% in 1930 to 32.2% in 1932.) This is consistent with Crucini's (1994) and Irwin's (1998) finding that the deflation-induced rise in the tariff generally exceeded the legislated changes in tariff rates

[4] This problem particularly afflicts tariff revenue as a share of total imports, where there is substitution not only among dutiable imports but also between dutiable and nondutiable imports. Using total imports as the denominator, the average tariff increases from 13.5% to 14.6% between the second halves of 1929 and 1930, an 8.5% increase that amounts to just a 1.0% increase in the relative price of imports.

[5] Table 1 also indicates that the increase in duties brought about by Smoot–Hawley was not unprecedented—witness the even larger percentage increase in duties in the Fordney–McCumber tariff of 1922. Of course, the Smoot–Hawley tariff raised duties to a much higher level, arguably the highest since the Civil War.

[6] Irwin (1998) reports that the U.S. Tariff Commission in 1925 calculated that about 65% of dutiable imports was subject to specific or compound (specific plus *ad valorem*) duties. Crucini (1994) provides an extensive examination of the role of price fluctuations on the effective tariff for the interwar period.

FIGURE 2.—U.S. TARIFF INDEXES, 1919–1939



during this period. Thus care must be taken in distinguishing between these two separate effects of the tariff on imports.

Though a fixed-weight tariff index is more desirable on conceptual grounds, the tariff revenue measure is simple to calculate and conveniently available on a high-frequency basis. Furthermore, the correlation between Lerdau's fixed-weight index and tariff revenue as a share of dutiable and total imports is 0.940 and 0.872, respectively, from 1919 to 1939. Given this high correlation, tariff revenue as a share of dutiable imports will be taken as a proxy for the average *ad valorem* tariff rate in the empirical estimation. These tariff data, along with series on import prices and domestic wholesale prices, are used to construct a variable for the relative price of imports. U.S. import demand (the volume of imports) is explained principally by the relative price of imports and the real GNP. This equation is estimated following Clarida's (1994) cointegration methodology and using quarterly data from the first quarter of 1929 to the fourth quarter of 1939. The appendix describes the data and the techniques used to estimate the import demand equation in greater detail.

Table 2 presents the estimated parameters of the import demand equation. The relative price elasticity of import demand appears to be about −0.8 and the real income elasticity is about 1.5. These results are comparable to at least one other estimate of such elasticities for the United States in the interwar period. Chang (1946) uses annual data from 1924 to 1938 and finds a relative price elasticity of U.S. import demand of −0.97 and an income elasticity of 1.27. Adler's (1945) results are less clear: using annual data from 1922 to 1937, he reports a relative price elasticity of U.S. import demand of −0.09 and an income elasticity of 1.01, although in the sample 1922–1929 the price elasticity becomes −0.52 and the income elasticity 1.16. (Using annual data from 1920 to 1938 and including a trend, I estimated a relative price elasticity of −0.82 and an income elasticity of 1.65.)

Given these parameter estimates, table 3 (part A) considers the effects of various tariff changes on import volume. These parameter estimates imply that Smoot–Hawley itself had a modest impact on import demand: holding import and domestic prices and domestic income constant, imports would have fallen 4% as a result of a 5% increase in the relative price of imports and a −0.8 relative price elasticity of import demand. (The substitution bias discussed above implies that this somewhat understates the true impact of Smoot–Hawley.) Deflation from the second half of 1930 to the second half of 1932, when there were no legislative changes to rates of import duty, contributes an additional 30.8% increase in the effective tariff rate, or an additional

TABLE 2.—TESTING FOR COINTEGRATION IN U.S. IMPORT DEMAND, 1928–1939

A. Augmented Dickey–Fuller Regression

$$\Delta u_t = \delta u_{t-1} + \rho \Delta u_{t-1}$$

where u_t is from $m_t = \alpha_1 + \alpha_2 t + \beta_1 p_t + \beta_2 y_t + u_t$

Estimated δ	−0.711
Standard error	(0.173)
t-statistic	4.11 (1% critical value = 3.59)

m = log of volume of imports
p = log of relative price of imports
y = log of real GNP
t = time trend
u = error term

B. OLS Parameter Estimates of
$$m_t = \alpha_1 + \alpha_2 t + \beta_1 p_t + \beta_2 y_t + u_t$$

Coefficient	Estimate
α_1	−1.088 (0.531)
α_2	−0.011 (0.003)
β_1	−0.811 (0.292)
β_2	1.457 (0.153)

C. Nonlinear Least-Squares Estimate of
$$m_t = \beta' x_t + \rho(m_{t-1} - \beta' x_{t-1}) + v_1 \Delta p_{t+1} + v_2 \Delta p_t + v_3 \Delta p_{t-1} + v_4 \Delta y_{t+1} + v_5 \Delta y_t + v_6 \Delta y_{t-1} + \epsilon_t$$
where $\beta = [\alpha_1, \alpha_2, \beta_1, \beta_2]'$ and $x = [1, t, p_t, y_t]'$

Coefficient	Estimate
α_1	−0.807 (0.621)
α_2	−0.010 (0.003)
β_1	−0.747 (0.372)
β_2	1.377 (0.186)
ρ	0.449 (0.178)

Note: Standard errors are in parentheses.

TABLE 3.—PARTIAL EQUILIBRIUM EFFECTS OF THE SMOOT–HAWLEY TARIFF ON U.S. IMPORTS

A. *"Back of the Envelope" Calculations*

	Initial (1929)	Smooth–Hawley (1929–1930)	Deflation (1930–1932)	Combined (1929–1932)
Average *ad valorem* tariff[a]	40.1	47.1	61.6	—
Percentage change in tariff	—	17.4	30.8	53.6
Percentage change in relative price of imports	—	5.0	9.9	15.3
Percentage change in import volume (assuming price elasticity = −0.8)	—	−4.0	−7.9	−12.2

B. *Counterfactual Impact of Tariff from Forecasted Import Demand Equation (Percentage Change, Second Quarter of 1930 to Third Quarter of 1932)*

	Actual	Fitted	Scenario A	Scenario B	Scenario C
Percentage change in import volume	−41.2	−39.8	−31.9	−34.3	−38.3
95% forecast confidence interval	—	−34.7 to −44.9	−26.8 to −37.0	−29.2 to −39.4	−33.3 to 43.3

Note: Scenario A—no Smoot–Hawley, 1922 duties converted to *ad valorem;* scenario B—*ad valorem* equivalent of Smoot–Hawley imposed; scenario C—no Smoot–Hawley, 1922 duties continue in effect.
[a] Average *ad valorem* tariff is tariff revenue/dutiable imports for second half of 1929, second half of 1930, and second half of 1932.

9.9% increase in the relative price of imports.[7] Using the estimated price elasticity of import demand, the deflation-induced increase in the effective tariff results in an 8% reduction in imports, about twice as much as the initial Smoot–Hawley duties. Over this entire period, from the second half of 1930 to the second half of 1932, the effective tariff rose about 54%, resulting in a 15% increase in the relative price of imports. Roughly one-third of this increase was due to the Smoot–Hawley legislation, the remaining two-thirds were due to the deflation-induced increase in the burden of specific duties. The combined impact translates into a 12% reduction in the volume of imports.

It would be incorrect to compare this estimate to the 40% actual decline in imports. The above *ceteris paribus* calculation cannot be compared with the actual outcome, in which both the (tariff-inclusive) relative price of imports and the national income were falling. Therefore another way of assessing the tariff is to take the parameters of the import demand equation and the actual paths of import and domestic prices and real GNP as given, and then determine how much the volume of imports would have fallen in the absence of the Smoot–Hawley tariff? Consider three different counterfactual scenarios for the tariff. Scenario A assumes that there was no Smoot–Hawley tariff, but that the 1922 duties were exclusively *ad valorem* and remain in place (i.e., there is no change in the tariff). Scenario B assumes that the Smoot–Hawley duties were imposed, but that they were exclusively *ad valorem* duties (i.e., duties rise to 47%). Scenario C assumes that there is no Smoot–Hawley tariff, but that the specific duties of the 1922 act remain in place (i.e., duties rise due to deflation and peak at about 58% in the third quarter of 1932).

The results from these counterfactuals (and the associated 95% forecast confidence intervals) are presented in table 3 (part B), which considers the time period from the second quarter of 1930 (just prior to the imposition of the tariff) to the third quarter of 1932 (the point at which the real tariff peaks and import volume troughs). Even without the Smoot–Hawley tariff or any deflation effect on real tariffs (scenario A), the volume of imports collapses just the same: without any tariff changes the forecasted volume of imports still falls 32%. Even in the absence of the Smoot–Hawley tariff (scenario C), the volume of imports still falls 38% because trade is constricted by declining income and the deflation-induced increase in the real burden of the existing 1922 duties. In other words, about 22% of the drop in imports can be attributed to the higher effective tariff, just 7% of the drop can be attributed to the Smoot–Hawley tariff alone.

These results imply that the economic contraction was primarily responsible for the precipitous drop in imports. The volume of imports, for example, had already fallen 15% in the year prior to the imposition of the Smoot–Hawley tariff (second quarter of 1929 to second quarter of 1930), a period when real GNP declined 7%. The Smoot–Hawley tariff revision, by itself, did not raise the relative price of imports enough to account for most of the tremendous collapse in imports. But the rise in the effective tariff, due both to Smoot–Hawley and to deflation, had a substantial and striking effect in reducing U.S. trade in the early 1930s.

How do these results compare to the two contemporary estimates of the trade impact of Smoot–Hawley cited by Eichengreen (1986) and Hirschfeld (1932) just compared U.S. imports in 1930 and 1931 and arrived at the qualitative conclusion that imports subject to high duties fell more than total imports. Hall's (1933) analysis is slightly more sophisticated. He divided imports into two categories, those subject to new duties as a result of Smoot–Hawley and those whose tariff treatment did not change. The reduction in imports in the latter category was taken to represent the impact of the depression, whereas any additional decline in imports in the former category was attributed to the tariff. During the year of October 1930 to September 1931, imports not affected by the tariff declined to 56.5% of their 1929 value, whereas imports affected by the tariff declined to 40.0% of their 1929 value. Absent the tariff, Hall concluded, these imports would have been $191 million higher. Thus

[7] Import prices fell 45% between the second quarter of 1930 and the third quarter of 1932. Irwin's (1998) estimate of a −0.64 elasticity of the average tariff rate with respect to import prices implies that deflation during this period should have increased the average tariff 29%, very close to the actual rise in the average tariff by the second half of 1932.

TABLE 4.—GENERAL EQUILIBRIUM MODEL: SECTORAL OUTPUT AND TARIFF DATA

Sector	Value Added	Gross Output	Exports	Imports	Pre-Smoot–Hawley Tariff	Post-Smoot–Hawley Tariff
Agriculture	6654	15229	1194	804	22	36
Food and tobacco	2137	13075	487	1022	56	66
Iron and steel	6843	12950	968	326	44	49
Automobiles	1367	4903	532	5	29	26
Mining and metals	1680	4673	308	225	34	36
Energy	2431	7093	682	151	10	10
Chemicals	1025	3008	219	144	30	40
Wood	1911	4283	256	377	25	22
Textiles	2656	6082	220	1002	40	50
Leather	532	1839	61	89	40	48
Other	1246	2483	181	220	40	46
Services	11312	12514	99	0	—	—

Source: Leontief (1951). Import and tariff data from U.S. Department of Commerce (1930).
Note: Figures in $ million. Some figures may not add to Leontief's total as his "undistributed" column has been excluded.

the tariff reduced imports by 4.4% in 1930–1931 compared with 1929.[8] Thus Hall's simple but clever calculation yields virtually an identical estimate of the impact of Smoot–Hawley as the "back of the envelope" partial equilibrium result reported on Table 3.[9]

III. Smoot–Hawley in General Equilibrium

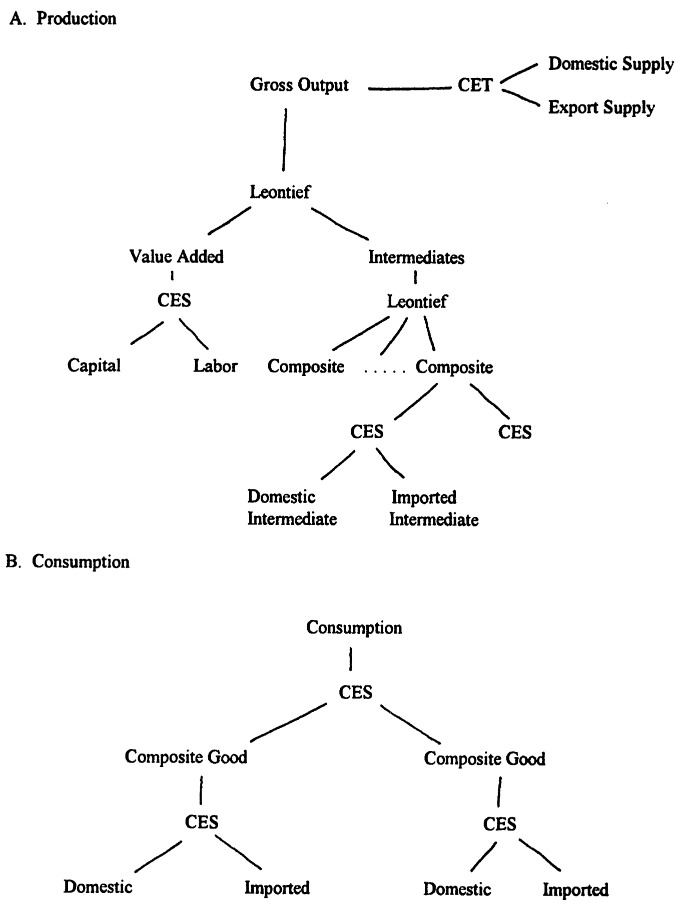
Although partial equilibrium provides a useful benchmark for assessing Smoot–Hawley, an applied general equilibrium model can furnish additional details about the impact of the tariff on production across sectors, account for aggregate (full employment) efficiency or income effects, and provide an estimate of the economic welfare consequences.[10]

Leontief's (1951) input–output matrix of the U.S. economy in 1929 forms the basis for the general equilibrium model developed here. Leontief's matrix contains information on the value of final production for 41 sectors, including exports, imports, intermediate (interindustry) goods flows, and payments for capital and labor services. These 41 sectors were aggregated up to 12 sectors. Leontief's data exclude government and certain service sectors (such as wholesale and retail trade and transportation), but the total output amounts to about 85% of the conventional estimates of the 1929 GNP.

Table 4 presents the data on each sector (value added, gross output, exports, and imports) and pre- and post-Smoot–Hawley tariff rates. There is no straightforward method of determining the average *ad valorem* tariff equivalent by sector. The initial tariff levels and the Smoot–Hawley changes are approximations based on disaggregated (fixed-weight) Tariff Commission data presented in Irwin and Kroszner (1996), and detailed tariff revenue data in Hayford and Pasurka (1991) and the Department of Commerce's *Foreign Commerce and Navigation of the United States* (1930). The trade-weighted average change in these assumed tariffs is about 20%, approximately the change brought about by Smoot–Hawley.

The structure of the model, sketched out in figure 3, follows closely that used by de Melo and Tarr (1992). Output in each sector is produced under a constant returns to scale function of a fixed ratio of value-added and intermediate goods. The value-added aggregate is a constant elasticity of

FIGURE 3.—STRUCTURE OF GENERAL EQUILIBRIUM MODEL



[8] Hall considers several adjustments to this figure, including attempts to account for the greater decline in raw material prices, the impact of deflation on specific duties, and the increased imports from anticipation of higher duties, but argues that these adjustments are largely offsetting.

[9] Eichengreen (1986) also uses extensive, disaggregated data on import volumes, regressing changes in volume on changes in tariff and import prices (omitting, notably, income), and arrives at the same general conclusion that Smoot–Hawley can explain only part of the decline in imports.

[10] For an overview of such models, see Shoven and Whalley (1992). The calculations were performed on MPS/GE; see Rutherford (1989).

substitution (CES) function of capital and labor services. The economy is endowed with a fixed amount of capital and labor, which are perfectly mobile across sectors. A Leontief function of intermediate goods nests CES functions of domestic and imported intermediates, which are therefore imperfect substitutes for one another.[11] For example, automobile production uses a fixed amount of steel and textiles, but there is substitution between domestic and foreign-produced steel and domestic and foreign-produced textiles. There is also differentiation between domestic and exported output, and gross output is a constant elasticity of transformation (CET) function of domestic and export supply.

Final demand is represented by a single, representative consumer with a CES utility function over composite goods, each of which is a CES function of domestic and imported products. There is no government sector in this model, and all revenue generated by the tariffs is returned as a lump sum to the representative consumer. The small-country assumption is employed as the external closure rule. All export and import prices are taken as exogenous, and in the simulation there can be no change in the balance of trade.

The model is calibrated by taking the 1929 data as the benchmark equilibrium. The subsequent output and welfare effects of the counterfactual tariff depend largely on seven elasticities of substitution and transformation. On the production side, the three elasticities are those of transformation between domestic and exported output, substitution between capital and labor, and substitution between domestic and imported intermediate goods. On the consumption side, the two elasticities are the upper level substitution elasticity between products and the within-product substitution elasticity between domestic and imported goods. As there are virtually no interwar estimates of these key (income- and output-compensated) elasticities, the range of values employed by de Melo and Tarr are used for this model as well and are taken as constant across sectors. Drawing upon empirical estimates, they find the following general tendencies: the elasticity of substitution between capital and labor in production is 0.5–1.0; the elasticity of substitution between domestic and foreign goods in production is 0.5–4.0; the elasticity of transformation between domestic and exported goods is 1.5–4.0; and the elasticity of substitution across goods in consumption is taken to be 0.5–1.0.

Table 5 presents the three aspects of the general equilibrium simulation results—the change in import volume, the equivalent variation (EV) measure of welfare change, and the EV as a percentage of the 1929 GNP—under various elasticity assumptions.[12] Part A considers the imposition of sectoral tariffs comparable in magnitude to Smoot–Hawley. The resulting decline in import volume varies from just under 5% (with low elasticities) to just over 8% (with high elasticities). As one might expect, the results are most sensitive to changes in the elasticity of substitution between domestic and foreign goods in production and consumption: the greater the elasticity of substitution, the greater is the reduction in imports from the higher tariff.

TABLE 5.—GENERAL EQUILIBRIUM EFFECTS OF SMOOT–HAWLEY DUTIES

A. Smoot–Hawley Tariff

		$\sigma_S = 0.5$, $\sigma_{DMC} = 1.0$	$\sigma_S = 1.0$, $\sigma_{DMC} = 2.0$
$\sigma_T = 2.0$	ΔM	−4.6	−7.3
$\sigma_{KL} = 0.8$	EV	−$60.7	−$296.1
$\sigma_{DMI} = 1.0$		(−0.1)	(−0.3)
$\sigma_T = 3.0$	ΔM	−6.2	−8.2
$\sigma_{KL} = 0.8$	EV	−$154.6	−$429.1
$\sigma_{DMI} = 2.0$		(−0.2)	(−0.4)

B. Smoot–Hawley Tariff Plus Deflation Effect on Tariff
(*Assumption:* Above plus additional 30% increase in tariff rates)

	"Small" Elasticities Scenario[a]	"Large" Elasticities Scenario[b]
ΔM	−11.3	−16.7
EV	−$173.5	−$1147.3
	(−0.2)	(−1.1)

C. Great Depression: Labor and Capital Unemployment
(*Assumption:* Labor endowment set to 76% of benchmark equilibrium, capital endowment set to 70% of benchmark, no Smoot–Hawley tariff)

	"Small" Elasticities Scenario[a]	"Large" Elasticities Scenario[b]
ΔM	−26.3	−28.7
EV	−$22,504.9	−$24,558.3
	(−21.8)	(−23.9)

Notes: (1) ΔM—percentage change in import volume; EV—equivalent variational change in welfare (in 1929 $ million); (·)—EV as percent of 1929 GNP ($103.1 billion).

(2) Consumption elasticities: σ_S—elasticity of substitution between products; σ_{DMC}—elasticity of substitution between domestic and imported products.

(3) Production elasticities: σ_T—elasticity of transformation between domestic and exported products; σ_{KL}—elasticity of substitution between capital and labor; σ_{DMI}—elasticity of substitution between domestic and imported intermediates.

[a] $\sigma_S = 0.5, \sigma_{DMC} = 1.0, \sigma_T = 2.0, \sigma_{KL} = 0.8, \sigma_{DMI} = 1.0$.

[b] $\sigma_S = 1.0, \sigma_{DMC} = 2.0, \sigma_T = 3.0, \sigma_{KL} = 0.8, \sigma_{DMI} = 2.0$.

The EV measures of the efficiency loss of the tariff amount to roughly $60 to $430 million (in 1929 dollars), or about 0.1–0.4% of the GNP. These microeconomic efficiency losses are, of course, quite small: a roughly 5% increase in the relative price of imports when imports amounted to just 4.2% of GNP in 1929 will not, in general, result in large efficiency costs. The efficiency losses are also small compared to the output losses generated by typical business cycle fluctuations. Unlike business cycles in which resource utilization rates can change significantly, this model assumes that all labor and capital resources are fully employed before and after the tariff.

These general equilibrium efficiency losses appear to be significantly larger than those arising from the partial equilibrium model. In partial equilibrium, the deadweight loss is approximated by $\frac{1}{2}\Delta p \cdot \Delta m$, where $\Delta m = \Delta p m \epsilon$. Here the elasticity of import demand $\epsilon = -0.8$, $m = \$4399$ million (imports in 1929), and $\Delta p = 0.05$. This results in an efficiency loss of less than $5 million, compared to the lowest general equilibrium loss of $60 million. There are

[11] Because the input–output matrix does not distinguish domestic and foreign sources of intermediates but only gives total imports of intermediates, the de Melo and Tarr (1992, p. 128) assumption that all sectors use domestic and foreign intermediates in the same proportion is followed.

[12] The equivalent variation is a money metric of the change between equilibria using the initial equilibrium as the point of reference; see Shoven and Whalley (1992, p. 125).

several reasons why the general equilibrium effects on imports and welfare are greater than the partial equilibrium estimates.[13] Most importantly, the underlying elasticities used in the general equilibrium calculation do not correspond to that used in the partial equilibrium exercise. In particular, the values assumed in the "small" elasticities case imply final sectoral demand elasticities that are greater than -0.8. De Melo and Tarr (1992, pp. 167–171) provide an analytical derivation of the implied sectoral demand elasticities from the underlying general equilibrium structure (hinging mainly on the substitution elasticities). When the substitution elasticities and other parameters are set such that all sectoral demand elasticities are close to -0.8, the tariff reduces the volume by 3.8% and results in an EV loss of $35 million. Similarly, when the partial equilibrium import demand elasticity is taken to be -1.65, the reduction in import demand is comparable to that in the "large" elasticities general equilibrium scenario.

Thus when the elasticities are comparable across approaches, the general equilibrium calculation of the tariff's impact on trade volume is reasonably close to that of the partial equilibrium estimate. Still, the general equilibrium welfare loss is substantially above (but much closer to) the partial equilibrium estimate. This may be due to variance of the tariff across sectors in the general equilibrium calculation, since the welfare effects vary with the square of the tariff and the higher tariffs are not typically applied to sectors according to Ramsey optimal inverse elasticity rules.

Which set of elasticities is preferable? Although the partial equilibrium elasticity has been estimated from interwar data, the highly aggregate estimate does not imply much (arguably implausibly low) flexibility at the sectoral level. The elasticities of substitution have been estimated too, albeit for a different time period using different data sources (although such estimates have tended not to vary much over time). These suggest much greater substitution possibilities than allowed for in the partial equilibrium setting.

As already noted, the deflation-induced increase in the burden of specific duties exceeded the legislated increase in the tariff. Part B of Table 5 assumes that these deflation effects were equivalent to an additional 30% increase in the equivalent *ad valorem* tariff rate beyond Smoot–Hawley. Depending on the configuration of elasticities, the decline in imports ranges from 11% to 17%. At the low end of the elasticity range, the general equilibrium result closely matches the partial equilibrium estimate, but otherwise the general equilibrium outcome is substantially larger. The efficiency losses of the combined impact of Smoot–Hawley and the price deflation amount to 0.2–1.1% of the GNP.

In results that are not reported, the general equilibrium model also yields simulated effects of the tariff on sectoral output. For most sectors, the change in output (either positive or negative, excluding the effect of deflation) is quite small, in the range of 0.1–0.3%. When proposals for a tariff revision were first discussed in 1928, the aim was to support agriculture. According to this model, the tariff succeeded in modestly protecting agriculture, where output increases by 0.6% under the "low" elasticities scenario. This protection acted to the detriment of the food and tobacco products industry, which showed a comparable decline in output despite receiving a higher nominal tariff. The others sectors that contract as a result of the tariff include leather, energy, and wood. Hayford and Pasurka (1991, p. 1391) report a correlation of 0.78 between nominal and effective rates of protection and state that Smoot–Hawley had "at most a minor effect on the average effective rate of protection." The correlation between their estimates of the change in sectoral effective rates of protection (before and after Smoot–Hawley) and the simulated change in output here is 0.36, indicating that higher effective (and nominal) tariffs (albeit imperfectly measured) are roughly correlated with the change in output generated by the model.

The general equilibrium model can also be used to evaluate various other propositions relating to Smoot–Hawley and the Great Depression. Smoot–Hawley is often thought to have resulted in foreign tariff retaliation against the United States. Although foreign tariffs rose significantly in the months after Smoot–Hawley was imposed, separating out the magnitudes of (1) discriminatory retaliations against the United States, (2) general tariff increases abroad sparked by Smoot–Hawley, and (3) general tariff increases abroad that would have occurred anyway, is difficult. As there is no good estimate of the impact of foreign retaliation on U.S. exports, the experiment considered here is of an exogenous 10% reduction in the price of U.S. exports—with no claim that this necessarily approximates the impact of foreign retaliation or tariff increase. In results that are not reported, the general equilibrium model with this effect indicates an additional reduction in trade, with import volumes falling 18–26% (the range determined by the "small" and "large" elasticity scenarios, respectively). The efficiency losses of the combined impact of Smoot–Hawley, price deflation, and export price reduction amount to 0.3–1.9% of the GNP, the larger figure being close to the upper bound estimate of the loss calculated by Crucini and Kahn (1996).

Another question is the degree to which a Smoot–Hawley trade shock may have contributed to the depression by affecting labor market clearing when those markets are characterized by real wage rigidity. Because the sectoral output effects of the Smoot–Hawley tariff are so small, leading to little reallocation of labor between sectors, the introduction of real wage rigidity (as in the ORANI model; see Rutherford (1989)) generates very little unemployment and a minuscule loss in aggregate output. Standard EV measures of welfare are unreliable in this context, but the additional aggregate output losses are comparable in magnitude to those resulting from Smoot–Hawley. This suggests

[13] In multisector general equilibrium calculations, the tariff affects resource allocation across many sectors through interindustry flows and other indirect channels. This can, but need not, lead to second-best effects that make the welfare effects more pronounced. Also, the measure of the tariff (tariff revenue as a share of dutiable imports) used in the partial equilibrium exercise is slightly biased downward.

that Smoot–Hawley operating through this channel probably did not contribute significantly to the economic downturn.

The model can also be used to determine the decline in trade resulting from the depression itself, in terms of the unemployment of labor and capital. In 1932, for example, 23.6% of the labor force was unemployed (U.S. Bureau of the Census, (1975, vol. 1, p. 135)). There are no official figures on capacity utilization or the unemployment of capital, but Nourse et al. (1934, p. 307) estimate that 83% of plant capacity was utilized in 1929. On the assumption that there was some labor hoarding during the depression, the general equilibrium model was simulated under the assumption that 24% of labor and 30% of capital was unemployed, and there was no change in tariffs. Part C of table 5 reports the results, which indicate a decline in imports of just over 25%. When this decline in imports (due to less employment of capital and labor) is combined with the decline due to higher tariffs (from the "large elasticities" scenario in panel B), the combined impact is close to the observed greater than 40% decline in imports. The result supports the general conclusions arising from the decomposition exercise using the partial equilibrium model. (The welfare losses are smaller as a share of the 1929 GNP than the actual fall in GNP because the model covers only about 80% of the 1929 GNP.)

IV. Conclusions

The main findings of this paper can be briefly summarized as follows. The Smoot–Hawley tariff increased import duties by about 20% on average, which translates into about a 5–6% increase in the relative price of imports. Partial and general equilibrium estimates suggest that the import volume would fall about 4–8% as a result. The combination of specific duties and deflation in the early 1930s, however, pushed up the effective tariff at least an additional 30%. The joint impact of Smoot–Hawley and the deflation-induced rise in the effective tariff reduced imports by about 12–20%. Taking the actual paths of import prices and income as given, the higher effective tariff (Smoot–Hawley plus deflation) accounts for about 22% of the observed 40% decline in the volume of U.S. imports in the two years after Smoot–Hawley's imposition. (Smoot–Hawley alone accounts for about 7% of this decline.) With imports amounting to just 4% of the GNP, the (full-employment) efficiency losses generated by the tariff are extremely small compared to the business cycle fluctuations experienced during this period.

In this paper, the Smoot–Hawley tariff has been analyzed in a strictly microeconomic framework to concentrate on its effects in reducing U.S. imports. In such a setting, a change in the relative price of importables should affect the composition of output but not the overall level of economic activity because efficiency losses do not readily give rise to unemployed factors of production or fluctuations in aggregate demand. What are the implications of the results in this setting to the larger issue of Smoot–Hawley's relationship to the Great Depression? The most important is that Smoot–Hawley itself appears to have been a very small direct shock to trade and therefore, it is likely, to the economy at large.[14] The additional rise in tariffs due to deflation and higher tariffs abroad intensified the impact of Smoot–Hawley. But the tariff could have had indirect, financial effects that magnified the initial shock into a larger macroeconomic one. Meltzer's (1976, pp. 467–468) focus on the financial implications of the tariff in worsening agricultural distress, and Eichengreen's (1989, p. 36) statement that the tariff had an "impact on the stability of the international monetary system and the efficiency of the world capital market," both require further investigation.

REFERENCES

Adler, J. Hans, "United States Import Demand in the Interwar Period," *American Economic Review* 35 (1945), 418–430.

Balke, Nathan S., and Robert J. Gordon, "Historical Data," in Robert J. Gordon (ed.), *The American Business Cycle: Continuity and Change* (Chicago: University of Chicago Press for the NBER, 1986).

Barger, Harold, *Outlay and Income in the United States, 1921–1938* (New York: National Bureau of Economic Research, 1942).

Chang, Tse Chun, "International Comparison of Demand for Imports," *Review of Economic Studies* 13 (1946), 53–67.

Clarida, Richard H., "Cointegration, Aggregate Consumption, and the Demand for Imports: A Structural Econometric Investigation," *American Economic Review* 84 (1994), 298–308.

Crucini, Mario J., "Sources of Variation in Real Tariff Rates: The United States, 1900–1940," *American Economic Review* 84 (1994), 732–743.

Crucini, Mario J., and James Kahn, "Tariffs and Aggregate Economic Activity: Lessons from the Great Depression," *Journal of Monetary Economics* 38 (1996), 427–467.

de Melo, Jaime, and David Tarr, *A General Equilibrium Analysis of U.S. Foreign Trade Policy* (Cambridge, MA: MIT Press, 1992).

Eichengreen, Barry, "The Political Economy of the Smoot–Hawley Tariff," National Bureau of Economic Research Working Paper 2001 (Aug. 1986).

——— "The Political Economy of the Smoot–Hawley Tariff," in Roger L. Ransom (ed.), *Research in Economic History,* vol. 12 (Greenwich, CT: JAI Press, 1989).

Gordon, Robert J., and James A. Wilcox, "Monetarist Interpretations of the Great Depression: Evaluation and Critique," in Karl Brunner (ed.), *The Great Depression Revisited* (Boston: Kluwer-Nijhoff, 1981).

Hall, Ray Ovid, "Smoot–Hawley Tariff Caused only about $165,000,000 of 1931 Import Shrinkage," *The Annalist* (Sept. 29, 1933), 403–404.

Hayford, Marc D., and Carl Pasurka, Jr., "Effective Rates of Protection and the Fordney–McCumber and Smoot–Hawley Tariff Acts," *Applied Economics* 23 (1991), 1385–1392.

Hirschfeld, Gerhard, "Effects of the Hawley–Smoot Tariff," *Barron's* (Apr. 1, 1932), 3, 9.

Irwin, Douglas A., "Changes in U.S. Tariffs: The Role of Import Prices and Commercial Policies," *American Economic Review* (forthcoming 1998).

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

League of Nations, *World Economic Survey, 1932–33* (Geneva: League of Nations, 1933).

Leontief, Wassily, *The Structure of the American Economy, 1919–1939* (New York: Oxford University Press, 1951).

[14] As Eichengreen (1989, p. 36) has concluded, "it is hard to dispute that the direct macroeconomic effects of the Smoot–Hawley tariff, operating primarily through the volume of trade, were small relative to the Great Depression."

Lerdau, E., "On the Measurement of Tariffs: The U.S. over Forty Years," *Economia Internazionale* 10 (1957), 232–244.
Meltzer, Allan, "Monetary and Other Explanations for the Start of the Great Depression," *Journal of Monetary Economics* 2 (1976), 455–472.
Nourse, Edwin G., et al. *America's Capacity to Produce* (Washington, DC: Brookings Institution, 1934).
Phillips, Peter C. B., and Mico Loretain, "Estimating Long-Run Economic Equilibria," *Review of Economic Studies* 58 (1991), 407–436.
Rutherford, Thomas, "General Equilibrium Modelling with MPS/GE," Department of Economics, University of Western Ontario (1989).
Saint-Etienne, Christian, *The Great Depression, 1929–1938: Lessons for the 1980s* (Stanford: Hoover Institution Press, 1984).
Shiells, Clinton R., "Errors in Import Demand Estimates Based upon Unit-Value Indexes," this REVIEW 73 (1991), 378–382.
Shoven, John B., and John Whalley, *Applying General Equilibrium* (New York: Cambridge University Press, 1992).
U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970,* 2 vols. (Washington, DC: U.S. Government Printing Office, 1975).
U.S. Department of Commerce, *Foreign Commerce and Navigation of the United States, 1929* (Washington, DC: U.S. Government Printing Office, 1930).
U.S. Senate, "Comparison of Rates of Duty in Pending Tariff Bill of 1929," Senate Doc. 119, 71st Congress, 2d Session, *Congressional Record* (June 14, 1930). (Washington, DC: U.S. Government Printing Office, 1930), p. 10748.

APPENDIX

Estimating U.S. Import Demand

A.1. Data

Estimation of an import demand equation requires data on the price and volume of U.S. imports and a measure of national expenditure. Quarterly data (first quarter 1929 to fourth quarter 1939) on the quantity and unit value of U.S. imports are available from the NBER Macroeconomic History database. (Available at http://www.nber.org/; original source for these data is *Survey of Current Business,* July 1951, p. 27.) Shiells (1991) finds little bias in using unit values as a proxy for import prices in estimating import demand equations with postwar data. The quarterly import price data are based on unit values for imports exclusive of the tariff. The average *ad valorem* tariff equivalent is tariff revenue as a share of dutiable imports, which is available annually in 1929 and monthly from January 1930 in the Department of Commerce's *Monthly Summary of Foreign Commerce.* These data were used to create a variable for the relative price of imports p, in which $p = (1 + \tau)p_M/p_D$, where τ is the *ad valorem* tariff equivalent, p_M is the import price index, and p_D is a measure of the prices of domestic goods, in this case the BLS's wholesale price index (also from the NBER's Macroeconomic History database). Quarterly real GNP is used as the measure of national expenditure, a series also available from the NBER Macroeconomic History database (originally deflated source: Barger (1942)). This series is close to that of Balke and Gordon (1986).

A.2. Estimation

Regressing nonstationary time series on nonstationary time series can lead to spurious results, particularly in the presence of stochastic trends. Therefore the cointegration approach of Clarida (1994) is followed in estimating the import demand equation. First, unit-root tests are performed on the logarithum of import volume m, the logarithum of the relative price of imports p, and the logarithum of the real GNP y. Results from the augmented Dickey–Fuller tests (not reported) indicate that the null hypothesis of a unit root in these series cannot be rejected even at the 10% level. However, pairs of these variables are not cointegrated (results not reported), which is consistent with two common stochastic trends. If there are two such trends, then the three variables are cointegrated and this vector may be unique.

The cointegrating vector can be estimated by the first-stage ordinary least-squares (OLS) equation that includes a constant and a time trend. The error term from this equation is then tested for the presence of a unit root. If the coefficient on the lagged error is found to be negative and significant, then the first-stage OLS estimates are consistent, despite the fact that a component of the error term may be correlated with p and y. Table 2, panel A, reports the estimates from the cointegrating regression and the unit-root test on the residuals. Under the null hypothesis that Δu_{t-1} is a random walk, the estimated δ is significant at the 1% level. This implies that the data are consistent with two stochastic trends and one cointegrating vector, which are estimated in table 2, panel B. These estimates point to a relative price elasticity of -0.81 and an real income elasticity of 1.46.

Clarida (1994) also employs the Phillips and Loretain (1991) parametric procedure for estimating the cointegrating vector when the variables are already known to be cointegrated. This approach yields asymptotically efficient estimates of the cointegrating vector and addresses the simultaneity problem by including lagged and led values of the change in the regressors and the autocorrelation problem by including lagged values of the stationary deviation from the cointegrating relationship (the error correction term). The results from this estimation procedure, presented in table 2, panel C, indicate a relative price elasticity of -0.75 and a real income elasticity of 1.38.