NBER WORKING PAPER SERIES

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Working Paper 5509

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1996

This paper was written while the author was visiting the American Enterprise Institute, whose support is gratefully acknowledged. I thank Pete Klenow, Randy Kroszner, Jeffrey Williamson and seminar participants at Harvard, Georgetown, Colorado, and Columbia for helpful comments. This paper is part of NBER's research programs in the Development of the American Economy, and International Trade and Investment. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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## 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 percent. 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 percent (ceteris paribus), although the combination of specific duties and deflation further raised the effective tariff and reduced imports an additional 8-10 percent. A counter-factual simulation suggests that nearly a quarter of the observed 40 percent decline in imports can be attributed to the rise in the effective tariff, (i.e., Smoot-Hawley plus deflation).

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# The Smoot-Hawley Tariff: A Quantitative Assessment

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## 1. Introduction

Sen. Reed Smoot (R-UT) and Rep. Willis Hawley (R-OR) will forever be associated with high U.S. tariffs, an outbreak of worldwide protectionism, and the onset of the Great Depression. As chairmen of the Senate Finance Committee and the House Ways and Means Committee, respectively, they gave their names to the Republican-sponsored tariff bill that pushed import duties to high levels on the eve of the economic collapse of the early 1930s. The bill was the subject of heated debate and controversy at the time: Democrats denounced the measure, more than 1,000 economists (led by Frank Taussig, Irving Fisher, Paul Douglas, and others) petitioned Congress not to pass the legislation, and foreign countries issued vehement protests.

But the Smoot-Hawley tariff became truly infamous only after several economic disasters appeared in its wake. Smoot-Hawley has been blamed for the 40 percent plunge in the volume of U.S. trade in the two years after 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]

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[1] In its World Economic Survey (1932-33), the League of Nations 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] Meltzer (1976) argues the former, and Eichengreen (1989) the latter.

Debate and speculation about the economic consequences of the Smoot-Hawley tariff continues to this day. Yet despite the importance often attributed to Smoot-Hawley in the events of the early 1930s, there have been virtually no empirical or quantitative studies of its effects on U.S. trade, a first step in determining its relationship to the Great Depression. This paper is devoted to ascertaining the magnitude of the Smoot-Hawley tariff and assessing its possible impact on U.S. trade and resource allocation. Section 2 uses a partial equilibrium model of U.S. import demand to determine the degree to which the sharp decline in U.S. imports can be attributed to Smoot-Hawley. Section 3 develops a general equilibrium model of the U.S. economy, based on Leontief's (1951) input-output matrix for the U.S. economy in 1929, to evaluate Smoot-Hawley's effect on trade, resource allocation, and economic welfare. Section 4 critiques several recent papers that consider the possible macroeconomic consequences of Smoot-Hawley. Section 5 summarizes the principal findings of this study.

## 2. 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.[3] Over the next two years, U.S. trade collapsed. As Figure 1 illustrates, the volume of U.S. imports plummeted 41.2 percent from 1930:2 to its local trough in 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 percent during this same period. A

[3] Irwin and Kroszner (1996) provide a brief legislative history and study the political economy of Congressional voting on the Smoot-Hawley tariff.

partial equilibrium answer to the question of Smoot-Hawley's contribution to this decline in imports can be obtained by estimating an import demand equation for the United States during this period and subjected it to counterfactual paths of the tariff. The answer then depends 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 percent in the second half of 1929 to 47.1 percent in the second half of 1930, a 17.4 percent increase which, if taken as the average ad valorem tariff rate, translates (ceteris paribus) into a 5.0 percent increase in the relative price of imports, calculated as $(1+t_1)/(1+t_0)$. This is a downwardly-biased indicator of the tariff because consumers substitute away from commodities that are subject to the higher duties, giving them a lower weight in the index (with imports subject to a prohibitive tariff getting zero weight).[4] In addition, this measure of the average tariff is subject to spurious volatility because fluctuations in the index can have nothing to do with changes in the tariff code.

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

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[4] This problem particularly afflicts tariff revenue as a share of total imports, where there is not only substitution among dutiable imports but also between dutiable and non-dutiable imports. Using total imports as the denominator, the average tariff increases from 13.5 to 14.6 percent between the second half of 1929 and the second half of 1930, a 8.5 percent increase that amounts to just a 1.0 percent increase in the relative price of imports. All data sources are described in the appendix.

this calculation, which indicates that the Smoot-Hawley tariff raised duties on average by 22.7 percent, bringing about a 5.8 percent increase in the relative price of imports, compared to the 1922 duty schedule. This fixed weight estimate exceeds that given by the variable weight measure above and indicates the magnitude of the substitution bias.[5] Because the existing 1922 tariff influences the 1928 import weights used in the Tariff Commission calculation, 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 1907-46 using weights from the BLS's wholesale price index (which includes nontraded goods). This tariff index rises from 20.9 percent in 1929 to 25.3 percent in 1931, a 21 percent increase that translates into a 3.6 percent increase in the relative price of imports.

Despite the different conceptual basis for each of these tariff indicators, they yield comparable estimates of the change brought about by Smoot-Hawley: roughly a 20 percent increase in duties, on average, sufficient to bring about a 4-6 percent 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. Crucini (1994) notes that many of the import duties were specific duties (a 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. This increase in the effective height of the tariff was unrelated to the changes brought about by the Smoot-Hawley revision and would have

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[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.

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 roughly 20 percent 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 percent from the second half of 1930 until mid-1931, then began to rise, peaking at over 60 percent in the second half of 1932. (Lerdau's tariff index rises similarly from 25.3 percent in 1930 to 32.2 percent in 1932.) This is consistent with Crucini's finding that the deflation-induced rise in the tariff generally far exceeded the legislated changes in the tariff during this period. Thus, care must be taken in distinguishing 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 1919-39. 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. An appendix describes the additional data needed and the techniques used to estimate the import demand equation for this period. Using quarterly data from 1929:1 to 1939:4 and following Clarida's (1994) cointegration methodology, the estimated import demand equation is presented in Table 2. This equation yield estimates of a relative price elasticity of import demand of about -0.8 and a real income elasticity of about 1.5.

Table 3 (part A) considers various changes in the tariff and, given these parameter estimates, calculates their effect on import volume. These parameter estimates imply that Smoot-

Hawley itself had a modest impact on import volume: holding import prices and domestic income constant, imports would fall 4 percent with a 5 percent 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 the tariff code, contributes an additional 30.8 percent increase in the effective tariff rate, or an additional 9.9 percent increase in the relative price of imports. Under the assumed import demand elasticity, the deflation-induced increase in the effective tariff reduced imports by an additional 8 percent, 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 to more than 53.6 percent resulting in a 15.3 percent increase in the relative price of imports. Roughly a third of this increase was due to the Smoot-Hawley legislation, the remaining two-thirds due to the deflation-induced increase in the burden of specific duties. The combined impact translates into a 12 percent reduction in the volume of imports.

It would be incorrect to compare this estimate to the 40 percent 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 national income were falling. Therefore, another way of assessing the tariff is to ask: given the parameters of the import demand equation and taking the actual paths of import and domestic prices and real GNP as exogenous, how much would the volume of imports have fallen in the absence of the Smoot-Hawley tariff? Figure 3 presents 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. Scenario B supposes that the Smoot-Hawley duties were imposed, but that they were exclusively ad valorem duties. Scenario C assumes that there is no Smoot-Hawley tariff, but that the specific duties of the 1922 act remain in place.

The results from these counterfactuals are presented in Table 3 (part B), which considers the time period from 1930:2 (just prior to the imposition of the tariff) to 1932:3 (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: the forecasted volume of imports falls 40 percent, and with no tariff changes the forecasted volume of imports falls 32 percent. Even in the absence of the Smoot-Hawley tariff (scenario C), the volume of imports still falls 38 percent because falling income and the deflation-induced increase in the real burden of the existing 1922 duties constricts trade. In other words, about 22 percent of the drop in imports can be attributed to the higher effective tariff, although just 7 percent of the drop can be attributed to the Smoot-Hawley revisions 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 percent in the year prior to the imposition of the Smoot-Hawley tariff (1929:2-1930:2). 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 deflation, had a substantial and striking effect in reducing U.S. trade in the early 1930s.

## 3. General Equilibrium

Although partial equilibrium provides a useful benchmark for assessing Smoot-Hawley, a

general equilibrium model can provide details about the multisector allocative impact of the tariff, account for aggregate (full employment) efficiency or income effects, and provide an estimate of the economic welfare consequences.[6]

Wassily Leontief's (1951) input-output matrix of the U.S. economy in 1929 provides 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 (inter-industry) 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, transportation, etc.), but total output amounts to about 85 percent of conventional estimates of 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. The trade-weighted average change in these assumed tariffs is about 20 percent, approximately the change brought about by Smoot-Hawley.

The structure of the model, sketched out in Figure 4, 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

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

fixed ratio of value added and intermediate goods. The value-added aggregate is a constant elasticity of substitution (CES) function of capital and labor services. Capital and labor 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.[7] 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 upon 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

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[7] As 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, 128) assumption that all sectors use domestic and foreign intermediates in the same proportion is followed.

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 few interwar estimates of these key 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; elasticity of transformation between domestic and exported goods is 1.5-4.0. 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 percent of 1929 GNP -- under various elasticity assumptions.[8] 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 percent (with low elasticities) to just over 8 percent (with high elasticities). As one might expect, 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 tariff increase. These figures are noticeably larger than the partial equilibrium estimates: in these multisector calculations, the tariff affects the allocation of resources in many markets through interindustry flows and other channels.

The EV measure of the efficiency loss of the tariff amount to roughly $60-$430 million (in

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[8] 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, 125).

1929 dollars), or about 0.1-0.4 percent of GNP. These microeconomic efficiency losses are, of course, quite small, primarily because a roughly 5 percent increase in the relative price of imports which amounted to 4.2 percent of GNP in 1929 will not, in general, result in large 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 (although not necessarily inefficiently), this model assumes that all labor and capital resources are fully employed before and after the tariff.

These general equilibrium efficiency losses can be compared to those arising from the partial equilibrium model. In partial equilibrium, the deadweight loss is approximated by $\frac{1}{2} \cdot \Delta p \cdot \Delta m$, where $\Delta m = \Delta p \cdot m \cdot \epsilon$, where $\epsilon$ (the elasticity of import demand) is -0.8, m is \$4399 million (imports in 1929), and $\Delta p$ is 0.05. This results in an efficiency loss of less than \$5 million, compared to the lowest general equilibrium loss of \$60 million. Once again, the general equilibrium model yields a large impact because the tariff has a ripple effect that distorts resource allocation in many sectors. In a quite different setting, Kokoski and Smith (1987) also find that single-sector partial equilibrium evaluations of welfare losses can be substantially below multisector general equilibrium calculations.

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 assuming that these deflation effects were equivalent to an additional 30 percent increase in the equivalent ad valorem tariff rate beyond Smoot-Hawley. (The import price index fell 45 percent between 1930:2 and 1932:3, but not all of the import tariffs were specific duties.) Depending on the configuration of elasticities, the decline in imports ranges from 11-17 percent. At the low end of the elasticity range, the general

equilibrium result closely matches the partial equilibrium estimate, but in general the general equilibrium outcome is substantially larger. The efficiency losses of the combined impact of Smoot-Hawley and price deflation amount to 0.2-1.1 percent of GNP.

Part C of Table 5 considers the possible impact of foreign retaliation against the United States. Although foreign tariffs rose significantly in the months after Smoot-Hawley was imposed, separating out the magnitudes of (i) discriminatory retaliations against the United States, (ii) general tariff increases abroad sparked by Smoot-Hawley, and (iii) 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 percent reduction in the price of U.S. exports -- with no claims that this necessarily approximates the impact of foreign retaliation or tariff increase. The results indicate an additional reduction in trade, with import volumes falling 18-26 percent. The efficiency losses of the combined impact of Smoot-Hawley, price deflation, and export price reduction amount to 0.3-1.9 percent of 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) is quite small, in the range of 0.1-0.3 percent. When proposals for a tariff revision were first discussed in 1928, the aim was to support agriculture. According to these model, the final tariff succeeded in modestly protecting agriculture, whose output increases by 0.6 percent under the "low" elasticities scenario. Despite the higher tariff for food and tobacco products, industries in this sector reduced their output by a similar magnitude primarily as a result of negative effective protection due to higher agricultural prices, an important intermediate. The others sectors that contract as a result of the tariff include leather, energy, and wood.

Up to this point, the Smoot-Hawley tariff has been analyzed in a strictly microeconomic framework to concentrate on its role in reducing trade and altering resource allocation. 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. The possible macroeconomic channels by which Smoot-Hawley affected the Great Depression, however, have been the subject of much speculation and some quantitative analysis on this issue deserves mention and comment.

## 4. The Macroeconomic Effects of Smoot-Hawley

A standard (if not consensus) view among economists has been that Smoot-Hawley played a relatively small role in the decline in national output and employment in the early 1930s. Dornbusch and Frankel (1987, 81) note that "there is no presumption in standard macroeconomic models that protection should reduce world aggregate demand, thus causing a depression." A tariff resulting in a 5-6 percent increase in the relative price of imports that accounted for 4 percent of GNP should be a second-order shock compared with the observed monetary contraction of the early 1930s.

If anything, standard macroeconomic theory suggests that a tariff could have a positive (if temporary) impact on output and employment. Dornbusch and Fischer (1986, 468-69) write that "from either a Keynesian or a monetarist perspective, the tariff by itself would have been an expansionary impulse in the absence of retaliation. In the Keynesian view, the reduction in imports diverts demand to domestic goods; in the monetarist view the gold inflow increases the

domestic money stock if not sterilized." Both of these channels operate through the balance of trade, but real net exports did not contribute to growth in 1930 or 1931 and gold inflows in the aftermath of Smoot-Hawley were not substantial. The equal-sized reduction in U.S. exports after Smoot-Hawley, however, could be due to declining foreign demand or to higher foreign tariffs, retaliatory or otherwise. Therefore, a macroeconomic simulation of the (ceteris paribus) effect of Smoot-Hawley on domestic output is still of interest.

This section will not provide any new evidence on the macroeconomic impact of Smoot-Hawley, but critique two recent papers that address this issue in a quantitative way: Eichengreen (1989) argues that Smoot-Hawley (even after accounting for foreign tariff increases) was expansionary and could have increased U.S. GNP by about 2 percent, while Crucini and Kahn (1995) argue that Smoot-Hawley (including the impact of foreign tariff increases) was contractionary and could have reduced U.S. GNP by about 2 percent. Eichengreen and Crucini and Kahn agree that Smoot-Hawley's effects appear to be small given the magnitude of the Great Depression, but they cannot dismiss the tariff as a negligible factor even though they differ about the direction of these effects.

Eichengreen (1989, 19) argues that "(i) that the direct effects of Smoot-Hawley were favorable for the U.S. economy and unfavorable abroad, (ii) that the impact of the tariff on foreign demands for U.S. exports did not offset these favorable effects, and (iii) that it is even unclear that foreign retaliation swamped these effects." Eichengreen reaches these conclusions by using a fixed exchange rate Mundell-Fleming model in which the tariff increases aggregate demand (by switching domestic expenditures from foreign to domestic goods) and increases aggregate supply (by reducing the real wage; the nominal wage is assumed fixed and the price

level rises). His simulations indicate that the tariff by itself could have raised GNP by up to 5 percent, or by 2.6 percent allowing for the reduction in foreign demand, or by 1.6 percent allowing for a symmetric increase in foreign tariffs, over 1929-31 when output fell 15 percent.

While Eichengreen concludes that "it is far from clear that Smoot-Hawley cum retaliation operating through standard macroeconomic channels was a major or, for that matter, even a contributing factor to the Great Depression," his simulations generate large stimulative effects for the tariff and it is important to understand the source of these effects. The various parameters of Eichengreen's model imply an elasticity of aggregate supply with respect to the tariff of 0.75, in the case of no foreign repercussions, or 0.2-0.4 in the case of declining foreign demand and retaliation. In other words, even when including retaliation, a 7 percentage point increase in the tariff could stimulate GNP by about 2 percent. This seems implausibly high: the scope for expenditure-switching was simply not that great during a period when imports constitute just 4 percent of GNP.

Was there scope for increasing aggregate supply by having the tariff expand the balance of trade surplus and generate gold inflows that would have increased prices, reduced real wages, and stimulated output in the short-run? That the magnitude of this channel was minuscule can be illustrated by reciting the Friedman and Schwartz (1963, 342) version of events of this period. They note that from October 1930 (the onset of the first banking crisis) to January 1931, the stock of high-powered money rose 5 percent, or $340 million, partly the result of gold inflows of $84 million of which only part (they suggest) can be attributed to Smoot-Hawley. However, the collapse in the money multiplier (resulting from declines in the deposit-currency and the deposit-reserve ratio) more than offset this expansion and the stock of money fell 3 percent over these

same four months.[9] Thus, the relatively small gold inflows hardly constituted much of a stimulative force and, in any event, were simply overwhelmed by the decline in the money multiplier that the Federal Reserve failed to offset.

Crucini and Kahn (1995) develop a real business cycle model in which to analyze the macroeconomic effects of Smoot-Hawley.[10] They first report reduced-form, log first-different regressions of industrial production on the U.S. tariff (tariff revenue as a fraction of dutiable imports), "unexplained" money growth, deposits of failed banks, and liabilities of failed businesses. Industrial production fell 75 percent from the end of 1929 to early 1933, but omitting the tariff variable from their regression reduces the predicted decline to just 14 percent. They also find that the tariff accounts for 5-9 percent of the variance of industrial production. "Based on these results," they conclude, "the tariff variable is quantitatively more important than money shocks or bank and business failures in explaining the downturn into the Great Depression." Then they develop a dynamic real business cycle model in which tariffs are capable of explaining 10 percent of output variance, imports are an important component in final production, among other features. They stress that production distortions introduced by the tariff may have had persistent, negative effects on output through changes in the capital stock.

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[9] Furthermore, Friedman and Schwartz (1963, 343) note that "the decline in Federal Reserve credit from December 1930 to March 1931 was greater than the gold inflow. In effect, the System was not only sterilizing the gold inflow, but exerting a contractionary influence greater than the expansionary influence of the gold inflow."

[10] The authors motivate this work partly a response to Lucas's (1994, 13) challenge that "it would be a term-paper-size exercise . . . to work out the possible effects of the 1930 Smoot-Hawley Tariff in a suitably adapted real business cycle model," predicting also that "we have accumulated enough quantitative experience with such [real business cycle] models to be sure that the aggregate effects of such a policy (in an economy with a 5 percent foreign trade sector before the Act and perhaps a percentage point less after) would be trivial."

However, attributing 80 percent of the sharp fall in industrial production to the tariff seems implausible at a time when imports amounted to 4 percent of GNP. As Crucini's earlier work demonstrated, the tariff measure of revenue over dutiable imports is correlated with changes in the price level, and it could be that the decline in industrial production should be attributed to whatever caused falling prices rather than the tariff per se. They end by concluding that U.S. GNP could have been reduced by 2 percent as a result of higher worldwide tariffs in the early 1930s. This finding is actually not that far from the upper bound estimates obtained from the static general equilibrium model in section 3.

Although elements of the Eichengreen and Crucini and Kahn papers may exaggerate the role (either positive or negative) of Smoot-Hawley, this does not imply that the tariff had no impact on the Great Depression. The difficulty is finding and isolating the particular channel or mechanism by which the Smoot-Hawley tariff had important macroeconomic ramifications. One channel that requires further research is that proposed by Allan Meltzer (1976, 460), who develops a very brief argument that "assigns a large role to the Hawley-Smoot tariff and subsequent tariff retaliation in explaining why the 1929 recession did not follow the path of previous monetary contractions but became the Great Depression." Meltzer links the decline in agricultural exports (as a result of retaliation or declining foreign demand as a result of Smoot-Hawley) to bank failures and financial distress in the Midwest that had important real effects elsewhere as well. Further evidence is needed to support Meltzer's argument, however, as the financial distress in agricultural regions predates Smoot-Hawley by some period.

## 5. Conclusions

This paper assesses the impact of the Smoot-Hawley tariff on U.S. trade in the early 1930s. The Smoot-Hawley tariff increased import duties by about 20 percent, on average, translating into about a 5-6 percent increase in the relative price of imports. Partial and general equilibrium estimates suggest that import volume would fall about 4-8 percent as a result. However, the main impact of the tariff came from the combination of specific duties and the price deflation of the early 1930s, which pushed up the effective tariff rate at least an additional 30 percent. The combined impact of Smoot-Hawley and the subsequent rise in the effective tariff reduced imports an estimated 12-20 percent. Taking the actual paths of import prices and income as given, the Smoot-Hawley tariff alone accounts for about 7 percent and the higher effective tariff (Smoot-Hawley plus deflation) accounts for about 22 percent of the observed 40 percent decline in the volume of U.S. imports in the two years after Smoot-Hawley's imposition. With imports accounting for just 4 percent of national income, the (full employment) efficiency losses generated by the tariff are a relatively small percent of GNP, and certainly small compared to the business cycle fluctuations experienced during this period.

Appendix: Estimating U.S. Import Demand

A. 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 (from 1929:1-1939:4) on the quantity and unit value of U.S. imports are available from the NBER Macroeconomic History database (original source: Survey of Current Business, July 1951, 27). The quarterly import price data are based on unit values for imports exclusive of the tariff. Clinton Shiells (1991) finds little bias in using units values as a proxy for import prices in estimating import demand equations with postwar data. For 1919-38, the correlation between an annual unit value index and Robert Lipsey's (1963, 146-47) annual import price index is 0.999. 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 $p = (1+t)p_M/p_D$, where t 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 national income is used as the measure of national expenditure, a series also available from the NBER Macroeconomic History database (original source: Barger 1942).[11]

[11] Real consumption expenditures might be a better variable than real GNP because the latter may have a serially correlated error term (a positive shock to imports decreases national income through the accounting identities), thereby biasing the results. In results using annual data on real consumption, there is little difference in the estimated parameters.

B. 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 log of import volume (m), the log of the relative price of imports (p), and the log of national expenditure (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 percent 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 OLS ordinary least squares 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-A reports the estimates from the cointegrating regression and the unit root test on the residuals. Under the null hypothesis that $\Delta u_{t-1}$ is a random walk, the estimated $\delta$ is significant at the 1 percent level. This implies that the data are consistent with two stochastic trends and one cointegrating vector, which are estimated in Table 2-B. These estimates point to a relative price elasticity of -0.81 and an real income elasticity of 1.46. (Chang (1946), another interwar estimate of U.S. import demand elasticities, finds a relative price elasticity of -0.97 and an income elasticity of 1.27 using annual data from 1924-38.)

Clarida (1994) also employs the Phillips and Loretain (1991) parametric procedure for estimating 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 are presented in Table 2-C and indicate a relative price elasticity of -0.75 and a real income elasticity of 1.38.

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 |

Note: The equivalent ad valorem rates are calculated from the quantity and value of imports in the calendar year 1928.

Source: "Comparison of Rates of Duty in Pending Tariff Bill of 1929," Senate Document No. 119, 71st Congress, 2d Session, U.S. Government Printing Office, 1930. Congressional Record, June 14, 1930, p. 10748.

Table 2: Testing for Cointegration in U.S. Import Demand, 1929:1 - 1939:4

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 $\delta = -0.711$ s.e. = 0.173 $t = 4.11$ [1 percent critical value = 3.59]

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

| Coefficient | Estimate (Standard Error) |
|---|---|
| $\alpha_1$ | -1.088 (0.531) |
| $\alpha_2$ | -0.011 (0.003) |
| $\beta_1$ | -0.811 (0.292) |
| $\beta_2$ | 1.457 (0.153) |

C. Non-linear Least Squares Estimate of:

$m_t = \beta' x_t + \rho (m_{t-1} - \beta' x_{t-1}) + \upsilon_1 \Delta p_{t+1} + \upsilon_2 \Delta p_t + \upsilon_3 \Delta p_{t-1} + \upsilon_4 \Delta y_{t+1} + \upsilon_5 \Delta y_t + \upsilon_6 \Delta y_{t-1} + \epsilon_t$,
where $\beta = [\alpha_1, \alpha_2, \beta_1, \beta_2]'$ and $x = [1, t, p_t, y_t]'$

| Coefficient | Estimate (Standard Error) |
|---|---|
| $\alpha_1$ | -0.807 (0.621) |
| $\alpha_2$ | -0.010 (0.003) |
| $\beta_1$ | -0.747 (0.372) |
| $\beta_2$ | 1.377 (0.186) |
| $\rho$ | 0.449 (0.178) |

Table 3: Partial Equilibrium Effects of the Smoot-Hawley Tariff on U.S. Imports

A. "Back of the Envelope" Calculations

| | Initial (1929) | Smoot-Hawley (1929-30) | Deflation (1930-32) | Combined (1929-32) |
|---|---|---|---|---|
| Average Ad Valorem Tariff | 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 (e = -0.8) | -- | -4.0 | -7.9 | -12.2 |

Note: Average ad valorem tariff is tariff revenue/dutiable imports for second half of 1929, second half of 1930, and second half of 1932.

B. Counterfactual Impact of Tariff from Forecasted Import Demand Equation

(Percentage Change from 1930:2 - 1932:3)

| | Actual | Fitted | Scenario A | Scenario B | Scenario C |
|---|---|---|---|---|---|
| Percentage Change in Import Volume | -41.2 | -39.8 | -31.9 | -34.3 | -38.3 |

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

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 & Tobacco | 2137 | 13075 | 487 | 1022 | 56 | 66 |
| Iron & Steel | 6843 | 12950 | 968 | 326 | 44 | 49 |
| Automobiles | 1367 | 4903 | 532 | 5 | 29 | 26 |
| Mining & 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 | -- | -- |

Note: Figures in million of dollars. Some figures may not add to Leontief's totals as his "undistributed" column has been excluded. Import and tariff data from U.S. Department of Commerce, Foreign Commerce and Navigation of the United States, 1929 (Washington, D.C.: USGPO, 1930).

Table 4: Continued

C. Smoot-Hawley Tariff, Deflation-Effect on Tariff, Plus Foreign "Retaliation"

Assumption: Above plus 10 percent reduction in export prices

| | "Small" Elasticities Scenario | "Large" Elasticities Scenario |
|---|---|---|
| ΔM | -18.1 | -26.2 |
| EV | -$310.2 | -$1941.4 |
| | (-0.3) | (-1.9) |

"Small" Elasticities Scenario: $\sigma_S = 0.5$, $\sigma_{DMC} = 1.0$, $\sigma_T = 2.0$, $\sigma_{KL} = 0.8$, $\sigma_{DMI} = 1.0$
"Large" Elasticities Scenario: $\sigma_S = 1.0$, $\sigma_{DMC} = 2.0$, $\sigma_T = 3.0$, $\sigma_{KL} = 0.8$, $\sigma_{DMI} = 2.0$

Table 5: General Equilibrium Effects of Smoot-Hawley Duties

A. Smoot-Hawley Tariff

| | | $\sigma_S = 0.5$<br>$\sigma_{DMC} = 1.0$ | $\sigma_S = 1.0$<br>$\sigma_{DMC} = 2.0$ |
|---|---|---|---|
| $\sigma_T = 2.0$<br>$\sigma_{KL} = 0.8$<br>$\sigma_{DMI} = 1.0$ | $\Delta M$<br>EV | -4.6<br>-\$60.7<br>(-0.1) | -7.3<br>-\$296.1<br>(-0.3) |
| $\sigma_T = 3.0$<br>$\sigma_{KL} = 0.8$<br>$\sigma_{DMI} = 2.0$ | $\Delta M$<br>EV | -6.2<br>-\$154.6<br>(-0.2) | -8.2<br>-\$429.1<br>(-0.4) |

$\Delta M$ = Percentage change in import volume
EV = Equivalent variational change in welfare (in million 1929 dollars)
(·) = EV as percent of 1929 GNP (\$103.1 billion)

Consumption Elasticities:
- $\sigma_S$ = Elasticity of substitution between products
- $\sigma_{DMC}$ = Elasticity of substitution between domestic and imported products

Production Elasticities:
- $\sigma_T$ = Elasticity of transformation between domestic and exported products
- $\sigma_{KL}$ = Elasticity of substitution between capital and labor
- $\sigma_{DMI}$ = Elasticity of substitution between domestic and imported intermediates

B. Smoot-Hawley Tariff Plus Deflation-Effect on Tariff

Assumption: Above plus additional 30 percent increase in tariff rates

| | "Small" Elasticities Scenario | "Large" Elasticities Scenario |
|---|---|---|
| $\Delta M$<br>EV | -11.3<br>-\$173.5<br>(-0.2) | -16.7<br>-\$1147.3<br>(-1.1) |

"Small" Elasticities Scenario: $\sigma_S = 0.5$, $\sigma_{DMC} = 1.0$, $\sigma_T = 2.0$, $\sigma_{KL} = 0.8$, $\sigma_{DMI} = 1.0$
"Large" Elasticities Scenario: $\sigma_S = 1.0$, $\sigma_{DMC} = 2.0$, $\sigma_T = 3.0$, $\sigma_{KL} = 0.8$, $\sigma_{DMI} = 2.0$

Figure 1

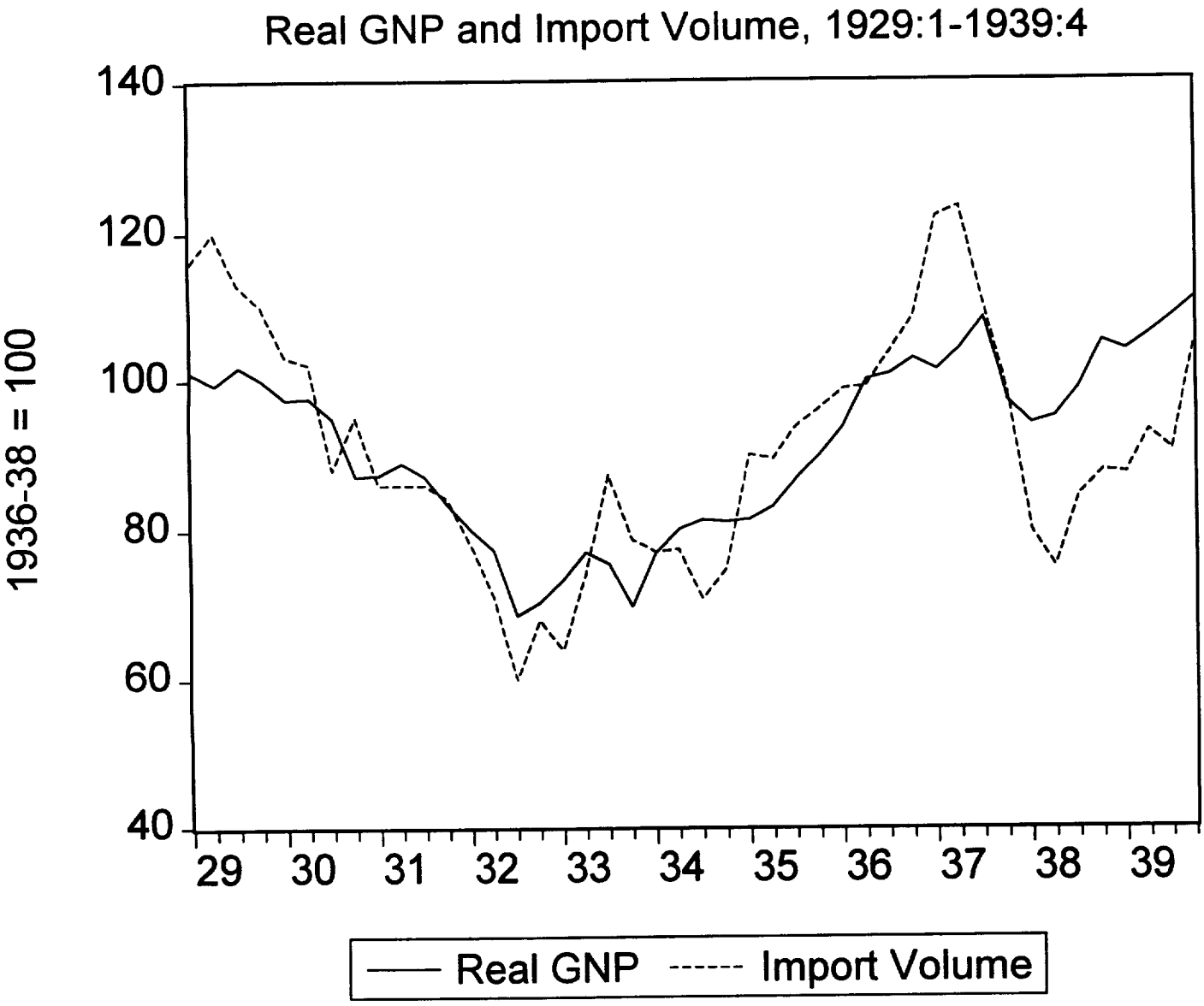

Real GNP and Import Volume, 1929:1-1939:4
1936-38 = 100
140
120
100
80
60
40
29
30
31
32
33
34
35
36
37
38
39
Real GNP
Import Volume

Figure 2

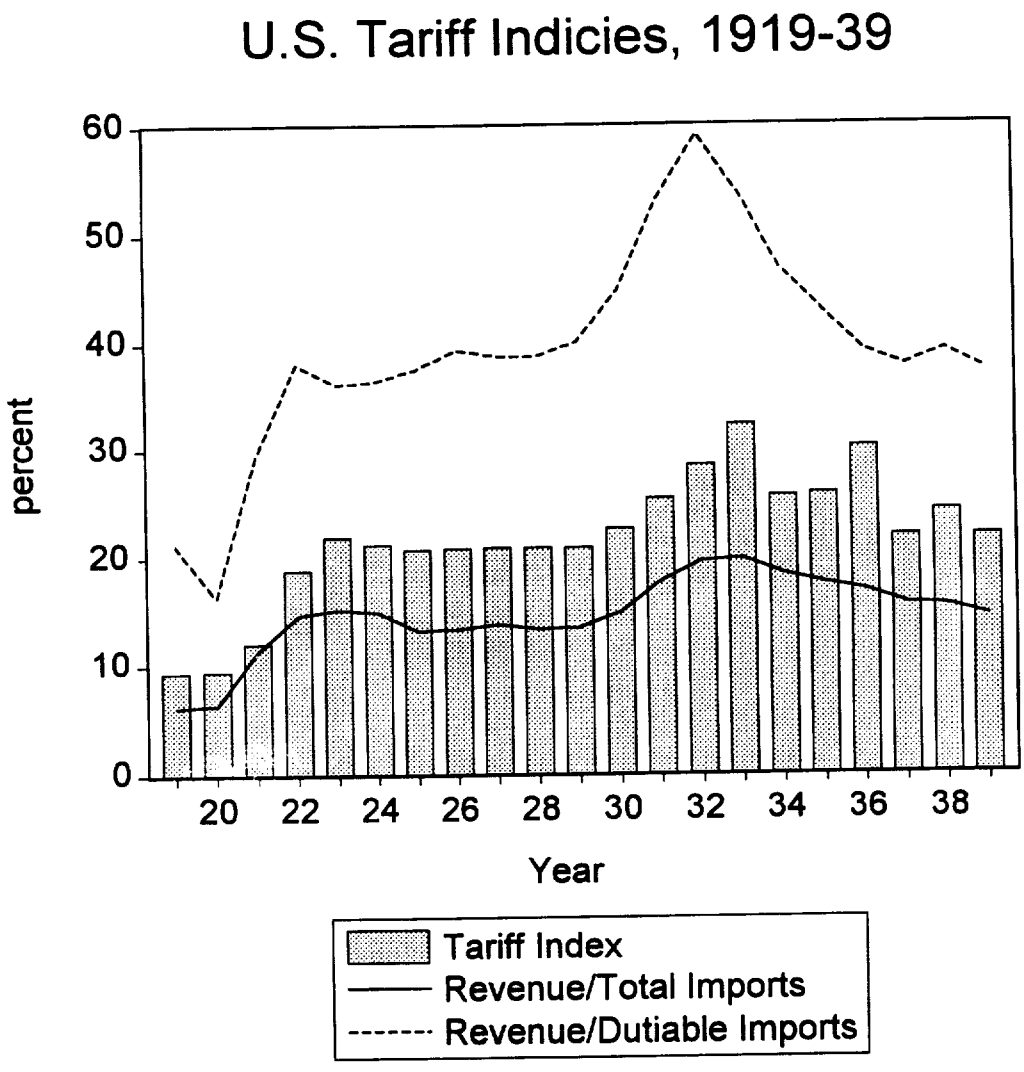

U.S. Tariff Indicies, 1919-39
60
50
40
30
20
10
0
percent
20
22
24
26
28
30
32
34
36
38
Year
Tariff Index
Revenue/Total Imports
Revenue/Dutiable Imports

Figure 3

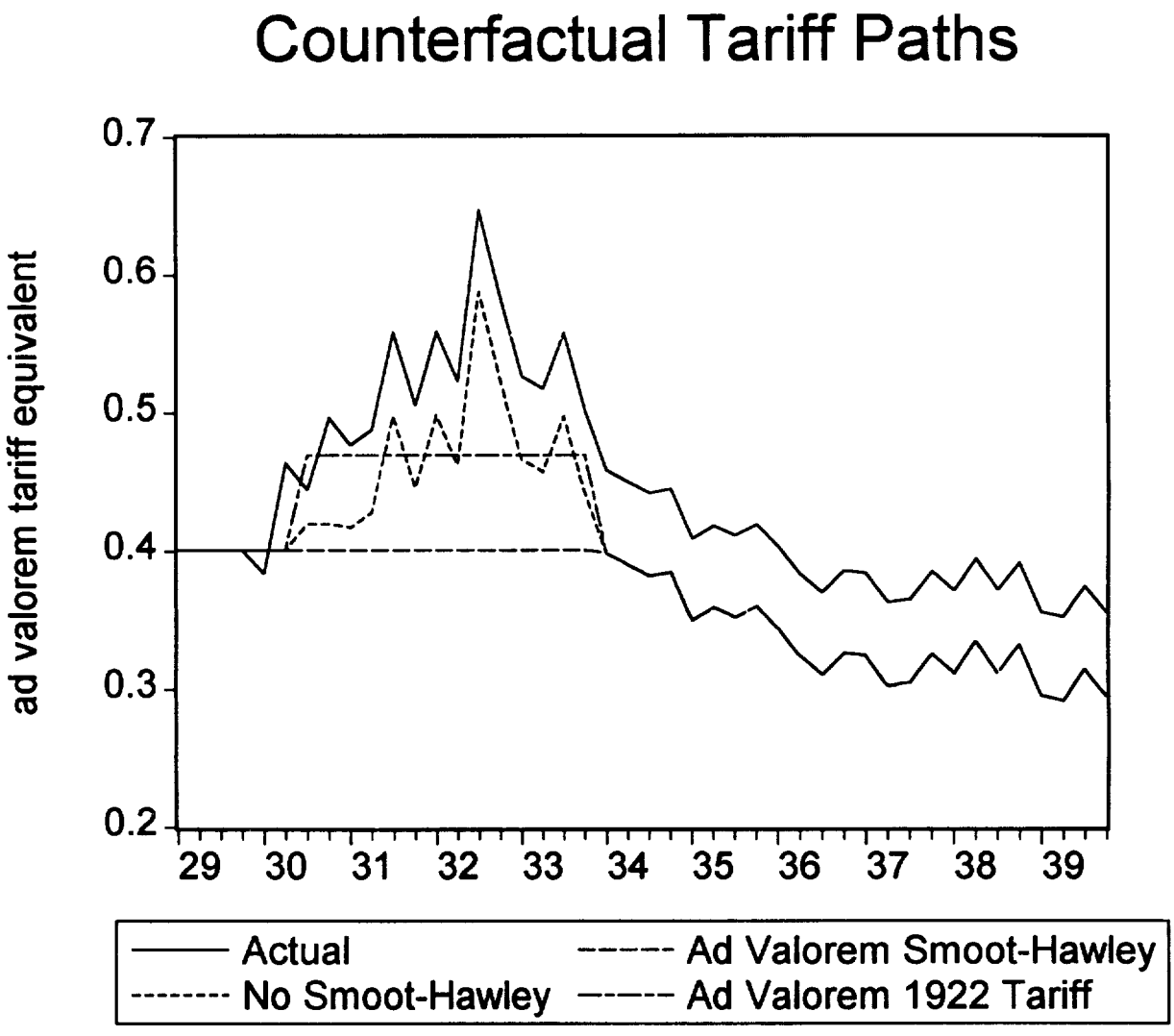
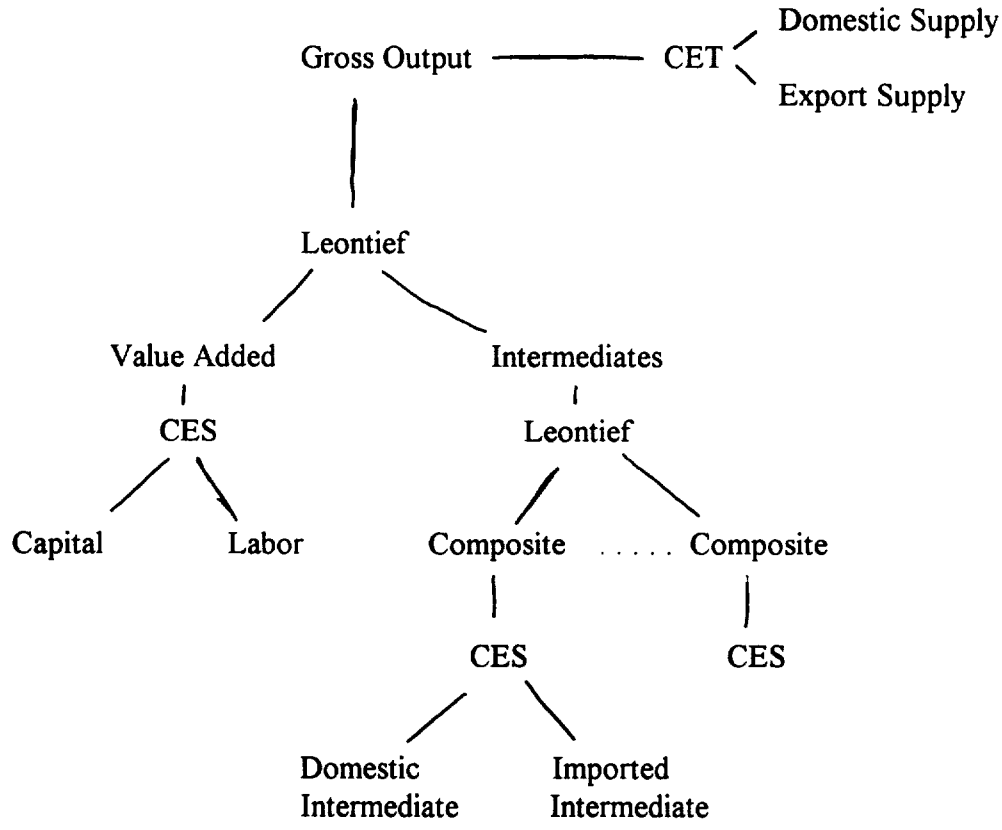
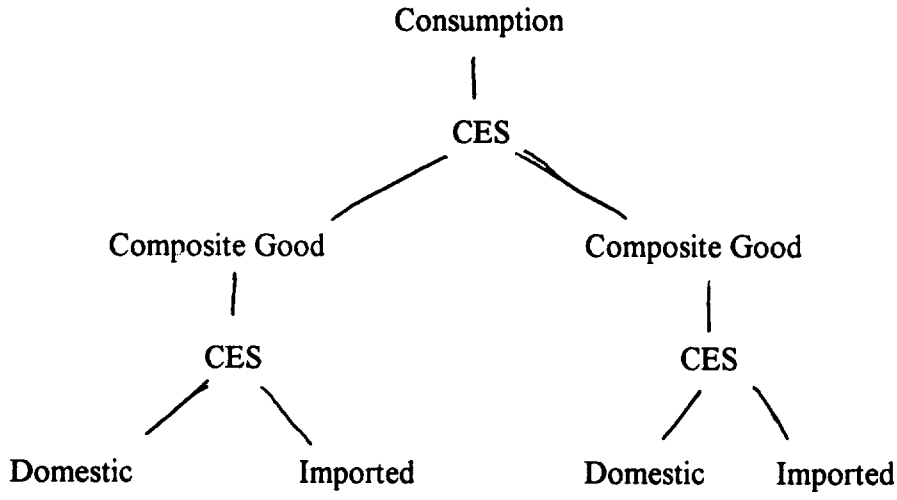

Counterfactual Tariff Paths
ad valorem tariff equivalent
0.7
0.6
0.5
0.4
0.3
0.2
29
30
31
32
33
34
35
36
37
38
39
Actual
Ad Valorem Smoot-Hawley
No Smoot-Hawley
Ad Valorem 1922 Tariff

Figure 4: Structure of the General Equilibrium Model

A. Production




B. Consumption



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