Dear Mr. Mead,

Please forgive me for having taken so long to return your paper. I wanted to read it very carefully and to make rather extensive comments before sending it back and other things have taken much of my time recently so that it is only now that I can get to it. I have read the paper with great interest and great care. The subject matter is central to one of the most important sections of my thesis. Although I have already done considerable work on it, I feel that your paper has contributed a number of new insights and new ideas which I can put to good use. It has also caused me to do a lot of thinking about my own work, for in a number of ways we have approached a common problem in different ways. In the process of trying to reconcile what you have done with what I did I have had to do quite a bit of integrating of loose ends in my grasp of the problem, which, of course, has been very profitable to me.

Because you have invited comment, and because you were good enough to lend me your paper, I will make a number of critical remarks about your treatment. My comments on this score are rather lengthy but I don't want you to feel that I have been only searching for weaknesses in your paper. I found it highly interesting. This was particularly so in the empirical sections. On the whole it is very original, imaginative, and well written.

My own interest in the problem is derived from my thesis problem which is to determine what the effect of changes in the American tariff under the Reciprocal Trade Agreements Program has been on imports from Canada. The portion which is directly related to effective protection begins with a conventional discussion of the difficulty of measuring the height of tariffs. I then derive a functional relationship between tariffs and prices from which one could, if the functions were known, find out how much the tariff keeps out and what the domestic and foreign prices and outputs would be without it. Then, I break supply functions into the cost of materials and the value added component, and discuss the concept of effective protection in the Barber sense. Finally, I discuss the limitations of this kind of functional analysis in terms of its simplified assumptions (income effects are not included) and in terms of the difficulties of empirically identifying functions in the real world.

I turn now to a critical discussion of your paper. I have two basic comments to make. Of these only the first is of major importance.
I. Effective protection is defined by you (p 16) as "a measure of the amount by which the tariff structure permits a producer's manufacturing costs to exceed those of a hypothetical non-protected manufacturer of the same article and still compete equally well with imports." In elaborating this approach, you, like Meade and Barber, proceed with a special type of partial equilibrium analysis. The basic assumption is, when a tariff is imposed, that no prices change save the price of the protected item and that this price increases by the full amount of the duty. Since this is so only in a special case, I feel that this is an inadmissible assumption except for very rough approximations.* Tariffs are a price phenomenon, and their effects should be studied with the theoretical apparatus of price theory. Thus, it develops that the price of a commodity after a tariff is imposed will generally be higher than the price before the tariff by less than the amount of the tariff. Then, the amount of effective protection will generally be greater than would be the case if the domestic price increased by the full amount of the duty. These ideas are spelled out below.

The change in price after a tariff, even in partial equilibrium analysis in which demand and supply are functions of only one variable - the price of the commodity in question, is dependent upon on four functions; the domestic supply function, the domestic supply function, and the corresponding two functions for the rest of the world. Haberler and Ellsworth demonstrate this in their respective books. A mathematical relationship expressing the price of any commodity as a function of the tariff levied on it can be derived.

if: \( f(p) \) is the demand function of the importing country
\( g(p) \) is the supply function of the importing country
\( r(p) \) is the demand function of the rest of the world
\( s(p) \) is the supply function of the rest of the world

the existing tariff is \( t \), and the change is \( \Delta t \)

the prime symbol indicates the first derivative with regard to price

then: in the case of a specific duty, \( t \) dollars,

\[
\int dp = \int \frac{1}{f'(p) - g'(p)} \cdot \frac{r'(p-t)}{r'(p-t) - s'(p-t)} + 1
\]

in the case of an ad valorem duty, \( t \) percent

\[
\int dp = \int \frac{p}{(1+x)(f'(p) - g'(p) + \frac{t}{1+x})} \cdot \frac{r'(p-t)}{r'(p-t) - s'(p-t)} + 1
\]

* to some degree you do recognize changes in raw material costs (p 15) but the idea is not developed fully.
where the prime symbol indicates the first derivative with respect to price, and

t is the specific or ad valorem tariff before any change.

Although these equations appear formidable, they are actually easy to derive. The fundamental relationship is the equality between imports and exports of the commodity on which the tariff is changed both before and after the change.

\[
\Delta \text{Imports} = \Delta q_2 - q_1
\]
\[
\Delta \text{Exports} = \Delta q_4 - q_3
\]
\[
\text{out} \quad \Delta q_2 - \Delta q_1 = \Delta q_4 - \Delta q_3
\]

\[
\Delta q_2 = \Delta p f'(p)
\]
\[
\Delta q_1 = \Delta p g'(p)
\]
\[
\Delta q_4 = (\Delta p - \Delta t) \cdot s'(p-x)
\]
\[
\Delta q_3 = (\Delta p - \Delta t) \cdot r'(p-x)
\]

The appropriate substitutions then yield the solution. As written, the absolute values for all symbols are used. Once the various functions are empirically derived, and actual tariff values are used, the equations yield numerical solutions, telling by how much a given tariff change will change the price in the importing country. Then the changes in quantities produced and demanded as a result of the tariff change can be determined.
The four functions can also be summarized as a pair of excess functions. This is actually the most convenient way of regarding them for purposes of geometrical exposition. Your case, in these terms, is actually the special case where domestic excess demand is absolutely inelastic. Only then does a tariff affect the price by the entire amount of the tariff without changing the amount produced or demanded. Of course, the domestic price will always exceed the foreign by the amount of the tariff, but the level of effective protection varies with the repercussion of the tariff on prices. For example, if the costs of materials are the same to domestic and foreign producers and we assume that these costs are not affected by the imposition of a tariff on the end product, then we may write (abstracting from transport costs):

<table>
<thead>
<tr>
<th>Foreign prices</th>
<th>Domestic prices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>before tariff</strong></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>50</td>
</tr>
<tr>
<td>Value added</td>
<td>50</td>
</tr>
<tr>
<td><strong>after tariff of 10 dollars is levied</strong></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>50</td>
</tr>
<tr>
<td>Value added</td>
<td>47</td>
</tr>
</tbody>
</table>

and effective protection equals 10/47

Once the importance of foreign demand and supply functions in contributing to the level of effective protection is recognized, then I think that the Barber and Meade approach has advantages over yours. First, by comparing domestic and foreign producers, their approach makes explicit what is far more implicit in your approach. Since you would also have to consider the foreign repercussions in order to get an exact solution, your approach has no advantage on this score. Second, their approach can as readily as yours be adapted to consider differing raw material costs. Third, I do not believe that your approach can avoid the difficulties of reckoning with transportation costs. These costs, together with the supply and demand functions, determine the exact equilibrium prices and outputs at home and abroad at any given level of tariffs. Adjustment when tariffs are changed must be considered as taking place from this initial position which was determined partly from by transportation costs. Inevitably, they affect the outcome.
To put the matter somewhat differently, on p 17, for example, c is not equal to l.la because of the 10% tariff, for the tariff will generally not succeed in raising the duty-free price by the full amount of the duty. Actually c would lie somewhere between a and l.la. We don't know by how much the 10% duty will raise the price of raw material without knowing the domestic and rest of world supply and demand functions for the raw material. Suppose that we can identify the four functions. With these, we could determine the price, a. We would look up the prevailing domestic price, which includes the existing duty. And we would look up the world price.

Knowing the functions and our starting position on them, we could assume the removal of the duty and arrive at the price, a. On the other hand, we could just as readily determine the transportation costs. Under ideal competitive conditions, these are equal to the difference between domestic and world prices minus the tariff.

And, if we know the transportation costs, it is much easier not to introduce hypothetical producers. Having recognized the relevance of four functions we know that the duty free and protected situations are actually two different equilibrium situations with differing world prices, and outputs. We could still ask by how much protected manufacturing costs can exceed hypothetical free trade manufacturing costs and still be equally competitive with imports. We would then have to consider two different equilibrium situations. It seems more relevant, to ask, rather by how much at the existing equilibrium, the tariff structure allows domestic costs to exceed the foreign. There we would deal only with one equilibrium situation. In fact, you do slip into this latter usage in your discussion in the first paragraph of p 21, particularly in the last sentence. I conclude that the notion of hypothetical domestic producers is unnecessary, makes the analysis more complex, and leads us to a question which may not be the one we are most interested in answering. Once transport costs are known, the question as I have asked it can readily be answered. We can determine the total amount by which the tariff and transport costs allow domestic manufacturing costs to exceed the foreign, and we can determine the amount of the total effective protection which is contributed by each of these two factors.

II. You say on p 24 that "the man who buys one unit of tariff free steel, adds another unit of value of manufacturing and processing, and sells a motorcycle protected by a 10% tariff is receiving 20% effective protection on his manufacturing process whether the tariff on parts is 0 or 50." This statement is not quite accurate although its main point is true. Consider the following example.

Let material costs in domestic and foreign countries be $x$.

- let material costs in the foreign country be $x$
- let material costs in the domestic country be $y$
- assume no transport costs

<table>
<thead>
<tr>
<th>foreign country</th>
<th>domestic country</th>
</tr>
</thead>
<tbody>
<tr>
<td>material costs</td>
<td>$x$</td>
</tr>
<tr>
<td>value added</td>
<td>$y$</td>
</tr>
<tr>
<td>total cost</td>
<td>$x + y$</td>
</tr>
<tr>
<td>$\text{tariff is 10% on the final product}$</td>
<td>$x + y$</td>
</tr>
</tbody>
</table>

$\text{Effective protection} = \frac{\text{domestic value added} - \text{foreign value added}}{\text{foreign value added}}$

$$\frac{x - \frac{9x}{1.1}}{\frac{9x}{1.1}} = 2 \quad = 22.22\%$$
The manufacturer would receive exactly 20% effective protection if it were the case that he contributed a value exactly equal to material costs before the tariff was levied,

thus before the tariff

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>material costs</td>
<td>$x$</td>
</tr>
<tr>
<td>value added</td>
<td>$x$</td>
</tr>
<tr>
<td>total price</td>
<td>$\frac{2x}{y}$</td>
</tr>
</tbody>
</table>

after a 10% tariff which has no effect on raw material costs

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>material costs</td>
<td>$x$</td>
</tr>
<tr>
<td>value added</td>
<td>$y$</td>
</tr>
<tr>
<td>total price</td>
<td>$2x(1 + 20%)$</td>
</tr>
</tbody>
</table>

therefore $y$ equals 1.2 $x$

and effective protection equals 20%

In conclusion, I want to say again how much I have benefited from reading your paper. These criticisms should not detract from its overall worth, or obscure my respect for the imagination which it so abundantly shows. My own experience in this field has convinced me that it is extremely difficult both theoretically and empirically. And I am far from certain that I will be able to advance matters significantly.

I hope that we may meet someday. Again, many thanks for having sent me the paper.

yours sincerely,

Gerald A. Pollack