Does Trade in Intermediate Goods Alter the Logic of Costs From Protectionism?

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With a sharp rise in protectionism looking like a real possibility for the first time in generations, one big question is how bad the consequences might be. There is very little dispute among economists over the proposition that a trade war would make the world poorer; but how much poorer?

Conventional trade models actually suggest that the cost would be relatively modest. Consider a country facing given world prices. A tariff raises the internal price of imports above the world price, leading to lower imports; this is costly because importing $1 less (at world prices) from abroad saves the nation only $1, but the domestic benefits from that foregone import would have been $(1+t), where t is the tariff rate. So the loss from a $1 reduction in imports is $t. To get the total cost of protectionism, imagine summing up the losses from a series of small tariff increases, starting at t=0. What you'll get is a "Harberger triangle," and the overall loss from protectionism is approximately 0.5*t*ΔM, where ΔM is the total reduction in imports from protection.

If you apply this logic to more or less plausible trade war scenarios, they indicate losses from even a quite serious trade war of only a low single-digit percentage of GDP. The average county now has imports equal to [about 30 percent of GDP](). Imagine global tariffs rising to 25 percent,

and cutting world trade in half. Then the loss for the average country would be half the tariff rate – 0.125 – times the fall in imports – 15 percent of GDP. So we get 1.875 percent of GDP losses. And this is, of course, for a trade war that reduces all trade by half; a more limited trade war, such as one that leaves intra-NAFTA and intra-EU trade intact, would have substantially smaller costs.

But my sense is that many economists are unwilling to accept such relatively low estimates. One argument I've been hearing in particular is that such calculations neglect the changed nature of trade, much of which is now in intermediate goods. Protectionism, this argument goes, will disrupt supply chains and hence reduce productivity, implying much larger costs than the Harberger triangle catches.

This argument sounds plausible, and to be honest as an opponent of Trumpian trade war I would like to believe it. And some academic papers, notably Melitz and Redding (2014) seem to support that view, although Melitz and Redding pose their question as gains from trade rather than costs of protection. My intuition was, however, that this couldn't be right – that absent some kind of market distortion the marginal value of an imported good to the economy must be its internal price, regardless of whether it is a final or intermediate good.

What I want to do here is use a simple model of two-stage production with intermediate imports to show that value chains do not, in fact, offer an argument for increased costs of

protection. Again, I don't have a policy agenda here, and in fact would prefer to believe the opposite; I just want us to think about these issues clearly.

So here we go. Imagine a country that uses labor and imported goods to produce an intermediate good, which is then in turn combined with imports to produce a final good that can either be consumed or exported. (By setting things up this way, we avoid having to specify a utility function.) We can write the production function for the intermediate good:

(1) $N = N(L, M_N)$

where L is labor and M_N is imports of intermediate goods used in production of N. We can also write the production function for the final good:

(2) $F = F(N, M_F)$

where M_F is imports for production of that final good.

The final good can be either consumed or exported. Assume world prices are given; we can avoid extra notation by choosing units so that the world price of the final good, and the prices of both kinds of imports, is 1. In that case, balanced trade requires that exports of the final good equal imports, so that domestic consumption of the final good – which is the same as welfare in this model – must obey a budget constraint:

(3) $C_F = F - M_N - M_F$

We suppose, however, that this country levies a tariff at a rate t on all imports. This means that the internal price of imported goods is higher than the world price; since we've set the world price at 1, the internal price P_M is 1+t. Let's also define P_N as the price of the domestically produced intermediate.

Assuming competitive markets, we get three first-order conditions, reflecting the requirement that each input be employed up to the point where its marginal value product equals its price:

(4) $P_N = \dfrac{\partial F}{\partial N}$

(5) $P_M = \dfrac{\partial F}{\partial M_F}$

(6) $P_M = P_N \dfrac{\partial N}{\partial M_N}$

Note that the price of F is set at 1, but the price of N is determined internally.

Now we can ask about the welfare effects of an increase in the tariff rate t, as measured by the change in consumption C_F. You might think that we need to solve for the change in imports and so on – but in the current context that's not necessary, since our only question is whether the conventional formula that the welfare cost of a small tariff increase is t*dM continues to hold.

Given the budget constraint (3), we must have

(7) $dC_F = dF - dM_N - dM_f$

But

(8) $dF = \frac{\partial F}{\partial N}\frac{\partial N}{\partial M_N}dM_N + \frac{\partial F}{\partial M_F}dM_F = P_N\frac{\partial N}{\partial M_N}dM_N + \frac{\partial F}{\partial M_F}dM_F$

And using the first-order conditions, this becomes

(9) $dF = P_M\,(dM_N + dM_F)$

(The marginal product of an additional unit of imports is equal to its internal price in both sectors.) But remember that P_M = 1+t. So the welfare effects of a tariff change are

(10)　　　$dC_F = t(dM_F + dM_N) = t * dM$

which is the conventional result for models without trade in intermediate inputs.

So value chains in trade don't really change the logic behind the costs of protection. This should, perhaps, have been kind of obvious: again, the value of an imported good to the

economy is its internal price, whether it's going directly to consumption or being used as an input into production, so the cost of forgoing that import is the wedge between the internal price and the world price. But enough people got hung up on questions about productivity (which this analysis handles *en passant*) that I think it was necessary to go through this exercise.

Does this mean that the Harberger-triangle-type analysis saying that the costs of a trade war aren't all that high is right? No. We could introduce various kinds of market distortion that might change the result. But trade in intermediate goods, per se, doesn't change the story.

REFERENCES

Marc J. Melitz & Stephen J. Redding, 2014. "Missing Gains from Trade?," American Economic Review, American Economic Association, vol. 104(5), pages 317-21, May.