Stolper-Samuelson is Dead
And Other Crimes of Both Theory and Data

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This conference asks what impact globalization has on poverty. What role are theorists to play in these discussions? A temptation is simply to write yet another model using newer and cooler techniques drawn from other fields. We are skeptical about whether this is what the world really needs (at least at the moment). In this, we are on the side of Descartes, who in his *Discourse on Method* enjoins the researcher to proceed from the simple to the complex. We think that we need to start with the absolutely simplest models that we can and add complexity only as persistent empirical evidence forces us to do so. At least as a starting point, H_0 should not be too complex.

Having argued that we should start with very simple models and add complexity only as necessary, let us head the other direction and critique our fixation on the predictions of the simplest models. Models exist to make a point. Just as a toy hammer prepares a child to use a real hammer, our toy models provide us with insights that will be immensely useful when we turn to more complex problems. But when we need to pound in a nail, we don't want to use a toy hammer. And we should be equally cautious spending all of our time testing toy theories or interpreting the data in terms of these theories. We shouldn't ignore them, discard them, or least of all mutilate them. But we do

[1] The views expressed in this Working Paper are those of the authors and do not necessarily represent those of the IMF or IMF policy.

need to ask what the deep lesson is from the simple models and how one should go about using this insight in a more complex setting.

For theorists, this poses a clear problem. As we will see below, the data keeps pushing us toward a world much less tidy than the elegant one where we spend most of our time theorizing. Why can't we live in a world more amenable to crisp models? For the data analyst, it likewise poses a problem. How do we make use of the real insights of the simple models in a world more complex by far?

One of the difficulties in reading empirical analyses for someone of theoretical proclivities is that the models under study are frequently alluded to only vaguely. What are the competing models of the world? What would lead us to believe one rather than another? When the prediction of one model is hard to find in the data, what are we to believe about the world? Too often one can't find a clear discussion.

Even if we trim down considerably the question of "globalization" and "poverty" to examine the relation between openness and wages, this is still a vast field with many different questions and difficult problems. What is the impact of liberalization by one country on wages of various groups in that country? What is the impact of liberalization by a large number of countries? What is the impact of different types of liberalization on wages? The approach that you would want will depend importantly on which question you want to answer.

Let's think for a while about the trading system as a whole. What model do you want to have in mind of the determinants of world trading patterns when we do this? Because we are now talking about world general equilibrium, we should realize that there are as many different potential models as there are models of any element of the

economy. Trade economists spend most of their time working with just a small set of these when considering questions of trade patterns - Ricardo, Heckscher-Ohlin(-Vanek), specific factors, monopolistic competition, economic geography, dynamic models of accumulation, growth, and trade, and models of trade and technical change. If we ask which of these are relevant to the world we live in, surely the answer is – all of them! The question should rather be to establish in which contexts each is helpful and to establish magnitudes.

There are theory crimes and there are data crimes. Sometimes we manage both at the same time. We commit theory crimes constantly – toy models are entirely in the realm of theory crimes. But they are misdemeanors in the service of higher ideals, namely developing our intuition about the workings of the models. Theory felonies occur when we are so entranced by the elegance of our toy models that we lose sight of the question we are trying to answer, indeed come to believe that we have provided an answer even when clearly central aspects of the problem are addressed inappropriately.

A prime example is the Stolper-Samuelson theorem. The year 1991 marked the 50th anniversary of the publication of the article by Wolfgang Stolper and Paul Samuelson that provided the first statement and proof of the Stolper-Samuelson theorem. In honor of this golden jubilee, international trade economists at the University of Michigan organized a conference in honor of this celebrated theorem. One of the highlights of the resulting volume was the original letter from the Editor of the *American Economic Review*, which praised the paper for it's "brilliant theoretical performance" but nonetheless rejected it for publication on the basis that it does not "have anything to say about any of the real situations with which the theory of international trade has to concern

itself." The conventional view of this referee report is that it is a howler, a monumental gaffe, a high water mark on the seas of academic idiocy. Yet the present paper will argue that, in one of the theorem's central applications, the referee report got it about right.

It is time to declare Stolper-Samuelson dead. A theorem, of course, is immortal. It is a logical relation that existed before there were humans and will survive them, just as surely as the theorem of Pythagoras. And the Stolper-Samuelson theorem has the hallmarks of great economic theory: an issue of great substantive importance, elegant analytics and surprising results. Yet an enormous problem arises when we try to apply the Stolper-Samuelson theorem, unthinkingly, specifically to the question of the consequences of trade liberalization for the poorest or least skilled in poor countries. In this context, Stolper-Samuelson has become a central reference point, indeed a mantra, a totem: "Stolper-Samuelson says that trade liberalization will raise the real income of the abundant (unskilled) labor in poor countries." Stolper-Samuelson, *qua* theorem, is not wrong, of course. But if we use it, as we so often have, as if it provides a reliable answer to this question of real human significance, then it is worse than wrong – it is dangerous.

Of course, the fact that the Stolper-Samuelson theorem fails to be robust to theoretical departures from its core assumptions is not news. Hence we will spare the reader a catalog of alternative theoretical assumptions that vitiate Stolper-Samuelson. Rather, we hope to appeal to a selection of recent empirical work on the part of trade economists that suggests that the conventional way of thinking about applying Stolper-Samuelson is hopeless.

A Primer on Issues with Stolper-Samuelson

The aim of this section is to give trade and non-trade economists a simple common language both to understand the insights of Stolper-Samuelson and also to understand its shortcomings as a tool for examining the problems of trade liberalization in developing countries. To do so, we will aim to develop a transparent exposition of the Stolper-Samuelson theorem, add some amendments that build our intuition about dimensions of robustness of the theorem, but also steer the conversation toward the dimensions in which the *practical or real world* use of the theorem breaks down.

Consider the case of a country which is small in the world market for two goods, X and Y. For simplicity, assume that X and Y are produced with fixed coefficient technologies in the two inputs, say skilled and unskilled labor (H and L). Perfect competition is assumed to reign in all goods and factor markets and there are no geographical or sectoral barriers to mobility within a country. Let X be the skill-intensive good. Assume that *both goods are produced in this country in equilibrium* (Figure 1).

Under these conditions, price must equal unit cost. For the Y sector, this is easily written as:

$$P_Y = w_H a_{HY} + w_L a_{LY}$$

If we want to graph this in factor price space, we simply get:

$$w_H = \frac{P_Y}{a_{HY}} - \frac{a_{LY}}{a_{HY}} w_L$$

This is a simple linear equation with slope equal to minus the inverse of the skill intensity. Equivalently, the skill intensity is given as the slope of the normal to the unit cost curve (so the “flat” line is that of the skill-intensive X sector).

Even before we establish equilibrium factor prices, there are lessons to be learned here which are more general than the framework we are using. The first is that we need to

pay attention to which goods price we are looking at – namely the domestic price. Second is that here this price gives us the revenue available to pay domestic factors of production. If the domestic price falls, *and the good continues to be produced under the same technology*, then some factor of production must receive less in compensation. If we think we see a good produced before and after a drastic trade liberalization, but can't seem to find any factor that has had more than a trivial change in its factor return, then we had better look again. One possibility is that the goods on which we liberalized trade are not really the same as the goods we are producing, so had a zero or negligible effect on domestic prices of the goods we do produce. A second possibility would be some kind of "induced technical change" in which the unit input coefficients fall with liberalization so that wages can be maintained. If this change in the apparent unit input coefficients represented increased effort, then one should be cautious to note the losses in real income implied by the disutility of the added effort.

With the relative goods price and technology given exogenously, the single competitive cost condition above is insufficient to determine two factor prices. However, these can be determined given the corresponding unit cost condition for X:

$$w_H = \frac{P_X}{a_{HX}} - \frac{a_{LX}}{a_{HX}} w_L$$

Positive production of both goods requires that the associated zero profit conditions intersect in the non-negative orthant of factor price space and that the country's endowments lie in the range spanned by the two goods' factor intensities. For now we assume this to be true. Then the factor prices are determined by the intersection of the two zero-profit lines, i.e. consistent with price equal to unit cost in both sectors.

The conventional argument that the unskilled in poor countries will benefit from trade liberalization requires just a few more steps. Assume that the poor country is an exporter of the unskilled intensive good and importer of the skill intensive good. Then $P_Y = P_Y^*$ and $P_X = (1+t) P_X^*$. Removal of the tariff lowers the *domestic* price of the skill intensive importable X without affecting that of the exportable Y. The reader can easily convince herself, based on this diagram or simple algebra, that the skilled wage falls in terms of both goods and the unskilled wage rises in terms of both goods (Figure 1).[2] This is the source of the conventional statement that "trade theory" suggests that liberalization will raise the wages of the unskilled in unskilled abundant countries.

Before moving on to critiques of this, we touch on a couple of additional topics. One is the role of non-traded goods. In this conventional setting, the prices of traded goods have already established the two factor prices (assuming both traded goods are always produced) as a function of the two domestic traded goods prices. Given these factor prices, cost minimization determines the price of non-traded goods, hence the demand in the non-traded sector, and local supply meets exactly that demand. Local demand shocks for non-traded have no affect on the equilibrium price of non-traded goods (i.e. are met with a pure supply adjustment) so long as both traded goods continue to be produced. Hence a long tradition by trade economists of ignoring non-traded sectors – which are typically the majority of output! – in discussions of trade and factor prices.

We now introduce the concept of a non-competing good. Up to now we have assumed that there is local production of all goods that are internationally traded. What

[2] The simplest way to see this graphically is to note how far the skilled wage would have fallen if the proportional decline in the price of X had fallen proportionally on both factors. Since equilibrium skilled wage with active production of both goods falls further yet, clearly the real wage has fallen in terms of both goods. Correspondingly, the new equilibrium features a higher nominal unskilled wage here, hence also real wage, since the price of Y is unchanged and that of X fell.

happens if there is some good Z that is produced elsewhere (continue assuming we are small in world markets), but consumed here. We can call Z a non-competing good because there is no local production and (by assumption) changes in tariffs on Z do not affect domestic prices of goods we do produce. In this case, the removal of a tariff on Z is a pure source of consumption gain for our consumers without affecting the product wages of skilled and unskilled in terms of X and Y. Both factors have higher real wages.

It is easiest to introduce the idea of intermediates here in a model in which the intermediate is a non-competing good that also enters with a fixed coefficient (say one unit of intermediate per unit of output, say in the X sector). As before, let $P_X = (1+t) P_X^*$ be the domestic price of the importable good. But now allow for an imported intermediate with price P_Z^* subject to a tariff t_Z. Then the domestic price must cover both payments to factors and the cost of intermediates, hence we must amend the zero profit condition of X to read:

$$(1+t)P_X^* = w_H a_{HX} + w_L a_{LX} + (1+t_Z)P_Z^*.$$

That is, the domestic price now must suffice to pay both domestic factors plus the tariff-inclusive price of intermediates. Rearranging, this also yields:

$$(1+t)P_X^* - (1+t_Z)P_Z^* = w_H a_{HX} + w_L a_{LX}.$$

The left hand side is now the per unit revenue associated with producing X, net of payments for intermediates, that can be used to compensate domestic factors. The important point to note is that *t*, the tariff on the domestically produced final product, and t_Z, the tariff on the imported intermediate, enter with opposite signs. A tariff on imports of the final good is protective (yields more revenue to compensate domestic factors per unit output); a tariff on imports of the intermediate import is anti-protective (yields less

revenue to compensate domestic factors per unit output). Or most simply of all, for an import competing producer, a tariff on final output is good news, while a tariff on intermediates is bad news. (Of course, if Z is steel and X is autos and both are domestically produced, then a tariff on Z is protective for steel but anti-protective for autos in the sense outlined here.). Figure 2 shows that the reduction in tariff on the intermediate good Z shifts the unit-cost curve outwards (since given the price of X, for each value of w_L, w_H will have to rise), unlike the reduction in tariff on final good X. This would lead to an increase in the returns to high-skill labor, and a decrease in the returns to low-skilled labor and hence an increase in wage inequality. Thus, it is possible that trade liberalization benefits the skilled labor in poor countries if liberalization takes place in the intermediates. The effect is exactly opposite to that shown in Figure 1.

Nearly all of the theoretical elements of the Stolper-Samuelson framework are reasonable objects of scrutiny. We will emphasize some more than others, not because they are the only important ones, but because based on existing models and data work in international trade, these seem to be the most troublesome elements. No doubt other elements will need to be added later. I will especially emphasize those relevant for people who would like to do empirical work on trade liberalization in poor countries. I'll postpone until later speaking about imperfections in goods and factor markets, though these are also surely present in developing countries, because many very significant problems emerge for Stolper-Samuelson without worrying about these.

In thinking about problems of international trade, and specifically in thinking about Stolper-Samuelson, there is above all one whirlpool to which the siren song calls most strongly both to theorists and empiricists. This is the question of aggregation, most

importantly here, the aggregation of goods. When we say that Stolper-Samuelson suggests that the unskilled in poor countries will benefit, the underlying model we have in mind is that we have two sectors, a skill (or capital) intensive importables sector and an unskilled intensive exportables sector. In this world, indeed, the only potentially relevant tariff will be on the skill intensive importable which is also produced locally, hence lower its domestic price, and yield precisely the effect conventionally described.

We have already alluded to many of the problems that may arise, both in theory and data analysis, from thinking about our problem in these highly aggregated terms. There may be final goods that are non-competing, hence enter our consumer price index but don't affect our product wages. If there are many such goods, it may be that some of these are more skill intensive than the goods we produce and some may be yet more unskilled intensive than the products we produce. In data analysis, changes in tariffs on truly non-competing goods should be ignored in terms of effects on product wages. Unfortunately, the industry and tariff data that we have access to doesn't provide any way to distinguish between goods that compete with local production from goods that don't. We will see below that this is a potentially important problem for data analysis.

When we add to the case of more than two goods also the possibility that there are more than two countries, we encounter another type of problem. Even if we can continue to speak of our country as "unskilled abundant" in global terms, and if we can continue to speak of it producing two goods, it no longer follows which good will be the exportable. As we will develop in more detail below, the pattern of trade will depend on a country's "local" rather than global factor abundance. That is, we need to be able to compare the country's factor abundance to others that produce the same sets of goods. Importantly, in

our context, it is possible that it is tariffs on the unskilled intensive good that is binding and it is thus possible that trade liberalization lowers the price of the unskilled intensive good produced locally, hurting those at the bottom of the ladder. In this type of world, trade is almost certain to hurt those at the very bottom of the ladder in some countries (unless the reduction in the CPI from drops in tariffs on non-competing goods sufficiently compensates for the fall in the real product wage).

The problem of aggregation of goods strikes again when we consider traded intermediates. We know that a large share of trade is in intermediates, rather than final goods. As sketched theoretically above, tariffs on intermediate products used in an industry must be treated differently than tariffs on final outputs produced locally – indeed enter with the opposite sign in the using industry. It is at least disconcerting, then, that much of the literature on trade liberalization and wages in developing countries either ignores the question of imported intermediates or provides poor documentation of how it has been addressed. We are at least left worried about how to interpret results.

Do Rich and Poor Countries Produce the Same Goods?

By now there is overwhelming evidence that, whether at the level of industries used in a great deal of empirical work, or even at very fine levels of disaggregation at which tariffs are applied, the goods in the import basket are often quite different from the domestically produced goods. They differ *systematically* in the factor input composition and they differ *systematically* in quality. Contrary to the way that we tend to treat them in both theoretical and data analyses, they are not perfect substitutes for the domestically

produced goods. Often it may be more appropriate to think of them as non-competing goods.

Let us spend a little time elaborating on this problem of aggregation. One area in which the problem of international aggregation of goods arose is in discussions of factor price equalization and measuring the factor content of international trade. In a pioneering study, Bowen, Leamer and Sveikauskas (AER 1987) assembled data on 12 productive factors for 27 countries, calculated factor contents of trade and compared these to predictions based on endowment differences. In calculating these factor contents for the central part of their paper, BLS committed the data crime of assuming that all countries use the US technology matrix (although they also explored some deviations from this). Almost contemporaneously, Dollar and Wolff , and Baumol (1988) were examining correlations between industry factor input ratios and country factor input availability. Assuming that all countries produce the same goods and that there are no problems of aggregation, Rybczynski (or its multi-good multi-factor equivalent) predicts that the correlation should be zero. The actual correlation is much closer to unity.

Davis and Weinstein (2001) revisited the question of Baumol, Dollar and Wolff. Their initial intent was to make adjustments for cross-country productivity differences ignored by BDW and to demonstrate that once this was done, we could have Factor Price Equalization (FPE) adjusted for factor quality. The key idea was that FPE could be consistent with measured factor differences within an industry if that industry contained many goods and capital abundant countries had their within-industry production on average skewed toward the more skill intensive varieties. The key piece of evidence they hoped to provide was to show that the correlation between capital abundance and capital

intensity within an industry arose only in traded goods, where the aggregation issue was more likely, but not in non-traded sectors, in which countries' consumption bundles would need to be much more similar. To their initial chagrin, Davis and Weinstein found that the correlation was essentially as strong in non-traded as traded sectors. This led them (and hopefully others!) to give up on trying to find a way to preserve any variant of "integrated equilibrium" as a useful way of thinking even about the subset of rich countries in the OECD. Moreover, it led them to think about a world with a high degree of specialization within the OECD, and a fortiori across a broader set of countries.

A very similar message emerges from the important work of Schott (2004). His work looks at price data at the most detailed available tariff categories for imports to the US (in later years at ten-digit harmonized system). What he finds is that even at this extremely disaggregated level, there are enormous differences in import prices (across manufacturing industries by a mean factor of *24*) and that the differences are systematically related to levels of development. It may be a matter of semantics whether we want to think of these as differences in quality or simply different goods – or probably more usefully as both. In combination with the earlier work, it strongly warns against thinking about imports as if all goods within a particular category compete closely with domestically-produced varieties.

As we launch further into a discussion of the impact of trade on wages in the South, we have the benefit of a very extended discussion of related issues vis-à-vis the United States (and to a lesser extent Europe). This discussion helped us to learn (or rediscover) quite a bit about the workings of our toy models. However – with a few notable exceptions – I am much less convinced that they told us a great deal about the

impact of international trade on US wages. Indeed, much of the writing had what, after the fact, can only seem to be a great air of unreality attached to them. An example and an important strand of the literature constituted the so-called factor content studies. These started out as empirical exercises which treated the implicit net factor content (often, though not always, using US coefficients) as a net addition or subtraction from the local labor supplies. The empirical studies in turn inspired theoretical work, usually in a two-good context, about the conditions under which such factor content calculations are justified. It was often hard to know whether the greater unreality lay in the fiction that all imports were the same as their domestic counterparts (the assumption in virtually all of the analytic work) or the methods used to calculate factor contents in the rare case that it was noted that imports and domestic goods are often not the same.

While it is easy to lash out at the studies that march forward as if it is fine to pretend that all countries produce the same goods, it is much harder to advise theorists or data analysts quite what they are to do with such an untidy world. Perhaps, though, a first step is to become more aware of the challenges that we face.

The Consequences of Moving to a More Complex World

Having set out our view that one of the great crimes in both the theoretical and data work is the assumption that all countries produce the same goods, let us now spend a little time talking about how this might affect the way that we think about problems of trade liberalization and wages. A more formal discussion of this is in Davis (1996). However we think that a verbal discussion of the results should suffice to make the major points. Following the injunction of Descartes, we will try to talk about this in the simplest

possible framework. Consider a world with a large number of countries, no one of which is large enough to influence world prices. Assume that we are in a conventional Heckscher-Ohlin world in which the two factors are skilled and unskilled labor. Assume that there are many goods and that endowment differences are too large to support factor price equalization. To start, assume all goods are final consumption goods (i.e. ignore intermediates). Again, for simplicity, assume that each of the resulting "cones" is formed by just two goods and that they are produced with fixed input ratios. How will this affect the standard theoretical results from the two-good FPE model and how should it affect the way that we look at data exercises?

The first thing to note is that there are some appealing features of such a model. It matches well with the Davis-Weinstein results on breaks in (adjusted) FPE and is consistent with the Schott results once one notes that our statistical categories have grouped goods of different factor intensities (and possibly also different qualities) within the same industry. Moreover, it helps to make sense of one of the robust features of the data work – namely that even countries that in we think of as (unskilled) labor abundant may protect their most labor intensive activities. In a standard Heckscher-Ohlin world, this would make no sense because this good would be an export, not an import! Here it makes perfect sense if we are looking at countries which are intermediate in labor abundance, since they may be importing goods from countries of both greater and less capital (skill) intensity. Protection of a labor intensive sector by a country that is in global terms itself labor abundant is not an anomaly. One might then need a political economy account of why protection is higher in these sectors, but that is fine.

While there are some appealing features of this model, this does not at all mean that it makes life simple for the researcher. Let's see why. An important fact about such a world is that, as in the standard H-O model, factor prices are determined by technology and domestic goods prices, but it is crucial to emphasize here that the relevant goods prices are those *produced* domestically because the factor prices emerge out of the binding zero profit conditions of producers (and only those goods actually produced locally are relevant). Prices of imports not produced locally can figure importantly in the CPI, hence real wages, but they figure not at all in the product wages paid by producers. Hence when we think about trade liberalization in this context, it is crucial to distinguish between competing goods (those produced locally) and non-competing goods (those imported, but not locally produced). Trade liberalization with respect to competing goods produces quasi-Stolper-Samuelson effects, while such liberalization with respect to non-competing goods provides a pure consumption gain and no Stolper-Samuelson effects.

As noted, this is a huge headache for the empirical researcher. Assuming again that within an industry the statistical agencies have grouped together some goods that are competing and others that are non-competing, then only some of these tariff changes should induce Stolper-Samuelson effects. But the empirical researcher is faced with the problem of deciding which goods are which – not an easy task! In this simple framework, though, theory does allow us to conjecture that the non-competing goods are likely to come from countries very different (in endowments, but probably also in technology) from the country under study.

If we loosen the grip of our analysis just a little here, so countries are not purely small and tariffs on imports not produced locally do substitute (if poorly) for locally

produced varieties, then this might help us to understand another seeming feature of the data exercises – that industry wage premia respond weakly to tariff changes (Blom et. al. study of Brazil and Feliciano, 2001 study of Mexico). While not the perfect setting to discuss this (more below), the basic point is pretty clear: if local political economy dictates the need to raise target factor prices, hence the relevant domestic goods price, and the only available target is a good that substitutes poorly for the local variety, then it will take a very large tariff to raise the price of the local good even a small amount. Taken in reverse, trade liberalization against a good that is a poor substitute for a local variety will affect local factor prices only weakly (because they affect the goods prices only weakly).

While we have been pointing to the evils of ignoring aggregation, thus far we have been focusing on the aggregation of different goods produced by different countries into a common industry category. We have not spoken so much about how the world changes when we allow for a world with large numbers – say, a continuum – of goods produced even within a country. Yet it is precisely in such models that a great deal of the most interesting work has been done. This work finds its foundation in the papers of Dornbusch, Fischer, and Samuelson (1977, 1980). The most important contributions have come from Feenstra and Hanson (1996), Xu (2003), and Melitz (2003).

Feenstra and Hanson (1996) is often discussed as if it is primarily a paper about intermediate trade. As a substantive matter, that is how they developed it because they thought this was important to the case they focused on – namely outsourcing from the US to Mexico. For the analytics, though, the novel insight was not the consideration of intermediates, but rather using a model with a continuum of goods to think about impacts

on factor prices. The basic insight is pretty simple. In a two good DFS (1980) world without trade costs, goods at the boundary of those produced in the US and Mexico will be the most skill intensive goods in Mexico and simultaneously the least skill intensive goods in the US. If accumulation in Mexico (due to capital inflows, domestic capital accumulation, population expansion, etc.) shifts the boundary to expand the range of goods produced in Mexico, the goods added on will shift relative labor demand in favor of skilled workers in Mexico and similarly in the US. What is crucial to the example is not that these are intermediates (although that was very apt in this case), but rather that boundary goods are the most skill intensive in one and the least skill intensive in the other. Impacts of neutral accumulation on factor prices are likely to move the same direction in both countries.

While Feenstra and Hanson focus on the consequences of accumulation shifting the boundary good, Xu (2003) considers the case of trade liberalization. Trade liberalization now has several effects to consider (for convenience, ponder a case of symmetric liberalization). Liberalization reduces the interval of non-traded goods at the margin of comparative advantage. To continue the example, Mexico entirely stops producing some of its most skill intensive non-traded goods (the most skill intensive of all goods produced there), but expands production of some goods that previously were non-traded but are now the most skill intensive products exported. At the same time, relative domestic prices of imports fall in each country shifting relative demand in each country toward importables. Xu's focus is to establish the possibility for a unilateral liberalization that the expansion of the range of exportables previously not traded can

dominate, shifting relative factor demand and factor prices in a way that enhances inequality.

It is worth pausing for a moment to ponder what it might look like if we were to merge the DFS (1980) model with the Davis (1996) or Davis and Weinstein (2001) approaches to trade relations – i.e. to have a model that allows for a continuum of goods, breaks in FPE, and many countries. We don't know whether anyone has sought analytic results in a general equilibrium version of such a model. (The complexity even in the Xu setting certainly suggests such results will not come easily.) It is worth pondering nonetheless because this is a case where two-ness is almost certainly the exception instead of the rule. The more general and surely more common case is that in which countries have two margins, one of greater and one of lesser (skill-capital-technological) intensity corresponding to countries above and below the country of interest. Whether both margins are crucial in a particular case may depend on the nature of the policy shock. A unilateral reform may more significantly involve both margins, whereas a bilateral Free Trade Area (FTA) may have most of the adjustment on one margin (although in general equilibrium, the other may be affected as well). This might help to understand the contrast in experience between Mexico's an early unilateral liberalization and the later opening to NAFTA (see Robertson 2004).

Both Davis (1996) and Feenstra-Hanson (1996) offer explanations of how trade or investment can worsen the situation of those least well off in a poor country. Davis (1996) focuses on the mechanism whereby even a country that is labor abundant when compared to the world as a whole is an importer of the labor intensive good it actually produces, leading liberalization to lower the domestic price of that good and thus wages

for the poorer groups in that society. In Feenstra and Hanson, the mechanism is that expansion of total output in the poorer country leads it to add new goods at the margin to its production mix. In the case considered the marginal goods are at the expense of the Northern country, so the most skill-capital intensive of the goods it produces, shifting relative factor demand against unskilled labor.

Topalova (2005) has suggested that liberalization in India may have worsened the situation of these least well off and emphasizes that a lack of geographical and sectoral mobility may have contributed to this. It is worth considering at least a very simple framework, consistent with a multi-cone world that makes the point. Suppose the world consists of three countries, A (which we can consider the North or the Rest of the World (ROW)), B, and C, (where the latter are two groups within India). For simplicity, let this be an endowment economy where A has sugar, B (a relatively skilled group) has tea, and C (the unskilled) has jaggery.[3] When India's trade barriers are high, members of group B can trade with C or not trade at all. Tea with jaggery is not very attractive for a relatively well off group, but is better than only tea. When the trade barriers come down, all goods become in principle tradable. But members of group A only like sugar and tea – not jaggery. Members of group B like sugar and tea, but will eat jaggery only when sugar is not available. Members of group C eat jaggery because it is cheap and would love to eat sugar except that even after liberalization it is too expensive. Moreover, with group B now having access to sugar, they want to sell less of their tea for jaggery, causing the relative price of jaggery to collapse. In effect, the initial trade barriers gave the poor a kind of monopoly power over B that disappears when B can trade with the rest of the world – leaving C worse off.

[3] Jaggery is a coarse unrefined sugar made from sugar cane juice.

Having thought about this model with a continuum of goods but no apparent industries, it is worth thinking about what we should observe if each industry is itself composed of a continuum of goods of varying factor (technological) intensity. This forces us to think about the difference again between averages and margins. A statement that a particular industry, for example, is skill intensive is a statement about an average over an integral across all varieties in that industry using production weights. Yet adjustment is at the margins. An industry that is relatively unskilled intensive on average may yet be expected to have production over a range of skill intensities.

Melitz (2003) develops a model with heterogeneous firms defined by varying productivities. He shows how exposure to trade induces only the more productive firms to enter the export market and simultaneously forces the least productive firms to exit, leading to a rise in aggregate industry productivity. This model could be used to explain the findings in Goh and Javorcik (2005) for Poland and Mishra and Kumar (2005) for India. These papers find that reduction in tariffs is associated with an increase in wages within the industry. Trade liberalization could lead to an inter-firm reallocation towards more productive firms and a rise in aggregate industry productivity which gets passed on to industry wages.

Verhoogen (2004) re-examines the case of Mexico and uses this to question the existing interpretations of rising wage inequality there till the mid-1990s. His first observation is that the rise in the relative skilled wage *did not* come about due to a shift in relative demand across industries in favor of those using skilled workers more intensively. He shows that the shift in relative outputs in Mexico in the relevant period actually were in favor of unskilled and low capital intensity sectors. Instead he focuses on

within-industry shifts. His hypothesis is that within industries, firms differ in productivity, with the more productive firms exporting (as in Melitz, 2003) and that there is differentiation in product quality (Anderson et. al 1992). When new opportunities for trade arise, in the case he examines due to the sharp devaluation of the peso, these new opportunities are seized by these most productive firms. These firms produce a better quality good for export than for the domestic market in order to appeal to richer developed-country consumers. Producing high-quality goods requires paying higher wags to all workers, but especially to skilled workers raising returns to all factors in those firms, but particularly to the most skilled. Here, the counterpart to the "technical change" argument that has been used in the North is a "product shift" argument within industries that accounts for the within industry shift in relative factor demand even as the across-industry shift would seem to point the other way.

It may seem odd that in a paper notionally devoted to theory that one of the requests we have for empirical researchers is to spend more time describing the data and how it is handled. An example is the treatment of tariffs on intermediates. An elementary point is that a tariff on goods competing with a local producer's outputs provides protection, but a tariff on its inputs is anti-protective. But in many of the papers I look in vain for the words "intermediate" or "input-output" in a description of the impact of tariffs. I simply don't know how the issue of tariffs on intermediates has been addressed. But clearly the fact that it reverses the sign of the anticipated effect of a tariff should suffice to draw some discussion. We all know that the researcher did not get to design the data collection and that it may be less than ideal for the task at hand. Confess your data crimes and much will be forgiven. And much more will be learned.

Economics and Geography

One of the most important analytic developments in the study of trade of the 1990s is that of economic geography.[4] The analytic underpinnings are very simple: Dixit-Stiglitz production and costs of trade. While the models come in many variants, a large number of them yield provocative predictions about the nature of economic development and the difficulties faced by countries and international institutions in moving poor countries out of poverty. Trade liberalization need not help! Indeed, trade liberalization in these contexts has two faces. One is the improved access that you have to sell your products abroad. However the other, particularly for a small country, is the possibility that the market becomes a site of consumption but not of production, at least of the crucial increasing returns activities that yield high real wages. This certainly should not be interpreted as a blanket rationale for import substitution activities. But it does provide additional paths of serious inquiry into the costs and benefits of protection.

One of the more interesting analyses relevant to our problem is contained in Puga and Venables (1996). They consider a problem in which a country of the North, say Japan, has rising world demand for its products. Those products incorporate both high and low order activities. With the rising demand, wages rise in Japan, making it attractive to outsource some of the low order activities to other locations. The question is to which country the outsourcing will be done. If we are in a neoclassical world, then if there are many similarly situated countries – geographically, in terms of policy, labor skill, etc. – then each such similar country will get a similar share of the outsourcing. However if we are instead in an "economic geography" world in which *local* sourcing of intermediate

[4] For monographs on the theory, see Fujita, Krugman and Venables (1999) and Baldwin, et al. (2003). Early work on the empirics includes Davis and Weinstein (1996, 1999). More recent empirical work includes Redding and Venables (2004), Hanson and Xiang (2004), and Davis and Weinstein (2004).

activities is crucial to the productivity in this outsourcing, then there will have to be both winners and losers. Some country or countries will receive this outsourcing and others not. Those that do receive it will see demand for their labor rise and real wages rise, possibly very significantly; but not so in the other countries.

These kind of models present very significant problems in cross country analyses. The cross country analyses assume that outcomes are smooth in the policy variables. In the economic geography world, outcomes are lumpy.

In addition to the problems that these kind of models present to the statistician, they present a yet greater problem to the policymaker. If the interaction of technology and geography dictates that Japan is going to outsource to just one country, then a dozen could pursue “good policies”, yet only one emerge victorious.

Trade and Growth

The discussion to this point has treated theoretical considerations from the perspective of comparative statics. This is a very useful perspective, particularly for the purpose of understanding short to medium horizon impacts. However, it is ultimately limited, and perhaps decisively flawed, for three reasons. The first is simply that over any reasonable horizon, the magnitudes of growth impacts swamp magnitudes of comparative static impacts. The second, crucial here, is that the answers we receive as to the comparative static versus dynamic effects of liberalization need not be the same. Finally, when dynamic considerations exist, i.e. the world we actually inhabit(!), one cannot really make sense even of comparative statics unless one has an eye on the dynamics that

govern the movements of resources. All of these elements point to the need to explicitly consider links between trade liberalization and growth.

It is useful to start with a perfect competitive market view of trade and growth. Stiglitz (1970) considered such a world with a dynamic Heckscher-Ohlin model. In this model, autarkic differences in capital to labor ratios arose endogenously from deeper parameters reflecting rates of time discount. The patient country would accumulate a great deal of capital per worker in the autarkic steady state relative to the impatient country. Several key conclusions emerge from his work. The first is that trade leads to greater divergence in accumulation and specialization in production. The logic is quite simple. Assuming the initial differences in endowments are not too large, factor price equalization insures that factor returns must be equalized across the trading partners. Incipiently this raises the return to capital in the country already abundant in it and reduces it in the other country. Accumulation resumes in the capital abundant country and decumulation sets in in the other country. Per capita incomes diverge. Since the rates of return must equal parametrically distinct national discount rates to be in a steady state, this can only arise if endowment differences become sufficiently great to break FPE (and under the assumption of barriers to capital flows that would be sufficient to arbitrage differences in factor returns). As noted, in the long run, the initial differences in per capita income would increase. Nonetheless, in this perfect markets equilibrium, there are dynamic gains even from the country that in the long run will have a lower per capita income as a result of trade. The reason, of course, is that along the path to the new steady state, it is possible to enjoy a higher level of consumption that more than compensates for the lower steady state level of consumption.

A first path into dynamic questions of trade liberalization in imperfect markets may come from a consideration of models of learning by doing such as those of Robert Lucas (1998) and Alwyn Young (1992). The imperfection in question is that learning here enters as an external effect proportional to production. Lucas considers this in a two country, two good framework, where the goods are distinguished according to fundamental rates of learning opportunity. The first insight from the Lucas framework is that if learning is external, even transitory differences in comparative advantage can determine long term growth opportunities. A country whose learning opportunities are diminished as a result of assignment by comparative advantage to slow learning sectors may yet experience not only static but dynamic gains from trade as learning in the other country is passed on through lower prices. The central insight of Young is to place this squarely in a North-South context. He introduces the idea that learning is bounded and sequential. The North is further along in its learning path. The consequence is that it introduces a presumption that trade liberalization releases labor from sectors where learning is exhausted to be deployed in sectors where learning opportunities still exist. And vice versa for countries of the South. Because of the possibility of real income gains from the consumption side, this does not quite establish dynamic losses from trade, but it is certainly suggestive of this possibility as comparative advantage dictates that production in the South be shifted toward sectors where learning is exhausted. Davis (1992) has argued that the restriction of this discussion to small dimensions in countries, goods, or both tends to understate the opportunities particularly for small countries to enjoy dynamic gains by specializing their learning in a small number of sectors. It is

much easier to converge to the world productivity frontier in one or a few sectors than many.

The work of Grossman and Helpman (1991), building on work by Romer (1986) and Aghion and Howitt (1992), advanced greatly the discussion of the dynamics of trade and income. This is a rich body of work that can only be touched on here. The central issues of interest are that they consider the engine of growth to be innovation and imitation, which in turn are purposeful activities driven by the incentives that markets provide to firms. The traditional incentives to augment capital as in Stiglitz (1970) are here augmented by incentives to invest in knowledge. A fundamental element is that knowledge is non-rival (although it may be excludable). There are gains to the world (and potentially to all countries) from only having to discover things once. There are likewise gains to the world from having innovation take place where it is least costly. Of course, many of the prior concerns about the distribution of these gains across countries emerge yet again here. Moreover, with markets imperfect, both the level and location of innovation can be non-optimal (and possibly the level even too great!).

Conclusions

This volume is dedicated to understanding the impact of globalization on poverty in poor countries. This paper has tried to discuss the theory that is most relevant for such a discussion in the context of trade liberalization. Since the question of the impact of trade liberalization on the poor in poor countries is such an obviously important question, it is a major embarrassment to the profession that we understand it so poorly. This volume takes many important steps forward, but the need for further inquiry is manifest.

Certainly a starting point is to cast off the shibboleths of Stolper-Samuelson in its global form as a useful way to think about the world that we actually live in. Insights from growth theory, from the theory of economic geography, as well as more traditional theories, will be important in moving us forward.

The empirical work contained in this volume, in combination with other work outside, has been extraordinarily useful. Its use will be all the greater if we spend less time coming up with immediately tidy explanations and spend more time identifying the puzzling aspects of the problem. They should not be in short supply. For the studies of trade liberalization, the most pressing line for further inquiry should be understanding the extent and process of reallocation. This will need to be studied with detailed reference to institutions and local characteristics. Labor market rigidities may explain why declining industries find it hard to fire workers. But it is hard to understand why expanding industries are not drawing in many of these same workers. It is not clear yet that there is a fully consistent story.

There is an old joke about a drunkard who explains that although he lost his keys in the park down the street that he is looking for them here under the lamppost because the light is so much better. A lot of our theoretical and empirical work has a taste of this logic. And it is not entirely crazy because our toy models do give us useful insights and the empirical work gives us some views of the data that might surprise and so inspire us. We hope, though, that we have made the case that in this untidy world of ours it might make sense to spend some time in the dark, on our knees, groping for the keys.

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Figure 1 –Trade Liberalization and Factor Prices – Stolper Samuelson Theorem

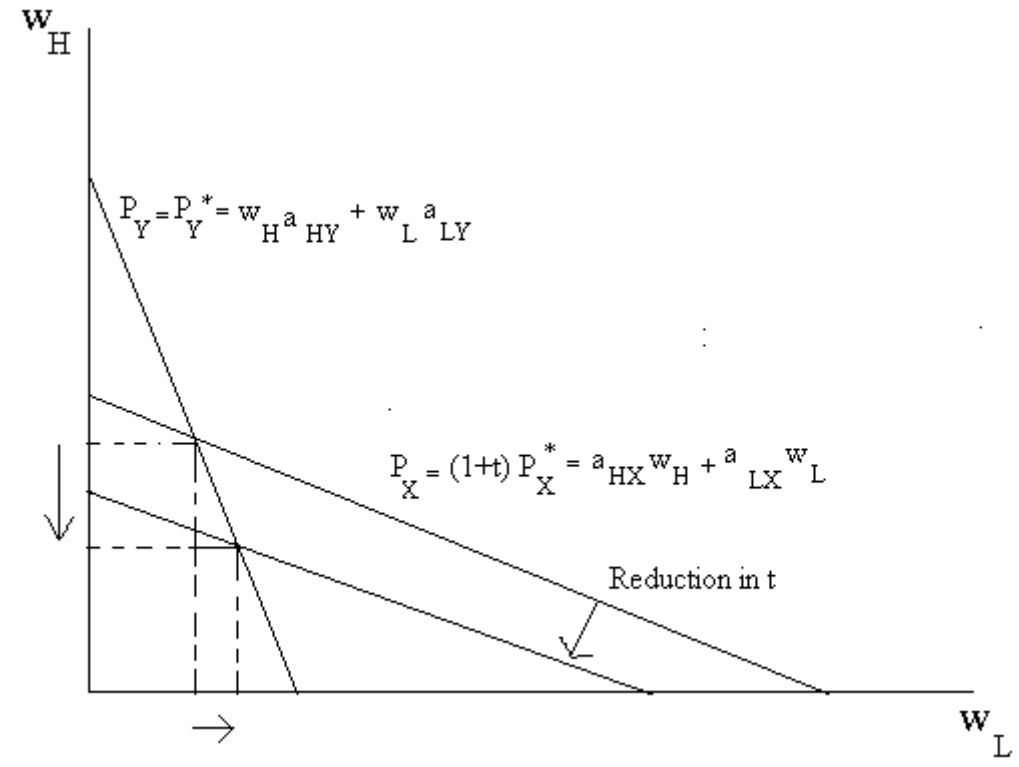

Figure 2: Trade Liberalization in Intermediates and Factor Prices