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The Gains from Trade in a New Model from the IMF:
Still Very Small

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Acknowledgements

Executive Summary

This paper takes a careful look at a recent International Monetary Fund (IMF) Working Paper that claims to find significant gains for liberalization of trade through the World Trade Organization.

It is not clear that the reported gains are at all large. The IMF paper shows that multilateral liberalization increases consumption perhaps 0.014 percent. This would be about 43 cents per person per month in the United States).

The IMF paper diverges from standard trade models in important and interesting respects. First, it looks at countries with significant market power, i.e., their demand for goods can influence international producer prices. As a result, a unilateral tariff can actually benefit the country that imposes the tariff as it shifts demand in favor of that country's production. This changes the international terms of trade in its favor.

By the same reasoning, the paper shows that a unilateral tariff reduction benefits the foreign country at the expense of the liberalizing country. This gives each country an incentive to push its trading partners to liberalize while maintaining its own protective barriers. This is contrary to the results of standard trade models, where a country can gain from unilateral liberalization; but it may explain better the positions of countries engaged in trade negotiations.

The very small gains from trade in the IMF model result partly from the fact that this paper—in contrast to other full-employment trade models-- takes into account the trade-off between labor and leisure. If production increases as a result of liberalization, in a full-employment model this means that people choose to work more. But since they are already fully employed, this means that they must give up leisure, and this ought to be taken into account in calculating the net change in welfare resulting from any agreement.

One significant result of the IMF paper is that potential gains of multilateral trade liberalization are very small even in a formal New Keynesian model incorporating economies with significant power in international markets.

Finally, this paper shows that the "New Keynesian" complexities introduced into the IMF model are unnecessary for the results.

Introduction

A recent International Monetary Fund (IMF) Working Paper[1] claims to find that World Trade Organization (WTO) trade agreements to liberalize international trade are (in theory) worth somewhat more than previously thought. The baseline result of the work is that a 1-percentage-point cut in bilateral tariff rates should increase trade by 1.5 percent. The authors report the estimated value of the agreement to households as 1.3 percent of consumption; however, as explained below, this is actually essentially equal to a lump-sum payment of 1.3 percent of one calendar quarter's worth of consumption. This amount is actually very small—about $128 per person.

Nevertheless, the authors describe this value as "much larger than in trade models" and attribute the result to "New Keynesian" features of the model. In fact the "New Keynesian" features are almost entirely unimportant and the output value of tariff reduction is comparable to previous work on trade agreements. The more interesting result from the model is that it shows that even under conditions where producers have considerable market power-- unlike in standard trade models where markets are competitive-- that the gains from trade liberalization are extremely small. And under these less competitive conditions, one country can gain from unilaterally imposing or increasing a tariff, and lose from unilateral liberalization-- the opposite of the results of standard trade models.

Liberalization Models

The orthodox argument for tariff reduction is that a country will benefit from even unilateral liberalization. With reduced tariffs, consumers may purchase imports at reduced prices. If producer prices do not change as a result of a tariff reduction, then the same income has greater purchasing power. Of course, nothing guarantees that prices and incomes remain the same. Consumers may shift some spending from domestic to foreign goods. Increased demand for imports and lowered demand for locally produced goods increases the trade deficit, shifting prices, and changing demand for labor.

The authors of the IMF paper seek to take such complexity into consideration yet even their new model for evaluating trade agreements is still conceived at a high level of abstraction. Briefly, this model assumes that there are two generic economies (one domestic and one foreign) but that each

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1   Giovanni Ganelli and Juha Tervala, "Value of WTO Trade Agreements in a New Keynesian Model." Washington, D.C.: Asia and Pacific Department, International Monetary Fund, February 2015.
   http://www.imf.org/external/pubs/ft/wp/2015/wp1537.pdf

economy produces one type of good. Households desire to consume both types of goods—not just the kind produced domestically; this provides the impetus to trade. They afford both goods by earning a wage for labor in the domestic industry. In the model, government's sole function is to tax imports and distribute the revenues to domestic households; there are no public services such as education or defense or prisons. Nor are there national parks, nor even public roads. In the real world, many developing countries are dependent upon tariff revenues for funding government operations.

Nor is there any unemployment insurance. In fact, the model permits no unemployment. Rather than causing layoffs, a fall in domestic production is achieved through voluntary reductions in work hours. Likewise, there is no social security, and households have an infinite time horizon in their planning. Households today plan for the infinite future hoping to maximize consumption with the least amount of work. Both the enjoyment they get from consuming goods and the disutility of laboring to produce goods are less important with every quarter of a year as they look further into the future. For example, the authors assume that a household would readily give up a month and a half of its consumption 100 years down the line in order to buy an additional 1.5 days worth of consumption today.

With the exception of international trade, these features are common in New Keynesian modeling. The authors write "[s]taggered price adjustment, endogenous labor supply and the presence of imperfect substitutability between goods produced within the country are the most important features of the model" but the important results in the paper may be reproduced almost perfectly in a stripped-down single-period model, laid out in the Appendix. We will use this simplified model to help explain the results outlined in the IMF paper.

For a given quantity of labor supplied in each economy, households hope to consume a certain amount of each type of good based on the relative consumer price. This may describe demand for each good. Note that a tariff increases demand for local production at the expense of foreign. This can be seen by the shift of demand curves for each country in **Figure 1**.[2]

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2   Note that the demand curve for Good 2 (the foreign good) slopes upward because the price of the foreign good is inverted on the common scale.

FIGURE 1

Demand for Domestic and Foreign Goods When a Tariff is Imposed in Country 1.
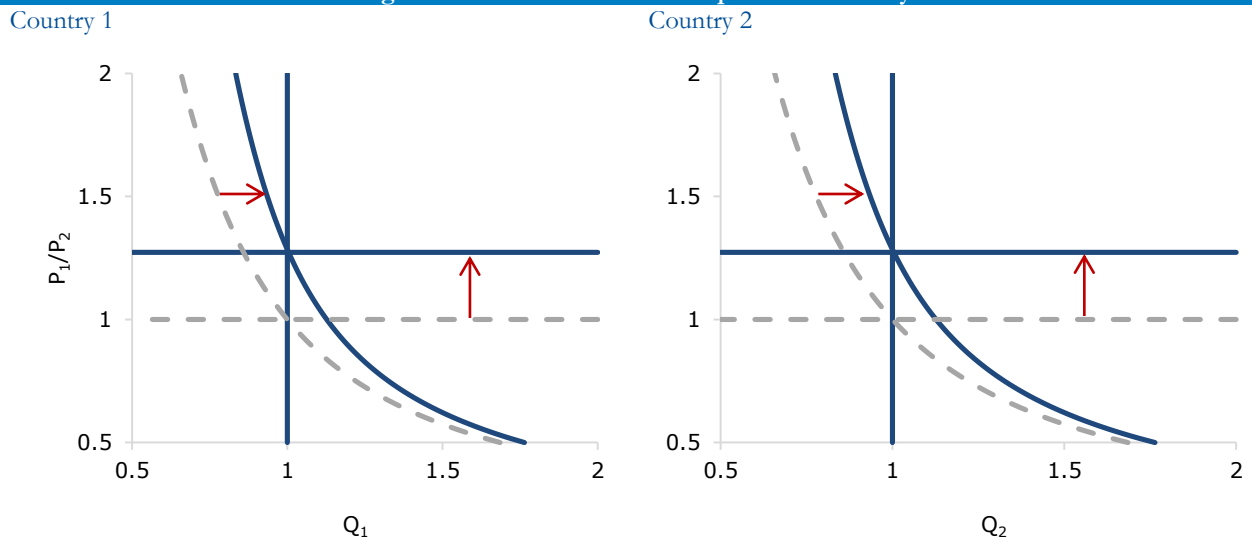
Country 1   Country 2


Source: Author's calculations.

The problem — not apparent in Figure 1 — is that with new tariff revenues redistributed to households in Country 1, households now have non-wage income. This changes the tradeoff for households between labor and leisure: with more non-wage income, the utility of additional consumption (gained with an additional hour of labor) is now less than the added disutility of labor. Thus, households choose to work a little less and consume a little less of both domestic and foreign goods, and the markets clear with a slightly higher price for the good produced by Country 1. **Figure 2** shows supply and demand for each good when accounting for household work preferences.

FIGURE 2

Effect of Labor Choice on the Supply of Goods
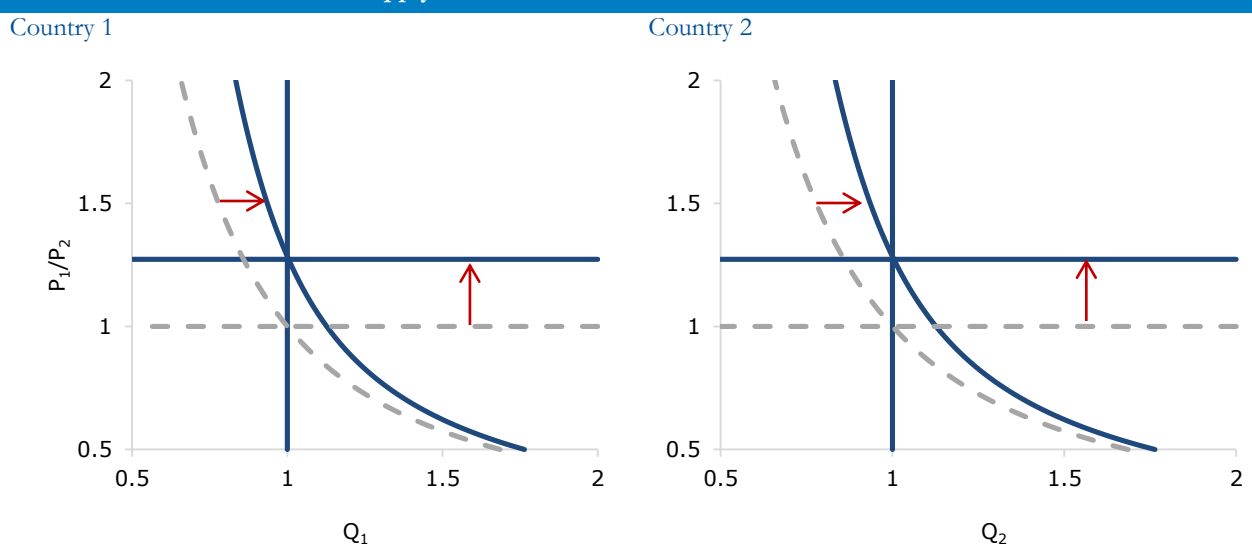
Country 1   Country 2

Source: Author's calculations.

In the end, however, households in Country 1 are made much better off from imposing the tariff. The tariff results in an improvement in Country 1's terms of trade, allowing those households to consume a little more while working a little less. The lowered relative price received by those in Country 2, however, means that real household incomes decline there and along with them consumption must also decline. While Country 2 households could work more to resist the decline in income, it is not worth the lost leisure to those households for them to do so. Inevitably, Country 2 is made worse off from the tariff imposed in Country 1. In this way, the consumers of Country 1 gain at the expense of Country 2 as a result of the tariff. This result runs contrary to standard trade theory, where the consumers of the country imposing the tariff lose. Flexible terms of trade accounts for the difference in model results. Because each country has significant international market power, Country 1 is able—through the imposition of a tariff-- to raise the price of its own product relative to that of the imported good.

With a bilateral tariff, the story is very different. So long as the countries are symmetric, there can be no terms-of-trade shock. Rather than shifting total demand, a bilateral tariff initially redistributes demand between the countries. Each country demands more domestic goods and fewer imports; hence, there is a reduction in trade. In addition, the unilateral tariff effect of lowering the marginal benefit of labor takes hold in both countries, lowering production as well. **Figure 3** shows the changes in Country 1's demand for imported Good 2 and Country 2's demand for imported Good 1.

FIGURE 3
Demand for Imports of Each Type of Good
Countries 1 & 2
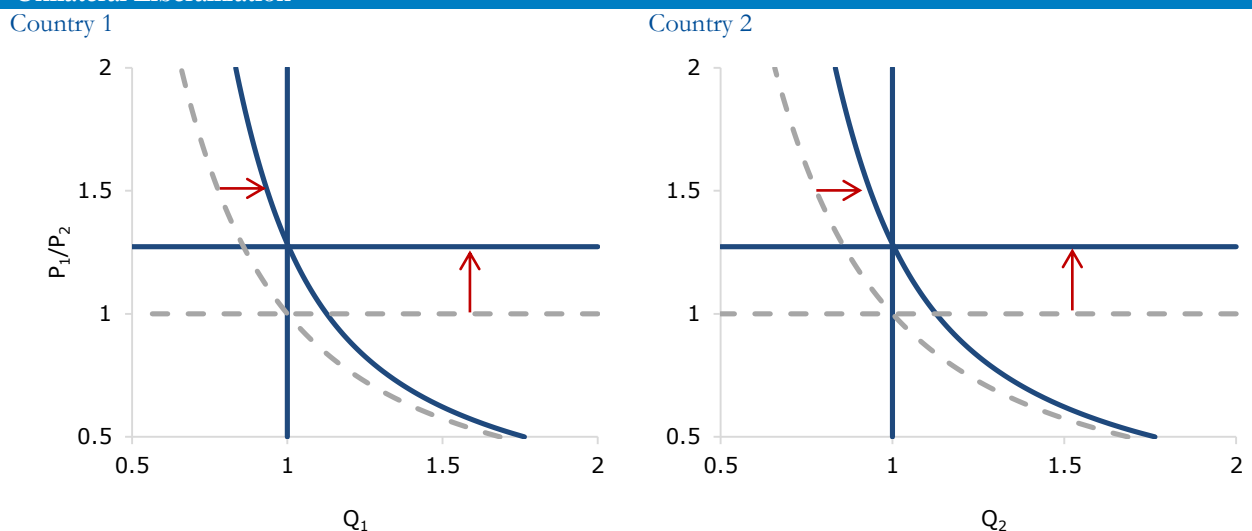
Source: Author's calculations.
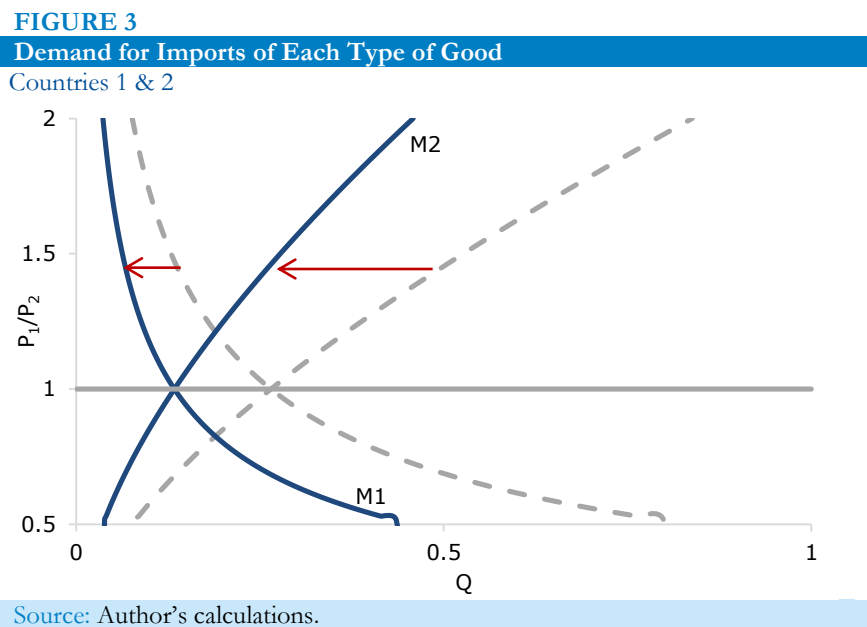
With neither country benefitting from changing terms of trade, households in both are made worse off.

Putting together the results from unilateral and bilateral tariffs, a prisoner's dilemma emerges. Either country would benefit at the expense of the other from the imposition of a tariff, but both countries lose if the other does likewise. Liberalization works exactly in reverse. If both countries reduce tariff rates, then both counties will benefit. But if its partner fails to cooperate, a liberalizing country is made worse off-- shifting the terms of trade against the liberalizing country just as the imposition of a unilateral tariff, above, shifted the terms of trade in favor of the country imposing the tariff.

In Figure 4, we see the effect of unilateral liberalization. Starting from a 4 percent tariff on imports of both goods, Country 1 reduces its tariff on imports to 3 percent.

FIGURE 4
Unilateral Liberalization

Source: Author's calculations.

Households in Country 1 consume 0.47 percent more imports but consume 0.21 percent fewer domestic goods and increase their hours by 0.12 percent. On balance, Country 1 is made worse off by liberalizing unilaterally. In the simplified model, we may quantify the extent to which the country is made worse off by noting that a household in Country 1 would be indifferent between the liberalization and the status quo if the tariff reduction came with additional funds sufficient to increase consumption by 0.15 percent.

By comparison, the IMF paper reports that in the first quarter post-liberalization, the tariff reduction is worth to the liberalizing country -0.2 percent of consumption and rising toward -0.15 of consumption by the tenth quarter.

On the other side, Country 2 works 0.002 percent less and consumes 1.1 percent more of good 1 but 0.16 percent less of Good 2. This makes households in Country 2 better off as a result of the tariff reduction in Country 1. Country 2 would be willing to give up nearly 0.17 percent of future consumption in order to ensure that Country 1 liberalizes.

The IMF paper suggests that to the trading partners of the liberalizing country, the tariff reduction is worth about 0.2 percent of consumption in the first quarter and falls to a bit over 0.15 percent by the tenth.

In other words, both the IMF paper and our simpler models show that unilateral liberalization has almost zero worldwide benefit compared to the larger gains and losses for individual households.

If, instead of unilateral tariff reduction, both economies reduce their respective tariffs from 4 to 3 percent then all households increase output by 0.12 percent as seen in **Figure 5**.

FIGURE 5

Bilateral Liberalization
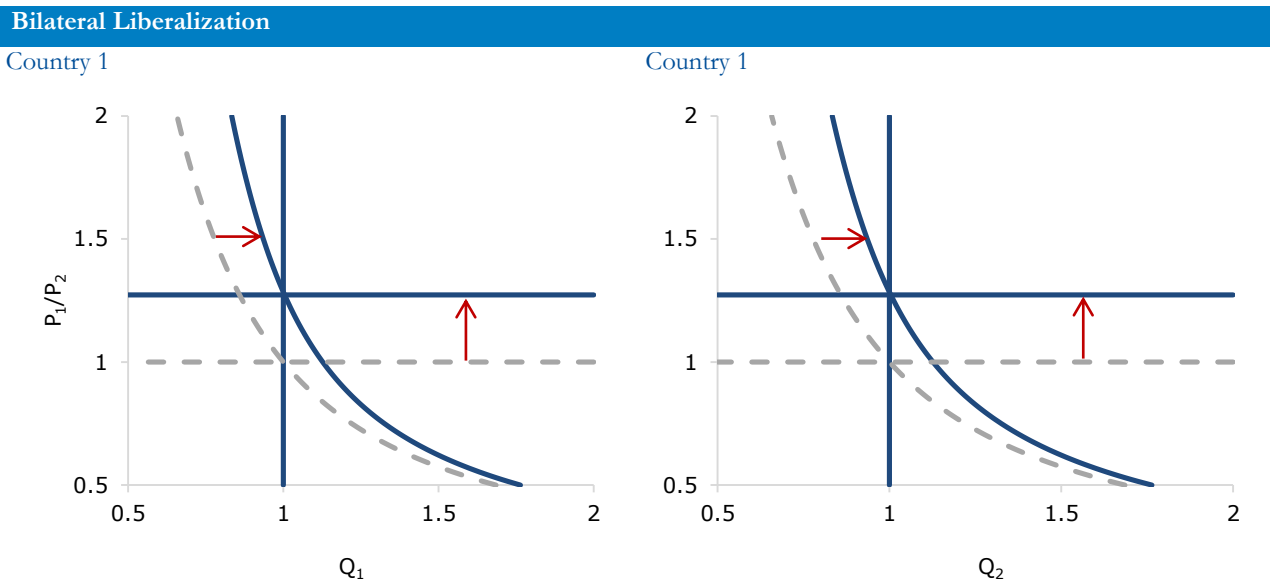
Source: Author's calculations.

Households increase imports by 1.6 percent and reduce consumption of domestic goods by 0.37 percent. With the loss of leisure, households are hardly any better off. No household would be willing to give up 0.014 percent of consumption in order to secure a bilateral tariff reduction. This amount is equivalent to less than 43 cents per person every month in the United States.

TABLE 1

Long-Run Model Comparisons	Unilateral		Bilateral	
	IMF	CEPR	IMF	CEPR
Pct. change in liberalizer hours	0.12	0.12	0.13	0.119
Pct. change in partner hours	0	-0.0023	0.13	0.119
Pct. change in liberalizer consumption	-0.035	-0.033		0.131
Pct. change in partner consumption	0.16	0.165		0.131
Pct. change in terms of trade	-0.61	-0.626	0	0
Pct. change in liberalizer exports	1.1	1.1	1.5	1.58
Pct. change in liberalizer imports	0.5	0.47	1.5	1.58
Value to liberalizing country	-0.15	-0.152	0.013	0.0137
Value to partner country	0.16	0.17	0.013	0.0137
Source: IMF and author's calculations.				
Note: IMF numbers are estimated from figures 1 and 2 of paper.				

As **Table 1** shows, many of the features of the IMF's model are unimportant to the underlying results. Our much more simple model produces all the relevant features. Furthermore, the increases in output are very small. Even complete liberalization increases GDP only 0.5 percent. The IMF paper cites several studies showing comparable income gains.[3]

Likewise, the Peterson Institute for International Economics and East-West Center (PIIE) estimated in 2013 that a similarly sized Trans-Pacific Partnership including the U.S., Japan and Korea could raise world GDP by as much as 0.2 percent by 2025[4] (equivalent today to an annual consumption benefit of $74 per person in the United States). The output gains in the IMF paper are also very small-- around $45 per person per year.

The benefits reported in the last two lines of Table 1 appear much smaller in comparison to those estimated by the Peterson Institute and other studies because the IMF paper counts not only the increase in consumption but also the lost leisure required to produce the extra goods. Within the model, there must be nearly zero net benefit or cost to a small change in consumption paid for with additional labor. The authors of the IMF paper—taking into account this cost to the household, in lost leisure time, of increased production—see a greatly reduced value of trade liberalization. At first blush, however, the authors seem to report a relatively large total value—1.3 percent of consumption, compared to 0.2 percent in the PIIE analysis. This larger estimate of the value of a

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3   See: Jonathan Eaton and Samuel Kortum, "Technology, Geography, and Trade," *Econometrica*, The Econometric Society, Vol. 70, No. 5 (Sep., 2002), pp. 1741-1779. http://www.eco.uc3m.es/~desmet/trade/EKEconometrica2002.pdf; Lorenzo Caliendo and Fernando Parro, *Estimates of the Trade and Welfare Effects of NAFTA*. Yale University and the Federal Reserve Board, May 15, 2014. http://faculty.som.yale.edu/lorenzocaliendo/ETWENAFTA.pdf; and Ralph Ossa. "Trade Wars and Trade Talks with Data," American Economic Review 2014, 104(12): 4104–4146. http://faculty.chicagobooth.edu/ralph.ossa/research/trade%20wars.pdf

4   Petri, Michael G. Plummer and Fan Zhai, *The Trans-Pacific Partnership and Asia-Pacific Integration: A Quantitative Assessment, Policy Analysis*, Washington: Peterson Institute for International Economics and East-West Center. Forthcoming. http://asiapacifictrade.org/wp-content/uploads/2012/10/Macro-results-1-Oct-2012.xlsx

trade agreement reflects a conceptual difference between the value measures and can easily be explained.

While the authors do estimate the value of a bilateral liberalization as about 0.013 percent of consumption in the long run, they actually describe the value of the agreement as some 100 times larger. The authors' final measure the worth of the tariff reduction is the amount each household would be willing to pay today in order to secure a deal with ongoing benefits for the infinite future.[5] (The idea is that if the household actually had to pay, then it would be indifferent between making the deal and maintaining the status quo.) Thus, when the authors write that the value of an agreement is 1.3 percent of consumption, they mean that a household would pay a one-time fee up to 1.3 percent of a single quarter's consumption (about $123 per person in the United States).

Importantly, this 1.3 percent then compares the lifetime benefit of a deal to a single-quarter's consumption. There is nothing inherently wrong with this, but it is not easily relatable to the results of other analyses. A better summary of the lifetime benefit might be to compare it to lifetime consumption. Likewise, a permanent 0.2 percent increase in consumption requiring no additional labor would be worth nearly 20 percent of a single quarter's consumption—nearly $1900 per person in the United States.

The IMF model thus appears to generate output gains comparable to previous analyses, but in accounting for lost leisure finds that the value to households is much less—not more.

Conclusion

Unfortunately, there are still many issues not considered by the model. Favoring increased consumption over leisure has consequences for climate change.[6] Not everyone would be affected in the same way by a real-world trade agreement. Not everyone in a country works in the same industry and not every industry faces the same pressure from international competition. In fact, WTO-style trade agreements typically include costly and highly distorting protectionist measures—particularly in the areas of patents and copyrights. Such favored treatment contributes to income inequality. We estimated back in 2013 that despite modest gains on average, increased inequality may well cause the vast majority of U.S. workers to suffer a net loss[7] as a result of trade agreements.

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5   Technically, the authors estimate over only 250 years but the discounted future means that the later years add almost nothing.
6   David Rosnick, "Reduced Work Hours as a Means of Slowing Climate Change," Washington, D.C.: Center for Economic and Policy Research, February 2013. http://www.cepr.net/index.php/publications/reports/reduced-work-hours-as-a-means-of-slowing-climate-change
7   David Rosnick, "Gains from Trade? The Net Effect of the Trans-Pacific Partnership Agreement on U.S. Wages," Washington, D.C.: Center for Economic and Policy Research, September, 2013. http://www.cepr.net/index.php/publications/reports/net-effect-of-the-tpp-on-us-wages

In conclusion, the IMF Working Paper on trade liberalization usefully considers an important trade-off between consumption and leisure and necessarily finds a very low benefit of even multilateral liberalization to households. Nonetheless, even the very small gains from this idealized model of trade agreements likely overestimates potential gain to most workers.

Appendix

Assume there are two economies, with each economy producing one good exclusively. Let Good 1 be produced by one ("domestic") economy and Good 2 that of the "foreign" alternative. Let starred consumption of each good, wage rate, labor, tariff rate, and government transfers indicate that in the foreign economy.

The economies will be symmetric by construction and therefore we will ignore the exchange rate by fixing it at 1.

Households

Consumption is aggregated as in equation 2 of the IMF paper though we dispense with the continuum-of-goods in equations (3) and (4)

$$C = \left[\kappa^{1/\rho} C_1^{1-1/\rho} + (1-\kappa)^{1/\rho} C_2^{1-1/\rho} \right]^{\rho/(\rho-1)} \tag{1}$$

$$C^* = \left[\kappa^{1/\rho} C_2^{*\,1-1/\rho} + (1-\kappa)^{1/\rho} C_1^{*\,1-1/\rho} \right]^{\rho/(\rho-1)} \tag{2}$$

Household preferences are as in equation 1 of the IMF paper but there is only a single period and therefore money balances are not considered.

$$U = \log C - \frac{\ell^{1+1/\nu}}{1+1/\nu} \tag{3}$$

$$U^* = \log C^* - \frac{\ell^{*\,1+1/\nu}}{1+1/\nu} \tag{4}$$

The household budgets are similar to equation 8 of the IMF paper but with neither money nor debt

$$p_1 C_1 + (1+\tau) p_2 C_2 = I = w\ell + T \tag{5}$$

$$p_2 C_2^* + (1+\tau) p_1 C_1^* = I^* = w^* \ell^* + T^* \tag{6}$$

Government

The government budget constraint parallels equation 15 of the IMF paper, again without money.

$$T = \tau p_2 C_2 \tag{7}$$

$$T^* = \tau^* p_1 C_1^* \tag{8}$$

Firms

One unit of labor is required to produce one unit of consumption, as in equation 16 of the IMF paper

$$C_1 + C_1^* = \ell \tag{9}$$

$$C_2 + C_2^* = \ell^* \tag{10}$$

Production is sold at cost, simplifying from equation 17 of the IMF paper

$$p_1 = w \tag{11}$$

$$p_2 = w^* \tag{12}$$

Optimization

Households maximize utility implicit in their preferences, constrained by their incomes.

$$\mathscr{L} = U + \lambda \left[w\ell + T - p_1 C_1 - (1 + \tau) p_2 C_2 \right] \tag{13}$$

$$\mathscr{L}^* = U^* + \lambda^* \left[w^* \ell^* + T^* - (1 + \tau^*) p_1 C_1^* - p_2 C_2^* \right] \tag{14}$$

For domestic households, internal extremum requires:

$$0 = \frac{\partial \mathscr{L}}{\partial C_1} = \frac{\kappa^{1/\rho} C_1^{-1/\rho}}{C^{1-1/\rho}} - \lambda p_1 \tag{15}$$

$$0 = \frac{\partial \mathscr{L}}{\partial C_2} = \frac{(1-\kappa)^{1/\rho} C_2^{-1/\rho}}{C^{1-1/\rho}} - \lambda (1+\tau) p_2 \tag{16}$$

and

$$0 = \frac{\partial \mathscr{L}}{\partial \ell} = -\ell^{1/\nu} + \lambda w \tag{17}$$

Likewise, for foreign households,

$$0 = \frac{\partial \mathscr{L}^*}{\partial C_1^*} = \frac{(1-\kappa)^{1/\rho} C_1^{*-1/\rho}}{C^{*1-1/\rho}} - \lambda^* (1+\tau^*) p_1 \tag{18}$$

$$0 = \frac{\partial \mathscr{L}^*}{\partial C_2^*} = \frac{\kappa^{1/\rho} C_2^{*-1/\rho}}{C^{*1-1/\rho}} - \lambda^* p_2 \tag{19}$$

$$0 = \frac{\partial \mathscr{L}^*}{\partial \ell^*} = -\ell^{*1/\nu} + \lambda^* w^* \tag{20}$$

Solution

From equations (15) and (16) we have

$$\frac{p_1}{(1+\tau)\,p_2} = \left[\frac{\kappa C_2}{(1-\kappa)\,C_1}\right]^{1/\rho}$$

or

$$\frac{p_1 C_1}{(1+\tau)\,p_2 C_2} = \frac{\kappa}{1-\kappa}\left[\frac{p_1}{(1+\tau)\,p_2}\right]^{1-\rho} = \frac{1}{\xi}$$

where

$$\xi = \frac{1-\kappa}{\kappa}\mathcal{P}^{\rho-1}$$

and

$$\mathcal{P} = \frac{p_1}{(1+\tau)\,p_2}$$

so that the fraction of income spent on good 1 is

$$\frac{p_1 C_1}{p_1 C_1 + (1+\tau)\,p_2 C_2} = \frac{1}{1+\xi}$$

and

$$\frac{C_2}{C_1} = \xi\mathcal{P}$$

This is particularly useful because the marginal benefit of additional work is

$$\frac{d\log C}{d\ell} = \left(\frac{\partial\log C}{\partial C_1} + \frac{\partial\log C}{\partial C_2}\frac{dC_2}{dC_1}\right)\frac{dC_1}{dI}\frac{dI}{d\ell}$$

or

$$\frac{1+\xi}{w/p_1}\frac{d\log C}{d\ell} = \frac{\partial\log C}{\partial C_1} + \xi\mathcal{P}\frac{\partial\log C}{\partial C_2}$$

or

$$\frac{1+\xi}{w/p_1}\frac{d\log C}{d\ell} = \frac{\left[\kappa^{1/\rho} + \xi\mathcal{P}\,(1-\kappa)^{1/\rho}\,(\xi\mathcal{P})^{-1/\rho}\right]C_1^{-1/\rho}}{\left[\kappa^{1/\rho} + (1-\kappa)^{1/\rho}\,(\xi\mathcal{P})^{1-1/\rho}\right]C_1^{1-1/\rho}} = \frac{1}{C_1}$$

Hence

$$\frac{d\log C}{d\ell} = \frac{w}{(1+\xi)\,p_1 C_1} = \frac{w}{I}$$

while from equations (15) and (16) we have

$$\lambda I = \lambda \left[p_1 C_1 + (1+\tau) p_2 C_2\right] = \frac{\kappa^{1/\rho} C_1^{1-1/\rho}}{C^{1-1/\rho}} + \frac{(1-\kappa)^{1/\rho} C_2^{1-1/\rho}}{C^{1-1/\rho}} = 1$$

so equation (17) implies

$$\ell^{1/\nu} = w\lambda = \frac{w\lambda}{I\lambda} = \frac{w}{I} = \frac{d\log C}{d\ell} \qquad (21)$$

meaning the marginal utility of consumption from additional labor is equal to the marginal disutility of work. Note also that

$$\frac{w\ell}{I} = \frac{p_1 C_1 + p_2 C_2}{p_1 C_1 + (1+\tau) p_2 C_2} = \frac{p_1/p_2 + \xi\mathcal{P}}{\mathcal{P} + \xi\mathcal{P}} = \frac{1 + \xi/(1+\tau)}{1+\xi}$$

Thus, equation (21) implies

$$\ell^{1+1/\nu} = \frac{w\ell}{I} = \frac{1 + \xi/(1+\tau)}{1+\xi}$$

Thus, when there is no tariff f = 1, and when there is f < 1. Furthermore, as the relative price of Good 1 falls, f approaches 1; as the relative price of good 1 rises f approaches $1/(1 + \tau)$. Continuing,

$$I = w\ell^{-1/\nu} = w \left[\frac{1 + \xi/(1+\tau)}{1+\xi}\right]^{-1/(1+\nu)}$$

so domestic demand for Good 1 is given by

$$C_1 = \frac{1}{1+\xi} \frac{I}{p_1}$$

and from domestic demand for Good 2

$$C_2 = \xi\mathcal{P}C_1 = \frac{\xi\mathcal{P}}{1+\xi} \frac{I}{p_1}$$

The results are symmetrical, so noting equations (11) and (12) we find total demand for each good to be

$$Q_1^d = \frac{1}{1+\xi}\left[\frac{1+\xi/(1+\tau)}{1+\xi}\right]^{-1/(1+\nu)} + \frac{\xi^*\mathcal{P}^*}{1+\xi^*}\left[\frac{1+\xi^*/(1+\tau^*)}{1+\xi^*}\right]^{-1/(1+\nu)}$$

$$Q_2^d = \frac{\xi\mathcal{P}}{1+\xi}\left[\frac{1+\xi/(1+\tau)}{1+\xi}\right]^{-1/(1+\nu)} + \frac{1}{1+\xi^*}\left[\frac{1+\xi^*/(1+\tau^*)}{1+\xi^*}\right]^{-1/(1+\nu)}$$

while total supply for each good is

$$Q_1^s = \ell = \left[\frac{1+\xi/(1+\tau)}{1+\xi}\right]^{\nu/(1+\nu)}$$

$$Q_2^s = \ell^* = \left[\frac{1+\xi^*/(1+\tau^*)}{1+\xi^*}\right]^{\nu/(1+\nu)}$$

Note that when $\varrho > 1$, supply of each local good is downward sloping in the relative price of the local good respecting the imported good.

Willingness to pay

To estimate the value of a change in tariff rates in the style of the IMF paper, we may assume that the change happens in the second period and is permanent. If we use overbars to indicate baseline values, then baseline discounted utility is given by

$$\bar{U} + \frac{\beta}{1-\beta}\bar{U}$$

If the country must change its consumption to C+ in the first period (with no change in labor) to secure the change in rates, then counterfactual discounted utility is given by

$$\log\frac{C^+}{\bar{C}} + \bar{U} + \frac{\beta}{1-\beta}U$$

The log change in the initial level of consumption which would make the country indifferent to the rate change is therefore given by

$$\log\frac{C^+}{\bar{C}} = \frac{\beta}{1-\beta}\left(\bar{U} - U\right)$$

If $U > \bar{U}$ then the country favors the change in tariffs and $\log C+/\bar{C} < 0$ means the country would be willing to make a one-time payment of any amount up to

$$\left\{1 - e^{[\beta/(1-\beta)](\bar{U}-U)}\right\}\bar{C}$$

in order to ensure the change. Likewise, if $U < \bar{U}$, then the country does not favor the change and would be willing to accept the change only if paid an amount at least

$$\left\{e^{[\beta/(1-\beta)](\bar{U}-U)} - 1\right\}\bar{C}$$

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