The question that we want to answer is: what is the optimal, unilateral tariff? So if a country decides to impose a tariff, and assuming that other countries do nothing, how should that country set its tariff. How does it relate to primitives in the economy.

The broad approach to tackle some of these issues is to (i) characterize the competitive equilibrium and (ii) characterize some form of a planners problem and then characterize the wedge / tax that makes (i) and (ii) equivalent. This is how I'm going to do it below. More broadly, I do think there should be more emphasis on more structure approaches, especialy like the optima tax / Ramsey plan literature discussed well in Chari and Kehoe (1999) handbook article. In fact, if someone in this class is well versed in this, they should write out the problem and do it like they do.

1. Two good, Two country, Endowment Economy

Super simple. Two goods (like in Armington) and two countries. No production, just endowments. Then we will jump to a far more general case.

The household in country 1 has the following problem:

$$\max U^1(c_1^1, c_2^1) \tag{1}$$

$$\text{subject to:} \quad c_1^1 + p(1+\tau_1)c_2^1 = E_1 + T_1, \tag{2}$$

where $T_1 = p\tau_1 c_2^1$. The household allocation satisfies

$$U_2^1 = p(1+\tau_1)U_1^1. \tag{3}$$

Then the next step is to consider a planner seeking to maximize the **welfare of consumer in Country 1**. This is not a global planner thinking about both countries, just one interested in country 1. The second thing to note the planner's allocations affect the price, i.e. I'm writing the price as a function of the country 1's imports of good 2 (or country 2's exports). The other thing is I'm going to write this out so it closely mimics the presentation in Dixit.

Thus, this planner solves the problem:

$$\max_{c,m,x} U^1(c_1^1, c_2^1) \tag{4}$$

$$\text{subject to:} \quad c_1^1 + x_1^1 = E_1, \quad [\pi_1] \qquad \text{the resource constraint,} \tag{5}$$

$$c_2^1 = m_2^1, \quad [\pi_2] \qquad \text{material balance condition,} \tag{6}$$

$$x_1^1 = p(m_2)m_2^1, \quad [\gamma] \quad \text{trade balance / offer curve.} \tag{7}$$

where the planner chooses consumption, exports, and imports subject to the several constraints (in the brackets, I have the associated multipliers). The first one is the resource constraint which specifies that domestic consumption plus exports x must equal the endowment. The second one just ensures that consumption of the foreign good equals imports.

The third constraint is the key issue that arises in an open economy. Here it is expressed as a balanced trade condition, so exports must equal imports. In the trade literature, it also is called the "offer curve" because it constrains all feasible trades between the two countries. Note, as we will see in the more general formulation, this could embed intertemporal issues, but for now it simply says that trade must be balanced.

Then this problem has two first order conditions

$$U_1^1 - \pi_1 = 0 \tag{8}$$

$$U_2^1 - \pi_2 = 0 \tag{9}$$

which then implies one condition that

$$\frac{U_1^1}{U_2^1} = \frac{\pi_1}{\pi_2} \tag{10}$$

which means that the ratio of marginal utility, i.e. marginal rates of substitution equal the "shadow prices" associated with the commodities. Good. Then there are two more conditions associated with exports and imports which are

$$\begin{aligned} \pi_1 &= \gamma \\ \pi_2 &= \gamma\left[p + \frac{\partial p}{\partial m_2/m_2}\right] \end{aligned} \tag{11}$$

Where the shadow prices are equated to some odd terms, but let me try and explain this as clearly as possible. Combining these two terms lead to the condition that

$$\frac{\pi_1}{\pi_2} = \frac{1}{p\left[1 + \frac{\partial p/p}{\partial m_2/m_2}\right]} \tag{12}$$

where the shadow prices should equal the marginal rate of transformation achievable through foreign trade. That is when country 1 increases exports or imports, the left hand side is how, internationally it is able to make that trade off. Efficiency then dictates that the planners shadow prices be equated with this rate of transformation. Now, at this point, it is kind of opaque about how to interpret this, but that is the next step.

Recall the goal is to relate the tariff in the competitive equilibrium to how the planner sets things. This turns out to be very clean. From the planners problem, now set marginal rates of substitution to the marginal rate of foreign transformation giving

$$U_2^1 = p\left[1 + \frac{\partial p/p}{\partial m_2/m_2}\right]U_1^1. \tag{13}$$

which when comparing the "wedge" in the competitive equilibrium and the terms in the box above, this tells us that the optimal tariff is related to the inverse elasticity of import demand. This is the classical result that a lot of people talk about. Side note, sometimes it's expressed in terms of export supply elasticities, but this just follows from noting how these elasticities have to be related through the balanced trade condition.

Let me talk through a couple of points about this formula:

- First, given how the relative price was setup, this led us naturally to think about a tariff. But it need not be that way, one generally would arrive at an equivalence between import tariffs and export taxes. Why, all that matters for allocations are relative prices, so the home country has two ways to actually manipulate relative prices in its favor — restrict exports or restrict imports. This concept relates to something one hears often which is Learner Symmetry.
- Note, the import demand elasticity is an equilibrium elasticity. Where as the trade elasticity is (in my opinion)

a partial equilibrium concept, which what I mean by this is that it is trying to measure, conditional on demand, prices, etc. how would a change in trade costs influence trade. This import demand elasticity embeds dependence on a trade elasticity, but also depends upon other stuff. As one example, of this is the discussion in Costinot Rodriguez-Clare or Donaldson notes, one can relate this to the trade elasticity adjusted by the exporting countries home trade share. So the idea that comes out of this is that if your relatively closed the optimal tariff is about one over the trade elasticity.

- Now what is the intuition about this. Its very much like a monopolist and the planner looks at this and realizes that if it restricts imports a bit then that lowers the price of those imports (as demand falls) and correspondingly, it's exports become value — thus the home countries terms of trade, how much imports it can get for exports improve. This seems dangerous as if one restricts things too much, well then your not eating any of the imported stuff which is bad. So that what the first order conditions embed with the planner equating on the margin how valuable things are in util terms with how easy or hard on the margin it can manipulate the terms of trade.

2. Super General, Dixit 1985

Dixit 85 is interesting because of its generality and he really wants to make a couple of points. First, issues around optimal tariffs can be characterized using public finance approaches. There are several layers of meaning, but I think one aspect is that some of the arguments made (like in the one above) were very trade-specific environments. The second issue was what the exact role of the tariff is especially when other issues are at play (i.e. redistribution concerns, externalities, etc.) By employing a primal approach (like the one above) I think it clarifies any issues about what role the tariff is playing and is not.

I'm going to keep things as many countries, but Armington. This helps keep clear who is importer exporter, etc. And we keep things as an endowment economy. I'll do rep agent, but this is not crucial either. I'm also going to drop the super-script and we always focus on the perspective of the home country

$$\max_{c,m,x} U(c_1, c_2, \ldots) \tag{14}$$

$$\text{subject to:} \quad c_1 + \sum_{n=2:N} x_{n1} = E_1, \quad [\pi_1] \qquad \text{the resource constraint,} \tag{15}$$

$$c_n = m_n, \quad [\pi_n \ \ \forall i = 2 \ldots N] \qquad \text{material balance condition,} \tag{16}$$

$$G(x, m) = 0, \quad [\gamma] \quad \text{offer curve.} \tag{17}$$

In some ways, this is nearly the same exact problem that we have above with very little modification. One thing to notice though is this function $G(x,m)$ which is a more general form of the offer curve. Again, this is just depicting all the feasible trades. One thing I want to highlight, is it seems not to hard to think about a dynamic environment. The key issue that arises (I think) is then the G function and what does it represent (buy stuff today, sell tomorrow, etc). This is a place to explore more and connect issues around capital controls (restrictions on intertemporal trades) and tariffs (infratemporal trades).

Then like above we have first order conditions,

$$U_n - \pi_n = 0, \quad \text{for each } n \tag{18}$$

which again just says that marginal utility should be equated with the proper shadow prices and that marginal rates of transformation between any two commodities should equal marginal rates of transformation. Then for exports and imports one has

$$\pi_1 = \gamma \tag{19}$$

$$\pi_n = \gamma \frac{\partial G}{\partial m}, \quad \text{for each } n \neq 1 \tag{20}$$

Where now the shadow prices are now equated with issues related to the more general offer curve like above. So lets consider how shadow prices should be set, we have

$$\frac{\pi_1}{\pi_n} = \frac{1}{\frac{\partial G}{\partial m}} \tag{21}$$

so this is very much looking like the two country, simple model above. But now it's just more general, where how elastic or not the G function is would depend (presumably) on a whole bunch of details about what the rest of the world looks like.

Let me return to some issues discussed above:

- Note how this has nothing to do with like really any specificities of the trade environment. The optimal tariff just boils down to the G function or how the country is able to trade off its imports and influence its terms of trade.
- Note also how issues about revenue, what is done with it, etc. They don't show up anywhere here (or above). In fact, I've virtually said nothing about the revenue issues. Yes, it may generate some, it may be useful, but the optimal tariff is dictated by the G function or terms of trade manipulation. Note, this is one difference versus traditional Ramsey plan problems where some revenue is required and the question is how. I think if one wanted to do that, then there would just be another constraint.
- Related to the point above, is the issue of "targeting." There are several ways to understand this. One nice example that Dixit provides is if there is some (say for national security) some minimum amount of production of some commodity required. Well, then there is another constraint, and an adjustment to the production first order condition, BUT it does not influence the tariff first order condition. The way the planner wants to relate to the rest of the world is exactly the same, no difference. Dixit talks through the same issue with an externality in production.

  One would be if we did not have a representative agent. In that case, the tariff is still set to respect the first order condition described above. Issues about equating marginal utility across households would be dealt with (i) lump sum transfers if allowed or (ii) consumption taxes if lump sum were not allowed. As he says, even in this case, "the monopoly argument is still the only one justifying tariffs; consumption taxes are superior for the redistribution role."

Some more thoughts on this before turning to quantitative work. I think the ideas are powerful. But two issues

- What is the optimal tariff. The G function is super general, and we don't know much outside of the two country case. This point is alluded to in various places. In some ways, this makes quantitative work valuable, but how to do it in a way that is compelling, and provides trust in the analysis.

- How / if tariffs should vary across partners, goods. In staring at the formula, you might want to think there is an optimal tariff structure based upon the G function? Is that right? What about goods, its also kind of hard to wedge this into the Ricardian model with a continuum of goods? Which of those should be tariffed or not? Related, we see a lot of variation in tariffs, what is that about?

- The third big issue is retaliation. All this is done assuming countries to not best respond to the country manipulating the tariff? How does that work.

3. Grossman and Helpman: Protection for Sale

This is an interesting paper in that it gives a different perspective as to why a government might impose tariffs. The answer is essentially politics and that the government maximizes some combination of political benefit (the sale part) and welfare of the nation. This determines the structure of tariffs in the economy. Contrast this with Dixit where the only rationale for a tariff is to manipulate the terms of trade. Here we have something very different.

A. Economic Environment

I'm going to set things up a little different than in the original paper (which I got from Dave Donaldson's notes) by studying an endowment economy rather than production economy. But otherwise, this presentation should match up well with the paper.

So there is a small open economy with endowments of many goods $i = 0, 1, \ldots n$ where good 0 is the numeraire and freely traded. In this country, there is a unit mass of households. Households have the same preferences, but are heterogenous in their endowment with fraction α_i of households having one unit of good i and one unit of good 0.

Households have preferences

$$u = x_o + \sum_{i=1:n} u_i(x_i) \tag{22}$$

so this is a quasi-linear setup. Associated with the problem are demand curves where $x = d_i(p_i)$ where p_i is the domestic price of good i. Note that p_i^* is the world price of good i and unlike the discussion above, agents in country i have no influence over the world price.

The government has only access to tariffs and trade subsidys — these are the only instruments available. Then the revenue collected and rebated lump sum is

$$t(\mathbf{p}) = \sum_{i=1:n} (p_i - p_i^*) \Big[d_i(p_i) - \alpha_i \Big] = \sum_{i=1:n} (p_i - p_i^*) m_i(p_i) \tag{23}$$

where the first equation is just the wedge in the domestic price vs. the world price times the amount imported. The amount imported is the difference in domestic demand vs. endowments. The second equation redifines the term in brackets as the net import demand function (which is taking a similar role as in the optimal tariff arguments).

Now there are a couple more things I need to describe. First is the indirect utility function associated with the household. This is

$$V^i(\mathbf{p}) = 1 + p_i + t(\mathbf{p}) + \sum_{i=1:n} u_i(d_i(p_i)) - \sum_{i=1:n} p_i d_i(p_i) \tag{24}$$

where with the quasi-linear setup, this is pretty simple. Indirect utility equals the households endowments (first two terms) plus tariff revenue (third term) plus utility minus expenditure.

Then there is the Government's objective function. This is the

$$G(\mathbf{p}) = \sum_{i=1:n} C_i(\mathbf{p}) + a\Big[\sum_{i=1:n} \alpha_i V^i(\mathbf{p})\Big], \tag{25}$$

this is important. The Government cares about two things. One are "contributions" from the interest groups or lobby i and this is given by the function C_i. Note the function C is an equilibrium object that needs to be characterized / discussed. Then the Government cares about households in a standard way but here there is parameter a which weights the relative importance of contributions vs. welfare of households.

B. The Political Game

In this environment, households play a game with each other and the government in terms of the contributions made and protection provided. I'm not going to go into detail about this game or properties of it (we really don't need to know much about it), but I will give a heuristic argument. First, the contributions that household wants to give

$$\max_{C} \quad \alpha_i V^i(\mathbf{p}) - C_i(\mathbf{p}) \tag{26}$$

so this lobby for group i wants to set contributions to maximize utility net of those contributions. This then gives a proposed set of contributions, given prices. In actuality, what we are looking for is a function over all prices prescribing contributions. The government looks at those contributions (the function) for all players i and then wants to set domestic prices to maximize

$$\max_{\mathbf{p}} \quad \sum_{i=1:n} C_i(\mathbf{p}) + a\Big[\sum_{i=1:n} \alpha_i V^i(\mathbf{p})\Big] \tag{27}$$

Then an equilibrium essentially is are prices and a contribution function that all players are ok with, i.e. a fixed point.

Here is the important result. In any Truth-telling Nash Equilibrium, the Governments objective function can be characterized as

$$\mathbf{p} = \arg\max \sum_{i=1:n} (\iota_i + a)\alpha_i V^i(\mathbf{p}) \tag{28}$$

where ι_i is an indicator function that takes the value one if group i is contributing and zero otherwise. So not everybody in the economy will necessarily be contribution. What is important about this result is that from the political game, we have a very standard looking social welfare function, but it weights different groups differently. This is a key contribution of this paper in that out of the game, we get what people had being doing before and in an ad hoc manner just postulating that the Government cares about different agents differently and this is connected to politics.

C. The Structure of Protection

Given that we have a very standard looking like objective function, we can now just differentiate things and solve for optimal tariffs. Consider the first order condition for price i for the i group

$$\alpha_i(\iota_i + a)\left[1 + (d_i(p_i) - \alpha_i) + (p_i - p_i^*)m_i'(p_i) + u_i'(d_i(p_i))\frac{\partial d_i(p_i)}{\partial p_i} - d_i(p_i) - p_i\frac{\partial d_i(p_i)}{\partial p_i}\right] \tag{29}$$

which there is a bunch of cancelations and essentially envelope-like results giving

$$\alpha_i(\iota_i + a)\left[1 + (p_i - p_i^*)m_i'(p_i) - \alpha_i\right] \tag{30}$$

Now this is only for the i term in the sum above, we need it for all the other terms not associated with i which are

$$\sum_{n \neq i}\alpha_n(\iota_n + a)\left[(p_i - p_i^*)m_i'(p_i) - \alpha_i\right] \tag{31}$$

where the only difference is that these groups don't own the endowment. But any perturbation in the price affects the value of the tariff revenue. Putting this all together the first order condition is

$$\alpha_i(\iota_i + a) + \sum_n \alpha_n(\iota_n + a)\left[(p_i - p_i^*)m_i'(p_i) - \alpha_i\right] = 0 \tag{32}$$

which then we are going to group the indicator functions (note how only running sum is over the n on the indicator. So define $a_L = \sum_{\iota_n = 1}\alpha_n\iota_n$ and this gives

$$\alpha_i(\iota_i + a) + a_L\left[(p_i - p_i^*)m_i'(p_i) - \alpha_i\right] + a\left[(p_i - p_i^*)m_i'(p_i) - \alpha_i\right] = 0 \tag{33}$$

$$\alpha_i(\iota_i) + a_L\left[(p_i - p_i^*)m_i'(p_i) - \alpha_i\right] + a\left[(p_i - p_i^*)m_i'(p_i)\right] = 0 \tag{34}$$

$$\alpha_i(\iota_i - a_L) + (a_L + a)\left[(p_i - p_i^*)m_i'(p_i)\right] = 0 \tag{35}$$

And this is the key equation that they solve for. A couple of more steps to get it into the way they have it, we will put the import demand derivative in elasticity form so

$$\alpha_i(\iota_i - a_L) + (a_L + a)\left[\frac{(p_i - p_i^*)}{p_i}\frac{\partial m}{\partial p_i/p_i}\right] = 0 \tag{36}$$

and then notice that we can write the ps in terms of the wedge so we have

$$\alpha_i(\iota_i - a_L) + (a_L + a)\left[\frac{t_i}{1 + t_i}\frac{\partial m}{\partial p_i/p_i}\right] = 0 \tag{37}$$

then solving out we have

$$\frac{t_i}{1+t_i} = \frac{\iota_i - a_L}{(a_L + a)} \times \frac{\alpha_i}{m_i} \times \left[- \frac{\partial m/m}{\partial p_i/p_i} \right]^{-1} \tag{38}$$

which is their main result.

A couple of things about this

- Notice how lobbying and specifically some lobbying, others not is core to the motivation for tariffs. For example, if all groups lobby, the $a_L = 1$ and then tariffs are zero. At the opposite extreme, if no one lobby, then tariffs are zero as well. So interestingly, and I don't have tons of intution about this, differential lobbying drives everything.
- Conditional on lobbying, who gets more protection, who gets less. This is where the second and third terms come in. The second term is ratio of the domestic endowment relative to net imports (note the sign here it could be fliping). And the third term connects back with the traditional formula where the inverse of the import demand elasticity matters.
- How does this relate to steel?

4. ACDS: WHY IS TRADE NOT FREE? A REVEALED PREFERENCE APPROACH

In many ways, this paper is a nice follow up to Grossman and Helpman. Here is the question: How to make sense of the tariffs that we see in the world? We have seen two rationales: one is terms-of-trade motives, the second are "politics" which in some sense a form of redistributive policies. Now ACDS want to make thing about redistributive issues but outside the box that Grossman Helpman propose. They do two things: (i) characterize constrained efficient tariffs (which Grossman and Helpman could fall under) and (ii) the use their characterization to reverse engineer how society values different groups from data.

A. The Model

The environment is fairly general, I'll simplify it a bit. First, there are $n \in N$ groups in a country. The size of each group is one. I'll think about these groups as locations, but this could be much broader than that. I'm also going to index each location by the goods available in the world. These are my choices, not theirs but it is easier to keep track of the indexing. And consumers in each location have a well defined utility function

$$u(\{c_n(n)\}_{n \in N}) \tag{39}$$

where the parenthesis index the location of consumer, the subscript indexes the types of goods out their in the world.

In each location there is are competitive firms using only labor in that location (again these are my assumptions but fit in with the FGGK implementation) with constant returns. This is what sometimes is called a specific factor model where labor in each location is specific to the production of the good in that location. We will just right the production function as

$$y_n = f(\ell(n)) \tag{40}$$

And then associated with this production environment, the competitive firms in the location pay $w_n(p_n)$ which is a function of the domestic price of the good.

There is a Government that sets specific trade taxes. What this means is that the tax is per unit, not ad valorem as we usually see. This is not a huge deal, but it makes the algebra work out nicely. And then the government rebates the revenue back to the consumers in a lump sum way that does not depend upon the location. Note this last part seems important, I think. Then this implies that the revenue of the government is

$$t \cdot m = N\tau \tag{41}$$

where m is a vector of length N imports or exports and then t is are the specific trade taxes on those different products. The sign determines if the good is exported or imported. Then the dot product of this is equal to the total revenue which the government pays out τ per consumer.

Now an element in the vector of m will be $-(y_n - \sum_N c_n(n))$ or the amount produced net of how much is domestically consumed. We will use this observation later.

Finally, prices take the following form where

$$p = p^w + t \tag{42}$$

where p is the domestic price and p^w is the world price.

B. The Problems

The households problem is

$$\max_{c_n} \quad u(\{c_n(n)\}_{n \in N}), \quad \text{subject to} \quad p \cdot c = w(n) + \tau \tag{43}$$

and associated with this is an expenditure function. They like to work with that, I won't much.

Now the government's problem is the important one to understand. They key idea in the paper is to think about the government setting tariffs in a way that is constrained efficient. Where the constraints come from is not of interest (again, this is the Grossman Helpman world), but given some constraints, the government set things where no one can be made better off. So this problem is

$$\max_{t} \max_{u_n} \quad u(n_0), \tag{44}$$

$$\text{subject to} \quad u(n) \geq \underline{u}(n) \quad \forall n \neq n_o \tag{45}$$

$$u_n \text{ are consistent with a CE} \tag{46}$$

so tariffs and allocations are maximizing some group n_0's utility subject to a bunch of constraints on how much utility the different groups can receive, and this must be a competitive equilibrium.

C. Optimal Tariffs

Now the question is what are the tariffs that solve the problem above. They have a fancy formula, its worth working through how they derive it. First, is the observation that the objective at the optimum of the governments problem can be written as

$$\mathfrak{L} = u(c(n_0)) + \sum_{n \neq n_0} \nu(n) \big[u(c(n)) - \underline{u}(n) \big] \tag{47}$$

then (at least how I like to imagine this) is suppose we perturb things a bit. Well because we are at an optimum, then this perturbation must imply that

$$\sum_{n} \nu(n) du(c(n)) = 0 \tag{48}$$

where the notation convention is the $\nu(n_0)$ is one. This is very natural, so if the Government say adjusted tariffs a little bit then that reallocation must be zero since we are starting from an optimum. And note that built in here are the multipliers on the constraints and these are reflecting essentially how much the Government cares or does not care about group n.

The next step is to characterize $du(c(n))$. This again appeals to envelope type arguments. I'm going to do this a little bit different from how they do it, they differentiate the expenditure function. So start from the budget constraint and lets image what a perturbation in domestic prices would led

$$dw(n) - dp \cdot c(n) + \frac{1}{N} \big[t^* \cdot dm + m \cdot (dp - dp^w) \big] \tag{49}$$

so you get a little bit more wealth, spend some more, and receive some additional transfers. And notice, Envelope theorems are being invoked here as we are evaluating things at the optimum of c and don't have to worry about how this changes. Now this term is in dollars, we can convert it into utils by multiplying by the marginal utility of wealth / expenditure which I will denote as $\mu(n)$. So now we have how much utility changes from the total change in prices or

$$du(n) = \mu(n)\Big[dw(n) - dp \cdot c(n) + \frac{1}{N}\big[t^* \cdot dm + m \cdot (dp - dp^w)\big]\Big] \tag{50}$$

Then we can make a couple of observations. Firs that $dw(n) = y(n)dp$ (where I think the notation is that for the non n entries, $y(n)$ is zero). So we have

$$du(n) = \mu(n)\Big[(y(n) - c(n)) \cdot dp + \frac{1}{N}\big[t^* \cdot dm + m \cdot (dp - dp^w)\big]\Big] \tag{51}$$

where that front term is now like location ns net import or export position. ACDS will relabel this as $d\omega(n)$. Now there is a similar term floating around but with entries for all commodities which is $m \cdot dp$. So we can group things like this

$$du(n) = \mu(n)\Big[(d\omega(n) - d\bar{\omega}) + \frac{1}{N}\big[t^* \cdot dm - m \cdot dp^w\big]\Big] \tag{52}$$

and then from here we just plug this into 48 and solves out for t^*. Note the final step is to defines these multipliers $\beta(n) \propto \mu(n)\nu(n)$ which represents two things (i) how much the government values group n and (ii) the marginal utility of wealth of group n. When one does this they get this expression which is the foundation for everything

$$t^* \cdot dm = -\beta(n)(d\omega(n) - d\bar{\omega}) + m \cdot dp^w \tag{53}$$

Now this says that one should set tariffs so (i) the marginal revenue of an additional dollar raised should equall (ii) the redistributive benefit where what the government is doing through manipulation of prices is creating "as if transfers" to those that are more valuable and (iii) the traditional terms of trade term which can also be thought of as a transfer from the rest of the world to the home country. A couple of more points about this

- This has a strong flavor of the Grossman-Helpman formula, but their key point is all they require is that the tariffs are constrained effecient, not some specfifics about a game as in their paper.
- If everyone was the same (or say labor is mobile) then the redistributive term becomes zero.
- Interestingly, they claim (and I don't quite see it) that if the planner is utilitarian (why?)

D. Quantification

Now basically, they have a linear relationship between tariffs and the $d\omega(n)$ terms and other stuff. So there idea is the following: lets take the observed tariffs, and run a regression on proxies for $d\omega(n)$ and recover the βs. This is where there are a lot of questions.

- Firs they need $d\omega(n)$s and specifically more structure on it to connect it with the data. This is where they use the FGGK paper and essentially return to the point that it is given by $dw(n) - dp \cdot c(n)$ which is how the real wage for group n changes in response to a change in imports.
- Now they do NOT estimate this object though. They use a calibrated model to stand in for the empirical object.

It's some combination of clever and weird. I get that its hard to estimate, but this is a big step. Note how they try and validate this, I have lots of questions after looking at it carefully.

- Talk through results.
- Difference with Ossa.
- Is this an interesting question? Lots of variation in tariffs that is unexplaind. How should we think about the requirement that we be on the (constrained) Pareto frontier?