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Distribution-Neutral Tax Policy- An
Elementary Framework

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ABSTRACT

The recent Brexit episode is being interpreted in some quarters as an anti-globalisation backlash. Free trade does not promise gains for all without a proper compensating mechanism that allows winners to bribe the losers. Also standard prediction of trade theory does point towards increasing wage inequality for the relatively skill abundant developed world. Theoretical discussion on compensating mechanism that addresses inequality is rare in trade literature. In a simple HOS model we consider tax policies that keep the pre-trade degree of inequality unchanged between skilled and unskilled workers. We discuss the problem of existence of such an inequality-neutral tax rate that generates a positive increment in the after tax skilled wage and unskilled wage. Such a mechanism exists and is independent of whether the tax is progressive or proportional.

JEL Classification:F11; J31; D63; H20; H23

Key Words: Trade Model; Wage inequality; Compensation mechanism; Tax policy;

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Free trade under ideal conditions generates overall gains from trade increasing real national income. This is a standard proposition in international trade. However, there are distributional consequences. Some gain and some lose. The general proposition is that gainers can bribe the losers. Thus political authorities should be able to generate compensation mechanisms to help the losers. As real income as a whole increases relative to autarky, potentially everyone can be made better off. Thus free trade benefits all in the sense that even those who do not gain by trade, can be compensated by the State, if needed. This is as much trade theory can tell us.

International trade theory does not suggest anything to take care of rising inequality after trade. If trade increases wage inequality between the skilled and the unskilled, absolute compensation is very unlikely to do the job. Theory of trade does not give any clue as to how gains from trade may be redistributed to contain rising inequality, if any. Hence one needs to integrate public finance with trade i.e. to explore the feasibility of a proper tax-transfer mechanism which this paper intends to do. Interfacing trade and public finance, for understanding both problems better, is necessary as mentioned by *Atkinson(2009)*, and very recently elegantly elaborated in *Pol Antras et al.(2015)* who have gone into the details of welfare consequences of tax policies in an extended trade model when such taxes create distortions. However, they do not discuss this elementary case i.e. whether a compensation mechanism which keeps inequality in check and increases after-tax income of skilled labor is at all feasible in the standard Heckscher-Ohlin-Samuelson model.

The traditional gains from trade theorem is directly related to Pareto criterion. If a change makes no one worse off and at least one better off, the change is Pareto superior to no change. If aggregate real income increases in free trade relative to autarky, one can distribute the gain in a way to make everyone as well off as before and at least one better off. Economists were concerned with the decline in the absolute value of real income and keeping everyone at the same level of welfare as in autarky was good enough policy to counter agitation against trade. The problem is that modern trade theorists could not anticipate that status quo in terms of the initial level of income was not good enough since everyone except the person who is better

off, will feel deprived as his relative position will worsen even if their absolute income remains pegged at the old level. Inequality has become more of a concern than to remain as well off as before. Those who directly gain from trade need to be taxed more heavily if one has to satisfy an inequality-neutral condition given that the degree of inequality remains the same as before, which necessarily means that those who are hurt by trade are duly compensated. At the same time one has to make sure that those who have directly gained from trade are not losing. This will put an upper bound on the quantum of redistribution. Redistributive policy must not make the tax payers worse off relative to autarky. Thus we introduce a new welfare criterion involving inequality that is an extension of the famous Pareto criterion. This is stated as follows.

Consider two social situations A and B. A will promise greater social welfare than B iff taxes, collected from better off people in A relative to B, are transferred to the worse off people in A relative to B to keep the degree of inequality in A same as in B and the tax payers have a greater after tax real income. We apply this principle in our exercise on tax policy in an open economy.

The specific purpose of this paper is to look for distribution neutral income tax rate under free trade as compared to autarky. It is now more or less recognised that the wage inequality between the skilled and unskilled workers in the developed countries has widened considerably along with the rising volume of trade. One can refer to a huge literature dealing theoretically and empirically with the problem in the context of relatively rich skill and capital abundant countries. A representative sample will be *Krugman(2000), Davis(1998, 2011), Jones and Engerman(1996), Feenstra(2010)* etc.

Very recently the Brexit episode has pointed towards reluctance towards integration and the voting pattern suggested that relatively affluent and educated Britons voted to remain within the EU and relatively blue coloured population wanted an exit. Although there is nothing conclusive yet in terms of the pattern of such decision, one needs to worry about import competition and outsourcing affected employment and wage situation in the rich countries. Even if by aggregate measure trade benefits a nation, the affected groups would continue to suffer and agitate if sufficient compensation is not made available to them at least in the short run to cope up with the adjustments even if trade guarantees longer run benefits. Adjustment problems

in trade and short run and long run effects of outsourcing have been discussed by *Chakrabarty (2004)*, *Marjit, Beladi and Chakrabarty (2004)*, *Marjit and Mukherjee (2008)*, *Bandyopadhyay, Marjit and Yang (2014)* etc.

It goes without saying that in a democracy rising inequality is a critical issue to the political competitors and without proper attention such inequality can jeopardize good economic strategies. Thus it seems natural that one would look for compensating policies to counter rising inequality, due to trade. i.e. due to increasing export of skilled products and import of cheaper unskilled items from abroad.

In terms of a text book model of international trade and with a standard tax-transfer mechanism we try to characterize distribution neutral tax policy which taxes skilled workers and transfers the proceeds to the unskilled workers. We find out the necessary increase in the tax rate which keeps the wage distribution unchanged at the pre-trade level and try to characterize such a tax in terms of underlying parameters. The interesting part of the problem is to check the existence of a distribution or inequality neutral tax-rate that is low enough to increase net of tax skilled wage relative to autarky. We argue that such a win-win situation will exist. We consider proportional as well as progressive tax rates and condition for existence is met independent of such difference.

Section 2 develops the model and results. Section 3 provides a general perspective and the last section concludes.

Section 2: Model and Results

Two products X and Y use skilled and unskilled labor for production via CRS and diminishing marginal productivity conditions. X is skilled labor intensive and Y is unskilled labor intensive. The competitive price equation with Y as the numeraire yields

$$w_s a_{sx} + w a_{lx} = p \quad (1)$$

$$w_s a_{sy} + w a_{ly} = 1 \quad (2)$$

The symbols have usual meaning a la Jones (1965). The country concerned is skilled labor abundant and as trade opens up with $\hat{p} > 0$, ' \wedge ' denotes percentage change.

$$\widehat{w}_s = \theta_{Ly} \frac{\hat{p}}{|\theta|} \text{ and } \widehat{w} = -\theta_{sy} \frac{\hat{p}}{|\theta|} \quad (3)$$

With $|\theta| = \theta_{sx} - \theta_{sy} > 0$ by the factor intensity assumption. This is the standard **Stolper-Samuelson** result. Opening up to trade increases inequality between w_s and w , with $\widehat{w}_s > 0$, $\widehat{w} < 0$. We now turn to the welfare policy of the government to compensate the unskilled workers.

Suppose the govt. taxes the skilled workers by taxing w_s with a proportional tax t and redistributes the tax proceeds to the unskilled workers. If S and L are the numbers of skilled and unskilled workers respectively then the after transfer wage to the unskilled worker is given by (4)

$$\widetilde{w} = w + t \frac{w_s \cdot S}{L} \quad (4)$$

and after tax wage rate of the skilled labor is

$$\widetilde{w}_s = w_s (1 - t) \quad (5)$$

We can easily prove the following proposition.

Proposition 1: If t is kept unchanged, increase in w_s will be enough to compensate for a decline in w iff $\theta_{Ly} \geq \lambda$,

where $\lambda = \frac{w}{w + t \frac{w_s S}{L}}$

$$\textbf{Proof: } \widehat{\widetilde{w}} = \lambda \widehat{w} + (1 - \lambda) \widehat{\widetilde{w}_s} \quad (6)$$

$$= \widehat{w}_s - \lambda (\widehat{w}_s - \widehat{w})$$

$$= \frac{\hat{p}}{|\theta|} [\theta_{Ly} - \lambda (\theta_{sy} + \theta_{Ly})]$$

$$= \frac{\hat{p}}{|\theta|} (\theta_{Ly} - \lambda) \quad (7)$$

If $\theta_{Ly} \geq \lambda$, increase in w_s due to trade provides full compensation to the unskilled workers for the initial loss due to trade. Thus, if the objective is to insulate the unskilled wage, a high θ_{Ly} or low λ should be desirable. Following observations are in order.

If initial tax rate is fairly low, then λ will be close to 1 and as $\theta_{Ly} < 1$, with the same t , govt. will not be able to compensate the loss. Such critical t , say \bar{t} is solved as follows.

$$\text{For } \theta_{Ly} = \lambda \Rightarrow \theta_{Ly} = \frac{w}{w + t \frac{w_s S}{L}}$$

$$\text{Or, } t = \bar{t} = \frac{(1 - \theta_{Ly})}{\theta_{Ly} \frac{w_s S}{w L}} \quad (8)$$

Thus initial tax rate has to be equal to \bar{t} for $\widehat{w} = 0$. Note that such a \bar{t} depends on initial relative wage $\left(\frac{w_s}{w}\right)$. Higher initial $\frac{w_s}{w}$ will reduce \bar{t} , because there is more to redistribute. Very high value of $\frac{L}{S}$ will demand a much higher initial tax rate to be in place for neutralizing the impact on w . The next step is to consider the case when raising w is not enough and the govt. tries to contain inequality.

Distribution-Neutral tax rate

We shall consider the case when the govt. worries about the inequality between after tax skilled wage and transfer supported unskilled wage. Thus the measure is given by $\frac{\widehat{w}_s}{\widehat{w}}$ instead of $\frac{w_s}{w}$. To start with before trade there was an initial value of $\frac{\widehat{w}_s}{\widehat{w}}$ and the govt. looks at the post trade value of $\frac{\widehat{w}_s}{\widehat{w}}$. Note that even if t is kept unchanged, increase in w_s by itself will raise income of the unskilled. But let us see to what extent.

Proposition 2: If t is kept unchanged, $(\widehat{w}_s - \widehat{w}) > 0$ i.e. inequality must increase.

Proof: We know $\widehat{w} = \frac{\hat{p}}{|\theta|} (\theta_{Ly} - \lambda)$ for $\hat{t} = 0$ (9)

$$\begin{aligned} \text{Hence } (\widehat{w}_s - \widehat{w}) &= \theta_{Ly} \frac{\widehat{p}}{|\theta|} - \frac{\widehat{p}}{|\theta|} (\theta_{Ly} - \lambda) \\ &= \lambda \frac{\widehat{p}}{|\theta|} > 0 \quad \mathbf{QED.} \end{aligned}$$

Proposition 2 suggests that to counter rising inequality t must increase.

Let us now consider the problem of existence of a distribution-neutral tax rate t_n such that it satisfies two conditions.

$$(\widehat{w}_s - \widehat{w}) = 0 \quad (10) \quad \text{and} \quad \widehat{w}_s > 0 \quad (11)$$

(10) implies that the degree of inequality is kept at the initial level neutralising the trade impact. (11) implies that after tax skilled wage is still greater under trade.

$$\widehat{w}_s = \widehat{w}_s - \hat{t} \frac{t}{(1-t)} \quad (12)$$

$$\widehat{w} = \lambda \widehat{w} + (1 - \lambda)(\hat{t} + \widehat{w}_s) \quad (13)$$

$$\text{Now } (\widehat{w}_s - \widehat{w}) = 0 \Rightarrow \widehat{w}_s - \hat{t} \frac{t}{(1-t)} - \lambda \widehat{w} - (1 - \lambda)(\hat{t} + \widehat{w}_s) = 0$$

$$\text{Or, } \hat{t} = \frac{\lambda(\widehat{w}_s - \widehat{w})}{(1-\lambda) + \frac{t}{(1-t)}}$$

$$= \frac{\lambda \left(\frac{\widehat{p}}{|\theta|} \right)}{(1-\lambda) + \frac{t}{(1-t)}} \quad (14)$$

The neutral tax rate t_n is given by $t_n = t(1 + \hat{t})$

$$\widehat{w}_s - \hat{t} \frac{t}{(1-t)} > 0 \quad [\text{from (11) \& (12)}]$$

$$\Rightarrow \theta_{Ly} \frac{\widehat{p}}{|\theta|} > \hat{t} \frac{t}{(1-t)} \quad (15)$$

Substituting for \hat{t} from (14) we get

$$\theta_{Ly} > \frac{\lambda t}{\lambda t + (1-\lambda)} \quad (16)$$

Equation (16) summarises two conditions. *First*, inequality is contained at the pre trade level and such taxation is fair in the sense that the skilled workers' after-tax income has been allowed to grow. But the problem is that whether such condition is likely to be satisfied, which will guarantee the existence of a t_n .

We simplify condition (16) further

$$\theta_{Ly} > \frac{\lambda t}{\lambda t + (1-\lambda)} = \frac{1}{1 + \frac{1}{t}(\frac{1}{\lambda} - 1)} \quad (17)$$

From the definition of $\lambda \equiv \frac{w}{w + t \frac{w_s S}{L}}$, equation (17) boils down to

$$\theta_{Ly} > \frac{1}{1 + \frac{1}{t}(t \frac{w_s S}{w L})} = \frac{1}{1 + \frac{w_s S}{w L}} \quad (18)$$

Proposition (3)

Such a tax- transfer mechanism will always exist.

Proof : Following from (18) that does not contain t , a little manipulation yields that

$$\text{for (18) to hold } \frac{w_s}{w} > \left(\frac{1}{\theta_{Ly}} - 1 \right) \frac{L}{S} \quad (19)$$

This boils down to $(S/L) > (a_{sy} / a_{sx})$

Note that as the country is a typical HOS economy exporting skill intensive good and is incompletely specialized this must hold as the endowment ratio must lie within the cone of diversification i.e. $(a_{sx} / a_{lx}) > S/L > (a_{sy} / a_{ly})$. QED

We know that free trade does not guarantee that everyone will gain due to trade, some will and some won't. But gainers should be able to bribe losers. Problem is that such compensation is not enough to tackle rising inequality due to trade. This is a different parameter which compensation schemes in the context of trade theory never took account of. Thus the standard compensation criteria did not have any formulation to design distribution-neutral compensation mechanism. We have proved that a distribution neutral tax transfer mechanism that guarantees a rise in

after tax wage of the skilled worker and maintains the degree of inequality at the pre-trade level does exist.

Progressive Tax

Now we redo the exercise with a progressive tax that increases with w_s . In particular we propose a tax elasticity ϵ such that $\hat{t} = \epsilon \hat{w}_s$. Working through the same process as before we get

$$\hat{w}_s = \hat{w}_s(1 - \epsilon a) \quad (20) \quad ; \text{ where } a = \frac{t}{(1-t)}$$

$$\hat{w} = \lambda \hat{w} + (1 - \lambda)(1 + \epsilon) \hat{w}_s \quad (21)$$

$$\hat{w}_s - \hat{w} = \lambda \frac{\hat{p}}{|Q|} - \epsilon(1 - \lambda + a) \frac{\hat{p}}{|Q|} \theta_{Ly} \quad (22) \quad ; \text{ [by (20)-(21) \& substituting for } \hat{w}_s \text{ and } \hat{w} \text{ from (3)]}$$

Note that with $\epsilon = 0$ equation (22) boils down to the case of a proportional tax.

$$\hat{w}_s - \hat{w} = 0 \text{ iff } \epsilon = \frac{\lambda}{\theta_{Ly}(1+a-\lambda)} \quad (23)$$

$$\hat{w}_s > 0 \text{ iff } 1 > \epsilon a \quad (24)$$

$$1 - \epsilon a > 0 \text{ iff } \frac{1+a-\lambda}{\lambda a} > \frac{1}{\theta_{Ly}}$$

Substituting for a and λ we get

$$1 - \epsilon a > 0 \text{ iff}$$

$$\frac{w_s}{w} > \left(\frac{1}{\theta_{Ly}} - 1 \right) \frac{L}{s} \quad (25) \text{ [using (23)]}$$

Note that condition (25) is exactly the same condition required in the case of proportional tax.

Section 3: A General Perspective and Conclusion

We started with the question whether one can design a compensation mechanism that not only protects absolute income of those who are adversely affected by trade, but also guarantees that the degree of inequality remains unchanged at the autarchic level and at the same time those who gain from trade continue to enjoy a higher after-tax income. We have used a standard HOS type model with skilled and unskilled labor and a trade induced rise in skilled wage and a decline in unskilled wage to show that without increase in the tax rate, the rise in skilled wage will not give enough resources to keep inequality under control. However, a tax rate proportional or progressive will always exist which, if implemented, will serve the purpose. Inequality will remain the same and skilled workers would still gain.

This result modifies the well-known Pareto ranking hypothesis which does not consider rising inequality while making welfare comparisons. One must compensate the losers more than what is needed to keep them on the same level of real income as before as inequality will be on the rise. The simple workhorse of trade theory shows that even such compensation can be designed through a transfer from gainers.

Marjit and Sarkar (2016) show that for any actual distribution that indicates an increase in aggregate value of the relevant attribute across agents relative to the original , one can construct a counterfactual distribution which is distribution neutral compared to the original distribution and guarantees greater value for everyone. Thus gains from trade theorem or higher growth of income will guarantee such outcome with a proper tax-transfer mechanism. This inequality preserving efficiency result is coined as Strongly Pareto Superior (SPS) allocation. Thus the present work represents a case of a more general proposition. In this paper we do not deal with aggregate welfare but with aggregate wage income. But one can easily recast the analysis in terms of aggregate income/ welfare following Marjit and Sarkar (2016). We discuss the case with aggregate income. The case with welfare will proceed in the same manner.

Note that aggregate income must increase under trade as aggregate labor income, skilled plus unskilled, is nothing but aggregate value of output $PX + Y$ and as terms of trade improve the change in income is captured by $dP.X > 0$, after using the simple

envelope property and with $dP > 0$. As total value of labor income goes up, one can design a tax-transfer mechanism, following Marjit and Sarkar (2016), that is distribution neutral and guarantees higher income level to both types of workers. Such a value of tax/ transfer is solved by setting the counterfactual degree of inequality between the skilled and the unskilled exactly the same as the autarkic inequality. Once that transfer is determined, one needs to impose the condition that after tax and transfer both skilled and unskilled workers are better off. This boils down to the condition that the aggregate labor- income must be higher, which is true under free trade. This is an alternative way of solving the problem.

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