External terms-of-trade and labor market imperfections in developing countries: theory and evidence

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ABSTRACT: The paper addresses the question of whether developing countries possess any built-in mechanism that can cope with external terms-of-trade (TOT) shocks. Using a two-sector, full-employment general equilibrium model with endogenous labor market distortion theoretically it shows that such countries possess an inherent shock-absorbing mechanism that stems from their peculiar institutional characteristics and can lessen the gravity of detrimental welfare consequence of exogenous TOT movements. This result has been found to be empirically valid based on a panel dataset of 13 countries from 2000-2012. Our analyses lead to recommendation of an important policy that should be adhered to preserve this in-built system.

Keywords: Terms-of-trade shocks, Labor market imperfection, Welfare, Developing countries, Panel Data.

JEL Classification: D59, D60, F41, F13, J42, J52.

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External Terms-of-Trade and Labor Market Imperfections in Developing Countries: Theory and Evidence

1. Introduction and motivation

In the literature on trade and development, a very large numbers of empirical studies have pointed out that developing countries are much more vulnerable to external terms-of-trade (TOT) shocks vis-à-vis the developed nations. These fluctuations are undesirable because they contribute to significantly increased volatility in the growth of output and hence social welfare. Studies e.g. Baxter and Kouparitsas (2006), Broda (2004), Mendoza (1995) and Kose (2002) have found that TOT fluctuations are twice as large in developing countries as in developed nations. According to them the nature of composition of export baskets, high degree of trade openness and very little influence over international commodity prices have been the main responsible factors.

For minimizing the adverse effects of unfavorable TOT movements studies like Hoffmann (2007), Tornell and Velasco (2000), Broda (2004), Broda and Tille (2003), Mendoza (1995) and Kose (2002), Edwards and Levy-Yeyati (2003) and Haddad et al. (2011) have suggested policies e.g. switching from fixed to flexible exchange rate regime and export diversification. Unfortunately, nowhere it has been pointed out that these economies have an in-built shock-absorbing mechanism that crops up due to their typical institutional characteristics and emphasized the necessity for adhering to development policies that do not impinge on this natural mechanism. In this study without undermining the efficacy of other suggested measures, we have demonstrated by using a 2×2 full-employment model for a small open economy with endogenous labor market distortion how the existence of labor market imperfection can minimize the severity of the detrimental TOT shocks. Analytically, our analysis also demonstrates that policies aimed at deregulating the labor market hurt the efficacy of small economies' inherent shock-absorbing capacity.

Then, we have conducted a quantitative assessment of the theoretical result based on an annual panel dataset of 13 small developing countries over the recent time period of 2000-2012. In terms of economic growth, this empirical analysis finds that developing nations with higher intersectoral wage differential have been less affected during the liberalized regime vis-à-vis some other developing countries with relatively lower wage dispersion. More specifically, we have established that TOT movements in either direction have caused smaller fluctuations in per capita GDP growth in the economies with larger wage dispersion vis-à-vis the other group of countries in the post-reform period. Quite a large number of empirical studies involving consequences of TOT changes on the developing economies are available in the literature on trade and development. However, there has been virtually no work that relates welfare outcomes of external price movements to labor market institutions of the southern countries and builds up a formal theoretical structure with empirical validation. Here lies the importance of this study.

2. The theoretical analysis and results

We consider a 2×2 full-employment model with labor market imperfection in sector 2 for a small open economy. In sector 2 (a formal sector) workers receive the endogenously determined unionized wage, W^*, while their counterparts in sector 1 (an informal sector) receive the competitive wage, W. There is perfect mobility of capital between the two sectors and its economy-wide return is r. All other standard assumptions of the Heckscher-Ohlin-Samuelson (HOS) model continue to hold. Sectors 1 and 2 are the export and import-competing sectors, respectively. Commodity prices, P_is are given by the small open economy assumption. Factor endowments are also exogenously given. Finally, commodity 1 is taken to be the numeraire.

The unionized wage is determined as a solution to the Nash bargaining game between the representative firm and the representative labor union in the unionized formal sector (sector 2) industry. Assuming homogenous firms and labor unions in sector 2 we here

directly borrow the simple unionized wage function as derived in detail in Chaudhuri and Mukhopadyay (2009) which is as follows.

$$W^* = W^*(P_2, W, U)\text{; with } (\frac{\partial W^*}{\partial U}), (\frac{\partial W^*}{\partial W}), (\frac{\partial W^*}{\partial P_2}) > 0 \quad (1)$$

In equation (1) the parameter, U denotes the bargaining strength of the labor union in each formal sector firm.[1] Besides, $E_W = (\frac{\partial W^*}{\partial W}\frac{W}{W^*}) > 0$; $E_P = (\frac{\partial W^*}{\partial P_2}\frac{P_2}{W^*}) > 0$; and, $E_U = (\frac{\partial W^*}{\partial U}\frac{U}{W^*}) > 0$ denote the elasticities of $W^*(.)$ with respect to W, P_2 and U, respectively; and, $(E_W + E_P) = 1$.[2]

The equations of the general equilibrium structure of the economy are as follows.

$$Wa_{L1} + ra_{K1} = 1 \quad (2)$$

$$W^*(P_2, W, U)a_{L2} + ra_{K2} = P_2 \quad (3)$$

$$a_{K1}X_1 + a_{K2}X_2 = K \quad (4)$$

$$a_{L1}X_1 + a_{L2}X_2 = L \quad (5)$$

where a_{ji} is the amount of the j th factor required to produce one unit of output of sector i for $j = L, K$; and, $i = 1, 2$. Equations (2) and (3) are the two competitive zero-profit conditions for the two sectors while equations (4) and (5) are the two full-employment conditions for capital and labor, respectively. Determination of factor prices and output levels are well-known.

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[1] One of the most important objectives of the labor unions is to bargain with their respective employers so as to set the unionized wage, W^* as much higher as possible above their reservation wage i.e. the informal sector wage, W. The higher their bargaining power, U the larger would be the intersectoral wage differential. However, U is amenable to policy measures. If the government undertakes different labor market regulatory measures e.g. partial or complete ban on resorting to strikes by the trade unions, reformation of employment security laws to curb union power, U takes a lower value.

[2] See Chaudhuri and Mukhopadyay (2009) in this context.

It is assumed that sector 1 is more (less) labor-intensive (capital-intensive) than sector 2 in value sense i.e. $\frac{Wa_{L1}}{a_{K1}} > \frac{W^* a_{L2}}{a_{K2}}$. As $W^* > W$ it automatically follows that sector 1 is more (less) labor-intensive (capital-intensive) than sector 2 in physical sense.

The demand side of the model is represented as follows.

Let V denote social welfare that depends on the consumption of two commodities, denoted D_1 and D_2. The strictly quasi-concave social welfare function is depicted by

$$V = V(D_1, D_2) \tag{6}$$

The balance of trade equilibrium requires that

$$D_1 + P_2 D_2 = X_1 + P_2 X_2 \tag{7}$$

The volume of import of commodity 2, denoted M is given by the following.

$$M = \underset{(-)}{D_2}(\underset{(+)}{P_2}, Y) - X_2 \tag{8}$$

In equation (8), Y denotes national income at domestic/international prices and is given by

$$Y = X_1 + P_2 X_2 \tag{9}$$

2.1 Theoretical results -- consequences of deterioration in TOT

Deterioration in TOT in the existing structure means an increase in the relative international price of commodity 2 i.e. P_2.

Totally, differentiating equations (1) – (5), the following proposition can be easily proved.

Proposition 1: Deterioration in the TOT leads to: (i) a decrease in the competitive wage, W; (ii) an increase in the return to capital, r; (iii) an ambiguous effect on the unionized

wage, W^*; (iv) decreases in wage-rental ratios, (W/r) and (W^*/r); (v) an increase in intersectoral wage differential, (W^*-W); (v) an expansion (a contraction) of sector 2 (sector 1); and, (vi) an increase in employment of labor in sector 2, $L_2(=a_{L2}X_2)$.

We verbally explain proposition 1 as follows. As P_2 rises a *Stolper-Samuelson effect* takes place that lowers W and raises r as sector 2 (sector 1) is capital-intensive (labor-intensive). W^* gets affected due to two reasons. An increase in P_2 produces a direct positive effect on $W^*(\because E_P > 0)$ while the decrease in W produces an induced negative effect $(\because E_W > 0)$. The net effect on W^* is, however, ambiguous. It depends on the magnitudes of different technological, institutional, and trade-related parameters. Nevertheless, even if the net effect on W^* is negative it would be less severe than that on W due to the presence of the additional direct positive effect on the former. Consequently, the (W^*-W) gap widens. However, it can be easily shown that the (W^*/r) ratio surely decreases.[3] Consequently, producers in both the sectors substitute capital by labor that raises the labor-output ratios, a_{L1} and a_{L2} and lowers capital-output ratios, a_{K1} and a_{K2}. A *Rybczynski type effect* takes place leading to a contraction (an expansion) of sector 1 (sector 2).[4] As sector 2 expands, the aggregate employment of labor in this sector, $L_2(=a_{L2}X_2)$ also increases.

We now investigate the welfare consequence of the TOT changes. Differentiating equations (1) – (9) the following expression can be derived.[5]

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[3] Mathematical proofs are quite straightforward.

[4] It is needless to point out that a *Stolper-Samuelson effect* is followed by a *Rybczynski type effect* if technologies of production are of variable-coefficient type.

[5] Interested readers can check these from proofs of similar results available in Chaudhuri and Mukhopadhyay (2014).

$$\left(\frac{1}{V_1}\frac{dV}{dP_2}\right) = (W^* - W)\left(\frac{dL_2}{dP_2}\right) - M \qquad (10)$$
$$(+) \quad (+) \quad (+)$$

From equation (10) the following proposition readily follows.

Proposition 2: The presence of labor market imperfection, reflected in intersectoral wage differential, can soften the blow of an exogenous TOT shock on welfare.

Proposition 2 can intuitively be explained in the following fashion. In the existing set-up an exogenous TOT shock can affect social welfare in two ways. First, as the relative price of the import good rises, the import-competing sector (sector 2) expands following a *Rybczynski type effect* at the cost of the export sector (sector 1). As the high wage-paying sector (sector 2) now absorbs more workers than previously the aggregate wage income rises. This we call the *labor reallocation effect (LRE)*, which produces a positive effect on welfare. On the contrary, welfare deteriorates because the economy has now to pay more for importing a certain amount of commodity 2 from the international market whose relative price has increased. This may be termed as the *value of import effect (VIE)*. The magnitudes of *LRE* and *VIE* are captured by the first and second terms of the right-hand-side of equation (10), respectively. Therefore, we find that social welfare improves due to positive *LRE* and worsens due to negative *VIE*. So, even if the positive *LRE* cannot outweigh the negative effect of *VIE*, it definitely neutralizes at least a part of the aggregate detrimental outcome of the latter effect on social welfare.

The degree of labor market distortion which is reflected in the magnitude of intersectoral wage differential, $(W^* - W)$ depends positively on the bargaining power of the labor

unions, U . From (10) we note that the higher (lower) the value of U the larger (smaller) would be the intersectoral wage differential and so would be the strength of the *LRE*. Now, labor market reform which means lowering, U weakens the strength of this beneficial effect on welfare. Thus, this policy would make the economy more vulnerable to unfavorable TOT movements at the international market. In the extreme case, when there is no labor market distortion we have $W^* = W$. Consequently, there would be no positive *LRE*. In this situation, the consequence of adverse TOT movements at the international market on national welfare would completely be felt by the economy. The final proposition of the theoretical analysis is now imminent.

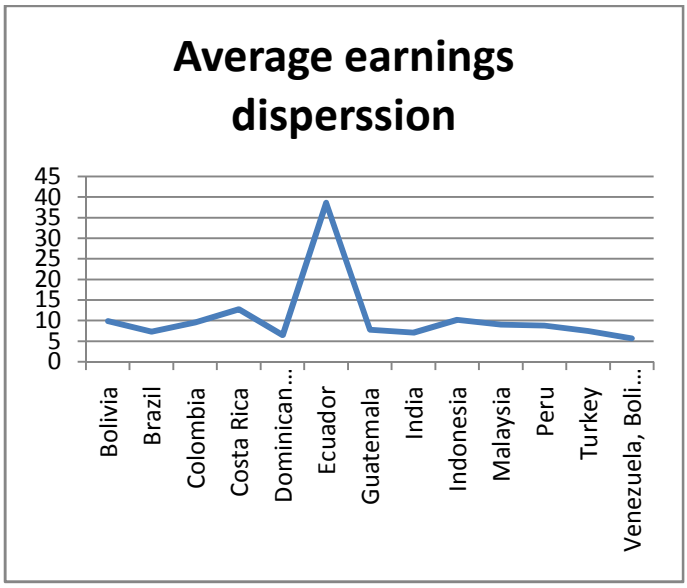
Proposition 3: Labor market reforms aimed at lowering the trade union bargaining power make the economy more susceptible to unfavorable exogenous TOT movements.

3. The empirical analysis

In this section we conduct an empirical analysis based on an annual panel dataset of 13 small developing countries over the recent time period of 2000-2012 to substantiate our main theoretical finding that the countries with higher wage dispersion are less prone to exogenous TOT changes compared to those countries with lower wage dispersion (proposition 2). Here countries are selected on the basis of 'earnings dispersion among employees (decile 9 versus decile 1)' data availability from ILOSTAT database from International Labor Organization (ILO) website.[6] We consider this earnings dispersion as

[6] In ILOSTAT database this variable is defined as "This measure of earnings dispersion refers to the ratio of average earnings of employees in the ninth decile to those of employees in the first decile of the earnings". There are 38 countries for which this variable is available and following

a proxy for wage dispersion which varies greatly among countries as it is evident from the following figure.



Based on median of these average earnings dispersion we create two groups of countries. Higher wage dispersion countries are Bolivia, Colombia, Costa Rica, Ecuador, Indonesia, and Malaysia while lower wage dispersion countries are Brazil, Dominican Republic, Guatemala, India, Turkey, and Venezuela. Now, a panel data analysis is conducted to empirically measure the effect of external *TOT* changes on the per-capita GDP growth (*pcgdp*) while controlling for openness (*OPEN*) as a measure of percentage of export and import over GDP. This empirical analysis utilizes the following basic formulation

$$pcgdp_{it} = \beta_1 + \beta_2 TOT_{it} + \beta_3 OPEN_{it} + u_{it} \qquad (11)$$

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our theoretical model's foundation we did not consider those countries which are in the high income (both OECD and non-OECD) groups and countries for which data either for *pcgdp*, or *TOT*, or *OPEN* are not available from 2000 to 2012.

where i = 1, 2,…, 7 for higher wage dispersion countries and i = 1, 2,…, 6 for lower wage dispersion countries and t = 1, 2, . . . ,13 and $E(u_{it}) \sim N(0, \sigma_u^2)$. The left-hand side is the annual percentage growth rate of GDP per-capita which is obtained from the World Development Indicators of the World Development Report (WDR) for different years**.** Note that instead of calculating *pcgdp* we have rather collected such series directly from the WDR database. The right-hand side involves annual percentage growth rates of *TOT* and *OPEN*. Before estimating this equation we have checked stationary aspect of each series and found that each of these series is highly stationary in terms of the well-known Augmented Dickey Fuller (ADF) test.[7]

At the beginning, equation (11) is estimated with ordinary least squares on pooled time-series cross-section data. Thereafter, we have considered a fixed effect (FE) model (11a) by adding dummy for each country so that we are able to estimate the pure effect of the explanatory variables on the *pcgdp* by controlling for the unobserved heterogeneity.

$$pcgdp_{it} = \beta_{1i} + \beta_2 TOT_{it} + \beta_3 OPEN_{it} + u_{it} \qquad (11a)$$

Each dummy (β_{1i}) is absorbing the time-invariant effects particular to each country, if any. Since our group of countries is diverse we have a reason to believe that differences across countries might have some influence on the RER, therefore, we have proceeded by considering a random effect model (11b).

$$pcgdp_{it} = \beta_1 + \beta_2 TOT_{it} + \beta_3 OPEN_{it} + e_i + u_{it} \qquad (11b)$$

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[7] For the sake of brevity we have not reported these results explicitly.

where e_i is a random error term with a mean value of zero and variance of σ_e^2.

Both fixed-effect (FE) and random-effect (RE) panel data regression models pass the standard F test for overall significance at the 1% level. Since we have used the time-series cross-section data for different countries, the residuals might have suffered from the heteroskedasticity problem and hence are adjusted by providing t-value based on heteroskedasticity corrected robust estimation method. The impact of *TOT* on the *pcgdp* is largely consistent with our theoretical model. The estimated coefficient of the *TOT* in the *pcgdp* equation is positive and statistically significant for FE and RE panel data models whereas, the control variable *OPEN* is not statistically significant for the group of countries with lower wage dispersion (see Table 2). On the other hand, for the group of countries with higher wage dispersion (see Table 1) although the estimated coefficient of the *TOT* in the *pcgdp* is positive it is not statistically significant in all the three panel data models. However, one thing should be noted that the signs of the estimated parameters for the coefficient of *TOT* are remarkably consistent and intuitively correct in all the underlying models.

[Insert Table 1 is about here]

Table 1: Panel data analysis with countries having higher wage dispersions

Variables	OLS (Pooled)	FE	RE
TOT	0.019	0.007	0.013
	(0.60)[a]	(0.23)	(0.46)
OPEN	0.071**	0.091*	0.082**
	(2.12)	(2.42)	(2.10)
Constant	2.866***	2.877***	2.872***
	(11.28)	(32.87)	(8.21)

[a] t-value (corresponding to robust standard error) in parentheses.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

[Insert Table 2 is about here]

Table 2: Panel data analysis with countries having lower wage dispersions

Variables	OLS (Pooled)	FE	RE
TOT	0.079	0.120**	0.102***
	(1.47)[a]	(4.17)[a]	(4.61)
OPEN	-0.011	-0.028	-0.022
	(0.23)	(0.84)	(0.75)
Constant	2.745***	2.705***	2.723***
	(6.10)	(45.58)	(3.81)

[a] t-value (corresponding to robust standard error) in parentheses.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

To check the robustness of the above findings, we have also considered this analysis without considering the control variable *OPEN*. Results relating to higher wage dispersion countries are reported in Table 3 whereas the estimates corresponding to lower wage dispersion countries are reported in Table 4. These results also support our analytical finding that countries with higher wage dispersion are relatively less affected by TOT fluctuations of recent years compared to those countries with lower wage dispersion.

[Insert Table 3 is about here]

Table 3: Panel data analysis with countries having higher wage dispersions

Variables	OLS (Pooled)	FE	RE
TOT	0.055	0.054	0.054**
	(1.85)[a]	(1.90)	(2.18)
Constant	2.838***	2.842***	2.840***
	(10.64)	(33.82)	(9.04)

[a] t-value (corresponding to robust standard error) in parentheses.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

[Insert Table 4 is about here]

Table 4: Panel data analysis with countries having lower wage dispersions

Variables	OLS (Pooled)	FE	RE
TOT	0.077	0.115**	0.097***
	(1.43)[a]	(5.55)[a]	(5.10)
Constant	2.719***	2.639***	2.677***
	(6.02)	(60.34)	(3.72)

[a] t-value (corresponding to robust standard error) in parentheses.

*** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

To decide between the FE and RE for the appropriate model particular to our dataset we have conducted well-known Hausman test where the null hypothesis considers that the preferred model is the RE model and have found that we fail to reject the null hypothesis. Thereafter, we have proceeded by conducting the Lagrange Multiplier (LM) test for the panel effect with the null hypothesis that the variance across countries is zero. The result indicates that we fail to accept the null hypothesis which in turn substantiates our empirical analysis with panel data instead of considering separate OLS regression for each country. Moreover, in view of the short time span and assumed parameter homogeneity, following Baltagi et al. (2009), we can conclude that the panel results should be more reliable vis-a-vis pooled OLS results (given in the first column in each of the above tables), which we have exactly done here.

This result suggests that, on average, a 1% increase in *TOT* across time and between countries with lower wage dispersion caused about 0.1% overall increase in the *pcgdp* whereas countries with higher wage dispersion had experienced either no **(see Table 1)** or lower (almost half) impact (0.05%, see Table 3) of TOT changes on the *pcgdp.* Hence, our findings are as follows: the effect of TOT changes on *pcgdp* growth had been typically small in absolute terms but consistently significant relative only to the developing countries with lower wage dispersion. These results provide systematic econometric evidence to support the hypothesis that the TOT changes had significant impact on economic growth in the countries with lower wage dispersion but negligible impact on growth in higher wage dispersion countries during the period, 2000-2012.

4. Concluding remarks and policy recommendations

Some recent empirical studies have found that developing countries are more prone to external terms-of-trade shocks compared to developed nations. Policies like switching from fixed to flexible exchange rate regime and diversification of the export basket have been advocated in general to minimize the negative effects resulting from such international disturbances. However, possibly no attempt has been made to identify the inherent shock-absorbing mechanism in the developing countries which arises out of their typical institutional characteristics. In this study, we have demonstrated how the existence of labor market imperfection can lessen the gravity of detrimental TOT shocks on social welfare. Moreover, by examining cross-country data we substantiate our findings that countries with relatively higher intersectoral wage differential have experienced smaller fluctuations in per capita GDP owing to TOT changes during the

period 2000-2012 relative to the other set of countries with smaller wage dispersion. We are of the opinion that the developing countries should not go for labor market reforms because these would impair the effectiveness of their internal shock-absorbing capacity against adverse international price movements.

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