Agricultural Trade-poverty Linkage : An Empirical Investigation

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Abstract

Many research studies paid attention seriously on the linkage between trade liberalization and poverty alleviation. Those studies applied different kinds of empirical technique to justify the relationship between trade openness and poverty. However, the results of those studies are mixed. The purpose of this paper is to examine empirically the channels by which agricultural trade liberalization could positively affect poverty in developing counties. This paper uses dynamic panel data to examine the relationship with linear-formed model. One-step difference GMM estimator and ordinary least square (OLS) estimator are applied to find statistical significance in the relation. The result indicates that agricultural trade have statistically positive effects to economic growth, poverty reduction, and equity improvement in developing countries whose the poor are dependent on agricultural sector.

1. Introduction

The relationship between trade liberalization and economic growth is still controversially debated between researchers who find the significant connection between trade openness and growth, i.e. Frankel and Romer (1999), and those who are skeptical of the linkage. Rodriquez and Rodrik (2000) scrutinized in the most prominent empirical studies on the relationship between trade barrier and economic growth. They suggested that there is probably a strong negative relationship between trade barriers and economic growth. Furthermore, Rodrik argued that many countries in South America have been the enthusiastic supporter to freer trade since 1980, but their economic performance has been significantly below pre-1980 level. Thus, these arguments imply that there is the gap between the prediction of classical theories and empirical outcomes.

However, there are many empirical studies which affirmed that trade liberalization supports growth and poverty reductions in developing countries, even though it may initially have adverse consequences, or resource reallocation cost (Winters, 2001). But

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almost all of those studies placed emphasis on the relationship between trade and growth (or sometimes poverty). They did not focus on the benefit effect transmission. Moreover, trickle-down effects from trade liberalization to the poor are still questionable, and this issue has being challenged in World Trade Organization (WTO) forums. The Stolper-Samuelson (SS) theorem claims that an increase in prices of tradable and labor-intensive products will raise real labor incomes and decrease real capital returns. Theoretically, there is a powerful relevance in direct and immediate results of the trade liberalization and poverty reduction linkage. Nevertheless, the theorem has restrictive assumptions, and they are easy to be violated in reality. The SS theorem is necessary but not sufficient to analyze poverty reduction through trade liberalization.

For more clearly, Convey (2004) proposed a conceptual framework for analyzing trade-poverty linkage. This framework identified four channels by which trade liberalization could affect poverty reduction: *consumption* (prices, faced by poor households, of the goods they purchase), *income* (return to the labor, assets and/or products of the poor), *provision of public goods* (government expenditures on health, education, sanitation, and social protection, accessible to the poor), and *security* (improved capacity to sustain long-term welfare through reduction and mitigation of risk, and increased capacity to cope with the consequences of a shock). Although this frame work enables to theoretically justify the positive relationship between trade liberalization and poverty reduction, it lacks empirical studies to vindicate the relationship, especially in developing countries.

Although simple Hechscher-Ohlin (HO) trade theory suggests that trade liberalization in unskilled-labor-intensive products will relieve poverty in relatively unskilled-labor-abundant countries, in practice other factors should be considered (Winters, McCulloch, and McKay, 2004). For example, many Latin America and Africa countries have very strong endowments in mineral and agricultural resources that are owned by capitalists, and trade liberalization will stimulate these sectors rather than labor-intensive one. This example allows us to imply that trade liberalization by developing country's governments probably has different effects on the incomes of different social groups (Conway, 2004). Additionally, the short-run costs of resource allocation in the classes of labor have to be in consideration even if trade liberalization is preferable for the economic growth in the long run. Many countries had anti-growth effects shortly after the liberalization because resource structure had been changed to new scenarios. Winters, McCulloch, and McKay (2004) suggests that this adverse effect can appear in higher unemployment rate and then lower growth rate, but just only for a short period.

The commitments to reduce agricultural supports in developed countries, i.e. Japan, will engage substantial changes in world agriculture product's price and rate of return. Many

developing countries, which are net exporters of agricultural goods, can gain more access to the world market. Moreover, agricultural trade flow will be substantially shifted. Agricultural trade from developing countries to big market in developed countries, i.e. USA and EU will be enlarged by more opportunities to access world market. Eventually, in developing counties, total trade expands and real income, especially among the poor in rural areas, increases dramatically.

Hence, this paper primarily examines empirically the income channel by which agricultural trade liberalization could positively affect poverty in export-oriented developing counties. The study will start with constructing suitable indicators for trade openness and income channel in Conway framework (i.e. socio-economic variables). Then, the linkage will be examined by the statistical method (i.e. Instrument Variables Estimation). Since, in developing countries, income of most poor people relies heavily on agricultural sector, the agricultural growth is the key to poverty reduction and the foundation of sustainable development. The unit of analysis should, therefore, be bounded only in agri-export oriented developing countries. The result of this study could empirically form crucial channels in capturing the positive relationship between trade liberalization and poverty reduction in developing countries.

2. Literature Review

The current studies examining the effects of trade liberalization to poverty consist of four board categories. The first one is Cross-country regression analysis. Dollar and Kraay (2002) examined the statistical relationship between inequality measures, i.e. Gini coefficient and trade volume, and found that trade volumes are not statistically correlated with inequality measures, but trade has positive relationship with economic growth. This result probably implies that since growth alleviates poverty, trade reduces poverty as well. Additionally, regression, including variables such as trade volume, education, and rule of law, is used to explain deviations around the one-to-one relationship between changes in average income and changes in poorest one-fifth's income (Dollar and Kraay, 2004). The finding is that there is no systematic relationship between average incomes and the share of the poorest income. It might imply that the poverty reduction is resulted from economic growth.

Secondly, many studies employ Partial-Equilibrium/Cost-of-Living analysis to explain the relationship between trade and poverty. Deaton (1989), Ravallion (1990), Ravallion and Van de Walle (1991), and Levinsohn, Berry, and Friedman (1999) combined price change in agriculture product and the household data i.e. household expenditure, and wage rate to find interaction

between price changes and welfare effects. Deaton (1989), Ravallion (1990), Ravallion and Van de Walle (1991) claimed that higher price in agricultural product from trade liberalization has positive effects on the poor household but, in the initial period, adverse effects might appear. While Levinsohn, Berry, and Friedman (1999) argued that disregarding self-produced agriculture and owned housing, mean increase in cost-of-living is 130 percents, with the rural poor suffering most. According to these effects, urban poor were most adversely affected. While Minot and Goletti (2000) used a multimarket spatial equilibrium model with different policy scenarios to analyze price change effects in rice market in Vietnam. This study argued that export liberalization raises rice prices within the country, and then gave a positive effect on rural income but slightly favorable impact on poverty.

General-Equilibrium simulation is a tool to analyze trade liberalization effects on welfare. Computable general equilibrium model (CGE) is developed to widely analyze welfare effects from economy shocks including trade liberalization such as admission to WTO, and implications of regional and bilateral trade agreements. Warr (2001), Cockburn (2001), Evans (2001), Harris (2001), Harrison, Rutherford, and Tarr (2000), Lofgren (1999) argued that trade policy reforms toward export promotions may have negative effect to the poor in both urban and rural area. Cogneau and Robilliard (2000) claimed that while relative income and price changes are generally significant, the impact of the various shocks on the aggregate indicators of poverty and inequality tend to be small.

The last category is Micro-macro synthesis. This approach consists of two steps in analysis. In the first step, general equilibrium model is shocked so as to find how large the changes in commodity and factor prices are. These are then calibrated to a post-simulation framework in micro level that calculates the disaggregated representative households. The several poverty measures can, hence, be applied to assess the poverty effects of the shocks. Hertel, Preckel, and Reimer (2001) argued that trade liberalization generally alleviates poverty in Brazil, Chile, Philippines, Indonesia, Thailand, Uganda, and Zambia, but its influence on particular groups within the countries is mixed. Ianchovichina, Nicita, and Soloaga (2001) studied the relationship between trade reform and household welfare in Mexico, and found that tariff reform will not have a negative effect on welfare for all income groups. Friedman (2001) studied impacts of trade liberalization on Indonesia's poor and non-poor in two different scenarios that are unilateral and global trade liberalization. This study claimed that under both scenario few or no households are worse off, but distribution of gains from liberalization tend to be distorted toward the urban rather than the rural and the wealthy rather than the poor.

The conclusion about trade liberalization effects in poverty reduction is still arguable between different methodologies and the same methodology. Some studies concluded that there are adverse outcomes from liberalization to the poor's welfare, while some studies support the trickle-down effects of trade liberalizations toward income inequality.

3. Trade Openness, Income and Inequality: The Poor's Agri-sector Dependency

We focus on the channels of agricultural trade-poverty linkage only in South East Asia countries including China and Central Asia countries since these countries are the main exporters of agricultural products and almost all poor people in these countries are dependent on agricultural sector and live in rural and arable areas. Thus, the relationship between trade liberalization and inequality reduction is expected to find any empirical evidence. Our study, hence, covers this set of countries: Cambodia, Indonesia, Lao, Malaysia, Philippines, Thailand, Vietnam, China, Bangladesh, India, and Sri Lanka.

This paper adopts two measures of inequality, the Gini[2] coefficient (GINI) and the ratio of income earned by the top income quartile to income earned by the bottom quartile (Q5/Q1). The data source of these inequality measures is the data set from the UNU-WIDER World Income Inequality Database (WIID), version 2.0c, which is issued in May 2008.

The measures of trade liberalization could be applied by trade openness which is the ratio of total trade (export plus import) to GDP, and average tariff rate. The average tariff rate is more explicitly a policy variable than trade openness but trade volume in particular goods may not be related to their tariff rate. This imply that trade volume is determined by not only a trade policy but the other factors to boot. The data available on tariffs are very imperfect to measure trade policy (Dollar and Kraay, 2004). Additionally, average tariff rates leave information about affects on non-tariff barriers. Whereas trade volume reflects these non-tariff barrio to trade and it is more precise. We measure trade liberalization by trade openness as an indicator.

Since many countries in South East Asia began to liberate international trade during 1980's, we begin to set the unit of analysis in terms of time period from 1980 to the year in which Gini coefficient is available for each country in particular. Thus, the dataset is unbalanced panel data.

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[2] The Gini coefficient is given as a proportion or percentage. Theoretically, the Gini coefficient will be equal to 0 when the distribution is equal to all. If the society's total income comes into the possession of only one person/household unit, leaving the rest with no income at all, then the Gini coefficient approaches 1, or 100%.

Trade volume in agricultural products is complied from FAO TradeSTAT dataset so that our study concentrates on the merchandize trade in agriculture products which is defined by FAO according to the standard International Merchandise Trade Statistics Methodology[3]. Our trade dataset, therefore, covers both food and other agriculture products and the trade data is evaluated at current price in term of US dollar. To calculate trade openness, we need GDP at current price. We compiled the GDP dataset, including agriculture share, of each country from World Development Indicators (WDI). More details about variable definitions and sources are shown in appendix. GDP per capita, PPP (constant 2005 international $), is considered as a proxy for income and used to calculate agri-income share.

To highlight inequality, agri-income, and inequality across countries and over time, Table 1 reports the unweighted average of their measures by country and decade. As can be seen from the table, South East Asia countries have relatively more inequality. The Gini coefficients of Malaysia, Philippines, and Thailand in the 1980's are quite high comparatively. In Malaysia, Philippines, and Thailand, Gini coefficients in the 1980's are 49.9, 44.6, and 48.3, respectively. At the meantime, inequality in China and India is much lower than in South East Asia countries, with Gini coefficients in the 1980's of 30.5 and 31.3, consecutively. Nevertheless, inequality in China rose very fast from 31.3 in the 1980's to 45.2 in the 2000's. During this period, GDP per capita in China grew surprisingly from 780 US dollars in the 1980's to 3,159 US dollars in the 2000's whereas income share in agriculture sector grew in much lower growth rate than the national income did. From this figure, it could be deduced that income of the rich in China grew very faster than the poor's income did such that inequality rapidly increased from 1980's to 2000's. This would, then, imply that the poor in China are dependent on agricultural sector.

In Central Asia countries, inequality has not been changed much from the 1980's to the 2000's while income has not been changed as well. In particular, Bangladesh and Sri Lanka have had decline in inequality, while India has increased gradually in inequality. Both India and Sri Lanka have had a big change in term of income. Their GDP per capita has much increased from 1,043 and 1,777 US dollars in the 1980's to 1,863 and 3,024 US dollars in the 2000's, respectively. In the meantime, Bangladesh's GDP per capita has grown gradually. All three countries in Central Asia have had overall income growing relatively faster than income share in agriculture sector. This would deduce that the poor in Bangladesh are in any sectors other than agricultural sector. Meanwhile, the poor in India and Sri Lanka would be in agricultural sector.

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[3] For more details, please visit official FAO website.

Table 1 Inequality, Income, and Trade openness: by Decade and Country

Country and Measure	1980's	1990's	2000's
Cambodia			
Gini coefficient	N/A	46.58	42.83
		(1.31)	(0.88)
Q5/Q1 ratio	N/A	9.43	7.78
		(0.64)	(0.41)
GDP per capita	N/A	838.33	1,136.20
		(62.28)	(109.75)
GDP per capita (Agri-share)	N/A	372.00	368.53
		(13.48)	(16.20)
Agri-trade Openness	N/A	0.42	0.92
		(0.17)	(0.15)
Indonesia			
Gini coefficient	34.60	39.45	36.19
	1.67	(1.51)	(2.00)
Q5/Q1 ratio	5.57	6.87	5.75
	(0.38)	(0.50)	(0.52)
GDP per capita	1,610.50	2,596.20	2,940.00
	(189.70)	(318.30)	(182.85)
GDP per capita (Agri-share)	371.10	462.41	439.15
	(35.66)	(42.57)	(14.61)
Agri-trade Openness	0.39	0.47	0.49
	(0.04)	(0.12)	(0.06)
Lao			
Gini coefficient	N/A	33.89	35.02
		(2.45)	(0.37)
Q5/Q1 ratio	N/A	5.19	5.47
		(0.65)	(0.11)
GDP per capita	N/A	1,223.50	1,511.33
		(119.36)	(60.53)
GDP per capita (Agri-share)	N/A	680.64	775.22
		(37.20)	(9.77)
Agri-trade Openness	N/A	0.53	0.47
		(0.11)	(0.05)

Table 1 (Continued)

Country and Measure	1980's	1990's	2000's
Malaysia			
Gini coefficient	49.96	48.32	41.90
	(1.30)	(2.02)	(1.26)
Q5/Q1 ratio	13.23	12.87	N/A
	(1.05)	(0.40)	
GDP per capita	5,799.50	8,723.80	10,630.60
	(323.21)	(1,262.42)	(444.67)
GDP per capita (Agri-share)	1,138.75	1,136.41	957.94
	(36.26)	(82.11)	(99.49)
Agri-trade Openness	0.98	1.57	1.87
	(0.14)	(0.19)	(0.07)
Philippines			
Gini coefficient	44.65	50.28	46.99
	(0.74)	(2.02)	(2.11)
Q5/Q1 ratio	8.70	12.29	10.80
	(0.27)	(1.20)	(1.36)
GDP per capita	2,269.60	2,432.00	2,677.25
	(100.71)	(95.75)	(60.97)
GDP per capita (Agri-share)	539.56	497.20	408.18
	(10.68)	(38.66)	(12.19)
Agri-trade Openness	0.38	0.64	0.99
	(0.05)	(0.17)	(0.03)
Thailand			
Gini coefficient	48.30	49.35	43.16
	(0.47)	(4.38)	(1.47)
Q5/Q1 ratio	12.76	13.82	8.53
	(0.38)	(5.34)	(0.77)
GDP per capita	2,851.89	5,286.00	5,865.00
	(474.21)	(684.61)	(175.42)
GDP per capita (Agri-share)	490.29	542.93	527.85
	(42.96)	(53.86)	(15.79)
Agri-trade Openness	0.48	0.74	1.05
	(0.08)	(0.09)	(0.03)

Table 1 (Continued)

Country and Measure	1980's	1990's	2000's
Vietnam			
Gini coefficient	N/A	36.07	36.57
		(1.14)	(1.38)
Q5/Q1 ratio	N/A	5.81	5.80
		(0.32)	(0.59)
GDP per capita	N/A	1,291.14	1,789.20
		(165.66)	(159.82)
GDP per capita (Agri-share)	N/A	346.66	413.90
		(29.47)	(22.44)
Agri-trade Openness	N/A	0.69	1.09
		(0.11)	(0.14)
China			
Gini coefficient	30.59	40.36	45.28
	(3.46)	(3.17)	(1.38)
Q5/Q1 ratio	4.91	8.06	11.03
	(0.88)	(1.38)	(0.95)
GDP per capita	780.90	1,770.10	3,159.40
	(207.17)	(483.45)	(418.76)
GDP per capita (Agri-share)	223.76	346.37	427.17
	(39.49)	(51.04)	(36.45)
Agri-trade Openness	0.50	0.67	0.65
	(0.12)	(0.10)	(0.08)
Bangladesh			
Gini coefficient	36.09	33.13	32.45
	(2.05)	(3.26)	(0.56)
Q5/Q1 ratio	6.05	5.11	4.72
	(0.63)	(0.77)	(0.10)
GDP per capita	649.78	770.00	977.33
	(21.13)	(58.73)	(62.12)
GDP per capita (Agri-share)	205.02	207.12	220.44
	(8.35)	(9.51)	(7.57)
Agri-trade Openness	0.15	0.21	0.30
	(0.01)	(0.05)	(0.03)

Table 1 (Continued)

Country and Measure	1980's	1990's	2000's
India			
Gini coefficient	31.33	33.25	36.48
	(0.64)	(1.93)	(0.25)
Q5/Q1 ratio	4.65	5.06	5.68
	(0.17)	(0.47)	(0.05)
GDP per capita	1,043.00	1,393.70	1,863.60
	(77.42)	(170.53)	(140.65)
GDP per capita (Agri-share)	319.42	382.11	397.06
	(14.20)	(24.74)	(11.24)
Agri-trade Openness	0.11	0.17	0.23
	(0.01)	(0.02)	(0.02)
Sri Lanka			
Gini coefficient	37.67	32.39	36.45
	(5.93)	(1.53)	(3.72)
Q5/Q1 ratio	6.64	4.93	5.94
	(1.93)	(0.34)	(0.90)
GDP per capita	1,777.80	2,424.70	3,024.67
	(135.49)	(284.11)	(63.85)
GDP per capita (Agri-share)	484.79	569.14	543.09
	(33.51)	(18.75)	(95.59)
Agri-trade Openness	0.57	0.64	0.70
	(0.09)	(0.04)	(0.07)

Note: unweighted mean value, with standard deviations in parentheses. See the appendix for data sources.

For South East Asia, all countries have had high economics growth until the great economic crisis in 1997. We can categorize these countries into two groups, high and mild economic growth countries. High economic growth group consists of Indonesia, Malaysia, and Thailand. In theses countries, overall income has grown very fast. Especially in Malaysia, their GDP per capita increased rapidly from 5,799 US dollars in the 1980's to 10,630 US dollars in the 2000's, whereas the income share in agricultural sector has not grown as faster as than the overall income has. Meanwhile, inequality in theses countries have different changes in term of directions. For Malaysia and Thailand, the inequalities have a tendency to decrease over time, while the inequality in Indonesia has not changed much but fluctuated over time. The agricultural sector in theses countries has shrunk

after industrialization was seriously introduced into their economy in the 1980's. Since the downturn in returns of agriculture sector, the resource in agricultural sector, especially low-skilled labor, most of whom are the poor, are allured to move into industrial sector with higher returns. However, any parts of the poor in these countries are still dependent on the agricultural sector.

For the agricultural trade openness, most countries in South East Asia have been quite open since the 1980's and had a tendency to enlarge over time, especially in Cambodia, Malaysia, Philippines, Thailand, and Vietnam. China and Sri Lanka have been also quite open since the 1980's but the agricultural trade openness has not been quite changed over time. At the meantime, Bangladesh and India have been still remained closed since the 1980's.

4. Empirical Method and Result: Growth and Equality

As discussed in the previous sections, this paper will focus on examining the linkage between trade liberalization and poverty alleviation in income channel. On the other word, the question "Does trade liberalization improves growth and eventually reduces poverty?" has been challenged. In the long run, economic growth is a crucial role to reduction of absolute poverty. Or expected "trickle-down" effects from economic growth will create resource for the poor or/and encourage to accumulate physical and human capital in the poor. Winters *et al* (2002) argued that if the "trickle-down" will be insufficient to pass by the growth benefit to the poor; the governments should have additional measures to affect to income redistribution as income is higher and growing faster. Thus, they implied that there are two parts in considering the question above. The first is "Effect of liberalization to growth" and the other is "Effect of growth to poverty/ or income distribution".

Effect of trade liberalization on growth

The classic theory indicates with good reasons that trade has positive effects on real income. Under the classic trade theories, international trade between countries is caused by the difference in resource endowments between countries. Moreover, the theory proposed many reasons to anticipate trade liberalization to boost economic growth in general. In the short term, (static) benefits in efficiency improvement from trade could be considered as a growth booster. In the long-run, the potential positive factors from more competition enforce markets to access new technology and appropriate intermediate and capital goods; to gain benefits of economies of scale and competition; and to constrain government incompetence of corruption (Grossman and Helpmann, 1991 and Lucus, 1988). Moreover, modern trade patterns have recently been more complicated than before, therefore, the benefits from trade liberalization are much more complex to be decomposed.

The modern trade theory is devoted to make this claim stronger by introducing more realistic concerns into the model, i.e. trade in imperfect substitute or intra-industry trade, increasing return to scale, and endogenous technology. Unfortunately, nevertheless, none of the benefits is guaranteed and there are some models which strongly state that trade openness pushes countries into less dynamic sectors (e.g. primary extraction) and harms growth[4]. The empirical studies in effects of liberalization to growth are recently challenging in term of particular arguments.

For the agricultural trade in developing countries such as South East Asia countries, the international trade effect to the economic growth, particularly, hints on resource base of particular countries. For more concreteness, the particular economy which endows with agricultural resources, i.e. arable land and innate irrigation, should gain benefit in terms of long-run economic growth as agricultural trade is liberated. However, the decomposition of the benefit in this case is difficult since resource reallocation in developing countries, especially South East Asia countries, appeared across time under the distortion of trade liberalization (or unbalanced liberalization) between agricultural and industrial sectors. On the other word, theses economies are financially allured to pull the resource from agricultural (endowed) sector to newly industrial sector under the “trickle-down effect” assumption.

However, this paper found the empirical evidence supporting the link between agricultural trade and economic growth. We began with estimating the following standard growth regression (Dollar and Kraay, 2004) :

$$y_{i,t} = \alpha_0 + \alpha_1 y_{i,t-k} + \beta' X_{i,t} + \eta_i + \lambda_t + \nu_{i,t}. \quad (1)$$

Where $y_{i,t}$ is natural logarithm of GDP per capita at the end of particular period measured in real PPP adjusted dollar for country i , $y_{i,t-k}$ is its lag k years ago, and $X_{i,t}$ is a set of trade openness measures. This paper introduced two well-known openness indicators. Absolute trade volume and GDP normalized trade volume are included in the variable in $X_{i,t}$.

We adopted the estimation technique proposed by Caselli et al. (1996). This technique recommends that with panel growth data the equation (1) should be estimated in differences, using proper lags of the RHS variables as instruments (Dollar and Kraay, 2004). Thus, we estimated, in particular, the following regression:

[4] For example, see Rodriguez and Rodrik (2000)

$$y_{i,t} - y_{i,t-k} = \alpha_1(y_{i,t-k} - y_{i,t-2k}) + \beta'(X_{i,t} - X_{i,t-k}) + (\lambda_t - \lambda_{t-k}) + (\nu_{i,t} - \nu_{i,t-k}) \quad (2)$$

This equation showed a regression of growth on lagged growth and changes in the set of trade variable (openness measures). Dollar and Kraay (2004) stated that this approach has several desirable features for growth analysis. For instance, the estimated coefficients in the growth equation by differencing technique are leaving a correlation with omitted time-invariant country characteristics.

As can be seen in Table 2, the first three columns present coefficient by ordinary least square (OLS) estimators. Although this estimation method is inconsistent, it is very helpful to summarize the partial correlations in the data. The robust standard error is reported in parentheses. We estimated the coefficients and standard errors that are robust to heteroscedasticity and the first-order autocorrelation in the residuals induced by differencing.

The result of regressions is very striking that the normalized openness (trade volume) coefficient in (3) is negative and other coefficients in the model are all negative. However, we can find trade-growth evidence in (1) and (2) with high significant level. Model (2) indicates that changes in trade volumes are strongly correlated with the change in growth, with a point estimate indicating that 100% increase in the agricultural trade volume would have the effect of rising per capita income by 12.4%. The effect of agricultural trade on income is surprisingly too high. As OLS inconsistency was previously discussed, we introduced one-step difference Generalized Method of Moment (GMM) estimator into model (4). We still remain the first lagged period of income, but drop the second lagged period. The coefficient representing the effect of agricultural trade on income is milder and more reasonable with high statistical significance. In model (4), 100% increase in the agricultural trade volume would have the effect of rising per capita income by 4.5%.

Table 2 Growth and Trade Regressions

Dep. var : GDP per capita	(1) OLS	(2) OLS	(3) OLS	(4) GMM
Initial GDP per capita (*t-1*)	0.536	0.480	-0.095	(0.045)
	(0.105)***	(0.107)***	(0.101)	(0.025)***
Initial GDP per capita (*t-2*)		0.089	-0.121	
		(0.044)*	(0.080)	
Agricultural trade openness				
Absolute	0.117	0.124		0.045
	(0.034)***	(0.036)***		(0.025)***
Normalized			-0.069	
			(0.042)	
No. of Obs.	195	184	184	195

(**) (***) indicate significance at the 10 (5) (1) level

All regressions included period dummies (not reported)

GMM = One-step difference GMM estimator

OLS = Ordinary least square estimator

The plausible explanation for the apparent effect of trade liberalization on growth is that the enlarged agricultural market with higher volume of agricultural exports has the direct (static) effect on growth. Meanwhile, the more competitive market in agricultural sector enforces efficiency improvement such as more enforced productivity in farming and food industry (cultivating and processing).

This argument about the beneficial effect of trade liberalization on growth is consistent with the argument claimed by Dollar and Kraay (2004). They argued that the possible explanation for the effect of trade on growth is that it reflects improvement in institutional quality omitted from the regression analysis and this improvement is the significant direct effect on the growth and welfare of economy.

5. Effect from growth to poverty and income distribution

In general, many economists argue that the economic growth has a tendency to alleviate poverty. Nevertheless, unfortunately, this proposition is still controversial to some degree (Winters el at., 2002). Moreover, the controversy on the effect from growth to poverty reduction, especially in international trade case, is introduced explicitly in literature review part in this paper. For more concreteness in our particular case, agricultural trade effect on inequality and poverty alleviation, we estimated, in particular,

the following regression (Dollar and Kraay, 2004) to find any evidence in this concern.

$$y_{i,t}^{P} = \alpha_0 + \alpha_1 y_{i,t} + \beta' X_{i,t} + \eta_i + \nu_{i,t} \quad (3)$$

Where i and t index country and year, consecutively. Dollar and Kraay (2004) used natural logarithm of per capita income of the poor measured in real PPP adjusted dollar for country i. as the dependent variable, $y_{i,t}^{P}$ to concentrate only on poverty reduction, whereas this paper focuses on both poverty and income inequality such that we introduce not only the poverty measure but also inequality measures to be the dependent variable. The Gini coefficient (GINI) and the ratio of income earned by the top income quartile to income earned by the bottom quartile (Q5/Q1) are the dependent variables in the regression investigating inequality reduction, while the dependent variable in the regression examining poverty alleviation is the same variable used in Dollar and Kraay (2004).

$X_{i,t}$ is a vector of trade openness measures which is a ratio of total trade volume (export plus import) to GDP, or the normalized agricultural trade openness (that is used in growth regression model). $y_{i,t}$ denotes natural logarithm of nationwide per capita income. Like error terms in the growth regression, η_i and $\nu_{i,t}$ denote a composite error term including unobserved country effects.

As can be seen in Table 3, the first two columns present the regression examining poverty alleviation. Both absolute and normalized agricultural trade openesses are strongly correlated with the poor's income, with a point estimate in (2) indicating that 100% increase in the agricultural trade volume normalized by GDP would have the effect of rising the poor's per capita income by 9.8%. Thus, based on these empirics, the agricultural trade liberalization can have the positive effect on poverty in developing countries whose the poor are dependent on agricultural sector.

The regressions in (3) and (4) indicate that inequality measures, Gini coefficient and Q5/Q1 ratio, have strong negative relationship with the trade measure in normalized term. In regression (3), 100% increase in the agricultural trade volume normalized by GDP would have the effect of declining Gini coefficient by 3.279. In addition, from regression (4), 100% increase in the agricultural trade volume normalized by GDP would have the effect of declining Q5/Q1 ratio by 1.387. The inequality regressions argue that the more agricultural trade volume or the freer agricultural trade liberalization, the less inequality in developing countries whose the poor are dependent on agricultural sector.

The reason behind these arguments could be explained explicitly by the standard Heckscher-Ohlin two-factor, two good trade model. Every country exports those products using intensively abundant and relatively cheap factors of production. Hence, trade boom induced liberalization will cause exports and the demand for the cheap factor to boom too. Liberalization in developing country (agricultural resource abundance) should favor people in agricultural sector who are mostly poor. Our study indicated in previous section that most countries in our analysis have the poor dependent on agricultural sector or agri-production. As agricultural trade booms or is liberated, the poor in these countries will alleviate their poverty and be equated to the other groups in terms of money.

Moreover, Stolper-Samuelson (SS) theorem claims that an increase in prices of tradable and labor-intensive products will raise real labor incomes and decrease real capital returns. In our case, as agricultural trade booms, the prices of agricultural products in these countries increase because of larger market size and higher demand from around of the world. Then, the return in agricultural sector will increase as well. Eventually, real income of the poor who are dependent on agricultural sector will relatively increase. At the end, the inequality will decrease.

Table 3 Poverty/ Inequality and Trade Regressions

Dep. variable:	Poverty reduction		Inequality reduction	
	Poor's GDP per capita		Gini efficient	Q5/Q1 ratio
	(1)	(2)	(3)	(4)
Nationwide GDP per capita	0.675	0.790	6.485	2.742
	(0.065)***	(0.037)***	(0.997)***	(0.503)***
Agricultural trade openness				
Absolute	0.086			
	(0.029)***			
Normalized		0.098	-3.279	-1.387
		(0.039)**	(1.049)***	(0.531)**
R-sq: Within	0.8035	0.8012	0.1758	0.134
Between	0.7896	0.8489	0.2149	0.379
Overall	0.7645	0.8157	0.2608	0.284
No. of Obs.	208	208	217	208

(**) (***) indicate significance at the 10 (5) (1) level

All regressions used ordinary least square (OLS) estimator in panel data with fixed effect.

6. Conclusion

The empirical results presented in this paper provide support for agricultural trade effects on inequality, especially in the countries whose almost poor are in agricultural sector. We have identified the developing countries which originally endow with agricultural resources, i.e. arable land and natural irrigation and these countries' poor are dependent on agricultural sector in both farming and food processing senses. Then, we found that, in the case of these countries, agricultural trade liberalization (that we believe it causes agricultural boom) has effects on both growth, and poverty. Moreover, this effect will also improve inequality in these countries. ✍

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Appendix 1 Variable Definitions and Data Sources.

Variable	Definition	Source
Gini Coefficient	The Gini coefficient is given as a proportion or percentage. Theoretically, the Gini coefficient will be equal to 0 when the distribution is equal to all. If the society's total income comes into the possession of only one person/household unit, leaving the rest with no income at all, then the Gini coefficient approaches 1, or 100%	UNU-WIDER World Income Inequality Database (WIID), version 2.0c.
Q5/Q1 ratio	the ratio of income earned by the top income quartile to income earned by the bottom quartile	UNU-WIDER World Income Inequality Database (WIID), version 2.0c.
GDP per capita	GDP per capita at the end of particular period measured in real PPP adjusted dollar for country *i*.	World Development Indicator (WDI), World Bank.
Agricultural share	Agriculture, value added (% of GDP)	World Development Indicator (WDI), World Bank.
Openness indicator	The openness indicator can be expressed by the ratio between total trade (export plus import) and GDP. In our case, export and import in agricultural and food (based definition by FAO) are calculated.	Food and agriculture trade data, FAO STAT.
Per capita income of the poor	Q1 percentage multiply by GDP per capita	Computation