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STRUCTURAL CHANGE AND THE INTERSECTORAL TERMS OF TRADE: SOUTHEAST ASIAN EXPERIENCE

RICHARD GRABOWSKI AND SHARMISTHA SELF

Southern Illinois University, USA
University of Northern Iowa, USA

In this paper it is hypothesized that premature deindustrialization is related to the intersectoral terms of trade between agriculture and manufacturing. Using a dualistic model it is shown that factors which raise the price of agricultural goods relative to manufactured goods slow the rate of structural change from agriculture to manufacturing. Data from a number of Southeast Asian countries is used to create a panel data set to test the hypothesis. Indeed a rise in the relative price of agricultural goods does indeed slow structural change and that on important factor raising this relative price ratio has been the elimination of policies which indirectly tax agriculture. The policy implication is that in order to avoid this unexpected consequence of policy reform government policy must be aimed at dramatically increasing productivity growth in agriculture.

Keywords: Dualism, Intersectoral Terms of Trade, Deindustrialization, Southeast Asia
JEL Classification: O14, O13, O10

1. INTRODUCTION

Since the work of Lewis (1954) and Ranis and Fei (1961) the concept of dualism has played an important role in theories of economic development. This perspective sees the economy of a developing nation as composed of a number of different sectors (for simplicity in theorizing, usually two sectors) with productivity in some of these sectors being high, approaching levels found in higher income countries, and in others productivity being very low. These differences tend to persist ever long periods of time, with a wide variety of explanations put forward to explain the persistence of these differences.

From the dualistic perspective one can view economic growth and development as the result of two factors. First, innovation and the application of new technologies can raise overall productivity within each sector. Second, one can shift resources out of low productivity sectors and into high productivity sectors thus raising the overall level of productivity. This latter process has been labeled structural change (Chenery, 1960;

Kuznets, 1966). It is this process of structural change that is the focus of this paper.

One can actually think of the productivity growth that results from structural change as being of two types (Rodrik, 2013). The first is a comparative static gain. If the share of resources devoted to high productivity sectors increases, then overall productivity will rise. The second is a dynamic gain. Resources devoted to high productivity sectors in manufacturing seem to result in absolute convergence in those sectors. That is, the technology levels utilized and productivity levels generated approach those found in high income countries. Thus these sectors are like escalators in that once a country has established a critical threshold of activity in such a sector then productivity seems to rise to world levels characteristic for that sector.

Historically, the process of structural change has in the initial stages of economic development, involved a shift from agricultural production to production in manufacturing. As a result, the share of manufacturing in GDP and in terms of employment tends to rise, with productivity in manufacturing being significantly higher than that found in agriculture. However, in the last two decades evidence has arisen suggesting that this process of structural change may have altered significantly. McMillan and Rodrik (2011) have found that the process of structural change in Africa and Latin America has been very different from that found in parts of East Asia. In the latter region, labor has tended to move from low productivity to high productivity sectors (agriculture to manufacturing). However, in Africa and Latin America the shift of labor has been into low productivity sectors (agriculture to traditional sector services). As a result, structural change has not played its important role in the process of developments.

As pointed out above, the shift to manufacturing seems to have altered. In fact, empirical evidence developed by both Rodrik (2015) and Felipe et al. (2014) indicates that the typical relationship between GDP per capita and share of manufacturing in GDP and in total employment has changed significantly. Historically, this has been an inverted U relationship with the share of manufacturing in GDP and employment rising, peaking, and then falling as GDP per capita rises. The empirical evidence over the last two decades indicates that this inverted U relationship has shifted downward and moved closer to the origin for developing countries. This implies that the relationship between GDP per capita and manufacturing as a share of GDP and total employment has weakened, peaking at a lower level of GDP per capita and at a lower maximum share (of GDP and employment). This has been labeled in the literature as premature deindustrialization (Rodrik, 2015; Felipe et al., 2014). It is premature in the sense that deindustrialization is occurring before developing nations have achieved significantly higher levels of per capita income.

So, how is this altered relationship to be explained? This paper will argue that dualistic models offer a clear explanation of this phenomenon. The intersectoral terms of trade play a crucial role in these sorts of models. Very simply, the expansion of the high productivity sectors is likely to draw resources out of the low productivity sectors and thus raise the prices for the latter relative to the former. If the good produced in the low productivity sectors are important inputs into the production process in the high productivity sector, than the rising relative price of the former relative to the latter will slow down the expansion of the high productivity sector and may actually cause an absolute decline of this sector.

Simplifying the above, if the low productive sector is agriculture and the high productivity sector is industry, then the expansion of manufacturing (as a share of GDP and total employment) would be negatively affected by a rise in the relative price of agricultural goods. This would hold true if the output of agricultural goods is a crucial input in the production of manufactured goods. This would most likely be the case if agriculture produces the food and raw materials necessary for the production of manufactured goods. This could occur, it will be argued, even within the context of an open economy. This hypothesis, that increases in the price of agricultural goods relative to manufactured goods can account at least in part for premature deindustrialization, will be tested utilizing a panel data set of Southeast Asian countries that includes Thailand, Malaysia, Indonesia, and Vietnam.

The paper unfolds as follows. Section two will analyze the structural change process within the context of a dualistic economic framework. It will be shown that changes in the intersectoral terms of trade (price of agricultural goods divided by the price of manufactured or industrial goods) can indeed influence the extent to which structural change occurs. Thus this provides an explanation for the alteration in the structural change process, recently noted, that is complementary to other explanations that have been offered. Section three will discuss the empirical data utilized and the empirical model that is applied. The empirical results of the analysis are then discussed in some detail. Finally section four will summarize the paper and discuss policy implications.

2. ALTERATIONS IN THE PROCESS OF STRUCTURAL CHANGE: EXPLANATIONS

Baldwin (2011) has argued that the process of globalization has significantly altered the process of structural change. Dramatic changes in technology have led to an unbundling of the manufacturing process. Throughout much of economic history creation of a competitive manufacturing sector required construction of a domestic supply chain which ultimately culminated in the production of finished manufactured goods. As a result, the share of industry and manufacturing in both GDP and employment would have to increase dramatically. However, technological innovation and the rapid expansion of trade and globalization have allowed the industrial process to be unbundled. The supply chain has been split into different parts with each segment locating in different parts of the world where costs are lowest. Thus a developing country becomes home to only a part of the supply chain. Thus, the share of manufacturing in GDP and employment will rise, but not to the extent that it has in the past (Baldwin, 2011).

The explanation put forward in this paper is complementary to these arguments. It is based on the dualistic models of development first developed by Lewis (1954) and Ranis and Fei (1961). In the former the economy is divided into the modern and traditional sector. Although Lewis did not identify these two sectors as industry and agriculture, in this paper this characterization is made. The distinction between the two sectors was made on the basis of differences in decision making processes. In Industry, labor and capital is used, saving and investment occur, capital accumulates, and profits are maximized. In the traditional sector land and labor is used in the production process, there is surplus labor (marginal productivity of labor is negative or zero), and wages are determined by an institutional process which pays labor its average product. In this context economic development unfolds as the modern sector expands drawing labor surplus out of the agricultural sector. As long as surplus labor exists, the wage in manufacturing will remain constant.

Within this dualistic economy framework some difficulties can arise as industry expands and draws labor out of agriculture. Initially, given that the marginal product of labor in agriculture is zero or negative, an unlimited supply of labor is available to industry at a wage rate just a bit above that paid in agriculture (subsistence wage). Thus the share of profit in total output rises, saving and investment expand, the modern industrial sector enters a rapid growth phase. However, once enough labor has been drawn out of agriculture the marginal product of labor becomes positive and production in this sector is hampered. As a result, the price of agricultural goods rises relative to the price of industrial goods (intersectoral terms of trade). If the things produced in agriculture are important in the industrial production process, this change in the intersectoral terms of trade can slow or perhaps even halt the growth of the industrial sector. Thus structural change is hampered by a rise in the relative price of agricultural goods.

Thus if productivity in the agricultural sector does not sufficiently increase, then structural change will be reduced or eliminated if the country is closed to external trade. Even if the country is open to trade, deterioration in the terms of trade can occur if the large country case prevails. Expansion of the industrial sector would drive up international market prices. Given the thinness of international markets for food this may likely be the case for a number of countries (Gollin et al., 2007). In addition poor infrastructure development likely increases the probability that the prices of certain critical agricultural outputs are endogenously determined.

The relative rise in the price of agricultural goods relative to manufacturing goods can arise in another manner. A related explanation concerns the change in development strategy and policy which took place in the late 1980s. Prior to this time period most developing countries sought to insulate themselves from international markets by engaging in import substitution. This generally involved the use of policy instruments to protect domestic industries from foreign competition. This tended to lower the price of agricultural goods relative to the price of manufactured goods thus promoting the expansion of indigenous manufacturing. In the late 1980s, policies were liberalized and the economies in much of the developing world became more open to international trade and foreign investment. This in turn tended to raise the price of of agricultural goods relative to the price of manufactured goods. Those countries which did not have a strong comparative advantage in manufacturing became net importers of manufactured goods. Even in those countries initially possessing strong comparative advantages in labor intensive manufactured goods have found it difficult to maintain this comparative advantage as technology has evolved. This technology has been labor saving even in labor intensive sectors thus reducing the advantage of cheap labor in developing comparative advantage.

The role of technological change within the context of an open economy has been further developed by Rodrik (2016). He argues that technological innovation in developed countries has been much more rapid in industry relative to agriculture resulting in a fall in the relative price of industrial goods (rise in the relative price of agricultural goods). Thus in this scenario the difficulties of structural change in developing countries may be imported from technology developments in developed countries. The decline in the relative price of manufactured goods has made it much more difficult for manufacturing to survive in developing countries.

Finally, many developing nations have actually sought to insulate their agricultural markets from international trade in order to protect the agricultural sector. This has tended to occur as overall income per capita rises and the gap between income per capita in manufacturing and that found in agriculture rises. This creates political tensions which in some cases have led to policies which protect or insulate the agricultural sector from international competition (Timmer, 2014). This too would tend to raise price of agricultural goods relative to the price of manufactured goods and thus slow the process of structural change.

Now, one can quarrel with a lot about how the simple model of dualistic development discussed above is constructed. Why, for example, is capital only used in the modern sector? One could argue that this was the result of capital market imperfections that limit the flow of capital into the traditional sector. One could also argue that the concept of surplus labor is difficult to accept even in the most populous of nations. However, the relevant concept here may be the social marginal product of labor rather than the individual marginal product (Wang and Piesse, 2013). There are many other criticisms that can also be developed concerning this relativity simple model of dualistic development (Gollin, 2014). However, the main point to keep in mind is that dualism persists in most developing countries. Sectors of high productivity continue to co-exist with those of low productivity and thus significant growth and development can be the result of structural change. Within this context the intersectoral terms of trade (PA/PM) are critical in the process of structural change.

In the simple model discussed above, agriculture and industry are the two important sectors with productivity low in the former and high in the latter. If the output in agriculture is utilized in the production process in industry (food, raw materials, etc.) then the price of agricultural goods divided by the price of industrial goods (PA/PM) is critical to the process of structural change. If the expansion of the industrial sector or changes in policy (liberalization) or changes in technology cause the intersectoral terms of trade (PA/PM) to rise, this will slow the expansion of the industrial sector. Such a change in this ratio will thus have a negative effect on the process of structural change. All of this will occur even if one drops the assumption of surplus labor, opens the economy to trade, and allows capital to be utilized in the agricultural sector. The crucial characteristic is that dualism in terms of productivity exists, this dualism persists (for perhaps a wide variety of reasons), and agricultural production is crucial for industrial production (provides crucial inputs). Under these conditions the intersectoral terms of trade (PA/PM) play a crucial role in determining the extent to which structural change occurs.

3. EMPIRICAL ANALYSIS

Before carrying out the empirical analysis some of the characteristics of the structural change process in Indonesia, Malaysia, Thailand, and Vietnam will be examined. One can measure structural change two ways. One can look at the share of manufacturing output in GDP and the share of manufacturing employment in total employment. Due to data problems this paper will use the share of industrial employment in total employment. Figure One illustrates the former for all four countries while Figure Two represents the latter for three countries (data on industrial employment as a share of total employment is not available for Vietnam. As can be seen, structural change has proceeded more rapidly in terms of share of manufacturing in GDP relative to share in total employment. In addition, structural change measured either way tends to slow in the later part of the time period.

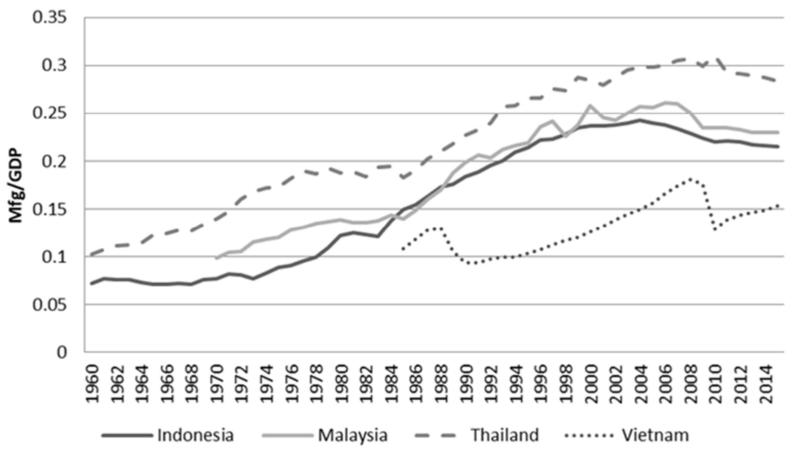

Figure 1. Share of Manufacturing in GDP

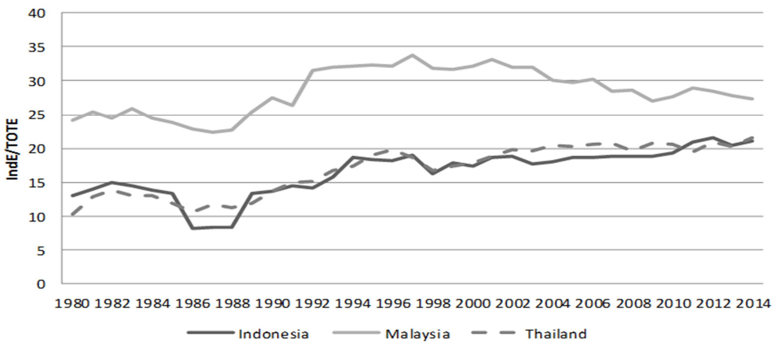

Figure 2. Share of Industrial Employment in Total Employment

The Variable of significant interest in this paper is PA/PM. Figure Three illustrates the path of this variable over time in the four countries which are the focus of this paper. As can be seen, for three of the countries (Indonesia, Malaysia, and Thailand) there is a clear upward trend in the latter part of the time period. Thus the hypothesis that will be tested in this paper, as discussed in the previous section of the paper, is whether movements in PA/PM have significant influence over the structural change process.

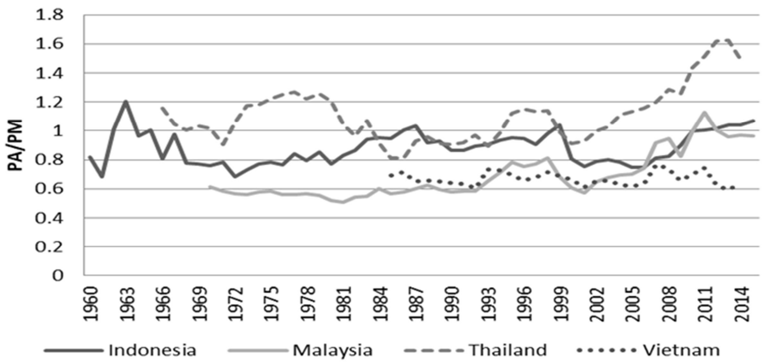

Figure 3. Intersctoral Terms of Trade

A Fixed Effects (FE) panel estimation method was chosen for conducting the empirical analysis. Panel data sets for economic research possess several major advantages over conventional time-series data sets. Panel data usually result in a large number of data points (N × T), increasing the degrees of freedom and reducing the collinearity among explanatory variables thereby improving the efficiency of econometric estimates (Hsiao et al., 1995). In this particular case, we had limited observations for each country. For example, Indonesia had observations for most variables from 1960 to 2015 except for observations of industrial employment as a share of total employment, which was available only from 1980 to 2014. There was a much smaller range of data (36 observations or less) for Vietnam. Such small samples greatly reduce the degrees of freedom. In addition, once the data is corrected for unit roots further observations are lost. In such cases the t-statistics and standard errors are not reliable. Panel estimations provide a greater breadth and depth of analysis of the data.

Additionally, Panel data allows for the control of omitted (unobserved) variables thus resolving a number of econometric problems that arise due to the presence of omitted variables that are correlated with explanatory variables. In other words, panel estimations account for individual heterogeneity. Panel estimations generate more accurate predictions for individual/country outcomes by pooling the data rather than generating predictions of individual country outcomes using the data on the individual country in question. If individual country behaviors are similar conditional on certain variables, panel data provide the possibility of learning an individual country's behavior by observing the behavior of others. Thus, it is possible to obtain a more accurate description of an individual country's behavior by supplementing observations of the individual country in question with data on other countries (e.g. Hsiao et al., 1993, 1989).

Given the above discussion, a panel data set is created for a number of Southeast Asian countries: Vietnam, Indonesia, Thailand, and Malaysia. This region is chosen, as stated previously, because it has experienced rapid growth in GDP per capita since the late 1970s. Thus if the intersectoral terms of trade are important for structural change one should be able to see its effects in the development of this region. Data on real GDP per capita are taken from World Development indicators. Data on the price of agricultural goods (PA) are derived by dividing the nominal value added in agriculture by the real value added in agriculture. The same procedure is utilized for deriving the price of manufactured goods. All of this data again comes from World Development Indicators.

Two measures of structural change are utilized. On the production side structural change is measured by the share of manufacturing in GDP (taken from World Development Indicators). On the employment side, it would have been ideal to measure structural change by the share of manufacturing employment in total employment. However, sufficient data for this variable is not available. Instead, employment in industry as a share of total employment is utilized as a measure of structural change in terms of employment (taken from World Development Indicators).

Given that the empirical analysis involves a number of time series variables, it is imperative to test for stationarity of each series before conducting any regression analysis. It is known that if two variables are trending over time, a regression of one on the other could have a high R-square value even if the two are totally unrelated. In this case we call this a spurious regression. In addition, if the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will not be valid. In other words, the usual "t-ratios" will not follow a t-distribution, so we cannot validly undertake hypothesis tests about the regression parameters. If a non-stationary series y_t must be differenced d times before it becomes stationary, then it is said to be integrated of order d. We write $y_t \sim \mathrm{I}(d)$. Pioneering work on testing for a unit root in time series was done by Dickey and Fuller (Dickey and Fuller 1979, Fuller 1976). The Augmented Dickey Fuller (ADF) Test improved upon the initial Dickey and Fuller test to make it more widely applicable. In this paper we utilize the ADF test to test for unit roots of all the variables. The ADF test showed that all variables had one Unit Root I(1) in levels (assuming an intercept and trend) except the real GDP per capita variable for Thailand, Malaysia and Indonesia. In addition, all the variables for Vietnam which were I(2). Accordingly all the I(1) variables were made stationary by taking the first differences and all I(2) variables were made stationary by taking the second differences before undertaking any estimations.

The estimating equations that will be utilized can be written as:

$$\frac{Mfg}{GDP} = a + blnGDPP + clnGDPP^2 + d\left(\frac{PA}{PM}\right) + eAsianCrisis + fTime + \varepsilon, \quad (1)$$

$$\frac{IndE}{TOTE} = a + blnGDPP + clnGDPP^2 + d\left(\frac{PA}{PM}\right) + eAsianCrisis + fTime + \varepsilon. \quad (2)$$

The first equation uses the share of manufacturing in GDP (Mfg/GDP) as the dependent variable. The natural log of GDP per capita (the level of real $GDPP$) is entered as a quadratic expression in equation one. This is due to the fact that previous empirical work (Rodrik, 2015; Felipe et al., 2014) has found that the relationship between GDP per capita and the share of manufacturing in GDP is quadratic in nature (an inverted U). Thus the sign for coefficients b and c respectively are hypothesized to have a positive and negative sign. The intersectoral terms of trade, PA/PM, is included in order to test the main hypothesis of this paper that the sign on d would be negative. The variable $AsianCrisis$ is a dummy variable taking on a value of one for the years 1998 and 1999 and zero otherwise. This is to capture the effects of the Asian financial crisis which disrupted economies in the region during the time period. The sign on this variable is not a focus of the paper and it is unclear what the sign is likely to be. If the crisis significantly damaged manufacturing then the sign would be negative. However, the crisis resulted in significant economic reform and this may have spurred manufacturing and thus the sign would be positive. Finally, the variable Time is included to determine whether as time passes the structural change process is strengthening (positive sign) or weakening (negative sign). The time period covered is from 1985 to 2015. Needless to say, all variables except dummy variables mentioned above have been first or second differenced for the purpose of the empirical analysis. For example, the dependent variable utilized for the analysis is the first difference of Mfg/GDP. Similar modifications apply to all the other time series variables.

Equation (2) uses the share of employment in industry in total employment ($IndE/TOTE$). The variables on the right hand side are identical to those for equation (1). The time period covered is from 1980 to 2014. While equation (1) is estimated for all four countries, equation (2) is estimated only for Indonesia, Malaysia, and Thailand. Vietnam is excluded because data on industrial employment as a share of total employment is not available.

The results of the estimation are presented in Tables 1 and 2. The results for structural change as measured by the share of manufacturing in GDP, equation (1), are presented in Table 1 and follow the trend found in previous empirical studies. The sign on per capita GDP and per capita GDP squared are positive and negative respectively. However, only the former is statistically significant.

The variable of special interest for this paper is PA/PM. As can be seen, the sign on this variable is negative and highly significant. Thus a rise in this relative price ratio is associated with a decline in the share of manufacturing in GDP. Thus structural change is slowed by a rise in the relative price of agricultural goods as hypothesized.

The sign on the time trend variable is also negative and statistically significant. This implies that over time the process of structural change has tended to weaken. This indeed is consistent with previous empirical work (Rodrik, 2015; Felipe et al., 2014).

Table 1. Fixed Effects Estimations with White Hereoscedasticity consistent standard errors Countries included: Indonesia, Malaysia, Thailand and Vietnam Time period: 1985 to 2015 Dependent Variable: Manufacturing as a share of GDP

Variables:	(1)	(2)	(3)
Per capita GDP	18.470**	12.932	16.613*
	(8.411)	(5.939)	(10.023)
Per capita GDP^2	-0.607	-0.428	-0.453
	(0.501)	(0.589)	(0.547)
PA/PM	-3.055**	-3.205**	-2.446***
	(1.407)	(1.434)	(1.207)
Asian Financial Crisis Dummy		0.427**	1.012***
		(0.189)	(0.274)
Time Trend			-0.089***
			(0.017)
Cross-section Fixed Effects:			
Thailand	0.137	0.143	0.109
Malaysia	0.003	0.015	0.045
Indonesia	-0.119	-0.065	-0.039
Vietnam	-0.016	-0.088	-0.111
Observations	119	119	119

Note: Standard errors in parenthesis; all estimations include cross-section weights; a constant term which has not been included here; per capita GDP and per capita GDP2 represent first difference and second difference respectively of natural logs of these variables; PA/PM represents first difference of the ratio of agricultural prices to manufacturing prices; ***, **, * correspond to statistical significance at 99%, 95% and 90% respectively.

Results for structural change as measured by industrial employment as a share of total employment are presented in Table Two. Vietnam is not included because this data is not available. The signs for GDP per capita ($GDPP$) and GDP per capita squared

($GDPP^2$) are negative and positive respectively and statistically significant. This implies that initial growth tends to reduce the share of manufacturing in total employment as this initial growth process is likely to be focused in agriculture. However, as the growth process accelerates it shifts towards manufacturing and the share of manufacturing employment rises. In terms of PA/PM, the sign is negative and statistically significant. This implies that a rise in this relative price ratio is associated with a decline in industrial employment as a share of total employment. Thus structural change in terms of employment is slowed by a rise in the relative price of agricultural goods as hypothesized.

The analysis was also carried out for each country separately. Obviously, the fixed effects aspect of the panel estimation could not be utilized. For all four countries the sign on PA/PM was negative and for three of the countries it was statistically significant.

Table 2. Fixed Effects Estimations with White Hereoscedasticity consistent standard errors Countries included: Indonesia, Malaysia, and Thailand Time period: 1980 to 2014 Dependent Variable: Industrial employment as a share of total employment

Variables	(1)	(2)	(3)
Per capita GDP	-15.916**	-17.775**	-17.844**
	(7.737)	(6.127)	(6.947)
Per capita GDP^2	1.371***	1.421***	1.367***
	(0.266)	(0.266)	(0.268)
PA/PM	-3.346***	-3.117***	-3.492***
	(0.517)	(0.615)	(0.972)
Asian Financial Crisis Dummy		0.172	0.568**
		(0.167)	(0.246)
Time Trend			0.022
			(0.015)
Cross-section Fixed Effects:			
Thailand	-0.130	-0.133	-0.122
Malaysia	-0.125	-0.131	-0.131
Indonesia	0.255	0.264	0.253
Observations	102	102	102

Note: All estimations include cross-section weights; a constant term which has not been included here; per capita GDP and per capita GDP2 represent first difference and second difference respectively of natural logs of these variables; PA/PM represents first difference of the ratio of agricultural prices to manufacturing prices; ***, **, * correspond to statistical significance at 99%, 95% and 90% respectively

The implication of the above analysis is that indeed the intersectoral terms of trade are indeed important for structural change. If the relative price of agricultural goods rise structural change in terms of production and employment will be reduced. Alternatively, if the relative price of agricultural goods falls, structural change will be enhanced. So what has been the time trend for PA/PM for these four countries? The results of time trend estimations (once the series have been made stationary) indicate that PA/PM had statistically significant positive time trends for all four countries. Thus in these countries the relative price of agricultural goods has risen through time. Given the above empirical results, this indicates that these price trends have served to slow the process of structural change.

The estimation was also carried out separately for each of the three countries. Obviously, the fixed effects aspect of the panel estimation could not be utilized. The sign on PA/PM was negative for all three countries and statistically significant for one.

The rise in PA/PM in these countries could have been the result of several factors. Rapid growth in these Southeast Asian nations has been associated with a rise in the relative price of agricultural goods. If these countries are large in terms of the market for agricultural goods, then this would have likely increased PA/PM. If these countries represent the small country case, then PA/PM is exogenous and the expansion of manufacturing in Southeast Asia would not have been the cause for the rise in PA/PM. This trend then might very well be the result of differential rates of technical innovation in agriculture relative to industry in the industrialized countries. That is, the rate of technical innovation in manufacturing was more rapid than in agriculture in developed as well as developing countries resulting, ceteris paribus, in a fall in the PM relative to PA or, in other words, a rise in PA/PM (Rodrik, 2015).

However, an important reason for the rise in PA/PM has been government policy towards agriculture relative to non-agriculture. It has been argued by many scholars and briefly discussed in an earlier section, that governments in most developing countries have traditionally promoted policies which indirectly tax agriculture and subsidize manufacturing (Schiff and Valdès, 1992). It is argued that this was the result of most countries following an import substitution policy after World War II. This type of strategy imposes tariffs/quotas to insulate the domestic manufacturing sector from international competition. The purpose of this policy was to promote the growth and expansion of domestic industry (Bruton, 1998). In addition, various government institutions were utilized to control agricultural prices so as to lower them relative to international levels. This was done in order to keep the prices of critical food staples low and to extract revenue for primary product exports (Lipton, 1937). The end result of these policies was to reduce PA/PM.

Now one might justify the policies discussed above by pointing out that this would have promoted structural change. Indeed, this happened as manufacturing initially grew quite rapidly. During the 1960s and 1970s, manufacturing as a share of GDP rose in many African and some Asian countries. However, such policy also discriminated against export agriculture limiting exports and creating balance of payments difficulties. In addition, the domestic industry that was created often failed to achieve economic efficiency and thus comparative advantage in this sector failed to develop. This led in the 1990s to reform policies which sought to eliminate or reduce the extent of industrial protection and to liberalize markets for agricultural products (Anderson, 2010).

Evidence for this policy evolution is provided by utilizing two different concepts: the relative rate of assistance to agriculture (RRA) and the nominal rate of assistance to agriculture (NRA). The nominal rate of assistance to agriculture is defined as the percentage by which government policies have raised gross returns to farmers above what they would be without government intervention ($NRAag > 0$) or lowered them below what they would have been without government intervention ($NRAag < 0$).

Of course government policies can also distort prices received for nonagricultural (tradable) goods. This is what import substitution policies do. Specifically they raise the gross returns to non-agriculture, $NRAnonag > 0$. This implies that the broadest measure of government policy towards agriculture would be to measure the rate of assistance to agriculture relative to that of non-agriculture, the relative rate of assistance (RRA), which can be written as

$$RRA = 100[(1 + NRAag_t/100)/(1 + NRAnonag_t/100) - 1]. \qquad (3)$$

If the nominal rate of assistance provided to agriculture exceeds that for non-agriculture then the $RRA > 0$ and if the reverse $RRA < 0$. If both sectors are equally assisted the $RRA = 0$. Using these concepts it will be possible to clearly characterize government policy towards agriculture (Anderson, 2009).

Data on the $NRAag$ and RRA are available for the four countries which are the focus of analysis of this paper, although the time period covered for Vietnam is quite limited. This data is from Anderson and Nelgin (2013) and is presented in Figures 4 ($NRAag$) and 5 (RRA). As can be seen, initially policy in these countries was strongly oriented towards indirect taxation of this sector. That is $NRAag$ was strongly negative as was RRA. This implies that policy sought to indirectly tax the agricultural sector by lowering the prices of its outputs (relative to international prices), increasing the cost of inputs to agriculture produced in the non-agricultural sector (above international prices), and raising the prices of non-agricultural goods (relative to international prices). This tended to keep PA/PM low in these countries.

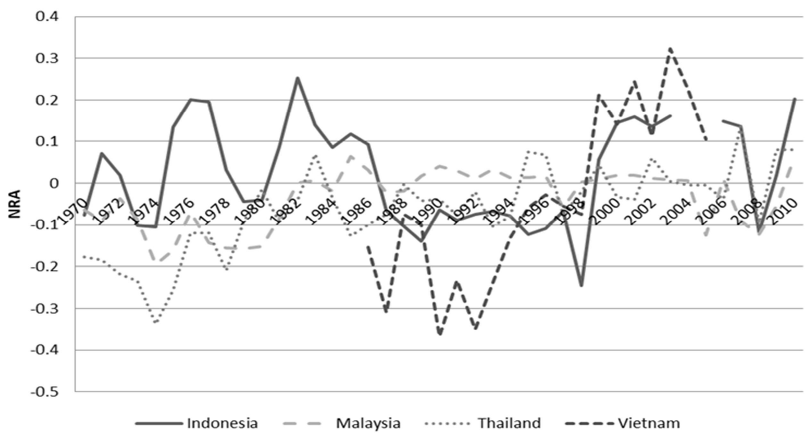

Figure 4. Nominal Rate of Assistance

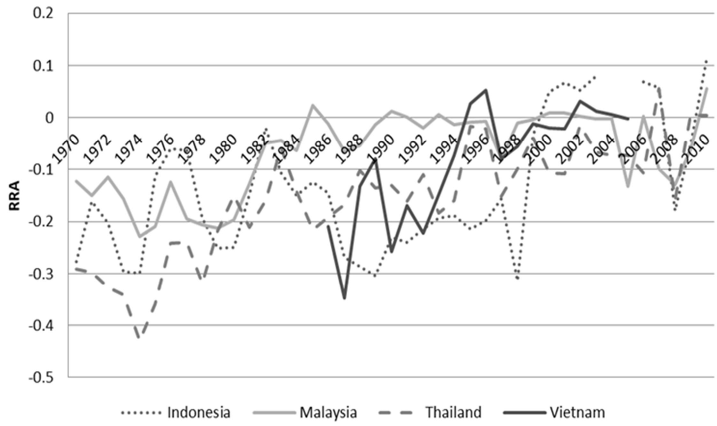

Figure 5. Relative Rate of Assistance

However, over time things changed rather dramatically. The $NRAag$ became less negative and by the last decade covered by the data actually became positive. This also holds for RRA. Thus the extent of indirect taxation declined with some evidence that agriculture was being protected not just absolutely, but also relative to the non-agricultural sector. The implication of this is that prices of agricultural outputs were rising (compared to international price levels) and the prices of non-agricultural outputs were falling (relative to international levels). This has tended, ceteris paribus, to raise PA/PM (relative to international levels).

Thus the policies followed by all four of these countries were very similar. Initially, policy was aimed at levying an indirect tax on the agricultural sector. This involved the use of tariffs, quotas, and pricing policies for outputs and inputs that sought in one way or another to reduce the net incentive to allocate resources to the agricultural sector. Beginning in the late 1980s and early 1990s all four countries engaged in liberalization and reform policies aimed at enhancing the net incentives for agricultural production. Tariffs and quotas were reduced and pricing policies were altered so as to become more favorable to agricultural production. Thus the net tax on agriculture in all four countries declined dramatically.

More recently policies have tended towards protection of the agricultural sector in these countries. For example, Indonesia pays procurement prices for rice which are above international prices. Fertilizer subsidies have expanded significantly, and import restrictions have been place on some agricultural commodities (FAO, 2017). In Thailand a rice pledging scheme guaranteeing rice prices significantly above international prices, although recently this has been somewhat altered. (Klyuer, 2015). In Vietnam as well policies have recently tended to push up some agricultural prices.

This has occurred within the context of a decline in the rate of growth in total factor productivity in the region. This implies that agricultural technical change has slowed and is likely linked to a slowdown in investment in the development of new technologies

(USDA, 2017).

Thus government policy has resulted in higher PA/PM and this, according to the analysis above, would have slowed the process of structural change in these countries. One might conclude from this that the elimination of policies which sought to indirectly tax agriculture was a mistake and should be reversed. However, this would be an incorrect conclusion to draw. Instead, policies aimed at reducing the indirect taxation of agriculture had an unexpected consequence of making structural change more difficult. This difficulty occurred because the elimination of indirect taxation was not accompanied by rapid productivity growth in agriculture, particularly in developing countries. Rapid productivity growth in agriculture reduces per unit costs of production thus tending to lower PA/PM thus offsetting the effects of eliminating the indirect taxation of agriculture on structural change.

The rise in PA/PM due to changes in economic policy combined with a slow rate of technical innovation in agriculture relative to manufacturing has a significant policy implication for the other developing nations. The negative impact of rising PA/PM can be reduced or offset by enhancing technical change in the agricultural sector. This would involve a significant increase in investment in research and development in the agricultural sector. This is especially important given that the world's population continues to grow dramatically even though fertility rates are declining in many areas. Increased productivity in this sector would reduce the extent to which PA/PM rises through time thus making it easier for structural change to occur.

The lack of rapid technical innovation in the agricultural sectors of many developing nations is reflected in the fact that grain yields in Asia and Africa have been flat since the early 1990s. In addition, the highest yielding experimental varieties at the International Rice Research Institute are no more productive than in 1990. Timmer (2009) argues that this slowdown in technical innovation in agriculture in developing nations represents the fact that international aid donors have not focused on and seem to have lost interest in the rapid development of agricultural technology. Thus the implication of this paper is that interest and resources must once again be focused on the development of agricultural technology.

The above analysis is similar to the notion of balanced growth put forward in the work of Ranis and Fei (1961). There expansion of the modern industrial sector must be balanced by productivity growth in agriculture in order to keep the intersectoral terms of trade from turning against the industrial sector. Here the rate of technical innovation in agriculture must be raised relative to that in manufacturing so as to allow structural change to unfold.

3. SUMMARY AND CONCLUSION

In dualistic models of economic development structural change plays a key role in the development process. With productivity high in manufacturing and industry relative to agriculture, the shift of resources from the latter to the former results in a comparative static rise in overall productivity. In addition, such a shift in resources also has a dynamic effect. Productivity levels in manufacturing are subject to absolute convergence. That is, if a developing country is able to establish a manufacturing sector productivity levels in this sector tend to rise towards those found in developed countries (an escalator effect). Thus structural change is a critical part of the overall development process.

The process outlined above seems to be an accurate description of the process of development in much of the postwar period, especially in East Asia. However, over the last several decades structural change seems to have weakened, whether one measures structural change by shares of GDP or shares of total employment in manufacturing and industry. This threatens the comparative static and dynamic gains associated with this process.

A number of ideas involving both globalization and technical innovation have been developed to explain this weakening of the structural change process. This paper has proposed an additional explanation that is complementary to these others. Within the context of a dualistic model, composed of agriculture and manufacturing, the sectoral terms of trade, PA/PM, play a crucial role. If PA/PM rises through time this will tend to slow expansion of the manufacturing sector both in terms of share of GDP and total employment. This was the main hypothesis proposed in this paper.

This hypothesis was tested utilizing a panel data set drawn from four Southeast Asian countries. The results indicated that PA/PM is negatively associated with the share of manufacturing in GDP and the share of industrial employment in total employment. It was shown that this rise in PA/PM partly stemmed from changes in government policy which increased both the NRAag and the RRA provided to agriculture (reducing the indirect taxation of this sector).

The policy implication of the above analysis is that policy reform had an unexpected consequence in making structural change more difficult. This unexpected consequence can be avoided by increasing the rate of productivity growth in agriculture. This will tend to moderate any rise in PA/PM. However, technical innovation in agriculture in many developing nations has tended to lag over the last several decades. In order to speed up the rate of innovation in this sector additional investment must be made in developing technologies that can rapidly raise productivity. As a result, structural change will be more likely to unfold and it will be easier to shift resources and labor from agriculture to manufacturing.

APPENDIX

Table A1. Time Series Estimations with White Heteoskedasticity Consistent Standard Errors Dependent Variable: Manufacturing as a Share of GDP

Variables: Time period:	(Indonesia) 1962-2014	(Malaysia) 1971-2015	(Thailand) 1968-2014	(Vietnam) 1987-2015
Per capita GDP	6.201	12.379*	10.577*	126.72
	(5.976)	(7.872)	(6.654)	(285.0)
Per capita GDP^2	-2.443	-1.811	-2.156	-633.78
	(2.211)	(2.136)	(2.063)	(142.5)
PA/PM	-7.482***	-3.791**	-0.253	-0.021**
	(1.543)	(1.887)	(1.367)	(0.010)
Asian Financial Crisis Dummy	-1.622***	-0.328	0.594	2.991**
	(0.503)	(0.524)	(0.546)	(1.155)
Time Trend	0.033**	-0.015	-0.033***	-0.172**
	(0.013)	(0.017)	(0.017)	(0.091)
Observations	53	45	47	29
R squared	0.53	0.28	0.16	0.25

Note: A constant term is included but results not presented here; per capita GDP and per capita GDP2 represent first difference and second difference respectively of natural logs of these variables; PA/PM represents first difference of the ratio of agricultural prices to manufacturing prices; all variables for Vietnam represent second differences; ***, **, * correspond to statistical significance at 99%, 95% and 90% respectively.

Table A2. Time Series Estimations with White Heteoskedasticity Consistent Standard Errors Dependent Variable: Industrial Employment as a Share of Total Employment

Variables: Time period:	(Indonesia) 1981-2014	(Malaysia) 1981-2014	(Thailand) 1981-2014
Per capita GDP	14.899***	13.418***	16.659**
	(4.253)	(4.214)	(6.122)
Per capita GDP^2	-0.009	-0.003	-0.0008
	(0.0008)	(0.000)	(0.000)
PA/PM	-0.888	-2.704	-4.295**
	(3.596)	(2.962)	(1.869)
Asian Financial Crisis Dummy	0.189	-0.275	-0.262
	(1.075)	(1.023)	(0.824)
Time Trend	-0.006	0.076	-0.011
	(0.091)	(0.131)	(0.107)
Observations	34	34	34
R squared	0.53	0.22	0.34

Note: A constant term is included but results not presented here; per capita GDP and per capita GDP2 represent first difference and second difference respectively of natural logs of these variables; PA/PM represents first difference of the ratio of agricultural prices to manufacturing prices; all variables for Vietnam represent second differences; ***, **, * correspond to statistical significance at 99%, 95% and 90% respectively.

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Mailing Address: 1402 Rocky Ridge Rd, Cedar Falls IA 50613, Email: ricardo@siu.edu.

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