Structural Change, Innovation and Income Distribution

Paul Cook and Yuichiro Uchida

Centre on Regulation and Competition
University of Manchester

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1. Introduction

In the capitalist system competition is the key to understanding economic change. In this system enterprises strive to develop their competitive advantage in domestic and international markets. In any given market enterprises will fail and exit the market, while some of the existing enterprises will survive and grow. In open markets new enterprises will enter to challenge incumbents with new products and innovative processes, which in turn will also encourage some survivors in the market to innovate. The essence of this competitive process is failure and growth in enterprises, which takes place at different rates and with some degree of uncertainty, and results in structural change which is fundamental to growth and development in the longer term (Metcalfe, Ramlogan and Uyarra, 2002).

The importance of structural change has been a recurring theme of development economists (Lewis, 1954; Johnston, 1970; Chenery and Syrquin, 1975). There has also been an associated literature on structural change and distribution in developing countries (Ahluwalia and Cheney, 1974; Ahluwalia, 1976), and more recently Anand and Kanbur (1993). This has largely examined the change in the inter-sectoral composition of output between agriculture, industry and the service sector, and is linked to the Kuznets (1955) thesis that a change in the structure of production has implications for the distribution of income. Kuznets observed an inverted U-shaped relation between per capital income and income inequality. It was observed that in slow growing largely agricultural based developing economies income inequality was greater than in developed economies.

Furthermore, Kuznets postulated that at relatively low levels of per capita income there was a positive relationship between the growth of income and inequality. Once a higher level of income was obtained inequality declined. Earlier empirical support for this can be found in Ahluwalia (1976), Chenery (1970) Bourguignon and Morrision (1990) using cross-country regression analysis with income inequality GDP as the dependent variable and per capita GDP as the independent variable. Using a new data base for income distribution Deininger and Squire (1996) found a U shaped relation between income and inequality, as do Anand and Knabur (1993). Dastidar (2004) examining inter-sectoral transformation in 18 developing countries between 1960-1994 and drawing on the Deininger and Squire data base concluded that structural change or a transition from agriculture to industry does not affect overall inequality. Dastidar argues that in Asia income distribution has only changed slowly, giving little support to the Kuznets thesis, and that other factors explain changes in income distribution.

More recently, there has been interest in examining the inter-industry pattern of development as part of structural change (Lall, 2000). In particular, a central feature of empirical research in this area has rested on examining patterns of trade and technological specialisation as evidence of structural change and developing economies catching up. This paper develops this approach by reporting new findings on patterns trade and technological specialisation, relating them to the level of competition in markets, and using these to investigate the relationship between structural change in developing countries and income distribution and poverty.

The paper is organised into five main sections. Following the introduction, section two discusses the role of competition in relation to growth and highlights the importance of change. The third section briefly reviews the literature on income distribution and poverty in relation to structural change. Section four outlines the approach of this paper in statistically examining the relationship between growth, structural change and income distribution. Section five reports and interprets the results of empirical analysis. The sixth and final section explores some of the policy implications arising from the analysis and draws conclusions.

2. Trade and Technological Specialisation and Competition

Much of the recent research on patterns of trade and technological specialisation has been confined to the study of OECD countries (Archibugi and Pianta, 1994; Laursen, 2000). Uchida and Cook (2005a) have recently examined the change in the pattern of trade and technological specialisation over time in relation to seven East Asian developing economies. Their analysis covered twenty-eight industrial sectors over the period 1978-1997.

The analysis in Uchida and Cook (2005a) revealed that Hong Kong's specialisation was in low technology industries. This contrasted with South Korea and Singapore, which have been moving to a greater extent towards high-tech industries. Specific sector were also acquiring technological competitive advantage, no doubt aided by the influence of direct foreign investment and multinational corporations activities. These included printing in Hong Kong, computers in Singapore, textiles in Indonesia, food and toys in Malaysia, rubber and toys in Thailand and electrical goods in the Philippines. Some economies were losing their competitive advantage in relation to technology, these included industries in Hong Kong (electronics and instruments), indicating that it is losing its technological edge, and in South Korea (textiles, rubber, fabricated metals, shipbuilding and toys).

Importantly, the study pointed out that specialisation or competitive advantage in trade was acting as a prerequisite for subsequent development in specific sectors of technological advantages. This was even the case for the more advanced East Asian developing, although the direction of causality appears to have changed and now technological specialisation is increasingly determining trade competitiveness.

The role of competition in structural change has been examined by Uchida and Cook (2005b) for developing countries in Latin America and Asia, and the results compared to industrialised countries such as the US, Germany and Japan. Levels of competition among the developing economies were highest in Hong Kong and the Asian economies in general and lower in Latin America. Lower and stagnant levels of domestic competition were evident in Brazil and Argentina. The study concluded that there were no industry specific characteristics with respect to changes in domestic competition except for the food industry. In the food industry high levels of entry are particularly evident. National and regional differences, however, are evident.

In general across the sample of developing countries changes in competition are most evident in medium and high tech industries such as fabricated metals, machinery, electrics and instrument industries. This contrasts with the advanced OECD countries where changes with the advanced OECD countries where changes in the level of domestic competition are more evident in the low tech industries.

Among the advanced countries, it is apparent that domestic enterprises in almost all industries in the US are operating in relatively competitive domestic markets. Exceptions are tobacco and petroleum. Japanese enterprises also operate in highly competitive domestic markets except for a few industries. Levels of domestic competition are lower for German industries, with foods, apparels, woods and chemicals being in the most competitive markets.

In East Asia, the level of domestic competition rose from the late 1980's in almost all industries, particularly in electronics, apparels and industrial machinery. South Korea had highly concentrated markets in the 1980s, and in less than 10 years almost all industries reduced their levels of concentration, particularly in textiles, foods and chemicals. Concentrated markets have persisted in Singapore in several industries, although plastics, industrial machinery and electronics witnessed increased levels of competition in their markets over time.

The picture was more mixed in the Latin American economies. Levels of concentration in some industries increased between the 1980's and 1990's in Argentina, Brazil and Mexico, while other sectors became more competitive such as foods and transport. Interestingly, market concentration in the electronics industry increased despite being one of the most dynamic industries in Mexico.

Uchida and Cook (2005b) also examined the relationship between changes in the level of domestic competition and technological and trade competitiveness. Changes in competition, as discussed, are more likely to be influenced by country and regional specific factors than industry specific ones. This contrasts with technological and trade comparative advantage where a mixture of country and industry specific characteristics, particularly in high tech industries, are important.

Although causality between the level of competition and technological and trade specialisation was not directly measured, the results are clearly indicative of the important relationship between the two. A number of statistically significant correlations were found between the change in the level of competition and technological and trade competitiveness. The number of correlations was greater between competition and trade than for technology, except in the US and South Korea.

In general technological competitiveness improves with increases in the level of domestic competition in the advanced economies. The pattern is, however, somewhat mixed. An increase in competition in Japan is positively associated with changes in technological competitiveness but negatively in Germany and the US. In these latter countries increased competition is also negatively correlated with trade competitiveness in the case of the electronics industry.

In developing economies higher levels of domestic competition are correlated with trade competitiveness to a greater extent than technological competitiveness, although this is not the case for South Korea where increased competition is associated with technological specialisation. Table 1 provides an overview of whether or not a positive or negative relation exists between competition and specialisation in each industry across countries.

Table 1 Correlation between Domestic Competition and Technological and Trade Competitiveness

Note: ***, **, and * are statistically significant at the 0.01, 0.05 and 0.10 levels, respectively.

		20	22	23	24	26	28	29	30	32	33	34	35	36	37	38	+ %	- %	Total
Germany 1980-1997*1	SRCA	0.21	-0.44**	-0.72***	-0.82***	0.72***	-0.80***	0.48**	-0.80***	-0.40**	-0.45**	-0.54**	na	-0.86***	0.09	-0.59***	16.7	83.3	78.6
	SRTA	0.10	0.86***	0.13	0.37	0.57***	0.85***	-0.40**	0.84***	0.12	0.10	0.31	na	-0.71***	0.05	-0.68***	57.1	42.9	50.0
Japan 1980-1997	SRCA	-0.70***	-0.71***	-0.93***	-0.81***	-0.88**	0.52**	0.81***	-0.78***	-0.46**	-0.88***	-0.93***	0.70***	-0.90***	-0.93***	-0.52**	20.0	80.0	100.0
	SRTA	-0.18	-0.52**	-0.61***	-0.46**	0.14	-0.80***	-0.72***	-0.14	0.72***	-0.38*	-0.66***	-0.27	0.69***	-0.77***	-0.88***	18.2	81.8	80.0
USA 1980-1997	SRCA	0.20	-0.58***	0.37*	-0.49**	-0.19	-0.94***	-0.10	0.20	-0.66***	0.16	0.11	-0.39**	-0.68***	-0.12	-0.23	14.3	85.7	46.7
	SRTA	-0.17	0.64***	0.65***	-0.23	-0.05	0.40**	-0.06	-0.32	-0.22	-0.35*	0.34*	0.96***	-0.77***	0.20	0.65***	75.0	25.0	53.3
Hong Kong 1983-1997*2	SRCA	0.92***	-0.31	-0.86***	-0.91**	0.30	0.87***	0.54	-0.83	-0.41*	0.76***	-0.32	0.17	-0.82***	-0.10	0.70*	62.5	37.5	53.3
	SRTA	0.51**	-0.23	0.56**	-0.76	0.01	0.20	0.54	-0.95*	0.16	0.32	0.14	0.41*	0.18	-0.09	-0.68*	60.0	40.0	33.3
S. Korea 1983-1997*3	SRCA	-0.59**	0.57	-0.54*	na	0.07	0.77***	0.70***	0.89***	-0.72***	-0.03	-0.68**	0.89***	0.60**	-0.35	0.36	55.6	44.4	64.3
	SRTA	-0.23	-0.37*	-0.50*	na	0.04	-0.47**	0.51**	-0.62**	0.20	0.00	-0.65**	-0.46*	0.80***	-0.75***	0.77***	30.0	70.0	71.4
Singapore 1983-1997*4	SRCA	-0.67***	na	0.28	na	-0.84***	-0.75***	-0.76*	-0.69**	0.22	0.62***	-0.15	0.75***	0.42*	-0.75***	0.95***	40.0	60.0	69.2
	SRTA	0.36*	na	na	na	na	0.26	0.21	-0.56*	-0.11	-0.50**	-0.68**	-0.59**	0.72***	0.58**	0.04	42.9	57.1	54.5
Argentina 1987-1997*5	SRCA	-0.44	na	na	na	na	-0.87**	-0.73***	-0.16	-0.40	-0.83***	-0.65*	na	na	0.70*	0.45	20.0	80.0	55.6
	SRTA	0.74**	na	na	na	na	-0.38	-0.27	-0.31	-0.79**	-0.64**	-0.31	na	na	-0.22	-0.75	33.3	66.7	33.3
Brazil 1989-1997*6	SRCA	0.34	-0.86***	-0.65*	-0.31	0.77***	0.29	-0.62**	0.63**	0.39	-0.76***	0.87***	-0.50*	-0.95***	0.08	na	33.3	66.7	64.3
	SRTA	-0.21	0.53	-0.17	0.22	-0.28	0.28	0.02	0.54*	-0.30	0.40	0.33	0.23	-0.31	0.32	na	100.0	0.0	7.1
Mexico 1983-1997*7	SRCA	-0.23	0.46**	na	na	0.19	0.57**	na	0.83***	0.45**	-0.09	0.71**	0.77**	0.35	0.91***	na	100.0	0.0	63.6
	SRTA	0.65***	-0.23	na	na	0.01	0.03	na	0.43*	0.38*	-0.30	0.79***	-0.21	0.55	0.08	na	100.0	0.0	36.4

20 = foods; **22** = textiles; **23** = apparels; **24** = woods; **26** = papers; **28** = chemicals; **29** = petro-products; **30** = plastics; **32** = stones; **33** = primary metals; **34** = fabricated metals; **35** = industrial machineries; **36** = electronics; **37** = transportation equipments; and **38** = scientific instruments.

+ % = the percentage of statistically significant positive results in relation to all statistically significant results.

- % = the percentage of statistically significant negative results in relation to all statistically significant results.

Total = the percentage of all statistically significant results in relation to all results, excluding na.

The columns with double lines are those industries that experienced a decrease in the level of domestic competition (see Graph 6).

***1: 23**=1985-97; **24**=1987-97; ***2: 24**,**26**=1994-97; **28**=1986-97; **29**,**30**=1995-97; **34**=1991-97; **37**=1985-97; **38**=1992-97; ***3: 23**,**30**,**33**,**34**=1988-97; **26**=1993-97; **35**=1986-97; **36**=1984-97; **38**=1989-97; ***4: 23**=1992-97; **26**,**30**,**38**=1991-97; **28**=1984-93; **29**=1993-97; **34**=1987-97; ***5: 20**,**37**=1992-97; **28**=1993-97; **32**,**34**=1991-97; **38**=1994-97; ***6: 22**,**23**=1991-97; ***7: 30**=1984-97; **34**=1988-97; **35**=1992-97; **36**=1989-97.

In East Asia higher levels of competition have also been associated with negative correlations, in particular industries that have lost some of their competitive advantages. Significantly, in South Korea and Singapore higher levels of competition have been correlated with changes in both technological and trade competitiveness in the electronics sector. In Latin America, there have been fewer associations and the level of domestic competition in the electronics industry has decreased.

Overall, the analysis has shown the importance of increasing levels of domestic competition in improving competitiveness, particularly in relation to trade, but also in some more limited cases in enhancing technological competitiveness.

3. Growth, Income Distribution and Poverty

There is a considerable literature on growth, income distribution and poverty. There are many factors that influence economic growth. Earlier works stressed the importance of labour and capital accumulation, saving and technical progress (Solow, 1956). It has also been argued that growth depends on government policies regarding public consumption and the protection of property rights (Barro, 1997). The endogenous growth literature incorporates the importance of human capital (Rower, 1986; Lucas, 1988). In developing countries it has been argued that accumulating physical capital and labour is more significant for growth where technological development is limited, and where technological development is limited, and where opportunities for specialisation exist (Peretto, 1999). While this is the case Cook and Uchida (2002) have shown that in the case of the so-called East Asian miracle economies initial impetus to growth through accumulation of factors of production gave way to growth being driven by technical innovation and greater technical efficiency.

The empirical research on economic growth indicates that it is not self-evident that a poorer country will grow faster simply because it is starting from a lower level. The findings of Barro (1997) using cross-country analysis show that the initial levels of per capita income and human capital, and other factors such as the fertility rate, the level of government consumption, the ratio of investment, the rule of law and the terms of trade are all important for growth, with a developed institutional environment and good policies being associated with lower transactions costs and a greater supply of information to reinforce economic decision-making, which if absent can reduce the scope for specialisation and economic growth. Similarly, incomplete markets for capital and finance and associated high costs of public funds arising from an inefficient fiscal system can undermine investment required for growth. Bleiger and Khan (1982) showed the importance of maintaining essential complementary public expenditure on infrastructure in order to stimulate private sector investment in productive activities. Growth has also been linked to the political environment (Lal and Myint, 1996) and to resource endowments (Lal, 2000).

There is also a growing literature that examines the trade-off between economic growth and equity, and the policy implications relating to redistributional policies to reduce poverty. This is often approached in terms of suggesting that growth creates inequalities, which if acceptable, can be offset by the effect of growth on reducing poverty (Dollar and Kraay, 2002). Dollar and Kraay found that on average the income of the poorest fifth rises proportionately with average income, so growth does not worsen poverty. Alternatively, redistribution may be the best way to reduce poverty but possibly at the cost of sacrificing the growth objective. It is also more politically acceptable if any redistribution takes place in the context of a growing economy. But even if not the preferred option emanating from the current research on growth and equity, it still requires as a condition of a well functioning and reasonable equitable fiscal system. Something which is absent in many developing economies, despite attention to fiscal reform pursued by the major international development agencies in recent years.

The evidence for a trade-off between growth and equity is mixed. As indicated earlier Deninger and Squire (1998) found no evidence of an invested U for individual countries as postulated by Kuznets. Similar results were obtained in empirical work by Ravallion and Chen (1997), which reinforces the conclusions derived by Dollar and Kraay (2002) that rapid economic growth can safely be used to reduce poverty. There are dissenters: Alesina and Rodrik (1994) argue that initial inequality does affect the prospects for economic growth, using a political economy framework to suggest that when there is a high initial inequality, median voters will demand redistribution which reduces incentives to save and invest, which further aggravates the situation. Collier and Gunning (1999) also support this kind of view by arguing that high vulnerability (defined as a high probability of not having enough in the future) of rural and urban populations in Africa limit prospects for growth and correspondingly for poverty reduction.

In terms of structural change in relation to income distribution, the debate has historically concerned the process of transferring from a traditional to a modern society or from an agricultural based to an industrial based economy (Lewis, 1954; Fei and Ranis, 1964; Myint 1958; Finlay 1970). Attention has also centred on improving growth in the agricultural sector through improving incomes and opportunities in farm and non-farm activities (Pinfold and Norcliffe, 1980; Bourguignon and Morrison,1998).

Interestingly, although evidence is provided for the link between an economies openness and economic growth, openness is often associated with increased inequality (Barro, 2000; Sanchez and Schady, 2003; Lopez, 2004). It is also implied in the research on the consequences of structural adjustment programmes in developing countries (Easterly, 2001). Dollar and Kraay (2002) find the opposite with a positive effect of trade openness on income distribution.

4. Data and Methodology

The study examines the relationship between the changes in income distribution and changes in technological and trade specialisation. The changes in income distribution were measured by Gini coefficients, and the data were obtained from the United Nations World Institute for Development Economics Research (WIDER) Income Distribution Database. The changes in technological and trade specialisation were measured by calculating technological and trade comparative advantages, and the primary data were collected from the NBER US Patent Database (Hall, Jaffe and Tratjenberg, 2001) and United Nations Comtrade Database, respectively.

The underlying data quality for Gini coefficients in the database vary considerably and therefore in almost all cases, the coefficients based on the most reliable data, together with other criteria, namely those covering all areas, population and ages, were initially chosen. The coefficients selected were based either on gross income or expenditure/net income and on household or person. Net income estimates were mainly based on household data. The problems relating to these differences are discussed in detail in Deninger and Squire (1996), Barro (2000), Kiiski (2003).

Similarly, technological and trade comparative advantage indices, in particular the former, are known to be troublesome when applied to an empirical econometric analysis. While Uchida and Cook (2005) discuss the issue, one of the well-known problems is a small sample bias or normality of the indices. In order to improve normality of the indices, the study adopted symmetric technological and trade comparative advantage indices, and prior to the transformation, all the technological comparative advantage indices that were greater than 10 were eliminated from the sample dataset. Technological and trade comparative advantage (TCA and RCA, respectively) were initially calculated on the basis of 28 industry categories, using concordance table compiled by the study. These were recategorised into four broad industries, namely low technology, mid-low technology, mid-high technology, and high technology industries, using OECD criteria (see Appendix 1).

These coefficients and indices were then averaged over four five year periods. The first period runs from 1978 to 1982, the second from 1983 to 1987, the third from 1988 to 1992, and the fourth period from 1993 to 1997. These were arranged into two unbalanced panel datasets, based on RCA and TCA. These periods were chosen on the basis of data availability and consistency. As a result, the number of sample countries was 58 for the RCA based dataset and 45 for the TCA based dataset, and the corresponding number of observations was 198 and 111 (see Appendix 2).

Since the number of observations is relatively small, following Barro (2000), the study applied the Seemingly Unrelated Regression (SUR) technique to examine the relationship between the changes in the Gini coefficient and TCA and RCA. Before examining this relationship, the relationship between economic growth and the changes trade and technological specialisation was conducted. In both cases, econometric models were specified in a fairly standard manner. The model with the Gini coefficient as the dependent variable included the log of GDP per capita, the log of GDP per capita squared to control for the Kuznet curve, dummy variables for the difference in income definition (either net or gross) and regions (Africa and Latin America). The model with economic growth or GDP per capita growth as the dependent variable included the Barro type of control variables, namely initial GDP per capita, population growth, gross domestic investment, and regional dummies.

5. Results and Interpretation

Before presenting the results for the relationship between Gini coefficients and technological and trade specialisation, the results for the economic growth regression are shown in Table 1.

Table 2 shows the relationship between GDP per capita growth and trade and technological competitiveness for various categories of industries. Results are reported for all countries, developing and advanced, and advanced countries. The overall results confirm the usual ‘barro’ type relationships and indicate that the measure of investment is strongly positively correlated with per capita growth in all regressions.

Table 2 GDP per capita growth

Exports

	All sample countries			**Advanced countries**		
	SUR	**GLS**	**OLS**	**SUR**	**GLS**	**OLS**
Low	0.010** (0.005)	0.008** (0.004)	0.011** (0.005)	0.008 (0.005)	0.006 (0.004)	0.005*** (0.011)
Middle-Low	0.011** (0.006)	0.008** (0.004)	0.011** (0.006)	0.023** (0.009)	0.024** (0.009)	0.024** (0.012)
Middle-High	-0.010** (0.005)	-0.007* (0.003)	-0.010** (0.005)	-0.034*** (0.008)	-0.035*** (0.007)	-0.040*** (0.004)
High	0.015*** (0.006)	0.011*** (0.004)	0.015*** (0.006)	0.035*** (0.007)	0.035*** (0.008)	0.039*** (0.003)
IGDP	-0.007** (0.003)	-0.007*** (0.002)	-0.008*** (0.003)	-0.012** (0.005)	-0.008 (0.005)	-0.007* (0.004)
POP	-0.497** (0.218)	-0.193 (0.148)	-0.520** (0.213)	0.137 (0.245)	0.307 (0.199)	0.232 (0.181)
GDI	0.162*** (0.029)	0.152*** (0.020)	0.174*** (0.029)	0.112*** (0.026)	0.112*** (0.021)	0.093*** (0.030)
AF	-0.011* (0.006)	-0.019*** (0.004)	-0.011* (0.006)			
EA	0.007 (0.006)	0.010** (0.005)	0.006 (0.006)			
LA	-0.004 (0.004)	-0.009*** (0.003)	-0.003 (0.004)			
Obs	36/47/56/53	192	192	20/22/21/21	84	84
R^2	0.27/0.41/0.51/0.37		0.41	0.72/0.40/0.71/0.55		0.60
Wald χ^2		230.65***			144.00***	

Notes: SUR = Seemingly Unrelated Regression estimator, GLS = Generalised Least Square estimator with heteroskedastic panels, and OLS = Ordinary Least Squares estimator with panels corrected standard errors. IGDP = log of initial GDP per capita for each period, POP = population growth, GDI = the ratio of gross domestic investment to GDP. AF, EA, LA = regional dummies for Africa, East Asia, and Latin America, respectively

Innovation

	All sample countries			**Advanced countries**		
	SUR	**GLS**	**OLS**	**SUR**	**GLS**	**OLS**
Low	-0.001 (0.007)	0.001 (0.007)	0.001 (0.013)	-0.009 (0.008)	-0.002 (0.008)	-0.005 (0.012)
Middle-Low	-0.003 (0.010)	-0004 (0.007)	0.001 (0.017)	0.016* (0.009)	-0.005 (0.009)	0.018 (0.012)
Middle-High	-0.010 (0.012)	-0.007 (0.011)	-0.012 (0.019)	0.031*** (0.009)	0.026** (0.011)	0.015 (0.014)
High	0.004 (0.012)	0.006 (0.010)	0.005 (0.020)	0.046** (0.013)	0.025** (0.012)	0.044** (0.019)
IGDP	-0.009** (0.004)	-0.008*** (0.003)	-0.008*** (0.003)	-0.003 (0.007)	-0.012** (0.006)	-0.010 (0.007)
POP	-0.379* (0.227)	-0.104 (0.163)	-0.349** (0.175)	-0.322 (0.246)	0.409 (0.256)	0.267 (0.348)
GDI	0.136*** (0.040)	0.110*** (0.027)	0.110*** (0.068)	0.117*** (0.031)	0.114*** (0.027)	0.096** (0.038)
AF	-0.019* (0.010)	-0.014*** (0.009)	-0.023*** (0.005)			
EA	0.027*** (0.006)	0.031*** (0.005)	0.027** (0.011)			
LA	-0.013* (0.007)	-0.013** (0.006)	-0.015* (0.008)			
Obs	22/28/30/31	111	111	17/19/19/20	75	75
R^2	0.61/0.52/0.74/0.40		0.57	0.35/0.21/0.39/0.22		0.21
Wald χ^2		213.48***			36.79***	

For the sample of all economies trade competitiveness contributes positively to growth and is statistically significant for all categories of industry. The relationship is less clear cut in the advanced sample of economies for low tech industries. The strongest relationship is between growth and high tech industries.

In terms of technological competitiveness the relationship for the whole sample is negative for all categories of industries except for those in the high tech sector. However, the results are only statistically significant for the advanced economies in the case of low tech industries. The relationship is actually positive and statistically significant for advanced countries for middle-high tech industries.

Table 3 reports the results of examining trade and technological specialisation in relation to income distribution (measured by the Gini coefficient). For the entire sample of economies it appears that low tech, middle-low tech and middle-high tech sectors show a negative correlation between trade specialisation and income distribution. Therefore, an increase in trade specialisation in these industries is associated with an improvement in income inequality. Trade specialisation in high tech industries, however, has resulted in an increase in income inequality. Results for low-teach and high-tech industries are statistically significant.

Table 3 Gini coefficient

Exports

	All Sample Countries			**Advanced Countries**		
	SUR	**GLS**	**OLS**	**SUR**	**GLS**	**OLS**
Low	-0.039**	-0.020*	-0.020**	-0.051*	-0.052*** (0.019)	-0.059***
	(0.018)	(0.011)	(0.010)	(0.027)		(0.022)
Middle-Low	-0.014	-0.012	-0.003	-0.094**	-0.104*** (0.021)	-0.112***
	(0.017)	(0.010)	(0.010)	(0.037)		(0.015)
Middle-High	-0.006	-0.008	-0.013*	-0.094**	-0.129*** (0.024)	-0.125***
	(0.016)	(0.009)	(0.007)	(0.037)		(0.021)
High	0.032**	0.033*** (0.010)	0.038***	0.056*	0.068*** (0.019)	0.058***
	(0.017)		(0.011)	(0.029)		(0.014)
LGDP	0.036	0.123*	0.019	-0.959**	-1.364*** (0.216)	-1.131***
	(0.135)	(0.076)	(0.113)	(0.410)		(0.235)
LGDP squared	-0.004	-0.009** (0.004)	-0.003	0.053**	0.076*** (0.012)	0.063***
	(0.008)		(0.006)	(0.022)		(0.013)
Net	-0.081***	-0.078*** (0.007)	-0.075***	-0.043***	-0.029*** (0.008)	-0.034***
	(0.013)		(0.005)	(0.015)		(0.005)
AF	0.098***	0.089*** (0.008)	0.099***			
	(0.021)		(0.009)			
EA	0.051***	0.052*** (0.012)	0.048***			
	(0.022)		(0.007)			
LA	0.110***	0.098*** (0.011)	0.107***			
	(0.017)		(0.005)			
Obs	36/47/56/54	193	193	20/22/20/21	83	83
R^2	0.65/0.66/0.60/0.60		0.63	0.57/0.71/0.74/0.63		0.69
Wald χ^2		908.01***			258.84***	

Notes: LGDP = log of GDP per capita, Net = a dummy for income distribution definition difference (1 = net/expenditure and 0 = gross), POP = population growth, and GDI = gross domestic investment.

Innovation

	All Sample Countries			Advanced Countries		
	SUR	**GLS**	**OLS**	**SUR**	**GLS**	**OLS**
Low	0.064** (0.027)	0.123*** (0.016)	0.113*** (0.021)	0.092** (0.034)	0.159*** (0.024)	0.169*** (0.026)
Middle-Low	-0.014 (0.031)	-0.035 (0.025)	-0.040 (0.036)	-0.027 (0.037)	-0.028 (0.036)	-0.036 (0.028)
Middle-High	-0.052 (0.043)	-0.059** (0.028)	-0.065** (0.032)	-0.145*** (0.044)	-0.158*** (0.033)	-0.166*** (0.023)
High	0.079** (0.042)	0.147*** (0.034)	0.131** (0.057)	0.101* (0.059)	0.220*** (0.049)	0.176*** (0.039)
LGDP	0.061 (0.258)	-0.363** (0.140)	-0.321*** (0.120)	-1.108 (0.823)	-0.770 (0.709)	-0.699 (0.739)
LGDP squared	-0.003 (0.015)	0.023*** (0.008)	0.020*** (0.008)	0.061 (0.044)	0.047 (0.038)	0.043 (0.039)
Net	-0.054*** (0.017)	-0.048*** (0.008)	-0.055*** (0.006)	-0.036*** (0.015)	-0.038*** (0.008)	-0.038*** (0.005)
AF	0.222*** (0.047)	0.296*** (0.035)	0.277*** (0.035)			
EA	0.009 (0.027)	0.013 (0.012)	0.010 (0.011)			
LA	0.150*** (0.035)	0.214*** (0.023)	0.200*** (0.018)			
Obs	22/28/30/30	110	110	17/19/19/19	74	74
R^2	0.69/0.68/0.70/0.62		0.69	0.48/0.57/0.43/0.41		0.55
Wald χ^2		372.86***			152.28***	

The pattern of relationships is the same for the advanced economies, and in this case all results are statistically significant.

In the case of technological specialisation and income distribution, the findings indicate for the complete sample of countries that both low tech and high tech industries have a worsening effect on income inequality. Both findings are statistically significant. Technological specialisation in middle tech (both high and low) industries have a positive contribution to reducing income inequality. Here the results are statistically significant in two out of the three regressions conducted for the middle high tech category. Again the pattern is repeated for the sample of advanced economies, with a higher proportion of statistically significant results.

6. Policy implications and conclusions

The policy implications arising from the results are wide ranging. Two main types of inferences for policy are examined. The first relates to competition policies. These are broadly defined to cover industry and trade policies, and competition policy more narrowly identified with anti-trust legislation and associated with stipulations against abuse of dominance, predatory pricing and price fixing behaviour of enterprises or groups of enterprises. Industry and trade policies also incorporate elements that may contribute to increasing the competitive nature of markets, as well as elements that may seemingly limit the scope for competition but nevertheless are aimed at improving the conditions for competitiveness in domestic and international markets. In other words industrial and trade policies are not only associated with interventions and restraints that inhibit competition and restrict entry into markets. Indeed, all countries included in the empirical analysis have over the years implemented a variety of industrial and trade policies, with differing degrees of emphasis towards how competitive markets ought to be (Amsden and Singh, 1994). Further, few developing countries has formal competition laws during the period examined (Gray and Davis, 1993; Cook, 2002). The second relates to policies that redistribute income and protect the more vulnerable segments of the population. These generally, consist of taxes and transfers that redistribute income and provide permanent or temporary social safety nets for the poor and lower income groups.

The main findings are that the development of high tech industries has the greatest prospects of contributing to growth, but has a poor record as far as income distribution is concerned. Developing high tech industries in relation to exports is particularly rewarding for developing economies in terms of growth, and ultimately in terms of poverty reduction if the arguments of a link between growth and poverty reduction are accepted. In this case the income inequality effects arising from specialisation in high tech industries could be offset if the growth effects are large enough and, therefore, contribute to reducing poverty by raising average incomes. The likely effect in income distribution results from the disproportionate employment of skilled workers drawn from the educated and existing pool of employed labour to this sector. Specialisation in low tech industries has a positive but lower effect on growth, but is more conducive to reducing income inequality. Success in developing labour intensive exports often involves links to global value chains through international buyers. In the garments industry there is evidence that indicates that workers are often migrants from relatively deprived regions, suggesting that employment is important for raising living standards and as a potential source of remittances to poorer areas. Equally, workers participating in global value chains may also not be the poorest. They may have secondary or higher education, with poorer, less educated workers being concentrated in the informal sector.

Medium-low and medium-high tech industries contribute little to growth, possibly owing to their high imported input content but they also have favourable income distribution effects. Competition in the medium-tech industries was also shown to be below levels obtained in high tech sectors and at the other end in the labour intensive food industry. In policy terms reducing levels of concentration in medium-tech industries may provide the incentives to improve competitive advantage.

The findings also highlight the need to examine more pragmatically issues relating to which sectors ought to be supported as part of a poverty reducing strategy and what resources ought to be provided as compensatory or offsetting measures for adverse social effects. Developing economies by definition have weaker institutions and less developed fiscal systems to provide the needed social safety nets. Tax revenue is already highly skewed, with urban populations and enterprises bearing most of the tax burden in many developing countries. The high cost of public funds (the deadweight loss estimated by the World Bank is greater than 1 compared to around 0.3 in advanced countries) also restrains development in this area (Beato and Laffont, 2002).

Undoubtedly, competition policy ought to tackle the excesses of market power that stifle competition through forestalling entry and acting collusively. Despite the extension of competition policy to over 80 countries in recent years (Evenett, 2004) there must remain questions over how effectively it can be implemented and enforced (De Paula, 2005). Similarly, although advanced countries have been able to encompass the issues relating to innovation and market structure in their approaches to implementing competition law, it continues to remain the case that developing countries may act to stifle innovation through competition policy (e.g. documented in Indonesia) and fail to sufficiently support technological development through other means.

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Appendix 1

Industry Classification

	ISIC classification code
High Technology Industries	
Aircraft and spacecraft	353
Pharmaceuticals	2423
Office, accounting and computing machinery	30
Radio, TV and communications equipment	32
Medical, precision and optical instruments	33
Medium-high Technology Industries	
Electrical machinery and apparatus	31
Motor vehicles, trailers and semi trailers	34
Chemicals excluding pharmaceuticals	24 excluding 2423
Railroad equipment and transport equipment	352, 359
Machinery and equipment	29
Medium-low Technology Industries	
Building and repairing of ships and boats	351
Rubber and plastics products	25
Coke, refined petroleum products and nuclear fuel	23
Other non-metallic mineral products	26
Basic metals and fabricated metal products	27, 28
Low Technology Industries	
Manufacturing, n.e.c, Recycling	36, 37
Wood, pulp, paper, paper products, printing and publishing	20, 21, 22
Food products, beverages and tobacco	15, 16
Textiles, textile products, leather and footwear	17, 18, 19

Source: OECD (2003)

OECD Science, Technology and Industry Scoreboard 2003: Towards a knowledge-based economy