Trade and growth – again

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Abstract

A stylised fact from the large and growing literature on relationships between trade and growth is that liberal trade policies may stimulate growth. However, there is no academic consensus that liberal trade policies are either necessary or sufficient ingredients in growth promoting policies. In this paper, the relationships between trade policy and growth are investigated. The paper adds some new findings. My measure of trade policy is not only applied average tariff rates which have been used by others, but such tariff rates for agriculture and manufacturing separately. The results indicate opposite results of the two: Protection of manufacturing correlates negatively with growth, while tariffs on agriculture imports seem to have a weaker though positive correlation. These results are robust in the sense that they remain significant with the same sign independently of different specifications and inclusions of various control variables.

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1. Introduction

Do liberal trade policies foster growth and development, or should, or could, protectionism and tariffs constitute ingredients in growth-promoting policies? Questions like these have been debated intensively in recent years. This is so in economics and among the general public. The fact that economists disagree on these issues, despite century-long theorising and hundreds of advanced empirical studies available, suggests important challenges for the research discipline.

Textbook economics suggests that countries should engage in trade. The theories of comparative advantages and the 'new trade theory' almost unanimously conclude that international trade promotes mutual benefits for the trading partners. But apart from such simple theorising, economics of trade, growth or development do not conclude clearly on these issues. A very short review of some issues is given in section 2 below.

Neither are the data clear. The recent surge of empirical literature on relationships between trade and growth reflects challenges for empirical research. Even after renewed energy has been devoted to these issues, we still lack clear-cut conclusions. In their authoritative review of the literature, Durlauf *et al*. (2005) cite 18 studies (and refer to 20 anonymous others) on the relationships between trade, trade policy and growth. According to Durlauf *et al.*, ten studies report a positive and significant result, three a positive, non-significant result, six studies report unclear effects while six report negative (for which two were significantly so) correlations between various trade-related variables and economic development.[1]

Consequently, one might conclude that the literature weakly suggests a (weakly) positive relationship between trade and growth. Rodriguez and Rodrik (1999) reject such a conclusion. They claim that several contributions to the literature wrongly conclude about a positive relationship. After scrutinising a sample of important papers, Rodriguez and Rodrik conclude that (p. 4)

> "Our bottom line is that the nature of the relationship between trade policy and economic growth remains very much an open question. The issue is far from having been settled on empirical grounds. We are in fact skeptical that there is a general, unambiguous relationship between trade openness and growth waiting to be discovered. We suspect that the relationship is a contingent one, dependent on a host of country and external characteristics."

Section 3 below does not aim at repeating the reviews (by Rodriguez and Rodrik and others) available. It does, however, discuss some of

[1] Several studies report more than one result so there is no contradiction that more results than studies are reported.

the commonly used measures of trade policy and openness. The existing literature has used advanced econometric methodology to reveal openness. Simple data available have not been used to the same degree. Tariff data have been used in some studies only. In this study, use is made of tariff data broken down on agriculture and manufacturing.

Section 4 discusses these data in some detail together with the other data used in this paper. The main empirical methodology is the standard one: In addition to standard and robust explanatory variables in cross-sectional growth studies, some new measures of trade policy are included. Thus, most of the data used in this paper are well known in cross-section economics on economic growth.

Section 5 presents the findings. These suggest that when tariff data for manufacturing and agriculture are used separately, there is a negative, significant and robust relationship between tariffs in manufacturing and growth, while this is not the case for agriculture protectionism. These results survive a number of robustness checks and alternative specifications. Some evidence on interaction with variables reflecting governance and institutions (as suggested by Rodriguez and Rodrik) is also reported.

Section 6 concludes.

2. A short review of the literature

Static models of comparative advantages give reasons for countries to engage in international trade. When countries specialise in producing the goods for which their domestic opportunity costs are the lowest, all countries may gain from trading with each other. Ricardian trade models suggest that international trade will increase welfare and factor rewards. Resource-based trade theory in the Heckscher-Ohlin tradition explains how trade may give rise to distributional conflicts. Still trade is predicted to be mutually beneficial for all countries in the sense that gains for winners in each country potentially can more than compensate losers in the same country. Theories about international trade are summarised in many textbooks. See e.g. Krugman and Obstfeld (2009) or Feenstra (2004)

Static models based on increasing returns, i.e. so-called ‘new trade theories’, similarly *most often* predict mutual gains from trade. When there are increasing returns, prices will be lower and product variety larger if countries specialise in producing few product varieties that are sold in several markets and exchange goods with other countries, rather than producing for their domestic markets only. But, in some

models, market size may be decisive for localisation choices. Increasing returns combined with trade costs stimulate localisation of production where markets are large. Firms may choose to locate where they have the highest market access. Therefore, international trade may in some instances disproportionally benefit large countries. De-industrialisation in small countries may occur. In terms of welfare, theory still often predicts gains from trade also for de-industrialised countries. The reason is that trade causes product prices to decline and therefore higher real wages. When there is migration of factors of production, de-industrialisation is more likely since market size becomes endogenous. These types of theories are summarised by Feenstra (2004), Dixit and Norman (1980) and Fujita *et al.* (1999). In many ways, these new trade theories give support to, and formalisation of, older theoretical approaches proposed by among others Kaldor (1972), Myrdal (1957) and Posner (1961).

Standard neoclassical growth models do not suggest dynamic growth effects from international trade (see e.g. Aghion and Howitt, 1998, ch. 11). Thus, growth and trade are often analysed separately in traditional neoclassical theorising. Capital accumulation leads to higher capital intensity which translates into lower returns from capital. Therefore, there will be income-level convergence in the neoclassical growth story. In case of resource-based international trade, factor price equalisation may speed up convergence of income levels.

Ventura (1997) argues that trade and growth are necessarily interrelated, however. When there is international trade, capital accumulation allows specialisation in more capital- intensive industries. Thus, decreasing returns to capital may occur slowly and for each industry as the result of global savings only (rather than accumulation of capital in each individual country). High growth may therefore result from accumulation even over longer periods, since decreasing returns from capital are counteracted by changing industrial structures. Ventura explains how such mechanisms can be important for growth miracles observed for instance in East Asia.

When countries have specialised according to e.g. comparative advantages and take part in international trade, they will benefit differently both from domestic economic growth and from growth in other countries. Some countries may experience negative *terms of trade* effects from growth in foreign countries if they are specialised in industries with low income elasticities. Also domestic growth in such industries may lead to deteriorating terms of trade and lower income. This is the case of 'immiserising growth' described by Bhagwati (1958). Closely related is the idea that developing countries may lose from trade if they are specialised in for instance agricultural production with low

income elasticities (Prebisch, 1959). On the other hand, being specialised in industries that do not experience falling prices and which have high income elasticities, often results in extraordinary benefits from being exposed to international trade.[2]

Endogenous growth models demonstrate how trade may boost economic growth for the global economy. The existence of international technology spillovers and larger markets often tend to reinforce positive growth effects of economic integrations (Helpman and Grossman, 1991, Rivera-Batiz and Romer, 1991). But endogenous growth models (as demonstrated by Lucas (1988) and Young (1991)) can explain the existence of low growth traps because of unfortunate specialisation. Countries specialise according to their static comparative advantages. However, endogenous growth mechanisms may differ between industries. Therefore, some countries may be lucky and get specialised in industries with great promises for the future in the sense that endogenous growth is high. Other countries may become specialised in industries without such potentials.

Matsuyama (1992) stresses another link between industrial structures, openness and development. The point of departure is the traditional view that there are decreasing returns in agriculture and increasing returns and endogenous growth in manufacturing. When there is endogenous growth, growth in productivity results more or less as an automatic by-product of production itself. Thus, productivity is the result of cumulated production experience in the industry. Endogenous growth in manufacturing supports the view of manufacturing as an engine of growth.

In the case of endogenous growth in manufacturing industries, openness versus closedness may be decisive for the consequences of productivity growth in the agricultural sector. In the case of a closed economy, there may be *positive* links between productivity growth in agriculture and economic growth. The reasons are that productivity growth in agriculture 1) makes it possible to feed a growing manufacturing workers population, 2) releases labour for manufacturing employment and 3) increases supply of domestic savings to finance investments. In the case of an open economy, the links between agricultural productivity and growth may be the *opposite*: High productivity in agriculture leads to specialisation in agriculture and deindustrialisation. The reason is that countries without comparative advantages in agriculture may get a head start in manufacturing. With

[2] Some raw-material-producing countries in recent years are *prima facie* evidence of this mechanism: Producing raw materials in periods of high growth in manufactured goods-producing countries has proven to yield double dividends – increasing prices on exports goods (because of increasing prices of raw materials) and decreasing prices on imports goods (because of high productivity growth in manufacturing).

learning-by-doing endogenous growth mechanisms, this may make it impossible to compete in manufacturing for countries that are specialised in agriculture.

Rattsø and Torvik (2003) argue that the negative links between agricultural productivity and growth in the open economy case may not necessarily be robust in a development economics perspective. When agricultural production is exported, such export earnings may be necessary to finance imports of intermediates goods for a growing manufacturing sector. In this case, high growth in agriculture may be a necessary condition for subsequent growth in the manufacturing sectors. According to this view, supportive policies for the agricultural sectors may make sense. Countries that are credit-rationed and have a large share of their export earnings from exports of agricultural goods may need to boost their exports from this sector in order to be able to import intermediates for their manufacturing sectors.

Based on a version of a similar modelling framework, Rodriguez and Rodrik (1999) argue for the opposite policy receipt: Manufacturing should be supported at the cost of agricultural production. Because of learning by doing in manufacturing, the optimal tariff for manufacturing sectors may be positive. The reason is that such a tariff will increase manufacturing employment, and therefore learning by doing, at the cost of agriculture employment where there is no learning by doing.

The modelling framework of the above two-sector models can easily be illustrated. Let X^M denote manufacturing production and X^A agricultural production. Production functions are given by:

$$1) \qquad X_t^M = M_t F(n_t)$$

$$2) \qquad X_t^A = AG(1 - n_t)$$

$$3) \qquad \dot{M}_t = \delta X_t^M$$

Above, M denotes productivity in manufacturing and A denotes productivity in agriculture; F and G are production functions with standard neoclassical properties and n_t denotes the share of the workforce that is employed in manufacturing. Thus, production in the two sectors depends on the division of the working force between them. δ is a positive parameter.

Agricultural productivity, A, is static (or has exogenous change). In the manufacturing sector there is endogenous growth in the learning-by-doing sense so that productivity growth depends on production. This last property is described in equation 3.

Employment dynamics in the two sectors is determined by the equilibrium condition for the labour market where marginal returns from labour in agriculture equal the marginal value of labour in manufacturing:

$$4) \qquad AG'(1-n_t) = p_t M_t F'(n_t)$$

Above, p_t is the price of manufacturing goods in terms of agricultural goods.

Preferences are assumed non-homothetic and with an income elasticity for food less than one. For the closed economy case, Matsuyama shows that under certain conditions these assumptions result in a steady state development path with a constant share of employment in each of the two sectors.

In this steady state there is a constant growth rate for the manufacturing sector. An exogenous productivity increase in agriculture releases employment to the manufacturing sector and thus results in permanent higher growth rates for this sector and for the economy. In the closed economy case, therefore, there is a *positive* link between agricultural productivity and economic growth.

In the open economy case, however, the link between productivity in agriculture and manufacturing may be *negative*. In the open economy case, prices on the two goods produced in the economy are given from abroad. Thus the division of labour between agriculture and manufacturing, and therefore the growth rate in the economy (via 3), will be the result of relative prices on the world market. A positive productivity shock in agriculture draws employment away from manufacturing towards agriculture. This increases static welfare, but reduces growth over time. Thus, there is a negative link between productivity in agriculture and growth.

Rodriguez and Rodrik (1999) discuss the implications of imposing a tariff on manufactured goods. Such a tariff increases the domestic relative price of manufactured goods and therefore manufacturing employment. For small tariffs, the effect on economic growth will be positive. For larger tariffs, distortionary effects dominate so that positive growth effects taper off. This is also a dynamic effect since it depends on the size of the manufacturing sector.

As stated above, Rattsø and Torvik (2003) show that the negative link between agricultural productivity and growth for an open economy may not necessarily be present. They extend the production function

for manufacturing goods with a new factor (intermediates, I) in a Cobb-Douglas fashion. In the cases where agriculture exports finance imports of intermediate goods to be used in the manufacturing sector, manufacturing production may depend on productivity in agriculture. Intermediates have to be imported from other countries and such imports are financed with exports of agricultural goods.

The above discussion indicates that trade policy may play important roles for countries' growth strategies. It is also demonstrated that supportive policies may be appropriate both for manufacturing sectors and for agriculture. Thus, our discussion gives support for investigating the potential different impacts of protecting manufacturing versus agriculture.

The above discussion shows how economic theories on trade and growth give scope for trade policy. Under certain circumstances, trade policy may stimulate economic growth. Messages from endogenous growth theories point in the direction of protecting manufacturing and industries with long-term growth potentials. But this is not an unconditional policy receipt. It depends, among other factors, on how exposed an economy is to international trade. Thus, how to design trade policy to stimulate growth need not be obvious.

In addition, of course, come all the political considerations on how to stimulate growth by means of trade policy rather than stimulating the needs of pressure groups and lobbyists. These are, however, considerations beyond the scope of this short paper.

3. Empirical strategies

The contradicting findings in the literature surveyed by Durlauf *et al*. (2005) indicate that the relationships between growth, trade and trade policies are not obvious and they demonstrate a lack of academic consensus. Figures 1 through 4 illustrate the ambiguities in the data.

Those figures show simple scatter plots of (log of) income per capita in 1995 and (log of) trade as share of GDP in 1995 (figure 1), growth in income per capita (in the period from 1995 to 2005 and (log of) trade as share of GDP (in 1995) (figure 2) and levels of and growth in income per capita versus average applied tariff rates (averaged over the period from 2000 to 2004) (figures 3 and 4). The data used to construct the figures are described in section 4 below.

Figure 1 Income and trade

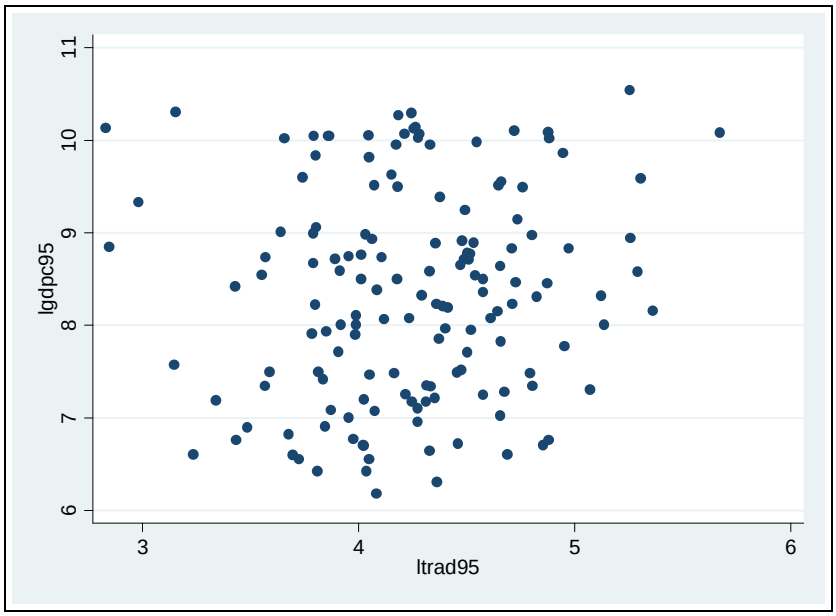


Figure 2 Growth and trade

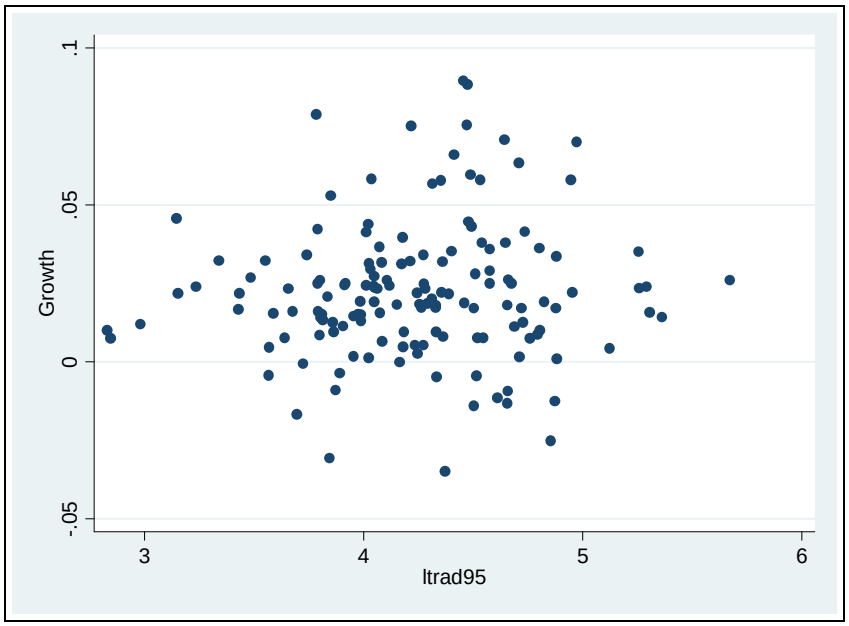


Figure 3 Income and tariffs

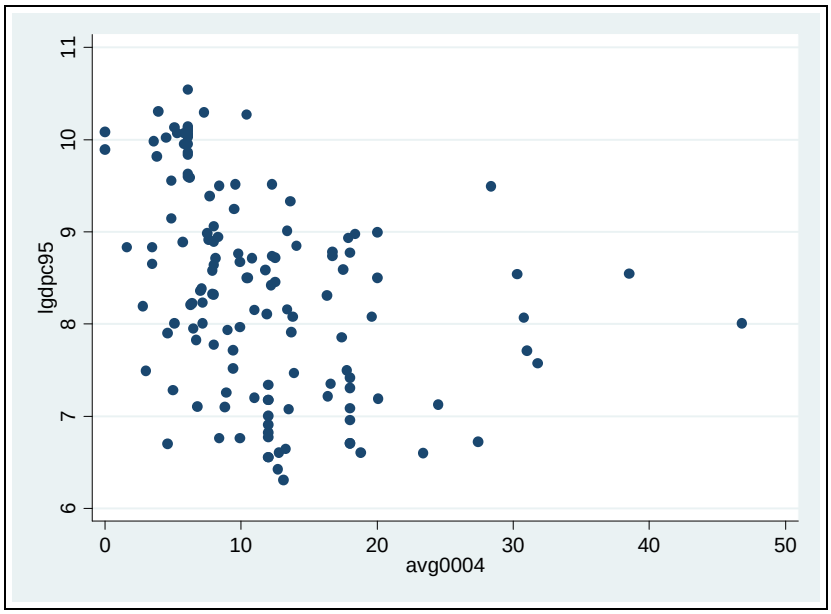
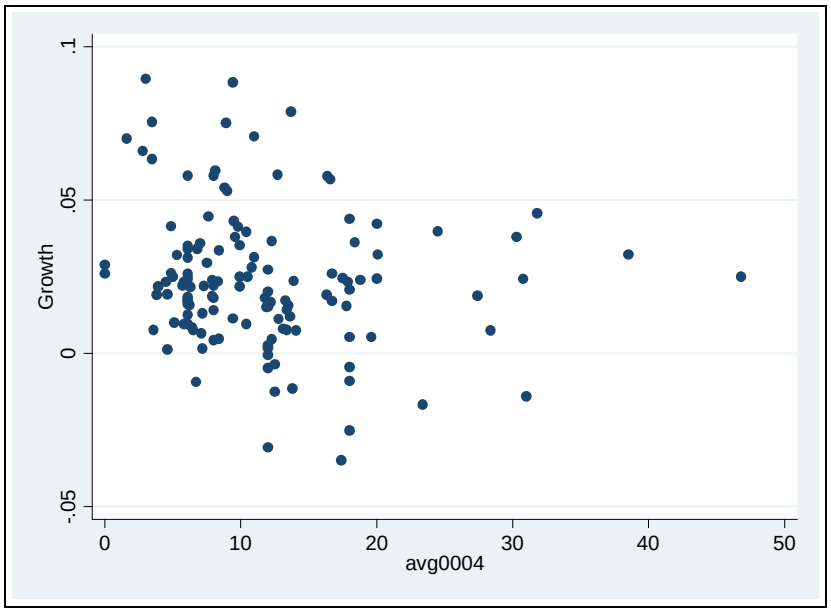


Figure 4 Growth and tariffs



The relationships do not support any clear-cut conclusion. In particular, there is no clear relationships between openness (measured as trade as share of GDP) and performance (income per capita and growth) while there seem to be weak negative correlations between performance and average tariff rates. The negative relationships are more pronounced between income per capita and tariff rates than between

growth and tariff rates. Thus, from the correlations above, we do not find evidence that open countries are richer or grow faster than closed economies. Nor is there any clear evidence that countries with liberal trade policies do differently from countries that protect their industries. There is a weak negative relationship both between income per capita and tariffs and between growth and tariffs, but these are so weak that the figures alone cannot support clear conclusions.

The lack of clear evidence has spurred a large literature. Some examples of this literature are mentioned below. These examples are chosen since they are often cited and since they employ different research strategies. A major research challenge has been how to measure openness. The examples listed below show different choices.

Edwards (1993,1998) gives a broad discussion of conceptual problems with measuring trade policies and openness. Openness as such, for instance measures such as trade as share of GDP, is one strategy. Above, it is demonstrated that this strategy does not reveal a clear relationship. This does not mean that trade does not influence development. First, also other variables influence on growth. A regression-based methodology where more variables are included, is needed. Second, trade is also influenced by many variables. One is trade policy. Others are economic size, population and localisation. From the gravity equation it is well known that trade depends on total income and bilateral distance between trading partners. Inclusion of trade as share of GDP (as in Edwards, Levine and Renelt (1992) and many others) cannot, therefore, be expected to measure the impact of trade policy on growth.

Dollar (1992) constructs two indicators of openness. These are real exchange rate distortion and this indicator's variability. Real exchange rate distortion is meant to reflect deviations from the law of one price and therefore deviations from free trade. This variable's variability over time is also assumed to reflect lack of openness. Dollar suggests that these variables do reflect trade policies and the impacts of trade policies. Rodriguez and Rodrik, however, argue that both measures hardly reflect trade policies and that many other variables, including bad macroeconomic policy, will be captured by both variables.

Edwards (1998) regresses growth in total factor productivity, TFP, on nine different measures of openness. He finds that several of these, among them trade as share of GDP, a composite openness indicator (see below), black market premiums and tariff rates all correlate negatively with growth. Rodriguez and Rodrik argue that most of these findings are due to econometric misspecifications and inappropriate weighting (based on total GDP rather than real heteroscedasticity).

The fact that many variables reflect openness motivated Sachs and Warner (1995) to try to construct a composite indicator of openness. Their indicator is a dichotomous variable that depends on six individual measures. A country was characterised as closed if any of five different criteria was fulfilled. These five are high tariff rates (above 40 %), high coverage of non-tariff barriers, a socialist economic system, state monopoly for major exports and a high black market premium for foreign currencies. If none of these conditions were fulfilled, a country is classified as open. Sachs and Warner found positive and significant effects on growth rates of their openness indicator. Their result, however, was harshly criticised by Rodriguez and Rodrik. They claim that the result is explained by the impact of two of the indicators least related to trade policy (black market premium and state monopoly). Wacziarg and Welch (2008) update and adjust the openness indicator developed by Sachs and Warner. They find that liberalisation, i.e. shift from closed to open, stimulates growth. They are not, however, able to find clear and significant effects in cross-section regressions. Wacziarg and Welch go a long way in controlling for spurious correlations in their panel data approach to the impact of trade liberalisation on growth. Such spurious correlations might arise, for instance, because reform policy that stimulates growth also contains trade liberalisation that does not influence growth. Whether they succeeded with their controls has been the subject of debates.

Trade is endogenous in the sense that it may itself influence growth but also be influenced by other factors that influence growth directly and independently of trade. Because of this, it may be that countries that experience high growth rates for some reasons are also observed to expand their trade even if there is no or just a weak causal relationship. Therefore, researchers may be led to wrongly conclude that trade has a large and significant impact on growth. Some authors, such as e.g. Frankel and Romer (1999), have tried to construct measures of openness that take such endogeneity into account. The approach is to estimate expected trade. Variables that are known to influence on trade, but do not have clear relationships with growth, are used to estimate trade. Thereafter, the effect of predicted trade on growth is estimated. Instruments for trade can for instance be geographical location. Based on this methodology, Frankel and Romer find a large and robust positive, but not very significant, effect of trade on income levels.

In a similar vein, Romalis (2007) hypothesises that trade is influenced by market access in other countries. Romalis estimates the extent to which increased openness induced by greater market access caused faster growth in developing countries in the time-series and cross-section dimension. He finds that market access seems to accelerate

growth. Romalis' approach is that market access can possibly be a solution to the endogeneity problem. Market access in other countries hardly reflects other domestic variables' impact on growth. Therefore, Romalis argues, market access may reflect impact of trade on growth that does not correlate with other causes of economic growth. However, it may be that market access is one type of openness with its own effect on trade and growth apart from countries' own trading policies. In trade policy debates, countries almost always demand increased market access in other countries. Thus, market access may well have separate effects on growth which differ from domestic trade policies. This is not discussed by Romalis.

As is demonstrated above, very few of the studies in question use tariff rates as such as their indicator for openness. The reasons for this are many.

First, tariff data have not been readily available in standardised versions as computer- readable files. Now, however, the WTO (and other sources) gives access to different tariff data at different levels of aggregation for many countries.

Second, some countries have made use of a wide set of trade policy tools, of which tariffs are only one type. There are many trade policy tools, like non-tariff barriers, export subsidies and a large set of 'red tape' barriers. Thus, it is not certain that tariff barriers accurately reflect a country's trade policy.

Third, many countries discriminate between their trading partners. In recent years, many new regional trade agreements (RTAs) have been signed so that most favoured nations' (MFN) average tariff rates actually may be atypical and applied to least favoured nations' trading partners.

Fourth, it is not always clear what tariff rates to use. Should one use applied tariff rates, bound tariff rates, MFN tariff rates, unweighted average tariff rates, weighted tariff rates etc.

Fifth, the scatter plots of the relationships between tariffs and economic performance above are indicative for many studies in this field: There is no evident correlation between tariff and growth. Our theoretical discussion above also warns against a priori expectations about such correlations.

The fact that tariffs have been so seldom used in the literature can therefore easily be understood and defended. In this paper, however, we will use tariff rates as our main indicator for countries' trade policy.

4. The data

The data used in this paper are standard data from the literature. Economic variables for our cross section of countries are taken from the World Development Indicators. The period chosen is for 1995 to 2005. The reasons for this are threefold: First, 1995 is a natural starting year for the recent period of globalisation. The results of the Uruguay round were being introduced from 1995 onwards with establishment of the WTO. In 1995 the transition shock for the post-communist countries was over (though many transition problems remain). Second, many more observations are available from 1995 onwards as compared to inclusion of earlier year. Restricting the period to the period from 1995 onwards therefore results in a larger cross-section dataset. Third, with the establishment of the WTO more standardised tariff data became available. Restricting our focus to the post 1995 period therefore allows a more consistent and larger data set.

The data included in the below growth regressions are the most common ones included in cross country growth regressions. They are those that were deemed robust by Levine and Renelt (1992). They are standard variables when one wants to test for inclusion of other variables (like tariff data in this respect).[3] The data included are gross domestic product per capita in purchasing power parities in 1995, its average annual growth rate in the period to 2005, population and average annual population growth, annual gross fixed capital formation (averaged over the period) and average secondary school attendance. In some of the regressions also trade (exports plus imports) share of GDP are included.

Average applied tariff data, for all goods and for manufacturing and agriculture separately (and much more) are available from the WTO for the most recent years. The data used in this paper, however, are taken from the World Trade Indicators. These are documented in the *user guide* for the project (World Bank, 2008) and both the paper and the data are downloadable from the World Bank's webpage.

The data for governance indicators stem from the World Governance Indicator project (also available from the World Banks webpage). These indicators are presented and discussed by Kaufmann *et al.* (1999a, 1999b, 2004) and in Maurseth (2009). These indicators are six individual indicators of governance. The six different indicators reflect the quality of governance along different dimensions. They are constructed on the basis of a massive aggregation exercise of many individual governance measures. Since tariff data are hardly inde-

[3] But the art and science of which variables to include and which to exclude in regressions like those reported in tables 1 and 2, are controversial. Also see Barro and Sala-I-Martin (1997) and Sala-I-Martin (1997).

pendent of governance quality, controlling for independent effects and interactions effects make sense. In this paper, *Governance Effectiveness* and *Control of Corruption* were chosen to be included as additional control. These were the variables (of the six) that influenced the results the most. The two governance variables rank countries on a scale from -2,5 to 2,5 and they are approximately normally distributed. [4]

Table A in the appendix presents a summary of the data of prime interest.

5. Results

Table 1 reports results from cross country growth regressions. The first column in table 1 is for well known and well recognised explanatory variables. These are (log of) initial income (lgdpc95), investment shares of GDP in terms of gross fixed capital formation averaged over the period (agfc), average secondary school enrolment in the beginning of the period (avgsec) and population growth (pgrowth).[5] It is seen that the regression results are 'respectable' in the sense that explanatory power is acceptable and that the variables enter with expected signs and significance.

4 In some contributions, inclusion of another variable from the six WGI indicators, *Rule of Law*, has been proposed (see e.g Sala-I-Martin, 1997). This is obviously relevant for cross-country growth regressions. Here, however, I stuck to *Governance Effectiveness* and *Control of Corruption* since they produce some interaction effect with the tariff data.

5 The reason why population growth is included is that it follows from neoclassical growth modelling. Taking growth rates of a Cobb-Douglas production function gives this result directly. Inclusion of population growth reduces the effect of tariff rates in this paper. It therefore also serves as check for the main hypothesis in this paper.

Table 1

Growth	*Regression 1*	*Regression 2*	*Regression 3*	*Regression 4*	*Regression 5*
Lgdpc95	-0.010***	-0.010***	-0.011***	-0.012***	-0.011***
Pgrowth	-0.399***	-0.400***	-0.378***	-0.375***	-0.396***
Agfc	0.0007*	0.0007*	0.0007*	0.0008*	0.0007*
Avgsec	0.0003**	0.0002**	0.0002**	0.0003**	0.0003**
Avg tariff		-0.0004			
Avg agri tariff			0.0001	0.0001	
Avg man tariff			-0.0006**	-0.0006*	
Ltrade95				0.0001	0.000
N	127	127	127	124	124
R^2	0.33	0.34	0.35	0.38	0.37

***, ** and * denote significant at the 1, 5 and 10 per cent levels, respectively. All significance results are reported for heteroscedasticity robust standard errors.

In the second column, the effects of including average applied tariff rates are reported. It is seen that the other variables keep their sign and significance and that tariff rates enter with a negative although insignificant sign. The p-value is 0.16.

The third column presents the main finding in this paper. The regression shows that including tariff rates on manufacturing and agriculture separately changes the results. In this case, the sign of tariff rates in agriculture is positive, but insignificant. The p-value is 0.17. The coefficient for manufacturing tariff rates, however, is negative and clearly significant (p-value of 0.039). The two last columns show the effect of including trade shares, either additionally to tariff rates or without inclusion of tariffs. The results do not lend support to inclusion of this simple indicator of openness (p-value higher than 0.9). Note that inclusion of trade shares does not change the result for the two separate average tariff rates included.

Table 2 reports results that check robustness of the above results. The first two columns report results from inclusion of two separate measures of governance (control of corruption and governance quality) in addition to the variables included in column 3 in table 1. The next two columns show results from interacting these governance indicators with our measures of trade policy. The reason for inclusion of governance indicators is that trade policies may very well correlate with other types of policies.[6] Therefore, it may be that the estimated effect of trade policies reflects effects of quality of governance in general rather than of trade policies.

6 Inclusion of both corruption and governance, however, resulted in a series of non-significant variables.

Table 2

Growth	*Regression 1*	*Regression 2*	*Regression 3*	*Regression 4*	*Regression 5*
Lgdpc95	-0.010***	-0.009***	-0.011***	-0.010***	-0.007*
Pgrowth	-0.372***	-0.557***	-0.369***	-0.570***	-0.373***
Agfc	0.0008*	0.0010**	0.0007*	0.0009**	0.0008*
Avgsec	0.000**	0.0001	0.0002**	0.0001	0.0002*
Avg agri tariff	0.0001	0.0000	0.0002*	0.0001	0.0025*
Avg man tariff	-0.0006**	-0.0003	-0.0008**	-0.0005	-0.0001
Governance	-0.0008		0.0015		
Control of corr		0.0012		0.005*	
Agrita*gov			-0.0002		
Manuta*gov			-0.0000		
Agrita*corr				-0.0002	
Manuta*corr				-0.0001	
Agrita*lgdpc					-0.000
Manuta*lgdpc					-0.0002*
N	127	116	127	116	127
R^2	0.35	0.37	0.35	0.38	0.36

***, ** and * denote significant at the 1, 5 and 10 per cent levels, respectively. All significance results are reported for heteroscedasticity robust standard errors.

Partly, this seems to be the case. When control of corruption is included in the regression, trade policy variables are not significant. But neither is control of corruption significant. Thus, control of corruption seems to correlate with trade policies so that their individual effects are indiscernible. The sign of the estimated coefficients remain however. They remain and stay significant when quality of governance rather than control of corruption is included in the regression. When interaction terms with governance (regression 3) are included, significance is higher than when these are left out. The opposite is the case when trade policy is interacted with control of corruption (regression 4). Still, the sign of the estimated coefficients remains.

The main finding in the paper is the effects of splitting the tariff variable in tariffs on agriculture and tariffs on manufactured goods. The results indicate opposite effects of the two. Protection of manufacturing does not seem to correlate positively with growth in the cross section of countries used here. The sign of the estimated coefficient is negative and significant in most specifications. Protection of agriculture, on the other hand, correlates positively (although with varying significance) with growth.

One possible objection to the results reported here is that protection of agriculture is a kind of *luxury goods* for rich countries. Most rich countries protect their agriculture to some degree. In fact, the correlation between average tariff rates in agriculture and income per capita

is positive, but low (0.02). But the interaction term with income per capita included in regression 5 does not give support to the objection. Richer countries have a more *negative* effect from protecting their manufacturing sectors, while there is no interaction effect between income per capita and protection of agriculture.

6. Conclusions

The findings reported in this paper are based on direct use of tariff data as indicator of trade policy. In the recent surge of empirical studies of relationships between growth and trade policy, such data have seldom been used. Instead many studies use a wide set of different measures of openness. From our review of theory of trade and growth, arguments for treating protective measures in different industries separately arose. Endogenous growth mechanisms may generally differ between different industries and between manufacturing and agriculture in particular. This paper adds to the literature by using average applied tariff rates in agriculture and manufacturing separately. This should be seen as a first step only. For more robust conclusions, more research on these topics is necessary. Therefore, we also hesitate in drawing clear policy conclusions. We have demonstrated different growth effects from protection of manufacturing and agriculture and possible interaction effects with development levels.

A. Appendix

Table A1. Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Number of obs	**127**			
growth	**2.45**	**2.23**	**-3.50**	**8.95**
gdpc95	**8110.46**	**8536.34**	**548.19**	**37747.00**
pgrowth	**2.62**	**2.25**	**-2.35**	**10.16**
agfc	**21.37**	**5.29**	**9.14**	**50.90**
avgsec	**69.63**	**32.79**	**6.61**	**144.22**
mfnapp0004	**11.04**	**6.48**	**0.00**	**31.80**
mfnaapp0004	**17.86**	**12.17**	**0.10**	**93.90**
mfnnapp0004	**10.01**	**6.48**	**0.00**	**32.60**
mfnnapp0004	**10.01**	**6.48**	**0.00**	**32.60**
trade95	**76.90**	**38.86**	**16.93**	**213.33**

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