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## Openness to International Trade and Economic Growth: A Cross-Country Empirical Investigation

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**Abstract** In this paper, we revisit the empirical evidence on the relationship between trade openness and long-run economic growth over the sample period 1960-2000. In contrast to previous studies focusing mainly on the period 1970-1990, this paper reassesses the openness-growth nexus over a much longer sample period, enabling us to better account both trade policy stance and long-run growth dynamics. We carry out our empirical investigation by employing various openness measures suggested in the literature rather than relying on a few proxy variables. We also construct three additional composite trade policy indexes directly measuring trade policy stance. Our findings indicate that many openness variables are positively and significantly correlated with long-run economic growth. However, in some cases, this result is driven by the presence of a few outlying countries. Adding to the fragility of the openness-growth association, the significance of openness variables disappears once other growth determinants, such as institutions, population heterogeneity, geography and macroeconomic stability are accounted for.

**JEL** F13, F43, O47.

**Keywords** Economic Growth; trade openness; outliers; weighted least squares

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# 1 Introduction

Does openness to international trade boost economic growth in the long run? Although this is one of the oldest questions in economics, the existing theory does not provide a decisive answer.<sup>1</sup> Therefore, the openness-growth nexus is basically an empirical question and has been extensively investigated by empirical cross-country work dating back to 1970s. This issue especially attracted renewed interest since the early 1990s, with almost all studies finding a strong and statistically significant positive relationship between trade openness and economic growth.<sup>2</sup>

However, the cross-country growth literature is still far from settled since the findings of this literature have been subject to an important criticism in terms of robustness. In particular, Edwards (1993) and Rodrik and Rodríguez (2000) argue that the strong results in favour of openness may arise from model misspecification and/or openness measures may be acting as a proxy for other macroeconomic policies or other important factors such as institutions and geography. In a nutshell, it is fair to say that the cross-country studies suffer from lack of robust and convincing evidence on the openness-growth connection and this issue is still highly controversial.

An outstanding but generally neglected feature of the empirical literature is that the substantial part of existing studies solely focuses on the period of 1970-1990. Although data availability is an important reason for this, investigating growth and openness link over the 1970-1990 period is troublesome: The first problem is that a time period of 20 years is rather limited to fully reflect long-run growth dynamics. Secondly, and more importantly, the sample period from 1970 to 1990 is inappropriate as most of the developing countries followed protectionist trade policies not only during the 1970s but

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<sup>1</sup>The traditional Ricardian-Heckscher-Ohlin trade theory points out that openness to international trade brings only a one-time increase in output, yet does not suggest any certain implications for long-run growth. The neoclassical growth model concludes that the long-run growth rate of per capita output is determined by the exogenous technological progress. Only the newer endogenous growth theories pay attention to implications of trade openness on growth in the long run since openness facilitates the transmission of technology by providing communication with foreign counterparts, directs domestic resources towards more research intensive sectors and increases market size (see Rivera-Batiz and Romer (1991) and Grossman and Helpman (1991, Chapters 6 and 9)). However, these models do not necessarily predict that openness leads to economic growth in all circumstances and for all countries. In other words, whether openness causes economic growth in the long run depends on country specific conditions.

<sup>2</sup>Examples include Dollar (1992), Edwards (1992, 1998), Lee (1993), Sachs and Warner (1995), Harrison (1996), Vamvakidis (1999), Frankel and Romer (1999), Greenaway et al. (2002), Yanikkaya (2003), Lee et al. (2004), Aksoy and Salinas (2006), Foster (2008), Kneller et al. (2008), Wacziarg and Welch (2008), Chang et al. (2009), Kim (2011).

also during 1960s and it is more likely that their trade policy measures did not change substantially over the period 1960-1980. However, most of them experienced relatively higher growth performance during the 1960s. Therefore the empirical evidence based on the sample period 1970-1990 is highly likely to be biased since it does not include the growth information of 1960s.

In this paper, we revisit the empirical evidence on the relationship between trade openness and long-run economic growth within the sample period 1960-2000. We do so by extending the augmented neoclassical growth model developed by Mankiw, Romer and Weil (1992) with a measure of openness. We carry out our empirical investigation by employing various openness measures suggested in the literature rather than relying on a few proxy variables since the empirical studies fail to provide satisfactory openness measures and their findings are very sensitive to employed openness variables as pointed out by many authors.<sup>3</sup> In doing so, we classify openness measures under four broad categories: trade volumes, direct trade policy measures, deviation measures, and subjective indexes.

Among these openness measures, trade volumes (conventionally expressed as the ratio of exports plus imports to GDP) is the most problematic one, at least conceptually since we define openness as removing or reducing policy barriers to international trade rather than trade intensity. It is obvious that a country's trade volume is affected not only by trade policy but also by other factors such as country size, distance to trade partners, transportation costs, world demand and so on. This implies that direct trade policy measures such as tariffs, non-tariff barriers are ideal measures to capture a country's degree of openness to trade. The main problem with these measures is, however, that they do not pick up differences in trade policy barriers across countries and hence testing openness-growth connection by using a single policy variable may be misleading. That's why we need reasonable weights for aggregation of different policy instruments if we want to investigate openness growth link by employing a composite indicator directly addressing and encompassing every aspect of trade policy.

We attempt to construct such a measure in this paper. We compute three composite trade policy indexes consisting of weighted averages of tariff rates, non-tariff barriers and black market premium. Weights are estimated using the models in which both nominal and real trade volumes as a share of GDP are regressed on the initial level of income, country size and trade policy instruments.

The contributions of this paper are twofold: First, in contrast to previous studies, mainly focusing on the period 1970-1990, this paper analyses the

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<sup>3</sup>See, for instance, Pritchett (1996) and Rodrik and Rodríguez (2000) amongst others.

openness-growth link over a much longer time period. In other words the sample period is sufficiently long in order to account for both trade policy stance and growth dynamics in the long run. Second, we employ a myriad of openness measures suggested in the literature. Providing a wider picture, this enables us to better evaluate both existing openness variables and the openness-growth connection. We construct three additional composite openness variables arguably better capturing trade policy stance. We also check whether our findings are driven by outlying countries and carry out a sensitivity analysis, accounting for other important growth theories in order to check the robustness of our basic findings.

The cross-country empirical investigation in this paper indicates that many openness variables are positively and significantly correlated with long-run economic growth. However, in some cases, this result depends on the presence of a few outlying countries. More importantly, the significance of openness variables disappears once other growth determinants, such as economic institutions, population heterogeneity, geography and macroeconomic stability related to government consumption are accounted for.

The structure of this paper is as follows. Section 2 provides the basic framework for the empirical cross-country investigation of the openness-growth connection. Section 3 presents OLS estimates based on the cross-country data over the period 1960-2000. Section 4 examines how robust our findings are to alternative model specifications. Finally, Section 5 summarises our results and concludes.

## 2 Economic Growth and Openness to International Trade: Baseline Model

We adopt the empirical framework of the augmented neo-classical growth model suggested by Mankiw et al. (1992) for investigation openness-growth link. In other words, we extend this model by adding a proxy variable for openness as follows:

$$\begin{aligned} \log y_i(t) - \log y_i(0) = & \gamma_0 + \gamma_1 \log y_i(0) + \gamma_2 \log(n_i + g + \delta) \\ & + \gamma_3 \log s_{i,K} + \gamma_4 \log s_{i,H} + \gamma_4 OP_i + \varepsilon_i \end{aligned} \quad (1)$$

where,  $y_i$  and  $(n_i + g + \delta)$  denote the level of GDP per worker and the sum of rates of population growth, technological progress and depreciation in country  $i$ , respectively. Similarly, the terms  $s_{i,K}$  and  $s_{i,H}$  represent the

rates of accumulation of both physical and human capital for country  $i$ , respectively. Finally, the term  $OP$  indicates country  $i$ 's degree of openness.

Following MRW, we assume that the sum of rates of depreciation and technological progress is constant and equal to 0.05 across countries. We measured  $s_{i,K}$  by the ratio of real investment to real GDP and  $s_{i,H}$  by the secondary school gross enrolment rate.<sup>4</sup> Data are compiled from standard sources: GDP per capita and investment rates are taken from the Penn World Tables Version 6.1 (Heston, Summers and Aten, 2002); population, labour force and gross secondary school enrolment rates come from the World Bank World Development Indicators (2002, 2006). Using labour force as the total population between ages 15 and 64, GDP per capita is converted to GDP per worker. All of these variables are averaged over the period 1960-2000 except the initial level of income. The variables and their sources are detailed in the Appendix.

In summary, we estimate the following cross-country growth regression in this paper:

$$\begin{aligned} \log y_{i,2000} - \log y_{i,1960} = & \gamma_0 + \gamma_1 \log y_{i,1960} + \gamma_2 \log(n_i + g + \delta) \\ & + \gamma_3 \log(\textit{Investment rate}_i) \\ & + \gamma_4 \log(\textit{School enrolment rate}_i) \\ & + \gamma_5 \textit{Openness}_i + \varepsilon_i \end{aligned} \tag{2}$$

Once we specify the cross-country growth regression expressed in equation (2), the problem of simultaneity arises immediately: Does openness leads to economic growth or vice versa? A country may abandon protectionist or inward-looking trade polices after specialising in sectors with the dynamic comparative advantage in terms of rapid productivity growth and large technological spillovers. In this case, causality occurs from economic growth to trade openness. The openness variable in equation (2) is, therefore, likely to be correlated with the error term,  $\varepsilon_i$ . This means that the OLS estimate of  $\gamma_5$  will be biased and the direction of causality between growth and openness will remain unclear. However, overcoming this problem is not easy because finding a valid instrumental variable (IV) is almost impossible in the cross-country growth works. The reason for this is that growth theories are

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<sup>4</sup>Using the school enrolment rate as a proxy for the saving rate of human capital is problematic in the literature and leads researchers to employ average years of schooling as more reliable variables for human capital (see, for instance Bils and Klenow (2000), amongst others). We, however, employ the secondary school enrolment rate in order to follow the theoretical framework suggested by Mankiw et al. (1992) more strictly as years of schooling are a stock rather than a flow variable for human capital. In addition, school enrolment rates are available for a larger sample of countries.

opened, that is they are complementary and hence there is a wide range of different explanations for growth such as economic and political institutions, trade openness, geography, culture and so on. Therefore, finding an instrument which is not a direct growth determinant and/or correlated with other omitted growth determinants is extremely difficult.<sup>5</sup> More importantly, if IV is not valid, the coefficient estimate will be again biased and in this case the OLS estimate would be more preferable as argued by Durlauf et al. (2005).

It may be, therefore, possible to conclude that the cross-country growth regressions can never reveal the direction of causality. Despite this fact, the cross-country works still provide useful information between growth and a variable of interest. Even if we can not establish the causality between growth and openness, a statistically significant partial association can be used to reject alternative hypotheses which fail to provide statistically significant correlation and one can provide plausible causal statement (Mankiw (1995), Wacziarg (2002)). For instance, if we conclude that OLS estimate of  $\gamma_5$  is positive and statistically significant and fail to conclude the statistically significant negative association between openness and growth, then it is not reasonable to reach an inference such that openness is harmful for economic growth. Similarly, Warner (2003) argues that it is very difficult to attribute a positive coefficient estimate on openness variable to reverse causality from growth to trade polices. The reason is that there are no specific cases in which countries opened to international trade, grew slowly and then closed again because of poor economic performance.

### 3 Empirical Results

In this section we present and discuss the findings of our empirical investigation under four categories of openness measures: Before evaluating the regression results, we want to emphasise two points about the regressions. First, in each regression we check the normality assumption applying median

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<sup>5</sup>Mankiw (1995, p.303) points out “[W]hen looking for instruments, it is easy to fall prey to temptation.” Durlauf, Johnson and Temple (2005, p.) argue that “[t]he belief that it is easy to identify valid instrumental variables in the growth context is deeply mistaken.” In some studies the lagged values of endogenous variables are used as instruments. However, lagged values of endogenous variables do not guarantee that they are directly uncorrelated with growth and hence they are proper instruments. The reason is that many growth variables such as measures of educational attainment affect growth with a substantial delay. More importantly, even if they are valid instruments, whether the instrumental estimate shows the effect of endogenous variable or of lagged value of that variable on economic growth remain unanswered. According to Mankiw (1995) the answer is generally neither.

and inter quartile range comparison suggested by Hamilton (1992) which is originally based on Hoaglin, Iglewicz and Tukey (1986) on regression residuals and conclude that residuals are normally distributed. Therefore, we may assume that actual errors are normally distributed (at least approximately).

Second, in each regression we also check the constant error variance assumption by employing the Breusch-Pagan test for heteroscedasticity and carry out regression analysis employing  $t$ -statistics based on the usual standard errors unless we reject the homoscedasticity assumption. We report  $t$ -statistics based on the heteroscedasticity consistent (White-robust) standard errors only for the regressions in which the assumption of homoscedastic error variance is rejected.<sup>6</sup>

### 3.1 Trade Volumes

We start our estimations with the ratio of trade volume to GDP. We obtain two measures for this variable: one is from the World Bank and the other is from Penn World Tables (Version 6.1). One advantage of the World Bank measure is that the data are published in terms of exports and imports. Thus, this allows us to investigate the export-growth connection and import-growth connection separately. On the other hand the trade ratio of the Penn World Tables is published only as a sum of exports and imports at current prices. This data have the advantage that they are available for a larger number of countries. This is a very common proxy in the cross-country growth literature and some times referred to as “current openness”. The simple correlation between these two trade ratios is almost one (Table 1).

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<sup>6</sup>The common practice in cross-country growth literature for dealing heteroscedasticity is reporting regression results with the heteroscedasticity consistent (White-robust) standard errors since they work well regardless of heteroscedasticity in the actual errors. However, these errors are consistent but not unbiased. More clearly they are justified only asymptotically. In small samples, heteroscedasticity consistent standard errors may have distributions that are not close to those of usual standard errors which means that they may be larger or smaller than the usual ones. As pointed out by Wooldridge (2003) heteroscedasticity consistent standard errors are generally found to be larger than the usual standard errors. This can affect the subsequent statistical inference such that one can conclude that a variable is statistically insignificant according to  $t$ -test based on the heteroscedasticity consistent standard errors even if that variable is significant (at least marginally) in the case of usual  $t$ -test. Therefore, there is no reason to use heteroscedasticity consistent standard errors as long as the homoscedastic error variance assumption holds and the errors are normally distributed.



**Table 1:** Economic Growth and Trade Volumes: Pairwise Correlations

1960-2000 averages

|                          | Average growth | GDP per worker in 1960 | Exports ratio | Imports ratio | Trade Ratio | Current open. | Real open. | Trade ratio with OECD |
|--------------------------|----------------|------------------------|---------------|---------------|-------------|---------------|------------|-----------------------|
| Average growth           | 1.000          |                        |               |               |             |               |            |                       |
| GDP per worker in 1960   | 0.137          | 1.000                  |               |               |             |               |            |                       |
| Exports ratio of WB      | 0.359          | 0.231                  | 1.000         |               |             |               |            |                       |
| Imports ratio of WB      | 0.288          | 0.004                  | 0.840         | 1.000         |             |               |            |                       |
| Trade ratio of WB        | 0.335          | 0.120                  | 0.958         | 0.960         | 1.000       |               |            |                       |
| Current openness of PW   | 0.344          | 0.152                  | 0.958         | 0.962         | 0.996       | 1.000         |            |                       |
| Real openness by A&C     | 0.426          | 0.381                  | 0.846         | 0.721         | 0.812       | 0.868         | 1.000      |                       |
| Trade ratio with OECD    | 0.280          | 0.184                  | 0.851         | 0.850         | 0.876       | 0.909         | 0.815      | 1.000                 |
| Trade ratio with NonOECD | 0.276          | 0.036                  | 0.672         | 0.661         | 0.687       | 0.880         | 0.759      | 0.687                 |

Table 2 provides the estimation results. Columns 1 and 2 show the regression results using the ratio of exports and the ratio of imports, respectively. Column 3 includes the trade ratio as a sum of the ratio of exports and the ratio of imports. In each regression the coefficient of the openness variable is to be found positive but not significant. Therefore, a significant association between growth and openness is not established using the World Bank data. However, we find that coefficient estimate of openness is positive and highly significant when employing current openness of the Penn World Tables in column 4. The regression results indicate a 10 percent increase in trade ratio would raise the growth by 2.73 percent over the 1960-2000 period. This is equivalent to 0.07 percent increase in annual growth rate over the same period ( $2.73/40=0.07$ ). In column 5 we estimate our baseline model with the variable of real openness from the Penn World Tables. This variable is suggested by Alcalá and Ciccone (2004) and defined as the ratio of exports plus imports relative to GDP in constant prices. Alcalá and Ciccone (2004) argue that real openness is a better measure of openness compared to current openness in the presence of trade-driven productivity. As can be seen, we conclude positive and strongly significant coefficient estimate. Furthermore, the estimated coefficient of real openness is higher compared to that of current openness and implies that a 10 percent increase would raise the growth rate 3.99 percentage points over the period 1960-2000 (which is equal to 0.10 percent increase in annual growth rate for the same period).

We estimate our benchmark model adding trade ratio with OECD and trade ratio with non-OECD countries in columns 6 and 7. The rationale is straightforward as Yanikkaya (2003) points out. In the light of recent endogenous growth theories countries, particularly the developing ones, can benefit more from trade with technologically advanced countries in order to stimulate growth. If this argument is true then one would expect a higher coefficient estimate of trade ratio with the OECD with respect to that of the trade ratio with non-OECD countries. However, the regression results in columns 6 and 7 show that the coefficient of the trade ratio with OECD is not only less than the coefficient of trade ratio with non-OECD but also is statistically insignificant. These results confirm the findings of Yanikkaya (2003) and imply that technology spillover effects of international trade on economic growth are not very important compared to the effects of comparative advantage and scale economies.

In summary, the regression results in Table 2 show a positive association between economic growth and international trade and confirm the findings of previous work (Vamwakidis (2002), Dollar and Kraay (2003), Yanikkaya (2003), Alcalá and Ciccone (2004) are a few examples). However, it is puzzling that we could not find any statistically significant relation between

**Table 2:** Economic Growth and Trade Volumes: OLS Estimates<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              | (7)              |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.471<br>(6.46) | -0.456<br>(6.16) | -0.462<br>(6.31) | -0.429<br>(6.46) | -0.464<br>(6.97) | -0.454<br>(5.81) | -0.434<br>(5.66) |
| log( $n_i + g + \delta$ )                      | -1.108<br>(2.66) | -1.063<br>(2.52) | -1.080<br>(2.58) | -1.100<br>(2.93) | -1.021<br>(2.77) | -1.153<br>(2.97) | -1.286<br>(3.38) |
| log of Investment rate                         | 0.410<br>(3.80)  | 0.400<br>(3.66)  | 0.403<br>(3.72)  | 0.360<br>(3.98)  | 0.338<br>(3.74)  | 0.507<br>(4.68)  | 0.468<br>(4.38)  |
| log of School enrolment                        | 0.436<br>(4.28)  | 0.453<br>(4.46)  | 0.445<br>(4.38)  | 0.430<br>(5.11)  | 0.438<br>(5.28)  | 0.391<br>(3.89)  | 0.390<br>(4.00)  |
| Exports ratio of WB                            | 0.388<br>(1.58)  | -                | -                | -                | -                | -                | -                |
| Imports ratio of WB                            | -                | 0.316<br>(1.37)  | -                | -                | -                | -                | -                |
| Trade ratio of WB                              | -                | -                | 0.185<br>(1.51)  | -                | -                | -                | -                |
| Current Openness of PW                         | -                | -                | -                | 0.273<br>(2.85)  | -                | -                | -                |
| Real Openness by A&C                           | -                | -                | -                | -                | 0.399<br>(3.29)  | -                | -                |
| Trade ratio with OECD                          | -                | -                | -                | -                | -                | 0.358<br>(1.74)  | -                |
| Trade ratio with NonOECD                       | -                | -                | -                | -                | -                | -                | 0.787<br>(2.80)  |
| Constant                                       | 2.730<br>(2.23)  | 2.734<br>(2.22)  | 2.725<br>(2.22)  | 2.244<br>(2.08)  | 2.731<br>(2.60)  | 2.603<br>(2.20)  | 2.018<br>(1.71)  |
| Number of observations                         | 93               | 93               | 93               | 105              | 105              | 89               | 89               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.95             | 0.94             | 0.95             | 0.64             | 0.81             | 0.43             | 0.69             |
| Adjusted $R^2$                                 | 0.60             | 0.60             | 0.60             | 0.63             | 0.64             | 0.64             | 0.66             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup>Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

trade ratios of the World Bank and growth despite the very high correlations between these measures and current openness.<sup>7</sup> The reason is that regressions including trade ratios of World Bank have smaller samples than those including current openness and real openness. More clearly, some countries are dropped from the regressions when we use the World Bank data and hence this implies that the positive and statistically significant relation between growth and trade ratios of Penn World data may be driven by outlying countries.

When we look at the data of current openness, we highlight that Singapore has the highest trade ratio with a value of 323 percent. This country not only has the highest trade ratio but also records the highest growth rate over the 1960-2000 period. However, Singapore is missing in the trade ratios of World Bank since data for this country are available only over the 1974-2000 period. When we add Singapore to the regressions based on the trade ratios of the World Bank using the average values over the 1974-2000 period instead of the 1960-2000 period, we find a positive and statistically significant relationship between growth and all three trade ratios of World Bank.<sup>8</sup> This finding clearly indicates that Singapore is a highly influential country in the cross-country regressions in Table 2.

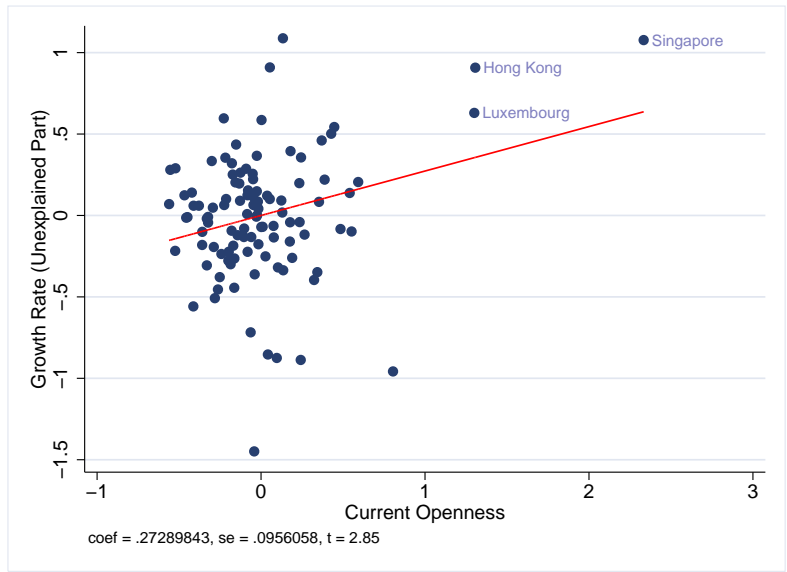
In order to check possible outliers we apply the method suggested by Hadi (1992) on each data set subject to cross-country growth regressions in Table 2. We identify four countries namely Singapore, Hong Kong, Luxembourg and Tanzania as outliers in the regressions including current openness and real openness. Except Tanzania, these countries are clearly outliers in current openness and/or real openness (See figures 1(a) and 1(b) for a graphical inspection).<sup>9</sup> Their outstanding characteristics are that they have the highest trade ratios with an average value of 244 percent according to the current openness and experience very high growth performances over the sample period. In addition, we also identify Hong Kong and Luxembourg as outliers for the data set including trade ratios of the World Bank. A sample of countries based on the trade ratios with the OECD and non-OECD concludes that only Singapore for the data set including trade ratio with the OECD and five countries namely Congo Democratic Republic, Hong Kong, Singapore, Malaysia and Hungary for the data set including trade ratio with non-OECD as outlying observations.

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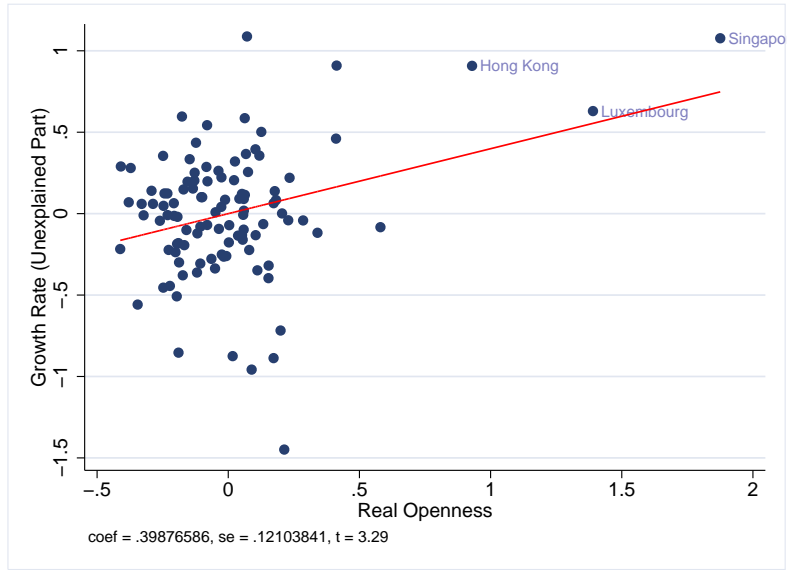
<sup>7</sup>For a comparison see Table 1. As can be easily seen, the correlation between current openness and real openness is smaller than the correlations between current openness and trade ratios of the World Bank.

<sup>8</sup>Regression results are available from the author on request.

<sup>9</sup>Tanzania has the smallest school enrolment rate in our sample and hence it is an outlier in the saving rate for human capital.



(a) Current Openness: Exports plus Imports as a ratio of GDP in current prices



(b) Real Openness: Exports plus Imports as a ratio of GDP in PPP

**Figure 1:** Partial Associations between Growth Rate and Trade Shares

When we drop all outlying countries from our regressions, we find that all openness variables except trade ratios with the OECD and non-OECD

are negative but statistically insignificant (Table 3). Therefore, our findings such that both current openness and real openness are significantly and positively correlated with growth may not be robust. As shown in Table 3 after dropping outliers we conclude very similar findings to our first result for the trade ratio with the OECD such that this variable is still positive but not significant. Contrary to our first findings, we find a significantly negative coefficient estimate of the trade ratio with non-OECD which implies that trading with non-OECD countries, and hence technologically less advanced countries, is not beneficial for economic growth.

However, omitting outliers from the sample may not be a good solution for cross-country growth analysis as Temple (2000) points out. Instead of dropping these countries an alternative and better way is to carry out the analysis by employing weighted least squares (WLS).<sup>10</sup> Therefore, we estimate the cross-country growth regressions in Table 2 employing Iteratively Reweighted Least Squares (IRLS).<sup>11</sup> However, the most important shortcoming of IRLS is that it is not robust to high leverage data points. This implies that estimation results will be more robust if one can identify and drop the observations with the high leverage value and then estimate the sample of remaining observations by IRLS. Hence, before applying IRLS, we firstly highlight high leverage countries in each data set. To do so, following Huber (1981) we determine the countries as risky whose leverage values are greater than 0.2. In the second step, we delete these risky countries from each sample and then estimate the cross-country growth regressions by IRLS.

Table 4 provides IRLS regression results. The first four columns of the table shows that both trade ratios of the World Bank and current openness are significantly and positively associated with economic growth. However, we could not conclude the same thing for the real openness. As seen in column 5 of Table 4, the coefficient estimate of real openness is positive but not statistically significant. In columns of 6 and 7, we report regressions including the trade ratios with OECD and non-OECD, respectively and conclude that both are positive. Yet, trade ratios with OECD is not found to be statistically significant.

In summary, we conclude a positive and significant association between

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<sup>10</sup>Indeed, omitting some observations from OLS regression is another kind of WLS estimation such that we assign each observation a weight of 1 if it is included in the regression or a weight of 0 if omitted. In contrast to these extreme weights, WLS gives each observation a weight between 1 and 0 such that outlying cases are down-weighted gradually.

<sup>11</sup>IRLS is based on iterative computation of case weights obtained from the residuals. Weight functions for the observations are first Huber weights and second the Tukey bisquare weights. See Hamilton (1992) for more information about the IRLS.

**Table 3:** Economic Growth and Trade Volumes: OLS Estimates without Outlying Countries<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              | (7)              |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.495<br>(6.83) | -0.496<br>(6.67) | -0.496<br>(6.76) | -0.444<br>(6.81) | -0.441<br>(6.64) | -0.458<br>(5.97) | -0.526<br>(7.72) |
| log( $n_i + g + \delta$ )                      | -1.170<br>(2.86) | -1.175<br>(2.84) | -1.174<br>(2.86) | -1.159<br>(3.16) | -1.167<br>(3.17) | -1.269<br>(3.30) | -1.429<br>(4.20) |
| log of Investment rate                         | 0.384<br>(3.62)  | 0.385<br>(3.62)  | 0.385<br>(3.63)  | 0.357<br>(3.70)  | 0.355<br>(3.66)  | 0.465<br>(4.30)  | 0.333<br>(3.53)  |
| log of School enrolment                        | 0.478<br>(4.71)  | 0.474<br>(4.76)  | 0.476<br>(4.75)  | 0.444<br>(5.00)  | 0.441<br>(4.95)  | 0.411<br>(4.15)  | 0.497<br>(5.77)  |
| Exports ratio of WB                            | -0.073<br>(0.24) | -                | -                | -                | -                | -                | -                |
| Imports ratio of WB                            | -                | -0.044<br>(0.17) | -                | -                | -                | -                | -                |
| Trade ratio of WB                              | -                | -                | -0.031<br>(0.21) | -                | -                | -                | -                |
| Current Openness of PW                         | -                | -                | -                | -0.071<br>(0.49) | -                | -                | -                |
| Real Openness by A&C                           | -                | -                | -                | -                | -0.024<br>(0.12) | -                | -                |
| Trade ratio with OECD                          | -                | -                | -                | -                | -                | 0.132<br>(0.58)  | -                |
| Trade ratio with NonOECD                       | -                | -                | -                | -                | -                | -                | -1.299<br>(2.09) |
| Constant                                       | 2.862<br>(2.36)  | 2.855<br>(2.35)  | 2.860<br>(2.36)  | 2.406<br>(2.25)  | 2.318<br>(2.19)  | 2.327<br>(2.00)  | 2.467<br>(2.34)  |
| Number of observations                         | 91               | 91               | 91               | 101              | 101              | 88               | 84               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.58             | 0.60             | 0.59             | 0.76             | 0.84             | 0.74             | 0.47             |
| Adjusted $R^2$                                 | 0.61             | 0.61             | 0.61             | 0.62             | 0.62             | 0.63             | 0.69             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup>Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

**Table 4:** Economic Growth and Trade Volumes: IRLS Estimations<sup>†</sup>

|                          | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              | (7)              |
|--------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960  | -0.492<br>(7.99) | -0.468<br>(7.31) | -0.477<br>(7.60) | -0.442<br>(7.79) | -0.464<br>(7.97) | -0.503<br>(7.64) | -0.487<br>(7.24) |
| $\log(n_i + g + \delta)$ | -1.157<br>(3.28) | -1.115<br>(3.07) | -1.124<br>(3.14) | -1.302<br>(4.05) | -1.215<br>(3.77) | -1.280<br>(3.87) | -1.307<br>(3.95) |
| log of Investment rate   | 0.394<br>(4.33)  | 0.375<br>(3.98)  | 0.379<br>(4.08)  | 0.331<br>(3.90)  | 0.305<br>(3.57)  | 0.403<br>(4.34)  | 0.425<br>(4.55)  |
| log of School enrolment  | 0.442<br>(5.13)  | 0.466<br>(5.32)  | 0.457<br>(5.26)  | 0.427<br>(5.53)  | 0.441<br>(5.65)  | 0.452<br>(5.30)  | 0.434<br>(5.07)  |
| Exports ratio of WB      | 0.564<br>(2.72)  | -                | -                | -                | -                | -                | -                |
| Imports ratio of WB      | -                | 0.385<br>(1.93)  | -                | -                | -                | -                | -                |
| Trade ratio of WB        | -                | -                | 0.247<br>(2.36)  | -                | -                | -                | -                |
| Current Openness of PW   | -                | -                | -                | 0.231<br>(2.27)  | -                | -                | -                |
| Real Openness by A&C     | -                | -                | -                | -                | 0.209<br>(1.29)  | -                | -                |
| Trade ratio with OECD    | -                | -                | -                | -                | -                | 0.279<br>(1.42)  | -                |
| Trade ratio with NonOECD | -                | -                | -                | -                | -                | -                | 0.771<br>(2.07)  |
| Constant                 | 2.741<br>(2.64)  | 2.668<br>(2.51)  | 2.693<br>(2.56)  | 1.805<br>(1.95)  | 2.234<br>(2.41)  | 2.592<br>(2.59)  | 2.423<br>(2.35)  |
| Number of observations   | 93               | 93               | 93               | 103              | 102              | 88               | 88               |
| Adjusted $R^2$           | 0.69             | 0.67             | 0.68             | 0.69             | 0.67             | 0.70             | 0.70             |

Note:  $t$ -statistics are in parentheses.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

trade volume and economic growth and except real openness, confirm the findings of previous literature. However, the ratio of trade volume to GDP is not a good proxy to measure trade openness.<sup>12</sup> First, some large countries may appear closed economy by this measure. For instance, according to the current openness the United States and Japan are the fourth and seventh

<sup>12</sup>The ratio of trade volume in GDP can be defined as follows:

$$openness = \frac{X + M}{A + X - M}$$

where  $X$  is exports,  $M$  is imports and  $A$  is domestic absorption (sum of consumption and investment). Assume that the world economy consists of two identical countries. In this setting the country running trade deficit will be more open than the other country.



most closed economies in our sample. Second, the volume of international trade is affected not only by trade policies but also by other factors such as transportation costs, world demand, geography, natural resource dependence and so on. Hence, it is likely that a positive association between trade to GDP ratio and growth rate implies the impact of international trade rather than the effect of trade policies on economic growth.

### 3.2 Direct Trade Policy Measures

In the second step we investigate the openness-growth connection by employing direct trade policy measures namely tariff rates, non-tariff barriers on imports and black market premium for exchange rate. It is obvious that the first two measures directly affect a country's trade volume and reducing or removing them clearly indicates a more open trade regime. Yet, the use of the black market premium as a measure of trade barriers is debatable in the literature. Authors such as Sachs and Warner (1995) and Warner (2003) argue that a high black market premium causes increases in the price of imports relative to domestic prices and thus plays the same role with tariff and non-tariff barriers. Others, such as Rodrik and Rodríguez (2000) claim that a high black market premium generally shows macroeconomic imbalances rather than trade policy barriers.

Undoubtedly, directly addressing trade policy both tariff rates and non-tariff barriers are ideal measures in order to capture a country's degree of openness to international trade. Yet, unfortunately we do not have good data for these measures across countries and over time. The most common data for these measures in the literature come from the data set by Barro and Lee (1994). In this data set, tariff rate and non-tariff coverage ratios are weighted averages by the product shares in a country's overall imports. However, both variables cover the only imports of intermediate inputs and capital goods over the 1983-1985 period. In addition, they have a problem of downward bias since both measures are weighted by their own-import value. Finally, it is not likely that all non-tariff barriers can be measured and they accurately reflect the intensity of non-tariff barriers.

Employing these two measures as an openness variable, we estimate our baseline model. The estimation results are reported in Table 5. In columns 1 and 2 of Table 5, we only include tariff rate and non-tariff barriers, respectively. Both measures enter the regressions with negative but insignificant coefficient estimates. In column 3, we allow both tariff rate and non-tariff barriers together. As can be seen, tariff rate and non-tariff barriers are neither individually nor jointly significant. In the fourth column, we replace tariff rate with the collected import duties as a ratio of imports over the

1970-1998 period and find a positive but insignificant coefficient estimate. It is well-known fact that the ratio of collective import duties in a country's overall imports is a problematic measure in order to reflect a country's tariff structure due to the fact that a country with very high tariff rates may appear open by this measure. In column 5, we include unweighted average tariff rate over the 1990-2000 period that is provided by Wacziarg and Welch (2008). The difference between this measure and tariff rate of Barro and Lee (1994) is that the former is simply averages of ad valorem tariff rates across commodities subjected to imports. The estimated coefficient of unweighted tariff rates is negative but again statistically insignificant.

We include average black market premium over the 1960-2000 period in column 7 and find that the black market premium is negatively and significantly associated with economic growth. In columns 8 and 9, we replace average black market premium with two dummy variables, respectively. The first dummy variable takes the value of 1 if the average black market premium exceeds 20 percent in the 1960s or the 1970s or the 1980s or the 1990s while the second one is equal to 1 if the average black market premium is higher than 20 percent over the 1960-2000 period. Our aim in constructing for these dummies is to check the relation between growth and a larger level of black market premium. Following Sachs and Warner (1995), we assume 20 percent as a threshold level. As shown in the table, in each case the dummy variables are negatively correlated with growth and strongly significant. In column 10, we include tariff rate, non-tariff barriers and average black market premium jointly. The result is essentially same. Both tariff rates and non-tariff measures are not significant but black market premium is. In the last column, the regression is exactly the same as the regression in column 10, the only difference is that we replace average black market premium with the dummy variable for black market premium. As seen, the result is unchanged.

**Table 5:** Economic Growth and Direct Trade Measures: OLS Estimates<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              | (7)              | (8)              | (9)              | (10)             |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.485<br>(5.82) | -0.476<br>(5.74) | -0.497<br>(5.78) | -0.446<br>(5.29) | -0.479<br>(6.14) | -0.484<br>(7.30) | -0.499<br>(7.24) | -0.506<br>(7.59) | -0.493<br>(6.88) | -0.505<br>(7.46) |
| $\log(n_i + g + \delta)$                       | -1.291<br>(2.85) | -1.274<br>(2.77) | -1.229<br>(2.65) | -1.109<br>(2.60) | -1.061<br>(2.80) | -1.092<br>(3.09) | -0.996<br>(2.74) | -1.043<br>(2.98) | -1.269<br>(3.54) | -1.194<br>(3.39) |
| log of Investment rate                         | 0.428<br>(4.20)  | 0.433<br>(4.24)  | 0.420<br>(4.07)  | 0.443<br>(4.02)  | 0.400<br>(4.14)  | 0.327<br>(3.53)  | 0.323<br>(3.42)  | 0.329<br>(3.61)  | 0.319<br>(2.49)  | 0.336<br>(2.77)  |
| log of School enrolment                        | 0.423<br>(4.08)  | 0.426<br>(4.12)  | 0.440<br>(4.21)  | 0.445<br>(4.14)  | 0.448<br>(4.79)  | 0.475<br>(5.57)  | 0.495<br>(5.63)  | 0.483<br>(5.71)  | 0.441<br>(4.85)  | 0.436<br>(5.06)  |
| owti <sup>a</sup>                              | -0.327<br>(1.12) | -                | -0.290<br>(0.93) | -                | -                | -                | -                | -                | -0.309<br>(1.07) | -0.096<br>(0.33) |
| owqi <sup>b</sup>                              | -                | -0.116<br>(0.60) | -0.050<br>(0.24) | -                | -                | -                | -                | -                | 0.088<br>(0.48)  | 0.019<br>(0.10)  |
| Import Duties <sup>c</sup>                     | -                | -                | -                | 0.377<br>(0.44)  | -                | -                | -                | -                | -                | -                |
| uwti <sup>d</sup>                              | -                | -                | -                | -                | -0.477<br>(0.90) | -                | -                | -                | -                | -                |
| $\log(1+BMP)^e$                                | -                | -                | -                | -                | -                | -0.233<br>(2.84) | -                | -                | -0.224<br>(2.26) | -                |
| BMP dummy <sup>f</sup>                         | -                | -                | -                | -                | -                | -                | -0.199<br>(2.32) | -                | -                | -                |
| BMP dummy <sup>g</sup>                         | -                | -                | -                | -                | -                | -                | -                | -0.263<br>(3.22) | -                | -0.275<br>(3.01) |
| Constant                                       | 2.556<br>(1.96)  | 2.495<br>(1.91)  | 2.821<br>(2.08)  | 2.654<br>(1.88)  | 3.109<br>(2.56)  | 2.937<br>(2.78)  | 3.357<br>(3.00)  | 3.301<br>(3.11)  | 2.523<br>(2.14)  | 2.874<br>(2.51)  |
| Number of observations                         | 87               | 85               | 85               | 93               | 101              | 101              | 101              | 101              | 83               | 83               |
| $p$ -value for heteroscedasticity <sup>h</sup> | 0.82             | 0.70             | 0.83             | 0.59             | 0.81             | 0.30             | 0.47             | 0.39             | 0.12             | 0.11             |
| $F$ -value <sup>i</sup>                        | -                | -                | 0.61             | -                | -                | -                | -                | -                | 2.09             | 3.51             |

*Continued on Next Page...*

Table 5 – *Continued*

| Adjusted $R^2$ | 0.60 | 0.60 | 0.60 | 0.56 | 0.61 | 0.64 | 0.64 | 0.65 | 0.62 | 0.63 |
|----------------|------|------|------|------|------|------|------|------|------|------|
|----------------|------|------|------|------|------|------|------|------|------|------|

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

† Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Own-import weighted tariff rates on intermediate inputs and capital goods.

<sup>b</sup> Own-import weighted non-tariff frequency on intermediate inputs and capital goods.

<sup>c</sup> Collected import duties as ratio of imports over 1970-1998 period.

<sup>d</sup> Unweighted average tariff rate over the 1990-99 period.

<sup>e</sup> Logarithm of one plus average value of black market premium over the 1960-1999 period.

<sup>f</sup> Dummy variable is equal to 1 if the average black market premium exceeds 20 % in either the 1960s or the 1970s or the 1980s or the 1990s.

<sup>g</sup> Dummy variable is equal to 1 if the average black market premium exceeds 20 % over the 1960-2000 period.

<sup>h</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

<sup>i</sup> Test for joint significance of openness variables.

As a result, our empirical investigation between growth and direct trade policy measures indicates that the significant association with economic growth is established only for the black market premium. However, Warner (2003) points out that the time period should be 1970-1990 for testing the impact of trade protection through tariff rates. The reason is that the majority of developing countries have liberalised their trade regime during the late 1980s and early 1990s. In other words, the large cross-country variation in tariff rates in the earlier period was eliminated after the 1980s. In addition, he indicates that India is a clear outlying observation. Therefore, according to Warner (2003), one can find a negative and significant correlation between growth and tariff rate if he omits India from the sample and estimates the growth regression over the 1970-1990 period.

In order to test Warner's claim we estimate our baseline model over the period 1970-1990 for the same sample without India. The regression result is given in the first column of Table 6 and shows a negative but statistically insignificant coefficient estimate of the tariff rate. In addition to India, we identify three more countries namely Burkina Faso, Guyana, and Tanzania as outliers applying the Hadi methodology on the data set over the 1970-1990 period. In the second column of Table 6, we drop these countries as well as India from the regression and conclude that tariff rate is again negative but not significant. Therefore, our findings indicate that Warner's claim is not valid over the 1970-1990 period.

However, it may be more reasonable to investigate growth-tariff connection over the period 1960-2000. As we argue in the introduction, most of the developing countries followed protectionist trade policies not only during the 1970s but also during 1960s and experienced relatively higher growth performance in the 1960s. This means that the time period suggested by Warner (2003) might be biased since it does not include the growth information of 1960s. Therefore, in column 3, we estimate our baseline growth model with the tariff rate whilst dropping India over the 1960-2000 period and conclude that coefficient of tariff rate is negative and significant at the 11 percent significance level. In addition if we also omit Tanzania, the other outlier over the sample period, from the regression in column 4, we find that tariff rate is negative and significant at 9 percent significance level. It is possible to conclude that tariff rate is negatively associated with economic growth over the 1960-2000 period at the marginally significant level once we take into account outlying countries.

In summary, our cross-country empirical investigation indicates that among the direct trade policy measures only tariff rate and black market premium are negatively correlated with economic growth. However, we conclude that this correlation is marginally significant in the tariff case while strongly sig-

**Table 6:** Economic Growth and Tariffs: OLS Estimates under Different Time Periods and without Outliers<sup>†</sup>

|  | 1970-1990        |                  | 1960-2000        |                  |
|--|------------------|------------------|------------------|------------------|
|  | (1)              | (2)              | (3)              | (4)              |
| log of Initial GDP per worker                        | -0.289<br>(4.64) | -0.357<br>(6.33) | -0.488<br>(5.87) | -0.494<br>(5.95) |
| $\log(n_i + g + \delta)$                             | -0.494<br>(1.57) | -0.818<br>(2.69) | -1.151<br>(2.47) | -1.209<br>(2.59) |
| log of Investment rate                               | 0.302<br>(4.57)  | 0.364<br>(5.40)  | 0.424<br>(4.17)  | 0.493<br>(4.30)  |
| log of School enrolment                              | 0.193<br>(2.92)  | 0.174<br>(2.51)  | 0.420<br>(4.07)  | 0.355<br>(3.10)  |
| owti <sup>a</sup>                                    | -0.360<br>(1.12) | -0.444<br>(1.48) | -0.725<br>(1.64) | -0.762<br>(1.73) |
| Constant   | 2.280<br>(2.45)  | 2.140<br>(2.46)  | 3.006<br>(2.22)  | 2.990<br>(2.21)  |
| Number of observations                               | 86               | 83               | 86               | 85               |
| <i>p</i> - value for heteroscedasticity <sup>b</sup> | 0.36             | 0.21             | 0.86             | 0.80             |
| Adjusted $R^2$                                       | 0.41             | 0.54             | 0.60             | 0.61             |

*Note:* *t*-statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level *t*-statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Own-import weighted tariff rates on intermediate inputs and capital goods.

<sup>b</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

nificant for the black market premium.

### 3.2.1 Black Market Premium: A Proxy for Trade Policy or Macroeconomic Imbalances?

As mentioned above, whether the significant association between black market premium and economic growth reflects the relationship between growth and restrictive trade policies or the connection between growth and other poor macroeconomic policies rather than trade policies is debatable. Now, we consider this point further.

Our data for black market premium come from Global Development Network (2005). Unfortunately, we lack data on the black market premium for several countries in the 1960s. In addition, for many countries data are missing during the mid 1990s. In order to increase the number of observations, we take the averages of black market premium for the 18 countries

over the 1970-2000 period instead of 1960-2000 period. Of course, this approach implicitly assumes that for these countries the black market premium in the 1970s reflects the black market premium in the 1960s. Indeed, this assumption is not very realistic since we do not observe a certain pattern on the black market premium during the 1960s and the 1970s for the countries whose data are available in both decades. Among the 103 countries we identify, 43 of them experience a higher level of black market premium in the 1970s compared to the 1960s. Most of these countries are located in Africa and Latin America. On the other hand only 39 countries mostly located in the Middle East, North Africa, East Europe, Asia and Pacific have a lower level of black market premium in the 1970s with respect to the 1960s. 21 developed countries have zero black market premium in both decades.

**Table 7:** Black Market Premium (%): Summary Statistics

|  | Number of Observations | Mean value | Standard Deviation | Minimum value | Maximum value |
|--|------------------------|------------|--------------------|---------------|---------------|
| <i>The Largest Sample</i>                |                        |            |                    |               |               |
| BMP 1960-2000                            | 121                    | 259.701    | 2114.377           | -0.442        | 23235.250     |
| BMP in 1960s                             | 103                    | 48.685     | 228.780            | -0.090        | 2276.400      |
| BMP in 1970s                             | 121                    | 36.319     | 72.469             | -6.960        | 451.790       |
| BMP in 1980s                             | 121                    | 129.106    | 600.604            | -1.410        | 6406.610      |
| BMP in 1990s                             | 121                    | 1205.328   | 12627.680          | -0.350        | 138935.900    |
| <i>The 2<sup>nd</sup> Largest Sample</i> |                        |            |                    |               |               |
| BMP 1960-2000                            | 103                    | 297.5641   | 2291.072           | -0.442        | 23235.250     |
| BMP in 1960s                             | 103                    | 48.68505   | 228.7795           | -0.090        | 2276.400      |
| BMP in 1970s                             | 103                    | 39.39447   | 77.2462            | -1.290        | 451.790       |
| BMP in 1980s                             | 103                    | 139.4033   | 648.8455           | -1.410        | 6406.610      |
| BMP in 1990s                             | 103                    | 1411.573   | 13686.08           | -0.350        | 138935.900    |
| <i>The Regression Sample</i>             |                        |            |                    |               |               |
| BMP 1960-2000                            | 101                    | 66.520     | 199.778            | -0.442        | 1796.679      |
| BMP in 1960s                             | 90                     | 47.521     | 241.983            | -0.090        | 2276.400      |
| BMP in 1970s                             | 101                    | 32.399     | 64.711             | -6.960        | 451.790       |
| BMP in 1980s                             | 101                    | 137.674    | 654.984            | -1.410        | 6406.610      |
| BMP in 1990s                             | 101                    | 30.501     | 124.572            | -0.350        | 1199.310      |
| <i>The Smallest Sample</i>               |                        |            |                    |               |               |
| BMP 1960-2000                            | 90                     | 67.668     | 209.826            | -0.442        | 1796.679      |
| BMP in 1960s                             | 90                     | 47.521     | 241.983            | -0.090        | 2276.400      |
| BMP in 1970s                             | 90                     | 33.895     | 67.323             | -0.870        | 451.790       |
| BMP in 1980s                             | 90                     | 142.192    | 692.166            | -1.410        | 6406.610      |
| BMP in 1990s                             | 90                     | 32.662     | 131.741            | -0.350        | 1199.310      |

Table 7 provides summary statistics of black market premium for each decade. As can be seen, for the first and largest sample in Table 7, both the

mean and standard deviation of black market premium is higher in the 1960s compared to the 1970s. In order to provide a better comparison we also report the summary statistics of black market premium for 103 countries whose data are available in each decade (the second largest sample). Again both the mean and standard deviation of the black market premium is higher in the 1960s compared to the 1970s. Therefore, it is likely that we underestimate average black market premium over the 1960-2000 period by using the 1970-2000 averages for the countries whose data are missing during the 1960s. However, since we conclude that a negative and highly significant association between black market premium and economic growth over the 1960-2000 period, this bias in the data makes our result stronger.

The other important point is that the mean of the black market premium is substantially higher in the 1990s compared to the other decades in the largest sample. At the first sight, this might be thought to be surprising because most of the developing countries have liberalised their capital accounts since the late 1980s and one would expect very low black market premium for these countries during the 1990s. However, this is mainly a result of a small number of countries with the extreme values of black market premium in this decade such as Iran, Iraq, Afghanistan, Liberia, Syria and Libya. As shown in Table 7, not only is the mean value of black market premium substantial but also its standard deviation is high during the 1990s. Of course, from our point summary statistics of regression sample are of great concern rather than those of the largest samples. When we consider only the regression sample, both mean and standard deviation of black market premium in the 1980s are considerably higher than other decades. In addition, the statistics of black market premium based on the smallest sample consisting of the countries whose data are available in each decade support this fact. This implies that the negative and statistically significant association between black market premium and economic growth over the 1960-2000 period may be as a result of both the high level and variation of the black market premium during the 1980s.

Therefore, in Table 8 we estimate our baseline model with the averages of black market premium in each decade. In column 1, we allow average black market premium in each decade to vary continuously and conclude that none of them are statistically significant despite a negative sign. In addition, they are jointly insignificant. However, the  $t$ -statistics of black market premium in the 1980s is relatively higher. In columns 2-5, we insert average black market premium in each decade separately and find that the only average black market premium in the 1980s is negatively and significantly correlated with growth. Therefore, it is possible to conclude that the significant and negative correlation between black market premium and economic growth



**Table 8:** Economic Growth and Black Market Premium: OLS Estimates<sup>†</sup>

|  | (1)    | (2)    | (3)    | (4)    | (5)    |
|--|--------|--------|--------|--------|--------|
| log GDP per worker 1960                        | -0.514 | -0.507 | -0.483 | -0.456 | -0.475 |
|  | (7.14) | (6.39) | (8.00) | (6.99) | (6.92) |
| $\log(n_i + g + \delta)$                       | -1.032 | -1.180 | -1.222 | -1.008 | -1.070 |
|  | (2.94) | (3.05) | (3.64) | (2.85) | (2.91) |
| log of Investment rate                         | 0.294  | 0.324  | 0.341  | 0.336  | 0.362  |
|  | (2.69) | (3.17) | (3.14) | (3.68) | (3.84) |
| log of School enrolment                        | 0.511  | 0.506  | 0.452  | 0.453  | 0.470  |
|  | (5.93) | (5.11) | (6.05) | (5.36) | (5.34) |
| log (1+BMP) in 1960s                           | -0.113 | -0.132 | -      | -      | -      |
|  | (0.76) | (1.16) |        |        |        |
| log (1+BMP) in 1970s                           | -0.068 | -      | -0.244 | -      | -      |
|  | (0.26) |        | (1.16) |        |        |
| log (1+BMP) in 1980s                           | -0.130 | -      | -      | -0.186 | -      |
|  | (1.35) |        |        | (3.07) |        |
| log(1+BMP) in 1990s                            | -0.034 | -      | -      | -      | -0.181 |
|  | (0.28) |        |        |        | (1.52) |
| Constant                                       | 3.318  | 2.855  | 2.560  | 2.925  | 2.941  |
|  | (2.84) | (2.53) | (2.50) | (2.79) | (2.64) |
| Number of observations                         | 90     | 90     | 101    | 101    | 101    |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.08   | 0.53   | 0.11   | 0.21   | 0.91   |
| $F$ -value <sup>b</sup>                        | 1.81   | -      | -      | -      | -      |
| Adjusted $R^2$                                 | 0.62   | 0.61   | 0.63   | 0.65   | 0.62   |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

<sup>b</sup> Test for joint significance of log of average black market premium in the decades.

over the 1960-2000 period mainly depends on the high level and high variation in the black market premium during the 1980s in which many developing countries launched the liberalisation programs after the debt crises in the late 1970s and the early 1980s. Hence, it is more likely that negative and significant connection between black market premium and economic growth over the period 1960-2000 reflects the adverse relation between macroeconomic

**Table 9:** Economic Growth and Black Market Premium Dummy: OLS Estimates<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              |
|--|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.560<br>(6.24) | -0.511<br>(6.43) | -0.517<br>(7.63) | -0.476<br>(8.46) | -0.545<br>(7.96) |
| log( $n_i + g + \delta$ )                      | -1.117<br>(3.64) | -1.139<br>(2.97) | -1.181<br>(3.39) | -1.001<br>(3.18) | -1.266<br>(3.67) |
| log of Investment rate                         | 0.321<br>(2.70)  | 0.318<br>(3.10)  | 0.340<br>(3.75)  | 0.334<br>(3.21)  | 0.380<br>(4.25)  |
| log of School enrolment                        | 0.488<br>(5.32)  | 0.520<br>(5.11)  | 0.476<br>(5.64)  | 0.452<br>(5.97)  | 0.445<br>(5.36)  |
| BMP dummy in 1960s <sup>a</sup>                | -0.026<br>(0.21) | -0.137<br>(1.26) | -                | -                | -                |
| BMP dummy in 1970s <sup>a</sup>                | -0.150<br>(1.34) | -                | -0.261<br>(3.17) | -                | -                |
| BMP dummy in 1980s <sup>a</sup>                | -0.103<br>(0.85) | -                | -                | -0.275<br>(3.38) | -                |
| BMP dummy in 1990s <sup>a</sup>                | -0.173<br>(1.01) | -                | -                | -                | -0.385<br>(3.65) |
| Constant                                       | 3.555<br>(3.11)  | 3.007<br>(2.62)  | 3.022<br>(2.88)  | 3.138<br>(3.06)  | 3.052<br>(2.96)  |
| Number of observations                         | 90               | 90               | 101              | 101              | 101              |
| $p$ -value for heteroscedasticity <sup>b</sup> | 0.09             | 0.58             | 0.18             | 0.12             | 0.50             |
| $F$ -value <sup>c</sup>                        | 3.09             | -                | -                | -                | -                |
| Adjusted $R^2$                                 | 0.65             | 0.61             | 0.65             | 0.66             | 0.66             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Dummy variable is equal to 1 if the average black market premium exceeds 20 %.

<sup>b</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

<sup>c</sup> Test for joint significance of the black market premium dummies.

imbalances and growth. In Table 9 we exactly replicate the cross country growth regressions in Table 8. The only difference is that in Table 9 we use a dummy variable which takes the value of 1 if the average value of black market premium exceeds 20 percent. As can be seen, the dummy variables

are continuously and separately negative and significant, except the dummy in the 1960s. This implies that a higher level of black market premium is particularly harmful for economic growth.

In conclusion, our findings about the relationship between economic growth and direct trade policy measures are not in favour of more liberal trade policies. We find evidence for the adverse growth-tariff connection, but the tariff rate is only marginally significant. More to the point this finding implies that imposition of tariffs on intermediate inputs and capital goods is harmful for growth rather than the negative impact of all kind of tariffs on economic growth as our tariff variable includes only imports of intermediates and capital goods. On the other hand our finding concerning the statistically significant association between black market premium and economic growth may indicate the negative relation between growth and macroeconomic imbalances rather than the trade restrictive effect of black market premium.

### 3.3 Deviation Measures

Cross-country growth regressions including only single trade policy measures have low-power for testing openness-growth connection. The reason is that each trade policy measure takes into account only one aspect of trade policy and hence tells only part of story (Leamer (1988)). Therefore, we need a single general measure encompassing all aspects of trade policy for testing the protectionism in general. As noted by Warner (2003, p.4) “The right regression for testing the impact of protectionism would seem to entail some aggregation of the policy instruments.”

One way in order to overcome this problem is employing deviation measures. These measures basically show the difference between predicted and actual trade and hence can be used as an indicator of the overall level of trade protectionism. Deviation measures are essentially based on the following rationale. According to the traditional small country model, international trade is determined by the factor endowments, international prices, technology, preferences, natural trade barriers and trade policy instruments (Leamer (1988)). Therefore, differences among the countries in the level of trade can be considered as trade policy barriers if the countries are substantially identical in terms of factor endowment, technology, preferences, and natural barriers or their effects are controlled for. This implies that if one constructs a model which sufficiently explains trade flows across countries, then residuals obtained from that model can be considered as an overall measure of trade barriers subject to only trade policy. Of course this approach implicitly assumes that trade policy barriers are the only important omitted variables and they are uncorrelated with the other determinants of trade.

In the literature many deviation measures as an indicator of openness to international trade have been suggested. In this respect, outward orientation index by Syrquin and Chenery (1989) and predicted trade shares by Frankel and Romer (1999) are the most well-known measures. In addition to these, we also use estimated residuals from a very simple model as:

$$\begin{aligned} ((X + M)/GDP_i) = & \alpha_0 + \alpha_1 \log(\text{Initial per worker GDP}_i) \\ & + \alpha_2 \log(\text{Area}_i) + \alpha_3 \log(\text{Average labour force}_i) + \varepsilon_i \end{aligned} \quad (3)$$

The model in (3) includes the dependent variable which is the exports plus imports as a share of GDP and hence already takes into account the size of country. We employ the real GDP per worker as a proxy for factor endowments of country. In order to avoid the possible endogeneity problem we use the 1960 value of per worker GDP. The other explanatory variables are the land area and average labour force. Both variables are expressed in logarithms and represent the country size. As pointed out by Frankel and Romer (1999) country size is an important determinant of international trade due to the fact that there are more opportunities for within country trade in the larger countries.

The specification in (3) is of course very simple in many aspects. First, the dependent variable is the average total trade as a ratio of GDP rather than the sum of bilateral trades across countries. Obviously estimating total trade as a sum of bilateral trades by employing a model including some gravity variables such as distance between two countries, common border dummy as well as other determinants would be better. However, unfortunately we lack data on bilateral trades across countries over the period 1960-2000. Second, this specification assumes that the only important omitted variables are trade policy barriers. A better specification therefore would be to include trade policy barriers such as tariffs and non-tariff barriers on imports (we will consider this point later). Finally we assume that preferences and technology are constant among countries. Even though these are important shortcomings for the model in (3), we believe that the estimated residuals from this model can be used as a more reliable indicator for openness compared to simple actual trade ratios. Obviously, a large value of residual implies that the country is more open to international trade once the initial factor endowments and country's size are controlled.

Employing the current openness as a dependent variable we estimate this model by OLS over the 1960-2000 period. Column 1 of Table 10 presents the resulting OLS estimate. In column 2, we also include a dummy variable for

**Table 10:** Exports plus Imports as a Share of GDP: OLS Estimates

| Dependent variable <sup>†</sup>                     | Current Openness |                  | Real Openness    |                  |
|---|------------------|------------------|------------------|------------------|
|   | (1)              | (2)              | (3)              | (4)              |
| log GDP per worker 1960                             | 0.061<br>(2.08)  | 0.050<br>(1.59)  | 0.150<br>(5.23)  | 0.150<br>(4.70)  |
| log Area  | -0.110<br>(2.57) | -0.106<br>(2.40) | -0.094<br>(2.62) | -0.094<br>(2.54) |
| log Average Labour Force                            | -0.049<br>(1.52) | -0.054<br>(1.56) | 0.003<br>(0.11)  | 0.003<br>(0.09)  |
| Landlocked country dummy <sup>a</sup>               | -                | -0.072<br>(0.91) | -                | -0.005<br>(0.09) |
| Constant  | 2.218<br>(5.73)  | 2.354<br>(5.59)  | 0.222<br>(0.72)  | 0.231<br>(0.67)  |
| Number of observations                              | 111              | 111              | 111              | 111              |
| <i>p</i> -value for heteroscedasticity <sup>b</sup> | 0.00             | 0.00             | 0.00             | 0.00             |
| Adjusted $R^2$                                      | 0.45             | 0.45             | 0.40             | 0.40             |

*Note:* *t*-statistics based on heteroscedastic-consistent (White-robust) standard errors are in parenthesis.

<sup>†</sup> 1960-2000 averages.

<sup>a</sup> The landlocked countries in Europe are dropped.

<sup>b</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

landlocked countries in order to control for natural trade barriers.<sup>13</sup> However, inserting the landlocked country dummy neither changes the basic results nor improves the fit of the model. Therefore, we prefer to employ residuals which come from the first regression as an openness variable and label it as *RESID\_Current Openness*. In columns 3 and 4, we replicate the regressions in the first two columns. The only difference is that in columns 3 and 4 we use the real openness as the dependent variable. As can be seen, the regression results in columns 3 and 4 are different from those in columns 1 and 2 in some aspects: First, when the dependent variable is real openness the coefficient estimate of initial income is considerably larger and highly significant. Second, average labour force is not only significant but also very close to zero. Third, the  $R^2$  values of the regressions in columns 3 and 4 is

<sup>13</sup>While constructing this dummy variable, we omit the landlocked countries in Europe such as Austria, Luxembourg, Switzerland and Hungary since becoming landlocked for these countries may not create an important disadvantage.

smaller and hence it is possible to conclude that these regressions are less precise. On the other hand, as in the case of current openness, including a landlocked country dummy does not improve the goodness of fit of the regression in column 3. Therefore, we again use the estimated residuals in column 3 as an openness measure and label it as *RESID\_Real Openness*.

Table 11 reports the estimation results by employing deviation measures in the framework of our baseline cross-country growth model. In column 1 we include the outward orientation index by Syrquin and Chenery (1989) and conclude that its coefficient estimate is negative but insignificant. However, it is more plausible to estimate this index over the period 1960-1985 since the index covers 1965-1980 period. Therefore, in column 2 we setup our benchmark model over the 1960-1985 period and estimate it with the outward orientation index. Now, coefficient estimate of index is positive but again insignificant. In column 3 and 4 we include *RESID\_Current Openness* and *RESID\_Real Openness* and conclude that both variables are positively and significantly associated with growth. Notice that this association is stronger for the *RESID\_Real Openness*, with the *RESID\_Current Openness* being only marginally significant.

The regression in column 5 includes the Frankel-Romer predicted trade shares from a gravity model. Since this variable is predicted for only 1985 the cross-country growth regression covers 1960-1985 period. Estimation results show that the Frankel-Romer predicted trade share is positive and statistically significant. Recall that this variable is predicted trade shares from a gravity model based on the geographical characteristics of the countries. That is why this result can be only seen as an indication of a positive impact of international trade on economic growth if one assumes that geography influences growth only through international trade. In column 6, we estimate our benchmark model with the Frankel-Romer predicted trade shares over the 1960-2000 period. For this regression we employ the predicted trade shares provided by Dollar and Kraay (2003). This variable is different from the original Frankel-Romer predicted trade shares in two aspects: First it is based on the data on bilateral trade in 1995; Second, it expresses the bilateral trade in US dollar as a fraction of GDP at purchasing power parity (PPP) US dollar rather than current prices. Therefore, this variable is identical to real openness once the geographical characteristics of the countries are controlled for. The regression results implies that the predicted trade share has a positive and significant effect on economic growth. As seen, this effect is substantially stronger than the effect found in the previous regression.

**Table 11:** Economic Growth and Deviation Measures: OLS Estimates<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              |
|--|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.480<br>(6.39) | -0.331<br>(5.87) | -0.415<br>(6.09) | -0.418<br>(6.16) | -0.340<br>(6.71) | -0.406<br>(6.22) |
| $\log(n_i + g + \delta)$                       | -1.199<br>(3.00) | -0.339<br>(1.26) | -1.198<br>(3.03) | -1.118<br>(2.91) | -0.191<br>(0.74) | -0.817<br>(2.27) |
| log of Investment rate                         | 0.415<br>(4.42)  | 0.296<br>(5.16)  | 0.359<br>(3.80)  | 0.349<br>(3.66)  | 0.302<br>(5.41)  | 0.397<br>(4.52)  |
| log of School enrolment                        | 0.471<br>(5.11)  | 0.266<br>(4.75)  | 0.429<br>(4.99)  | 0.446<br>(5.22)  | 0.279<br>(5.29)  | 0.405<br>(4.82)  |
| Outward orientation by S&C                     | -0.036<br>(0.42) | 0.082<br>(1.29)  | -                | -                | -                | -                |
| RESID_Current Openness                         | -                | -                | 0.268<br>(1.91)  | -                | -                | -                |
| RESID_Real Openness                            | -                | -                | -                | 0.323<br>(2.07)  | -                | -                |
| log F&R predicted trade in 1985                | -                | -                | -                | -                | 0.091<br>(2.39)  | -                |
| log F&R predicted trade in 1995                | -                | -                | -                | -                | -                | 0.209<br>(3.35)  |
| Constant                                       | 2.745<br>(2.39)  | 3.283<br>(4.05)  | 2.038<br>(1.76)  | 2.268<br>(2.04)  | 3.544<br>(4.65)  | 3.672<br>(3.43)  |
| Number of observations                         | 103              | 103              | 105              | 105              | 107              | 107              |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.73             | 0.35             | 0.69             | 0.71             | 0.21             | 0.93             |
| Adjusted $R^2$                                 | 0.61             | 0.53             | 0.61             | 0.62             | 0.57             | 0.65             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

### 3.4 Subjective Measures

In the fourth and last step, we consider some subjective measures for openness. These measures are in some sense similar to the deviation measures such that both try to capture all aspects of trade policy. The main difference is that they are partly or completely based on the subjective judgment.

We start with the real exchange rate distortion index suggested by Dollar (1992) as an openness variable. Our data on this variable come from Global Development Network (2005) and cover the 1970-2000 period. This measure compares the domestic prices of tradable goods across countries. Assuming that the law of one price always holds, a higher level of distortion index indicates a more distorted trade regime. Our estimation results reported in column 1 of Table 12 show that the distortion index is significantly and negatively associated with growth. However, the coefficient estimate of the index is very small (-0.003!) which implies that the distortion index does not have any influence on growth. In column 2, we include the variability index which is simply a coefficient of variation of the real exchange rate distortion index over the 1970-2000 period and conclude that the variability is negative and significant with a substantially larger coefficient estimate. However, in a difference to Dollar (1992), we find an insignificant coefficient estimate of the distortion index when both distortion and variability indexes are included in the regression together. As shown in column 3, the regression result shows that the distortion index is not only insignificant but also is very close to zero (-0.001). It is, therefore, more reasonable to attribute these findings to the importance of real exchange rate stability rather than the liberal trade policies for better growth performance.

In column 4, we include the dummy variable for openness suggested by Sachs and Warner (1995, SW henceforth). The SW dummy variable is a single openness measure covering all major kinds of trade restrictions, namely non-tariff barriers, average tariff rate, black market premium for exchange rate, a socialist country, state monopoly on major exports. However, differently from SW, we extend the openness dummy over the period 1960-2000 rather than 1970-1989 period. This means that we consider only 26 countries as always open during the 1960-2000 period while SW define 33 open countries between 1970 and 1989. More clearly we define the countries Taiwan, Jordan, Ireland, South Korea, Indonesia, Japan and Australia as closed over the 1960-2000 period since these countries opened their trade regimes during the 1960s according to the SW criteria. Notice that in our regressions Germany and Taiwan are always omitted because of missing data on these countries over the sample period. In spite of this difference, we conclude that the SW dummy variable is statistically significant and positive. Regression



result in column 4 implies that in the long run GDP per worker in an open economy would have 2.6 times that in a closed economy once the other determinants are controlled.<sup>14</sup> <sup>15</sup> In addition, in column 5 we employ the SW dummy over the period 1970-2000 period which is exactly identical to the original SW dummy variable. Now the coefficient estimate of the dummy is larger and indicates that GDP per worker in an open economy would be equal to 3.2 times the GDP per worker in a closed economy in the long run.

The SW dummy variable is, however, heavily criticized by Harrison and Hanson (1999) and Rodrik and Rodríguez (2000). The most important criticism is that the strength of the dummy is mainly the result of the criteria related to state monopolies on exports and the black market premium. According to Rodrik and Rodríguez (2000), the export monopolies component of the SW dummy acts like a sub-Saharan Africa dummy while the black market premium component reflects poor macroeconomic conditions and imbalances rather than restrictive trade policies. That is why, in column 6 we insert a sub-Saharan Africa dummy to the regression. The regression result indicates that the coefficient estimate of the SW dummy is now higher and highly significant. In column 7, we substitute the sub-Saharan African dummy with a composite regional dummy for both sub-Saharan Africa and Latin America. Now, the coefficient estimate of SW dummy is relatively smaller, but still statistically significant. In column 8, we introduce the black market premium dummy which takes the value of 1 if the average black market premium exceeds 20 % in any of the 1960s, 1970s, 1980s or 1990s as well as the composite regional dummy variable. The regression result shows that the coefficient estimate of SW dummy is not only smaller but also marginally significant at the 7 % level. In column 9, we substitute the black market premium dummy with logarithm of average black market premium and conclude the same re-

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<sup>14</sup>The effect of openness dummy on the long run income level can be calculated as  $\exp(-\gamma_5/\gamma_1)$  where  $\gamma_5$  is the coefficient of openness dummy and  $\gamma_1$  is the coefficient of the initial level of income. According to the regression result in Column 4,  $\gamma_5 = 0.463$  and  $\gamma_1 = -0.483$ , hence the long run level of GDP per worker in an open country would be  $2.6 = \exp(-0.463/-0.483)$  times the GDP per worker in a closed economy.

<sup>15</sup>Moreover, we test the absolute convergence hypothesis for open economies over the 1960-2000 period. In order to facilitate comparison with SW, we employ annual growth rate and initial income according to GDP per capita rather than GDP per worker and conclude the following cross-country growth regression for 24 countries which are always open during the 1960-2000 period (robust *t*-statistics are in parentheses).

$$[\log y_{i,2000} - \log y_{i,1960}]/40 = \underset{(6.14)}{15.349} - \underset{(5.00)}{1.397} \log y_{i,1960} \quad \bar{R}^2 = 0.68$$

where  $y_i$  is the real GDP per capita. As can be seen, the coefficient estimate of initial income is very close to that estimated by SW (They report the coefficient estimate of initial GDP per capita as minus 1.368 in column 3 of Table 11 p. 48).

sult. Therefore, it is possible to conclude that the SW dummy is sensitive to the black market premium for exchange rate, but not to dummy variable for sub-Saharan Africa.

We employ the fraction of open years according to SW liberalisation dates over the 1960-2000 period in column 10.<sup>16</sup> This variable is more reasonable with respect to the SW dummy since SW liberalisation dates are based on the intensive survey of the country cases as pointed out by Wacziarg (2001) and Wacziarg and Welch (2008). The regression result indicates that the fraction of open years is strongly and significantly correlated with economic growth over the period 1960-2000.

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<sup>16</sup>For the period 1990-2000, we employ the liberalisation dates provided by Wacziarg and Welch (2008) updating the SW dummy and liberalisation status. In their systematic review, Wacziarg and Welch (2008) disagree with SW on the liberalization status or dates in the case of several countries. Some countries such as Panama and Cape Verde which were not included in SW are classified in the study by Wacziarg and Welch (2008). There are five countries namely, Ivory Coast, the Dominican Republic, Mauritania, Niger and Trinidad and Tobago for which Wacziarg and Welch (2008) disagree with SW assignment of liberalization dates and four countries which remains closed as of 2001 according to Wacziarg and Welch (2008) while SW classifies them as open in the early 1990s. These countries are Belarus, Croatia, Estonia, and India. In this study, we follow the Wacziarg and Welch (2008) for the disagreement cases. See Sachs and Warner (1995) and Wacziarg and Welch (2008) and appendices therein for more information about SW liberalisation dates.

Table 12: Economic Growth and Subjective Measures: OLS Estimates<sup>†</sup>

|   | (1)              | (2)              | (3)              | (4)              | (5)              | (6)              | (7)              | (8)              | (9)              | (10)             |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                         | -0.498<br>(6.91) | -0.520<br>(7.63) | -0.515<br>(7.42) | -0.483<br>(7.10) | -0.478<br>(7.44) | -0.500<br>(7.37) | -0.454<br>(6.72) | -0.469<br>(6.57) | -0.472<br>(7.81) | -0.496<br>(7.43) |
| $\log(n_i + g + \delta)$                        | -1.245<br>(3.29) | -1.042<br>(2.83) | -1.041<br>(2.81) | -0.315<br>(0.79) | -0.310<br>(0.84) | -0.294<br>(0.75) | -0.258<br>(0.66) | -0.483<br>(1.21) | -0.506<br>(1.39) | -0.524<br>(1.44) |
| log of Investment rate                          | 0.536<br>(5.49)  | 0.526<br>(5.65)  | 0.524<br>(5.58)  | 0.335<br>(3.71)  | 0.316<br>(3.65)  | 0.313<br>(3.48)  | 0.302<br>(3.38)  | 0.278<br>(2.98)  | 0.261<br>(2.36)  | 0.317<br>(3.57)  |
| log of School enrolment                         | 0.421<br>(4.36)  | 0.466<br>(5.05)  | 0.460<br>(4.92)  | 0.471<br>(5.65)  | 0.426<br>(5.35)  | 0.383<br>(4.04)  | 0.409<br>(4.76)  | 0.424<br>(4.70)  | 0.421<br>(4.95)  | 0.397<br>(4.84)  |
| Distortion Index by Dollar (1992) <sup>a</sup>  | -0.003<br>(2.47) | -                | -0.001<br>(0.46) | -                | -                | -                | -                | -                | -                | -                |
| Variability Index by Dollar (1992) <sup>b</sup> | -                | -0.468<br>(3.81) | -0.428<br>(2.83) | -                | -                | -                | -                | -                | -                | -                |
| Openness Dummy (1960-2000) <sup>c</sup>         | -                | -                | -                | 0.463<br>(3.69)  | -                | 0.510<br>(4.03)  | 0.397<br>(3.15)  | 0.269<br>(1.86)  | 0.244<br>(1.89)  | -                |
| Openness Dummy (1970-2000) <sup>c</sup>         | -                | -                | -                | -                | 0.549<br>(4.88)  | -                | -                | -                | -                | -                |
| Sub-saharan Africa                              | -                | -                | -                | -                | -                | -0.242<br>(1.85) | -                | -                | -                | -                |
| Latin America and Africa <sup>d</sup>           | -                | -                | -                | -                | -                | -                | -0.234<br>(2.30) | -0.210<br>(2.06) | -0.234<br>(2.44) | -                |
| BMP dummy <sup>e</sup>                          | -                | -                | -                | -                | -                | -                | -                | -0.072<br>(0.73) | -                | -                |
| $\log(1+BMP)^f$                                 | -                | -                | -                | -                | -                | -                | -                | -                | -0.195<br>(2.42) | -                |
| Fraction of open years <sup>g</sup>             | -                | -                | -                | -                | -                | -                | -                | -                | -                | 0.645<br>(4.31)  |
| Constant  | 3.240            | 3.828            | 3.831            | 4.839            | 4.675            | 4.971            | 4.765            | 4.302            | 4.269            | 4.097            |

Continued on Next Page...

Table 12 – *Continued*

|  |        |        |        |        |        |        |        |        |        |        |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Number of observations                         | (2.94) | (3.57) | (3.56) | (4.18) | (4.43) | (4.34) | (4.21) | (3.66) | (3.51) | (3.90) |
| $p$ -value for heteroscedasticity <sup>h</sup> | 87     | 87     | 87     | 102    | 102    | 102    | 102    | 98     | 98     | 102    |
| Adjusted $R^2$                                 | 0.68   | 0.82   | 0.72   | 0.77   | 0.37   | 0.68   | 0.55   | 0.26   | 0.15   | 0.91   |
|  | 0.67   | 0.70   | 0.70   | 0.65   | 0.68   | 0.66   | 0.67   | 0.65   | 0.67   | 0.67   |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Real exchange rate distortion index, 1970-2000 averages.

<sup>b</sup> Coefficient variation of real exchange rate distortion index over the 1970-2000 period.

<sup>c</sup> Dummy variable for open countries according to the Sachs and Warner (1995) criteria.

<sup>d</sup> Composite regional dummy variable for Latin America and Sub-saharan Africa.

<sup>e</sup> Dummy variable is equal to 1 if the average black market premium exceeds 20 % in either the 1960s or the 1970s or the 1980s or the 1990s.

<sup>f</sup> Logarithm of one plus average value of black market premium over the 1960-1999 period.

<sup>g</sup> Fraction of open years according to liberalization dates in Sachs and Warner (1995) and Wacziarg and Welch (2008)

<sup>h</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

**Table 13:** International Trade and Trade Policy Indexes: OLS Estimates

| Dependent variable <sup>†</sup>                     | Current Openness |                  | Real Openness    |                  |
|---|------------------|------------------|------------------|------------------|
|   | (1)              | (2)              | (3)              | (4)              |
| log GDP per worker 1960                             | 0.019<br>(0.47)  | 0.041<br>(1.25)  | 0.091<br>(2.61)  | 0.100<br>(3.29)  |
| log Area  | -0.124<br>(2.24) | -0.072<br>(1.89) | -0.103<br>(2.28) | -0.055<br>(1.87) |
| log Average Labour Force                            | -0.021<br>(0.46) | -0.055<br>(1.46) | 0.034<br>(0.98)  | 0.003<br>(0.09)  |
| owti <sup>a</sup>                                   | -0.140<br>(0.72) | -0.063<br>(0.42) | -0.236<br>(1.19) | -0.193<br>(1.20) |
| owqi <sup>b</sup>                                   | -0.237<br>(2.06) | -0.162<br>(1.75) | -0.196<br>(2.01) | -0.115<br>(1.49) |
| log (1+BMP) <sup>c</sup>                            | -                | 0.016<br>(0.36)  | -                | -0.038<br>(1.11) |
| Constant  | 2.369<br>(4.10)  | 2.014<br>(4.71)  | 0.403<br>(0.83)  | 0.205<br>(0.52)  |
| Number of observations                              | 85               | 83               | 85               | 83               |
| <i>p</i> -value for heteroscedasticity <sup>d</sup> | 0.00             | 0.00             | 0.00             | 0.00             |
| <i>F</i> -value <sup>e</sup>                        | 2.19             | 1.11             | 2.60             | 1.76             |
| Adjusted <i>R</i> <sup>2</sup>                      | 0.43             | 0.43             | 0.40             | 0.40             |

*Note:* *t*-statistics based on heteroscedastic-consistent (White-robust) standard errors are in parenthesis.

<sup>†</sup> 1960-2000 averages.

<sup>a</sup> Own-import weighted tariff rates on intermediate inputs and capital goods.

<sup>b</sup> Own-import weighted non-tariff frequency on intermediate inputs and capital goods.

<sup>c</sup> Logarithm of one plus average value of black market premium over the 1960-1999 period.

<sup>d</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

<sup>e</sup> Test for joint significance of owti, owqi and log(1+BMP)

Finally, we construct a simple subjective openness measure. Recall that our simple model for international trade expressed in equation (3). As mentioned above, one of the weaknesses of this model is the assumption that the only important omitted variable is trade policy barriers. Now, we relax this assumption and introduce three trade policy instruments namely tariffs, non-tariff barriers and the black market premium. Our aim is to obtain approximate weights for these trade policy instruments in order to construct a composite trade policy indicator. Estimation results are given in Table 13.

Regression results are not very precise compared to our previous estimations in Table 10. First, introducing trade policy instruments does not improve the goodness of fit. Second, except for non-tariff barriers, all trade policy instruments are found to be statistically insignificant. One reason for the less precise results is that our data on tariffs and non-tariff barriers are not very satisfactory. Multicollinearity among the policy instruments may be another reason. However, in spite of the lack of precision, our results indicate that all trade policy instruments have the expected sign. The only exception is the regression in column 2 in which the sign of the black market premium is positive. Hence, except this regression, the coefficient estimates of trade policy instruments can be used as approximate weights. In the light of the regressions in Table 13, we define the following three trade policy indicators;

$$\text{Trade policy 1} = -0.14(\text{owti}) - 0.24(\text{owqi})$$

$$\text{Trade policy 2} = -0.24(\text{owti}) - 0.20(\text{owqi})$$

$$\text{Trade policy 3} = -0.19(\text{owti}) - 0.12(\text{owqi}) - 0.04 \log(1 + \text{BMP})$$

where BMP is the average black market premium and owti and owqi denote the own-import weighted tariff rates and non-tariff frequency on intermediate inputs and capital goods, respectively. Notice that the higher level of trade policy index implies a more open country since weights are negative numbers. Thus, one would expect a positive coefficient estimate of the indexes if openness is positively correlated with economic growth. Employing these indexes we estimate our baseline model and conclude them all of them have the positive but insignificant coefficient estimates (Table 14).

## 4 Sensitivity Analysis

In this section, we investigate the sensitivity of our findings on the relationship between openness and economic growth in the previous section. As acknowledged by many authors,<sup>17</sup> most of the studies in the empirical cross-country growth literature include a small set of explanatory variables. However, the main problem in these studies is that their results are very sensitive to changes in the list of explanatory variables. The empirical literature on openness and growth is particularly subject to this problem because many studies in this literature employ simple growth models and it is likely that

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<sup>17</sup>See, for instance, Levine and Renelt (1992), Mankiw (1995), Sala-i-Martin (1997), Temple (2000), Brock and Durlauf (2001).

**Table 14:** Economic Growth and Composite Trade Policy Measures: OLS Estimates<sup>†</sup>

|  | (1)              | (2)              | (3)              |
|--|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.484<br>(5.78) | -0.489<br>(5.81) | -0.489<br>(5.97) |
| log( $n_i + g + \delta$ )                      | -1.237<br>(2.68) | -1.221<br>(2.65) | -1.298<br>(2.87) |
| log of Investment rate                         | 0.431<br>(4.24)  | 0.428<br>(4.22)  | 0.363<br>(3.65)  |
| log of School enrolment                        | 0.432<br>(4.17)  | 0.436<br>(4.20)  | 0.439<br>(4.35)  |
| Trade policy 1                                 | 0.574<br>(0.86)  | -                | -                |
| Trade policy 2                                 | -                | 0.643<br>(0.99)  | -                |
| Trade policy 3                                 | -                | -                | 1.188<br>(1.40)  |
| Constant                                       | 2.682<br>(2.01)  | 2.783<br>(2.06)  | 2.464<br>(1.83)  |
| Number of observations                         | 85               | 85               | 83               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.73             | 0.77             | 0.37             |
| Adjusted $R^2$                                 | 0.60             | 0.60             | 0.60             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

many of the results of these works arise from model misspecification (Rodrik and Rodríguez (2000)). Therefore, the estimating framework requires a reasonably comprehensive set of explanatory variables. For this purpose, we redefine our baseline growth model expressed in equation (2) as:

$$\begin{aligned}
 \log y_{i,2000} - \log y_{i,1960} = & \gamma_0 + \gamma_1 \log y_{i,1960} + \gamma_2 \log(n_i + g + \delta) \\
 & + \gamma_3 \log(\text{Investment rate}_i) \\
 & + \gamma_4 \log(\text{School enrolment rate}_i) \\
 & + \gamma_5 \text{Openness}_i + \gamma_6 Z_i + \varepsilon_i
 \end{aligned} \tag{4}$$

where  $Z$  is a vector of other explanatory variables. We determine  $Z$  as follows: First, we include two variables related to macroeconomic policy, namely inflation rate and government consumption expenditures. Inclusion of these variables is particularly important since an important criticism on the openness-growth literature is that openness measures are proxy for other macroeconomic policies rather than trade policy per se. Second, we employ two variables in order to consider the effect of institutions and geography. For this, following Hall and Jones (1999), we measure institutional quality by using a composite index based on the data set of *International Country Risk Guide* (ICRG) published by a private international consulting company *Political Risk Services*. This index consists of equally weighting an average of four ICRG components for the years 1984-2000: i) investment profile as a average of three subcomponents namely, contract viability, profits repatriation and payment delays; ii) law and order; iii) corruption; and iv) bureaucratic quality. We use the share of population in geographical tropics in order to capture the effect of geography (Sachs (2001)). Finally, we include ethnolinguistic fragmentation index (ELF). This index shows the probability that two randomly selected persons of a given country do not belong to the same ethnolinguistic group and has become a standard variable in the cross-country growth literature since the important studies by Mauro (1995) and Easterly and Levine (1997).

Before carrying out our sensitivity analysis, we estimate an augmented neoclassical growth model with the only  $Z$  variables. Table 15 reports the estimation results. As seen in the first column, all  $Z$  variables are found to be statistically significant with the anticipated signs. Moreover, this regression has substantially high explanatory power such that it explains 76 percent of variation in growth of per worker GDP over the period 1960-2000. However, applying the Hadi method we identify six countries (namely Brazil, Bolivia, Argentina, Peru, Nicaragua and Congo Democratic Republic) as outliers. In the second column we present the regression results without these six outlying countries and conclude that, except for the inflation rate, all  $Z$  variables are statistically significant. In column 3, instead of dropping these countries, we estimate the same model by IRLS. Notice that in this regression we exclude two risky countries, Congo Democratic Republic and Nicaragua, because of their high leverage values. We again conclude that all  $Z$  variables are statistically significant with the expected signs, except the inflation rate. Therefore, in column 4 we omit the inflation rate and estimate the augmented neoclassical growth model with the remaining control variables. The regression results show that government consumption, institutions, having population living in tropics and ELF are significantly associated with growth. This regression does not include any outliers and hence can be con-



**Table 15:** Other Determinants of Economic Growth<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              |
|--|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.617<br>(8.54) | -0.624<br>(7.25) | -0.620<br>(9.01) | -0.650<br>(8.69) |
| $\log(n_i + g + \delta)$                       | -0.208<br>(0.57) | -0.233<br>(0.55) | -0.246<br>(0.71) | -0.281<br>(0.73) |
| log of Investment rate                         | 0.344<br>(3.46)  | 0.318<br>(2.84)  | 0.393<br>(4.11)  | 0.242<br>(2.01)  |
| log of School enrolment                        | 0.383<br>(3.93)  | 0.385<br>(4.26)  | 0.330<br>(3.59)  | 0.370<br>(4.52)  |
| Inflation Rate                                 | -0.099<br>(3.71) | -0.245<br>(0.68) | -0.005<br>(0.09) | -                |
| Government Consumption/GDP                     | -1.855<br>(2.17) | -1.761<br>(1.71) | -1.917<br>(2.36) | -1.725<br>(1.81) |
| Institutional Quality Index                    | 0.219<br>(3.54)  | 0.215<br>(2.44)  | 0.238<br>(4.03)  | 0.255<br>(3.42)  |
| Population in Tropics                          | -0.244<br>(2.36) | -0.272<br>(2.90) | -0.308<br>(3.11) | -0.279<br>(3.22) |
| Ethnolinguistic Fragmentation                  | -0.340<br>(2.45) | -0.321<br>(1.97) | -0.253<br>(1.90) | -0.301<br>(1.85) |
| Constant                                       | 6.013<br>(5.54)  | 5.972<br>(4.87)  | 5.852<br>(5.69)  | 5.706<br>(5.03)  |
| Number of observations                         | 80               | 74               | 78               | 80               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.17             | 0.06             | -                | 0.05             |
| Adjusted $R^2$                                 | 0.76             | 0.71             | 0.75             | 0.71             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

sidered as a reasonable model for sensitivity analysis. In this regard, we set

up the following cross-country growth regression:

$$\begin{aligned}
\log y_{i,2000} - \log y_{i,1960} = & \gamma_0 + \gamma_1 \log y_{i,1960} + \gamma_2 \log(n_i + g + \delta) \\
& + \gamma_3 \log(\textit{Investment rate}_i) \\
& + \gamma_4 \log(\textit{School enrolment rate}_i) \\
& + \gamma_5(\textit{Government Consumption}_i) \quad (5) \\
& + \gamma_6(\textit{Institutional Quality}_i) \\
& + \gamma_7(\textit{Population in Tropics}_i) \\
& + \gamma_8 \textit{ELF}_i + \gamma_9 \textit{Openness}_i + \varepsilon_i
\end{aligned}$$

We carry out our sensitivity analysis under four categorizations: trade volumes, direct trade policy measures, deviation measures and subjective indexes. However, we focus only on openness variables found to be significant in the previous section.

We start our sensitivity analysis with trade volumes, with Table 16 reporting our estimation results. All openness variables are found to be positive but not statistically significant. Table 17 then presents the results of sensitivity analysis for direct trade policy measures. As seen in column 1-3, the tariff rate and non-tariff barriers are neither individually nor jointly significant, albeit they have anticipated negative signs. In columns 4 and 5, we include the average black market premium and a dummy variable for the black market premium, respectively. Both variables enter the regression with negative but insignificant coefficient estimates. This may be attributed as another evidence in favour of black market market premium as a proxy for macroeconomic imbalances rather than trade policy.

In table 18, we estimate deviation measures for openness. In the first and second columns, we include adjusted trade ratios for current openness and real openness respectively, and conclude that both variables are insignificant. In column 3, we check the sensitivity of the Frankel-Romer predicted trade shares and find that the coefficient estimate on this variable is positive but statistically insignificant (Note that this regression is run over the 1960-1985 period because the Frankel-Romer predicted trade share is calculated for only 1985). In column 4, we enter the Frankel-Romer predicted trade shares at PPP in 1995. We again find that this variable is not statistically significant at conventional levels.

Finally, sensitivity analysis on subjective openness indexes is provided in Table 19. In column 1, we include the fraction of open years according to SW liberalization dates and conclude that this variable is significant at the 10 percent significance level. In columns 2-4 we include three composite trade policy indexes with only the third index being statistically significant at the

**Table 16:** Economic Growth and Trade Volumes: Sensitivity Analysis<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              |
|--|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.638<br>(8.39) | -0.630<br>(8.28) | -0.634<br>(8.35) | -0.644<br>(8.52) | -0.652<br>(8.67) |
| $\log(n_i + g + \delta)$                       | -0.036<br>(0.09) | -0.020<br>(0.05) | -0.028<br>(0.07) | -0.264<br>(0.67) | -0.266<br>(0.68) |
| log of Investment rate                         | 0.226<br>(1.70)  | 0.224<br>(1.69)  | 0.225<br>(1.70)  | 0.241<br>(1.98)  | 0.243<br>(2.02)  |
| log of School enrolment                        | 0.372<br>(4.63)  | 0.377<br>(4.70)  | 0.374<br>(4.67)  | 0.362<br>(4.46)  | 0.368<br>(4.47)  |
| Government Consumption /GDP                    | -1.820<br>(1.82) | -1.976<br>(1.95) | -1.901<br>(1.89) | -2.009<br>(1.93) | -1.860<br>(1.85) |
| Institutional Quality Index                    | 0.246<br>(3.17)  | 0.249<br>(3.22)  | 0.247<br>(3.20)  | 0.249<br>(3.30)  | 0.244<br>(3.10)  |
| Population in Tropics                          | -0.326<br>(3.62) | -0.327<br>(3.55) | -0.327<br>(3.60) | -0.308<br>(3.64) | -0.290<br>(3.31) |
| Ethnolinguistic Fragmentation                  | -0.344<br>(1.89) | -0.331<br>(1.81) | -0.338<br>(1.85) | -0.297<br>(1.80) | -0.297<br>(1.81) |
| Exports ratio of WB                            | 0.256<br>(1.18)  | -                | -                | -                | -                |
| Imports ratio of WB                            | -                | 0.295<br>(1.40)  | -                | -                | -                |
| Trade ratio of WB                              | -                | -                | 0.140<br>(1.31)  | -                | -                |
| Current Openness of PW                         | -                | -                | -                | 0.100<br>(0.92)  | -                |
| Real Openness by A&C                           | -                | -                | -                | -                | 0.094<br>(0.71)  |
| Constant                                       | 6.256<br>(5.18)  | 6.214<br>(5.15)  | 6.237<br>(5.17)  | 5.713<br>(4.93)  | 5.797<br>(5.06)  |
| Number of observations                         | 75               | 75               | 75               | 80               | 80               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.02             | 0.02             | 0.02             | 0.04             | 0.04             |
| Adjusted $R^2$                                 | 0.70             | 0.70             | 0.70             | 0.71             | 0.71             |

*Note:*  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are in parenthesis.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

**Table 17:** Economic Growth and Direct Trade Policy Measures: Sensitivity Analysis<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              | (5)              |
|--|------------------|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.641<br>(8.89) | -0.605<br>(7.68) | -0.635<br>(8.61) | -0.657<br>(8.93) | -0.659<br>(8.85) |
| $\log(n_i + g + \delta)$                       | -0.428<br>(1.14) | -0.561<br>(1.34) | -0.460<br>(1.14) | -0.293<br>(0.76) | -0.230<br>(0.57) |
| log of Investment rate                         | 0.255<br>(2.05)  | 0.237<br>(1.80)  | 0.228<br>(1.80)  | 0.236<br>(1.95)  | 0.233<br>(1.96)  |
| log of School enrolment                        | 0.343<br>(3.04)  | 0.346<br>(3.17)  | 0.368<br>(3.18)  | 0.395<br>(4.73)  | 0.405<br>(4.96)  |
| Government Consumption /GDP                    | -3.174<br>(2.66) | -2.441<br>(2.27) | -2.896<br>(2.39) | -1.559<br>(1.62) | -1.646<br>(1.66) |
| Institutional Quality Index                    | 0.226<br>(3.03)  | 0.221<br>(2.66)  | 0.217<br>(2.77)  | 0.229<br>(2.73)  | 0.219<br>(2.54)  |
| Population in Tropics                          | -0.324<br>(3.26) | -0.286<br>(3.03) | -0.317<br>(3.21) | -0.287<br>(3.23) | -0.285<br>(3.22) |
| Ethnolinguistic Fragmentation                  | -0.194<br>(1.10) | -0.256<br>(1.45) | -0.174<br>(0.99) | -0.271<br>(1.71) | -0.314<br>(1.92) |
| owti   | -0.493<br>(1.95) |                  | -0.524<br>(2.09) |                  |                  |
| owqi   |                  | 0.028<br>(0.19)  | 0.122<br>(0.80)  |                  |                  |
| log (1+BMP)                                    |                  |                  |                  | -0.057<br>(0.47) |                  |
| BMP dummy                                      |                  |                  |                  |                  | -0.079<br>(0.82) |
| Constant                                       | 5.622<br>(4.72)  | 4.753<br>(3.71)  | 5.422<br>(4.26)  | 5.823<br>(5.05)  | 6.105<br>(5.00)  |
| Number of observations                         | 69               | 67               | 67               | 78               | 78               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.00             | 0.00             | 0.01             | 0.06             | 0.04             |
| $F$ -value <sup>b</sup>                        |                  |                  | 0.09             |                  |                  |
| Adjusted $R^2$                                 | 0.71             | 0.69             | 0.71             | 0.71             | 0.71             |

*Note:*  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are in parenthesis. The variables *owti* and *owqi* refers to own-import weighted tariff rates and own-import weighted non-tariff frequency on intermediate inputs and capital goods, respectively. The term  $\log(1+BMP)$  denotes the logarithm of one plus average value of black market premium over the 1960-2000. The variable *BMP dummy* is a dummy variable which is equal to 1 if the average black market premium exceed 20 % in either the 1960s or the 1970s or the 1980s or the 1990s.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

<sup>b</sup> Test for joint significance of *owti* and *owqi*.

**Table 18:** Economic Growth and Deviation Measures: Sensitivity Analysis<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              |
|--|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.646<br>(8.77) | -0.647<br>(8.76) | -0.454<br>(6.29) | -0.633<br>(7.59) |
| $\log(n_i + g + \delta)$                       | -0.300<br>(0.77) | -0.289<br>(0.74) | 0.361<br>(1.35)  | -0.220<br>(0.55) |
| log of Investment rate                         | 0.235<br>(1.88)  | 0.239<br>(1.92)  | 0.202<br>(2.82)  | 0.256<br>(2.07)  |
| log of School enrolment                        | 0.366<br>(4.42)  | 0.370<br>(4.50)  | 0.206<br>(2.96)  | 0.355<br>(4.20)  |
| Government Consumption /GDP                    | -1.803<br>(1.71) | -1.756<br>(1.76) | -0.427<br>(0.56) | -1.936<br>(1.86) |
| Institutional Quality Index                    | 0.253<br>(3.43)  | 0.251<br>(3.39)  | 0.172<br>(2.99)  | 0.252<br>(3.35)  |
| Population in Tropics                          | -0.284<br>(3.31) | -0.279<br>(3.19) | -0.226<br>(2.76) | -0.272<br>(3.14) |
| Ehno-linguistic Fragmentation                  | -0.315<br>(1.80) | -0.307<br>(1.83) | -0.086<br>(0.66) | -0.282<br>(1.70) |
| RESID_Current Openness                         | 0.057<br>(0.27)  | -                | -                | -                |
| RESID_Real Openness                            | -                | 0.040<br>(0.20)  | -                | -                |
| log F&R predicted trade in 1985                | -                | -                | 0.024<br>(0.62)  | -                |
| log F&R predicted trade in 1995                | -                | -                | -                | 0.055<br>(0.90)  |
| Constant                                       | 5.633<br>(4.96)  | 5.674<br>(4.93)  | 5.416<br>(6.14)  | 5.941<br>(5.06)  |
| Number of observations                         | 80               | 80               | 80               | 80               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.04             | 0.04             | 0.18             | 0.04             |
| Adjusted $R^2$                                 | 0.71             | 0.71             | 0.59             | 0.71             |

*Note:*  $t$ -statistics are in parenthesis. In the regressions where the heteroscedasticity test is failed to pass at 15 % level  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are reported.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

9 percent level.

## 5 Summary and Concluding Remarks

This paper revisits the empirical evidence on the relationship between trade openness and economic growth over the sample period of 1960-2000. Departing from previous cross-country studies focusing mainly on 1970-1990 period, we reassess the openness-growth link over a much longer time period, enabling us to better account for both trade policy stance and growth dynamics in the long run. In doing so, we experiment with a large number of openness measures in the framework of the augmented neo-classical growth model developed by Mankiw et al. (1992). We briefly summarise our main findings as follows:

We conclude that ratio of trade volume to GDP is positively and significantly associated with economic growth. However, their significance in OLS estimate is mainly driven by a few outlying countries. When we repeat the analysis using weighted least squares, giving relatively lower weight to outlying countries, we find a significant and positive correlation between growth and trade ratios at nominal prices. We could not conclude the same result for the real openness which measures the ratio of trade volume to GDP in constant prices.

Our findings relating to direct trade policy measures indicate only weak evidence for the adverse growth-tariff connection such that the tariff rate is only marginally significant within the period 1960-2000. We could not find any statistically significant relation between non-tariff barriers and economic growth while the black market premium is negatively and significantly associated with growth. However, our empirical investigation on the link between black market premium and economic growth indicates the negative relationship between growth and macroeconomic imbalances rather than the trade restrictive effect of black market premium.

We find that adjusted trade ratios and the Frankel-Romer predicted trade shares are significantly and positively correlated with growth. Our findings, however, show an insignificant association between growth and outward orientation index by Syrquin and Chenery (1989).

Both the Sachs-Warner openness dummy and the fraction of open years on the basis of Sachs and Warner (1995) and Wacziarg and Welsh (2008) liberalization dates are positively and significantly correlated with economic growth over the period 1960-2000. We could not find any significant relation between growth and our composite trade policy indexes consisting of weighted averages of tariff rates, non-tariff barriers and the black market

**Table 19:** Economic Growth and Subjective Measures: Sensitivity Analysis<sup>†</sup>

|  | (1)              | (2)              | (3)              | (4)              |
|--|------------------|------------------|------------------|------------------|
| log GDP per worker 1960                        | -0.638<br>(8.98) | -0.611<br>(7.71) | -0.618<br>(7.90) | -0.625<br>(8.20) |
| $\log(n_i + g + \delta)$                       | -0.138<br>(0.30) | -0.502<br>(1.21) | -0.458<br>(1.12) | -0.432<br>(1.08) |
| log of Investment rate                         | 0.231<br>(2.01)  | 0.249<br>(1.91)  | 0.255<br>(1.98)  | 0.254<br>(1.98)  |
| log of School enrolment                        | 0.333<br>(3.98)  | 0.342<br>(3.17)  | 0.343<br>(3.17)  | 0.352<br>(3.26)  |
| Government Consumption /GDP                    | -1.519<br>(1.52) | -2.577<br>(2.38) | -2.707<br>(2.45) | -2.751<br>(2.48) |
| Institutional Quality Index                    | 0.200<br>(2.51)  | 0.221<br>(2.69)  | 0.221<br>(2.72)  | 0.212<br>(2.68)  |
| Population in Tropics                          | -0.306<br>(3.20) | -0.296<br>(3.13) | -0.306<br>(3.19) | -0.318<br>(3.31) |
| Ethnolinguistic Fragmentation                  | -0.299<br>(1.85) | -0.246<br>(1.37) | -0.230<br>(1.28) | -0.200<br>(1.11) |
| Fraction of Open Years                         | 0.278<br>(1.66)  | -                | -                | -                |
| Trade policy 1                                 | -                | 0.257<br>(0.53)  | -                | -                |
| Trade policy 2                                 | -                | -                | 0.498<br>(1.19)  | -                |
| Trade policy 3                                 | -                | -                | -                | 0.967<br>(1.71)  |
| Constant                                       | 6.003<br>(4.55)  | 5.026<br>(3.91)  | 5.258<br>(4.15)  | 5.451<br>(4.45)  |
| Number of observations                         | 79               | 67               | 67               | 67               |
| $p$ -value for heteroscedasticity <sup>a</sup> | 0.06             | 0.00             | 0.00             | 0.00             |
| Adjusted $R^2$                                 | 0.72             | 0.69             | 0.70             | 0.70             |

*Note:*  $t$ -statistics based on heteroscedastic-consistent (White-robust) standard errors are in parenthesis.

<sup>†</sup> Dependent variable is the log difference of real GDP per worker between 1960 and 2000.

<sup>a</sup> Breusch-Pagan test for heteroscedasticity in which the null refers to the homoscedastic errors.

premium.

We also conclude that existing openness variables are very sensitive to the inclusion of other growth determinants into the baseline growth model. To show this, we expand our baseline model by adding government consumption, economic institutions, geography, and ethnolinguistic fragmentation. Once we consider this model, our findings indicate that openness measures become insignificant whilst other variables remain significant with the expected signs.

In sum, in contrast to many previous cross-country growth studies, this paper does not support the proposition that openness has a direct robust relationship with economic growth in the long run. In light of data evidence here, one may conclude that trade openness does not matter for economic growth. However, it may be more reasonable to conclude that without building better institutions, maintaining conflict management along ethnolinguistic dimension, and following sound and stable fiscal policies, openness to international trade will not guarantee economic growth. Economic reforms in these areas should take priority over the policies enhancing trade openness.



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## 6 Appendix: Descriptions and Sources of Variables used in Cross-Country Growth Regression Analysis

### 6.A Augmented Neo-classical Growth Model

**Real GDP per capita (RGDPCH)** : 1996 international prices, chain series. **Source:** Global Development Network Growth Database (2005) which rely on Penn World Tables Version 6.1 (Heston, Summers and Aten (2002)).

**Population (TP)** : Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. **Source:** The World Bank World Development Indicators (2002, 2006).

**Labour force (LF)** : Labour force or economically active population defined as the total population between ages 15 and 64. **Source:** The World Bank World Development Indicators (2002, 2006)

**Share of labour force (SLF)** : Share of labour force in total population. The exact calculation is  $LF/TP$ .

**Real GDP per worker (PWGDP)** : 1996 international prices, chain series. The exact calculation is  $PWGDP = RGDPCH * (1/SLF)$ .

**Growth** : Average growth rate of real GDP per worker over the 1960-2000 period. The exact calculation is  $\log(PWGDP_{2000}/PWGDP_{1960})$ , where  $PWGDP_{1960}$  and  $PWGDP_{2000}$  is the real GDP per worker in 1960 and 2000, respectively.

**Initial income (PWGDP1960)** : Real GDP per worker in 1960.

**Population growth (n)** : Average rate of population growth between 1960 and 2000. The exact calculation is  $(1/40) * \log(TP_{2000}/TP_{1960})$ , where  $TP_{1960}$  and  $TP_{2000}$  are total population in 1960 and 2000, respectively.

**(g+ $\delta$ )** : Sum of exogenous rates of technological process and depreciation over the 1960-2000 period and assumed to be equal to 0.05.

**(n+g+ $\delta$ )** : Sum of rates of population growth, technical process and depreciation over the 1960-2000 period.

**Investment rate (INV)** : Average of Investment share in GDP at constant prices over the 1960-2000 period. **Source:** Penn World Tables Version 6.1 (Heston, Summers and Aten (2002)) and the World Bank World Development Indicators (2002, 2006).

**School enrolment rate (SCH)** : Average gross rate of secondary school enrolment over the 1960-2000 period. **Source:** The World Bank World Development Indicators (2002, 2006).

## 6.B Trade Policy

**Imports share from the World Bank (MGDP\_WB)** : Average share of imports of goods and services in GDP over the 1960-2000 period. **Source:** The World Bank World Development Indicators (2002, 2006).

**Exports share from the World Bank (XGDP\_WB)** : Average share of exports of goods and services in GDP over the 1960-2000 period. **Source:** The World Bank World Development Indicators (2002, 2006).

**Trade ratio from World Bank (XMGDP\_WB)** : Average share of exports plus imports of goods and services in GDP over the 1960-2000 period. The exact calculation is  $XMGDPWB = XGDPWB + MGDPWB$ . **Source:** The World Bank World Development Indicators (2002, 2006).

**Current Openness of Penn World (COPEN)** : Average share of exports plus imports of goods and services in GDP in current prices over the 1960-2000 period. **Source:** Penn World Tables Version 6.1 (Heston, Summers and Aten (2002)).

**Real Openness of Penn World (ROPEN)** : Average share of imports plus exports in US dollar in GDP in PPP US dollar over the 1960-2000 period. The Exact calculation is  $ROPEN = (PGDP/100) * COPEN$ , where  $PGDP$  is the Penn World variable of price level of GDP, unit: US dollar=100 in current prices, and  $COPEN$  is the current openness variable of Penn World. **Source:** Penn World Tables Version 6.1 (Heston, Summers and Aten (2002)).

**Trade ratio with OECD (XM\_OECD)** : Trade with OECD members over the 1960-1998 period (Exports plus Imports as a ratio to GDP). **Source:** Global Development Network Growth Database (2005).

**Trade ratio with NonOECD (XM\_NonOECD)** : Trade with Non-OECD countries over the 1960-1998 period (Exports plus Imports as a ratio

to GDP). **Source:** Global Development Network Growth Database (2005).

**Tariff rate (OWTI)** : Own-import weighted tariff rates on intermediate inputs and capital goods over the 1983-1985 period. **Source:** Barro and Lee (1994),

**Non-tariff Barriers (OWQI)** : Own-import weighted non-tariff frequency on intermediate inputs and capital goods over the 1983-1985 period. **Source:** Barro and Lee (1994).

**Import Duties (M\_DUTY)** : Collected import duties as a fraction of imports over the 1970-1998 period. **Source:** World Bank World Development Indicators (2002).

**Tariff rate (UWATR)** : Unweighted average tariff rates on all commodities over the period 1990-1999 period. **Source:** Wacziarg and Welch (2008)

**Black Market Premium (BMP)** Average of black market premium over the period 1960-1999. The black market premium is calculated as  $(\textit{Parallel Exchange rate}/\textit{Official Exchange rate}) - 1$ . **Source:** Global Development Network Growth Database (2005).

**log (1+BMP)** : Logarithm of one plus average of black market premium over the period 1960-1999.

**Black Market Premium Dummy 1 (BMP\_Dummy1)** : The dummy variable is equal to 1 if the average black market premium exceeds 20 percent in the 1960s or the 1970s or the 1980s or the 1990s.

**Black Market Premium Dummy 2 (BMP\_Dummy2)** : The dummy variable is equal to 1 if the average black market premium exceeds 20 percent over the 1960-2000 period.

**Outward Orientation Index by Syrquin and Chenery (SCOUT)** : Dummy variable for outward orientation based on Syrquin and Chenery (1989). **Source:** Levine and Renelt (1992)

**log F&R predicted trade 1985 (F&R85)** : Logarithm of the Frankel-Romer predicted trade shares from gravity model in 1985. **Source:** Frankel and Romer (1999).

**log F&R predicted trade 1995 (F&R95)** : Logarithm of the Frankel-Romer predicted trade shares from gravity model as a fraction of GDP in PPP in 1995. **Source:** Dollar and Kraay (2003).

**Exchange rate distortion index (RERD)** : The real exchange rate distortion index over the period 1970-2000. **Source:** Dollar (1992) and Global Development Network Growth Database (2005).

**Exchange rate variability index (RERV)** : Coefficient of variation of the real exchange rate distortion index over the 1970-2000 period.

**Sachs-Warner openness dummy (SW-Dummy)** : The Sachs-Warner openness dummy over the period 1960-2000. **Source:** Sachs and Warner (1995) and Wacziarg and Welch (2008).

**Sachs-Warner Open Years( SW-Years)** : Fraction of open years on the basis of Sachs-Warner and Wacziarg-Welch liberalisation dates over the 1960-2000 period. **Source:** Sachs and Warner (1995) and Wacziarg and Welch (2008).

## 6.C Other Growth Determinants

**Inflation Rate (INFLATION)** : Average inflation rate based on consumer price index over the 1960-2000 period. **Source:** The World Bank World Development Indicators (2002, 2006) based on International Monetary Fund, International Financial Statistics and data files.

**Government Consumption (GOVCONS)** : The ratio of general government final consumption expenditure in GDP. **Source:** The World Bank World Development Indicators (2002, 2006) based on World Bank national accounts data, and OECD National Accounts data files.

**Economic Institutions (ICRG Measure)** A measure of economic institutions based on four International Country Risk Guide (ICRG) components of Political Risk Services Group: 1) Investment Profile as a average of three subcomponents namely, contract viability, profits repatriation and payment delays; 2) law and order; 3) corruption; 4) bureaucratic quality. The index is calculated as the equal weighting average of these four categories for the years 1984-2000 (annual observations are calculated as the averages of the monthly indexes). The higher points indicates the greater institutional quality. **Source:** Political Risk Services (n.d.)



**Ethno-linguistic fragmentation index (ELF)** : The index shows the probability that two randomly selected persons do not belong to the same ethnolinguistic group in a given country and ranges between 0 and 1. The lower value of the index implies the more homogenous population. **Source:** Easterly and Levine (1997)

**Population in Tropics (TROPICPOP)** : The fraction of population living within the geographical tropics. **Source:** Center for International Development at Harvard University (n.d.)

**Table 20:** Summary Statistics of Openness Measures

|                                     | # of Obs. | Mean     | Std. Dev. | Min.    | Max.      |
|-------------------------------------|-----------|----------|-----------|---------|-----------|
| <i>Trade Volumes</i>                |           |          |           |         |           |
| MGDP_WB                             | 107       | 0.3377   | 0.1887    | 0.0723  | 1.0051    |
| XGDP_WB                             | 107       | 0.2958   | 0.1848    | 0.0656  | 1.0270    |
| XMGDP_WB                            | 107       | 0.6335   | 0.3583    | 0.1453  | 2.0320    |
| COPEN                               | 114       | 0.6432   | 0.4165    | 0.1477  | 3.2260    |
| ROPEN                               | 114       | 0.3734   | 0.3526    | 0.0436  | 2.4601    |
| XM_OECD                             | 106       | 0.3912   | 0.2627    | 0.0655  | 1.7622    |
| XM_NonOECD                          | 106       | 0.1409   | 0.1636    | 0.0156  | 1.2300    |
| <i>Direct Trade Policy Measures</i> |           |          |           |         |           |
| OWTI                                | 104       | 0.1688   | 0.1630    | 0       | 1.319     |
| OWQI                                | 102       | 0.1858   | 0.2372    | 0       | 0.888     |
| M_DUTY                              | 117       | 0.1229   | 0.0888    | 0       | 0.4645416 |
| UWATR                               | 121       | 0.1496   | 0.0932    | 0.003   | 0.547     |
| log (1+BMP)                         | 121       | 0.3776   | 0.6716    | -0.004  | 5.453     |
| BMP_Dummy1                          | 121       | 0.5455   | 0.5000    | 0       | 1         |
| BMP_Dummy2                          | 121       | 0.4463   | 0.4992    | 0       | 1         |
| <i>Deviation Measures</i>           |           |          |           |         |           |
| SCOUT                               | 119       | 0.3445   | 0.4772    | 0       | 1         |
| F&R85                               | 148       | 2.9882   | 0.7905    | 0.833   | 5.639     |
| F&R95                               | 195       | -2.8315  | 0.6409    | -4.4070 | -0.6378   |
| RESID_COPEN                         | 111       | 0.0000   | 0.3071    | -0.5700 | 1.9100    |
| RESID_ROPEN                         | 111       | 0.0000   | 0.2706    | -0.5495 | 1.5548    |
| <i>Subjective Measures</i>          |           |          |           |         |           |
| RERD                                | 94        | 114.6070 | 39.2534   | 59.2693 | 358.0221  |
| RERV                                | 94        | 0.2917   | 0.3220    | 0       | 2.7937    |
| SW-Dummy                            | 114       | 0.2281   | 0.4214    | 0       | 1         |
| SW-Years                            | 114       | 0.4322   | 0.3832    | 0       | 1         |
| POLICY1                             | 102       | -0.0684  | 0.0695    | -0.3978 | -0.0002   |
| POLICY2                             | 102       | -0.0780  | 0.0729    | -0.4942 | -0.0002   |
| POLICY3                             | 92        | -0.0724  | 0.0617    | -0.3666 | 0.0001    |

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