Trade Openness and Human Development

A Panel Analysis of the Human Development Index and its Components

Bachelor Thesis
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Chair of International Economics
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Summer Term 2016

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1. Introduction

The question, whether trade has a positive impact on standard of living has been broadly and controversially discussed in economics and other scientific environments ever since. A broad range of scientific papers has been published, striving to assess the true effect of trade on per capita income (Felbermayr and Gröschl 2013; Feyrer 2009; Noguer and Siscart 2005; Frankel and Romer 1999). In a more and more globalized and consolidating world, it is important to disclose the true effect trade has on societies in order to fully grasp the implications connected to the development of a society's people.

Most literature use gross national product (GDP) per capita as a common proxy for human development. There are scientists, however, who argue that per capita income does not capture the full picture when assessing standard of living. Other factors, such as health and education for instance, also play a crucial role in the determination of standard of living or human development. This is why other research and literature use a different proxy than per capita income, like Davies and Quinlivan (2006). The probably most renowned publically dicussed measure for human development is the Human Development Index, HDI from hereon, published by the United Nations Human Development Programme in its annual Human Development Reports since 1990 (United Nations Development Programme 2015a). The HDI captures three key dimensions of human development: (1) a long and healthy life, (2) being knowledgeable and (3) having a decent standard of living.

The relevance of using the HDI instead of per capita income is shown by a simple example. When randomly comparing two different countries, say Croatia and Kuwait, their level of income and their HDI can strongly differ as shown in Table 1: Coratia's 2014 GDP per capita has been $13.475 and its HDI has been 0.818; Kuwait's 2014 GDP per capita has been much larger than Croatia's, namely $43.594, but its HDI has been almost the same as Croatia's, namely 0.816. What is the reason for this immense difference in income levels while the two countries' HDI scores are almost equal? The reason for this discrepancy might arise from the impact of the HDI's non-income dimensions, health and education. Croatia and Kuwait are just one example of many. Table 1 contains further examples and also shows that countries might have similar income leves but a very different HDI (i.e. Moldova and Pakistan).

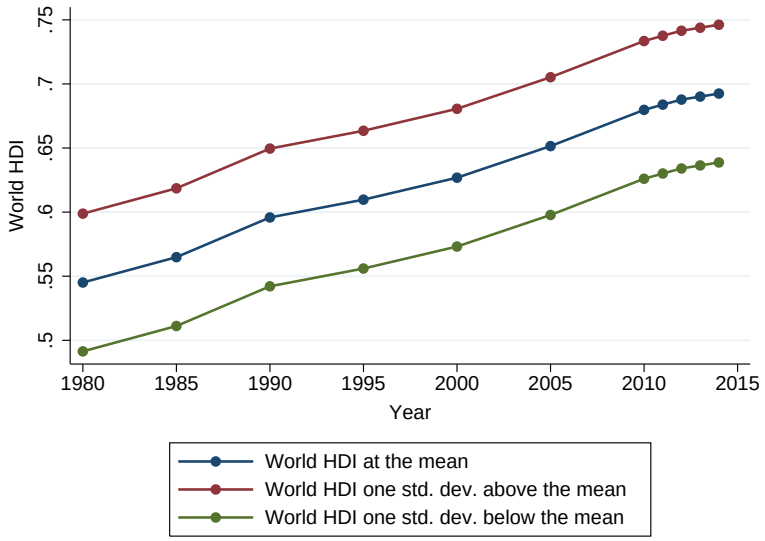
Table 1: Comparison of GDP per capita in PPP terms (in current international $) and the HDI (2014) for a choice of countries.

Country	**GDP per capita (PPP)**	**HDI**
Croatia	21635	0.818
Kuwait	73513	0.816
Vietnam	5650	0.666
South Africa	13083	0.666
Moldova	5010	0.693
Pakistan	4829	0.538
Romania	20372	0.793
Gabon	19501	0.684

Source: World Bank's World Development Indicators (WB 2016) database, United Nations Development Programme (2015a) and United Nations Development Programme (2016).

Figure 1 presents the development of the world HDI from 1980 to 2014 based on data from United Nations Development Programme (2015a) and United Nations Development Programme (2016). World HDI has constantly risen for the whole time period observed.

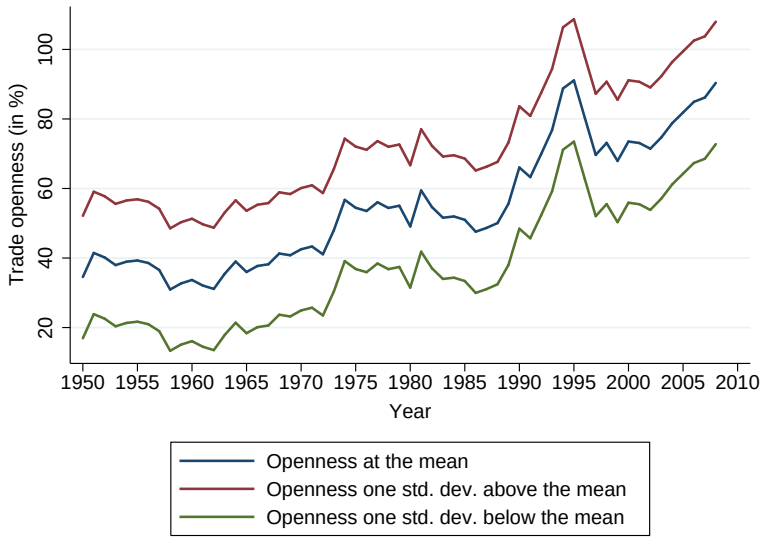
Figure 1: Development of the world HDI from 1980 to 2014.



Note: World HDI is the mean of the HDI for all countries for given year based on data from United Nations Development Programme (2015a) and United Nations Development Programme (2016).

Development of trade openness being the sum of nominal imports and exports over GDP for the period of 1950 to 2008 provided by Eppinger and Potrafke (2015) is demonstrated in Figure 2. Trade openness as well shows a constant upwards trend for the past decades.

Figure 2: Development of observed trade openness from 1950 to 2008.



Note: Trade openness is the sum of nominal imports and exports over GDP. The graph is based on observed trade openness provided by Eppinger and Potrafke (2015) and is the preferred variable for observed openness in the following analysis.

The inevitable successive question to ask is: Is the increase of the HDI over time associated with the rise in trade openness? This thesis sets out to assess this exact question. The empirical strategy of this thesis is orientated towards Felbermayr and Gröschl (2013) employing a panel data set covering a large number of countries and two time periods, 1960 to 2008 and 1976 to 2010, depending on the availability of data for the respective variables used in the regressions. The core of this thesis' analysis constitutes instrumental variable and two stages least squares estimation. The ambition of this thesis is to assess the effect of trade openness on human development, represented by the HDI. Since trade openness is likely to be an endogenous explanatory variable, an instrument for observed trade openness is required. The required instrument comes from Felbermayr and Gröschl (2013) who modify the instrument of Frankel and Romer (1999) to a time-varying variant, based on the fact that natural disasters have a significant impact on trade flows. The effect of large-scale natural disasters on the HDI will also be briefly discussed.

The analysis does not report a significant impact of trade openness on the HDI. Decomposing the HDI in the sensitivity analysis and regressing its components individually on trade openness and other variables does not change the results much. Soley a significant positive effect of trade openness on per capita GDP is found, as reported by Felbermayr and Gröschl (2013) and Frankel and Romer (1999) in previous research.

Section 2 discusses literature related to this thesis's topic; Section 3 introduces the HDI, offers criticism toward the HDI and presents other variables and the data used in the regression analysis; Section 4 explains the empirical strategy and methods ap-

plied in this thesis and presents the instrument designed by Felbermayr and Gröschl (2013); Section 5 reports results from regressions of income on trade openness; Section 6 presents the results of regressions of the HDI on trade openness; Section 7 checks the robustness of the previously reported results; and finally, Section 8 concludes.

2. Literature Review

Literature on trade and standard of living is plentiful. Therefore, the present literature review choses a quite narrow focus and reviews predominantly literature that has been consulted during the preparation of this thesis.

The most important literature related to this thesis is the work published by Felbermayr and Gröschl (2013) assessing the relation of trade openness and per capita income in a panel framework using instrumental variable estimation in order to disclose the true effect of openness on per capita income. They find a significant positive effect of openness on per capita income in virtually all their regressions and samples. The effect, however, being smaller than reported by previous research. Their instrument for observed trade openness originates from Frankel and Romer (1999), yet another renowned paper that uses the geographic component of trade to construct the instrument for trade openness. Frankel and Romer (1999) find a significant positive effect of trade on per capita income. Other reseach has confirmed their results (Noguer and Siscart 2005), but yet others found that the effect is not robust to the inclusion of further controls (Rodrik et al. 2004; Rodriguez and Rodrik 2001). Felbermayr and Gröschl (2013) use exogenous large-scale natural disasters to construct the instrument with time variation since they are able to show that disasters affect trade flows. Gassebner et al. (2010) and Oh and Reuveny (2010) present more empirical evidence on the impact of natural disasters on international trade. Gassebner et al. (2010) find a significant negative effect of major disasters on import and export flows, driving forces determining the impact of disasters being the level of democracy and a country's geographic size. Oh and Reuveny (2010) claim that if climate change increases the incidence of climatic disasters, as the scientific community suggests, then growth of economic globalization may decline.

Academic and scientific literature have discussed and approached the HDI a lot since its introduction in 1990. In a quite recent article, for instance, Klugman et al. (2011) comprehensively discuss the concept and key insights gained from the HDI, review current and past critiques and also explain the major modifications of the HDI formula and indicators in 2010. One point of criticism is the choice of variables included in the HDI, as the HDI only includes three dimensions of human development but excludes many others, such as equality, human rights, political freedom, happiness or sustainability.

They state an interesting idea: One should not recommend societies to maximize the HDI as this would imply to maximize the indicators included in the HDI and attributing zero weight to variables that are excluded from the HDI. More detailed criticism toward the HDI may be found in Section 3.2. Criticism of the Human Development Index.
Literature also exists on the topic of trade and human development. Davies and Quinlivan (2006) discuss the relation of trade and the HDI in a multi-country panel setup and find a positive effect of trade on social welfare in the long run. They also point to the urgent need of further studies in other fields related to social welfare, such as poverty, empowerment or gender equality. Ranis et al. (2000) also approaches the topic of economic growth and human development pointing out that they both form two chains. He finds a significant relation in both directions. He particularly stresses the importance of public expenditures on health and education in the human development to economic growth chain and the significance of the investment rate and income distribution in the human development to economic growth chain.

3. Variables and Data

3.1. The Human Development Index

The idea for a summary index for human development has been introduced predominantly by the Pakistani economist Mahbub ul Haq in 1990. He and his colleagues argued that there is more to standard of living than only economic growth putting the achievements in key dimensions of human development of a country in the focus. Mahbub ul Haq noted that "[a]ny measure that values a gun several hundred times more than a bottle of milk is bound to raise serious questions about its relevance for human progress." (Klugman et al. 2011, p. 250). Supported by the concept of capabilities advocated by Sen (1979), human development has been defined as enlarging people's choices, as written in the first Human Development Report in 1990 (United Nations Development Programme 1990, p. 10). Therefore, they developed the Human Development Index (HDI), a composite measure for achievements in key dimensions of human development. The HDI has been published annually in the United Nations Human Development Programme's Human Development Reports (HDR) since 1990 (United Nations Development Programme 2015a). The present section explains the construction of the HDI based on the modifications introduced in 2010. Before, the HDI has been constructed differently in regards to the functional form, the weights of the individual dimensions and indicators used to compute the HDI (Klugman et al. 2011, p. 251).
The HDI accounts for the idea that the level of development of a country is repre-

sented by far more than only per capita income or economic growth alone. The key dimensions of human development included in the HDI are: (1) a long and healthy life, (2) being knowledgeable and (3) having a decent standard of living. The HDI is computed from calculating the geometric mean of three individual indices representing three key dimensions of human development. The indicator for a long and healthy life is life expectancy at birth, the indicators for knowledge are mean years of schooling and expected years of schooling and the indicator for a decent standard of living is gross national income (GNI) per capita in PPP.

The methodology on calculating the HDI is based on United Nations Development Programme (2015c). Calculating the HDI takes two steps. In the first step, the dimension indices are computed. Therefore, minimum and maximum values are set for each subindex in order to transform the data measured in different units into indices normalized between one and zero. In the HDR 2015, life expectancy at birth has a minimum value of 20 years and a maximum value of 85 years, justified by historical evidence (Oeppen and Vaupel 2002; Maddison 2010; Riley 2005). The minimum values for the schooling indices are zero because societies can exist and function without any education at all. The maximum value of mean years of schooling is set to 15, whereas the maximum value for expected years of schooling is set to 18, which is equivalent to achieving a master's degree in many countries around the world. For GNI per capita, the minimum value is set to \$100 and the maximum value to \$75.000. Research has shown that there is virtually no additional gain for human development from income that exceeds \$75.000 annually (Kahneman and Deaton 2010). Now that the minimum and maximum value are defined, the individual dimension indices may be calculated with the formula

$$Dimension\ index = \frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value}. \tag{1}$$

Because the education dimension consists of two indicators, equation (1) is first applied independently to each of the education indicators and then the arithmetic mean of the two resulting indices is calculated afterwards. For the income dimension, the natural logarithm is used in order to account for the diminishing effect of increasing income.

In the second step, the geometric mean is used to calculate the HDI from the previously obtained subindices. The equation specifies as

$$HDI = (life\ expectancy\ index * education\ index * income\ index)^{\frac{1}{3}}. \tag{2}$$

As a matter of fact, certain data for a certain number of countries are missing. This is why the Human Development Report Office calculates the missing GNI per capita values in two subsequent steps. First, nominal GNI per capita data are converted into

PPP terms for 2011, which is the base year. Second, a time series of GNI per capita in 2011 PPP terms is constructed by applying real growth rates to the GNI per capita in 2011 PPP terms data.
For some countries, one of the education indicators may be missing. Therefore, the Human Development Report Office has estimated the missing values using cross-country regression models. In the HDR 2015, the indicator on expected years of schooling has been estimated for the Bahamas, Haiti, Papua New Guinea and South Sudan. The indicator for mean years of schooling has been estimated for Antigua and Barbuda, Cape Verde, Dominica, Eritrea, Grenada, Guinea-Bissau, Kiribati, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Seychelles and Turkmenistan.
Besides, the HDI is grouped in four categories representing different levels of human development, respectively, as shown in Table 2.

Table 2: The four categories of human development as specified by the United Nations Development Programme.

Level of human development	**HDI range**
Very high human development	0.800 and above
High human development	0.700-0.799
Medium human development	0.550-0.699
Low human development	Below 0.550

Source: United Nations Development Programme (2015c).

Although the HDI constitutes a summary measure of achievements in key dimensions of human development, it does yet not capture the full picture. When assessing human development, other aspects as well have to be considered in order to get a fuller insight on this topic. The United Nations Human Development Programme's Human Development Reports include further indices that deliver information on other aspects of human development, such as inequalities (i.e. gender inequality), poverty, human security, empowerment, etc. (United Nations Development Programme 2015a).
Another specialty of the HDI is that the HDI published in Human Development Reports from different years may not be compared. This is because the basis of calculation is adjusted for every single Human Development Report every year. Data on the HDI therefore used in this thesis's analysis therefore stem from the Human Development Report 2015 and the beta version of the HDR Data Tools 2015 exclusively in order to guarantee a valid analysis (United Nations Development Programme 2015a; 2016). The HDI is available in five-year intervals from 1980 to 2010 and annually from 2011 to 2014. These characteristics of the HDI data restrict the panel analysis to the period of 1980 to 2010 for the regressions using the HDI as the dependent variable.

3.2. Criticism toward the Human Development Index

Even though the HDI is likely to be the most popular composite index for human development and has been discussed extensively by economists and policymakers, the list of criticism is long. Therefore, only a selection of papers that offer criticism is presented in this section.

In their paper, Sagar and Najam (1998) take a critical stance toward the HDI arguing that ecological considerations and environmental sustainability are not paid sufficient attention to. They also criticize that the HDI only evaluates national performance of countries and does not pay much attention to development on a global level. Their suggestions to improve the HDI (geometric mean instead of arithmetic mean in the HDI formula, logarithmic treatment of income dimension and inequality considerations) have been incorporated in the 2010 revision of the HDI. They ask the question: "(...) human development, but at what cost?" (Sagar and Najam 1998, p. 263). What they mean by this is that countries like Brazil or Indonesia have improved their HDI rank substantially by turning their national capital into income at the expense of the environment to a certain extent, though.

Ravallion (1997) criticizes the vague definition of the HDI's target in its early years. He claims that the HDI's target of enlarging people's choices might as well serve as a rational to promote economic growth. Besides, he claims, that when talking about enlarging choices, one has to think about whose choices and choices over what matter for policy decisions in the end. Ravallion (2012) revisits the HDI after its major modifications in 2010 and offers new criticism. He points out troubling trade-offs in the new HDI, namely the reduction of the implicit weight on longevity in poor countries relative to rich ones and the unreasonably high valuation of gains from extra schooling.

Generally saying, the choice of indicators included in the HDI, the lack of attention toward sustainability and environmental considerations and theoretical issues concerning the calculation of the HDI are named oftentimes in the critiques. Further literature on criticism toward the HDI include Bagolin and Comim (2008), Bagolin (2004), Neumayer (2001), Noorbakhsh (1998) and McGillivray (1991).

3.3. Other Dependent, Explanatory and Control Variables

The other variables used in the regression analysis combine several different sources. Real GDP per capita in purchasing power parity terms and observed trade openness stem from the Penn World Table 7.1 database (Zeileis and Yang 2013). Population data have been taken from the World Bank's World Development Indicators (WB 2016) database. Data on natural disasters come from the Centre for Research on the Epidemiology of Disasters' (CRED) Emergency Events Database EM-DAT (D. Guha-Sapir 2016) database. The decision rule for large-scale disasters is following the one

applied by Felbermayr and Gröschl (2013).
Observed trade openness, predicted trade openness and different variants of the instrument computed by Felbermayr and Gröschl (2013) have been kindly provided by Eppinger and Potrafke (2015).
Data on GNI per capita in purchasing power parity terms combine two sources. For the years 1980 and 1985 data are taken from the Human Development Report Office's own calculations. Life expectancy at birth data stem from the World Bank's World Development Indicators (WB 2016) database. Mean years of schooling come from the Barro and Lee (2013) dataset. Expected years of schooling are taken from the Humanitarian Data Exchange (United Nations Development Programme 2015b) data platform, which is managed by the United Nations Office for the Coordination of Humanitarian Affairs. Categorization of different geographic regions follows the World Bank's (WB 2016) categorization. Country categorization according to income levels are based on GNI per capita data based on the Atlas Method taken from the World Bank's World Development Indicators (WB 2016) database. OECD and WTO membership data are taken from the Organization of Economic Co-operation and Development (Organisation for Economic Co-operation & Development 2016) and the World Trade Organization (World Trade Organization 2016), respectively. Polity Index data stem from the Polity IV Project (Marshall et al. 2015) and are transformed to a scale ranging from 1 to 21 (21 being the most autocratic and 1 being the most democratic country) according to Gurr and Moore (2003). Categorization of human development levels based on the HDI follows the baseline of United Nations Development Programme (2015a).
Three different country samples are mainly used in the regression analysis as done by Felbermayr and Gröschl (2013). The MRW sample as suggested by N. Gregory Mankiw (1992) omitts countries that have been part of the Soviet Union or have been Soviet satellite states. The MRW sample also excludes countries for which oil production constitutes a major share of GDP and trade due to the resulting bias. The MRW Intermediate sample, also suggested by N. Gregory Mankiw (1992), includes slightly less countries, additionally excluding those countries for which the data are likely to be subject to measurement error. The samples suggested by N. Gregory Mankiw (1992) are well-established in the growth context. The third (full) sample includes 162 countries for which data have been available; the MRW sample contains 94 and the MRW Intermediate sample 72 countries, respectively. Due to the fact that data are missing for some variables for certain countries and time periods, the actual number of countries included in a specific regression is subject to variation. Therefore, the exact number of countries included in a specific regression is reported explicitly in the corresponding table containing the regression results.

4. Empirical Strategy and Methods

As an introduction to this thesis' empirical strategy, first instrumental variables estimation and two stage least squares estimation are explained briefly. Then, the construction of the instrument computed by Felbermayr and Gröschl (2013) is presented.

4.1. IV Estimation and 2SLS Estimation

Instrumental variables estimation constitutes the core of this thesis' empirical strategy and analysis. The following brief overview on instrumental variables estimation is based on Wooldridge (2013).

When dealing with omitted variables or unobserved heterogeneity, there are different ways to deal with this issue. The present section presents instrumental variables estimation as a solution for omitted variable bias and the occurrence of endogenous explanatory variables. In order to demonstrate the issue, consider a simple regression equation that specifies as

$$y = \beta_0 + \beta_1 x + \varepsilon. \tag{3}$$

The assumption is that the explanatory variable x is correlated with the error term ε. Estimating equation (3) with OLS therefore consequently yields biased and inconsistent estimates. In order to be able to obtain unbiased and consistent estimates, a variable, say z, is required. z has to satisfy two conditions: (1) z has to be exogenous, which means that z has to be uncorrelated with the error term ε and (2) z has to be relevant, which means that z and the explanatory variable x have to be correlated. If z satisfies these two conditions, z may be called an instrumental variable (IV) or instrument for the endogenous explanatory variable x. The first condition, instrument relevance, can be tested statistically. The second condition, instrument exogeneity, however, cannot be tested statistically, so economic theory and common sense have to be applied in order to satisfy the exogeneity condition adequately. It oftentimes may be difficult to find an appropriate IV and instruments may be only weakly correlated with the endogenous explanatory variables. The last issue refers to the problem of weak instruments, which is addressed later on in this thesis.

In IV estimation, the R^2 cannot be interpreted as usual. It even may be negative unlike when using OLS estimation. This is because the sum of squared residuals (SSR) may actually be greater than the total sum of squares (SST)[1]. Therefore, the R^2 obtained

[1] Total sum of squares is the explained sum of squares plus the residual sum of squares. The variation in x is the total sum of squares. The variation in $\hat{x}$ is the explained sum of squares from the first stage (Wooldridge 2013)

from IV estimation is not very useful. The R^2 is still reported in the upcoming regressions though. Since the usual R^2 is not very useful, instrument relevance is assessed upon by the partial R^2, which indicates the partial correlation of the IV and the endogenous explanatory variable.
In order to apply IV estimation and to receive the IV estimator, two stage least squares (2SLS) estimation is required, from which the 2SLS estimator may be obtained. As the name implies, 2SLS consists of two stages, both applying OLS estimation. In the first stage, the endogenous explanatory variable x is regressed on all instrumental variables as shown in equation (4). In this case, the only IV is z.

$$\hat{x} = \gamma_0 + \gamma_1 z \tag{4}$$

Then, the fitted values for $\hat{x}$ are obtained. In the second stage, these fitted values $\hat{x}$ are then plugged into the original model, namely equation (5), substituting the endogenous explanatory variable x.

$$y = \beta_0 + \beta_1 \hat{x} + \varepsilon \tag{5}$$

In this manner, unbiased and consistent estimates may be obtained despite the presence of endogenous explanatory variables, given the IV satisfies the relevance and exogeneity conditions.

4.2. The Instrument of Felbermayr and Gröschl (2013)

The present section presents the empirical strategy of Felbermayr and Gröschl (2013) and shows how they constructed their instrument for trade openness. At the beginning, they specify their main regression equation as

$$\ln \bar{y}_\tau^i = \beta OPEN_\tau^i + \pi \ln POP_\tau^i + \sum_{s \leq \tau} \chi_s D_s^i + \nu^i + \nu_\tau + \varepsilon_\tau^i. \tag{6}$$

This equation originates from equation (4) of Frankel and Romer (1999) but additionally includes the terms $\sum_{s \leq \tau} \chi_s D_s^i$, ν^i and ν_τ. Natural disasters are absent in Frankel and Romer (1999) equation (4) as are fixed effects due to the fact that they estimate their equation on cross-country and not panel data. Equation (6) explains log per capita income in PPP terms $\ln \bar{y}_\tau^i$ as a function of observed trade openness $OPEN_\tau^i$ (sum of nominal imports and exports over GDP). The natural logarithm of population $\ln POP_\tau^i$ is a proxy for market size, which captures the extent to which individuals trade with other individuals within their country of residence. The effect of contemporaneous and lagged domestic natural disasters on per capita income is accounted for by the term $\sum_{s \leq \tau} \chi_s D_s^i$. Felbermayr and Gröschl (2013) include a full array of country

fixed effects ν^i in order to account for country-specific and time-invariant determinants of trade openness[2] and GDP per capita[3]. By including period dummies ν_τ, they control for common period effects. τ denotes five-year averages and purges the data from the influence of business cycles.

Felbermayr and Gröschl (2013) argue that in equation (6) openness to trade $OPEN^i_\tau$ is likely to be correlated with the error term ε^i_τ. This means, that $OPEN^i_\tau$ is an endogenous explanatory variable and this causes an endogeneity bias when estimating equation (6) with OLS, yielding biased und inconsistent estimates. Felbermayr and Gröschl (2013) name a number of reasons why $OPEN^i_\tau$ is likely to be an endogenous explanatory variable. The first reason is reverse causality: If richer countries are more open to international trade (i.e. since they are likely to have lower trade barriers), estimating equation (6) by OLS yields upwards biased estimates for the coefficient of $OPEN^i_\tau$. They also argue that $OPEN^i_\tau$ is likely to be a noisy proxy for the true role trade plays in the determination of per capita income, which biases the coefficient downwards when using OLS estimation. A third reason might be omitted variable bias. The instrument constructed by Frankel and Romer (1999), for instance, is not robust to the inclusion of additional geographic control variables (i.e. distance to the equator) as shown by Rodriguez and Rodrik (2001). In order to control for these country-specific observed and unobserved characteristics, Felbermayr and Gröschl (2013) include country fixed effects, which is possible as they use panel data. Since the original instrument proposed by Frankel and Romer (1999) cannot be employed in a panel setup[4], Felbermayr and Gröschl (2013) introduce an instrument that has time variation. They exploit the fact that natural disasters affect bilateral trade flows as they show in their work.

Before Felbermayr and Gröschl (2013) describe the construction of their instrument, they use a standard gravity regression to show that large natural disasters exert an economically substantial and statistically significant effect on trade flows. They estimate a gravity equation using the Pseudo Poisson Maximum Likelihood (PPML) approach in order to account for zero trade flows as they are frequent particularly in the early years of their data. Their presumption is that natural disasters have a direct positive effect on imports of country i and a negative effect on exports from country i to country j. This effect is conditional to openness to international trade and international finance.

[2] They name geographic characteristics as an example.

[3] Here they name proxies for institutional quality, such as distance to the equator or settler mortality.

[4] Frankel and Romer (1999) construct the instrument from the geographic component of trade. But geographic characteristics do not vary over time.

The gravity equation Felbermayr and Gröschl (2013) estimate has the form

$$\begin{aligned} M_t^{ij} = exp[&\delta_1 D_t^i + \delta_2 D_t^j + \gamma_1 \ln FINDIST^i * D_t^i + \gamma_2 \ln FINDIST^j * D_t^i \\ &+\gamma_3 \ln DIST^{ij} * D_t^i + \gamma_4 \ln(y_t^i/y_t^j) * D_t^i + \gamma_5 \ln FINDIST^i * D_t^j \\ &+\gamma_6 \ln FINDIST^j * D_t^j + \gamma_7 \ln DIST^{ij} * D_t^j + \gamma_8 \ln(y_t^i/y_t^j) * D_t^j \\ &+\xi_1 \ln GDP_t^i + \xi_2 \ln GDP_t^j + \xi_3 \ln(y_t^i/y_t^j) + \xi_4 FTA_t^{ij} + \xi_5 CU_t^{ij} \\ &+\xi_6 WTO_t^{ij} + \xi_7 MRDIST_t^{ij} + \xi_8 MRADJ_t^{ij} + \nu^{ij} + \nu_t] + \varepsilon_t^{ij}, \end{aligned} \tag{7}$$

where $\ln FINDIST^i$ and $\ln FINDIST^j$ denote measure of a country's international financial remoteness (Rose and Spiegel 2009), $\ln DIST^{ij}$ is the geographical distance between countries i and j and $\ln(y_t^i/y_t^j)$ is the natural logarithm of the ratio of per capita GDP of countries i and j. FTA_t^{ij}, CU_t^{ij} and WTO_t^{ij} are dummy variables that denote joint membership in a regional free trade agreement, a currency union or the World Trade Organization, respectively. $MRDIST_t^{ij}$ is a multilateral resistance term for distance and $MRADJ_t^{ij}$ is a multilateral resistance term for adjacency. Multilateral resistance terms account for the average trade barrier between trade partners (Anderson and Van Wincoop 2003). ν^{ij} is a dummy for each country pair to control for all bilateral time-invariant determinants of trade, ν_t controls for period effects and ε_t^{ij} is the error term.

Felbermayr and Gröschl (2013) report a significant positive effect of natural disasters on imports of country i in all their samples. They also find that the effect is larger the more financially integrated an importer is. Further, they report a negative effect of natural disasters on exports of country j to country i for almost all their samples. This effect tends to vanish the more a country's financial remoteness increases.

In order to construct the instrument, Felbermayr and Gröschl (2013) follow Frankel and Romer (1999) "(...) using a 'modified' gravity equation as a 'data reduction device' (...)" (Felbermayr and Gröschl 2013, p. 21) and regress bilateral trade openness $\omega_t^{ij} = (M_t^{ij} + M_t^{ji})/GDP_t^i$ on variables that are strictly exogenous to country i's real GDP per capita. Exogenous variables include population, natural disasters in *foreign*[5] countries and interaction terms of these disasters with bilateral geographic variables (i.e. distance and adjacency). Bilateral trade openness is specified as

$$\begin{aligned} \omega_t^{ij} = exp[&\delta_3 D_t^j + \gamma_9 \ln FINDIST^j * D_t^j + \gamma_{10} \ln AREA^j * D_t^j + \gamma_{11} \ln POP_t^j * D_t^j \\ &+\gamma_{12} ADJ^{ij} * D_t^j + \zeta_1 \ln POP_t^i + \zeta_2 \ln POP_t^j + \zeta_3 \ln DIST^{ij} + \zeta_4 ADJ^{ij} \\ &+\nu^i + \nu^j + \nu_t] + \varepsilon_t^{ij}, \end{aligned} \tag{8}$$

[5]Only natural disasters in *foreign* countries satisfy the exogeneity condition required to construct a valid IV.

where financial remoteness ($\ln FINDIST^j$), area ($\ln AREA^j$), population ($\ln POP_t^j$) and adjacency (ADJ^{ij}) are included; included exogenous control variables are population ($\ln POP_t^i$ and $\ln POP_t^j$), distance ($\ln DIST^{ij}$) and adjacency (ADJ^{ij}), following Frankel and Romer (1999).

Felbermayr and Gröschl (2013) report a significant negative effect of natural disasters on trade in all their samples. Control variables (i.e. importer and exporter population, distance and adjacency) and interaction terms of natural disasters with other variables (i.e. financial distance, area, population and adjacency) are significant and have the expected signs.

Using the full country sample as their preferred specification, Felbermayr and Gröschl (2013) "[...] construct an exogenous proxy for multilateral trade openness Ω_t^i based on predicted bilateral openness [...]" (Felbermayr and Gröschl 2013, p. 21), namely

$$\Omega_t^i = \sum_{j \neq t} \hat{\omega}_t^{ij}. \tag{9}$$

Computing the averages over five-year intervals, they obtain their instrument Ω_τ^i.

Their key "(...) identifying assumption is that, conditional on second stage controls, *foreign* disasters, population, and bilateral geographic variables have no effect on textit-domestic GDP per capita other than through openness (...)" (Felbermayr and Gröschl 2013, p. 22). As mentioned in the previous section, two conditions are required for the construction of a valid instrument: (1) exogeneity, which implies that the instrument and the error term are uncorrelated and (2) relevance, which implies that the instrument and the endogenous explanatory variable are correlated. Satisfying these conditions, Felbermayr and Gröschl (2013) obtain their instrument for observed trade openness, predicted trade openness Ω_τ^i.

4.3. Empirical Strategy

4.3.1. Second Stage

The current section presents the empirical strategy of this thesis and explains how and why the instrument of Felbermayr and Gröschl (2013) is implemented in this thesis' analysis. The ambition of this thesis is to estimate equation (1) of Felbermayr and Gröschl (2013) but in a modified setup. The equation has been adjusted and is specified as

$$\begin{aligned} hdi_\tau^i = \beta_1 open_\tau^i + \beta_2 \ln pop_\tau^i + \beta_3 largedisaster_\tau^i + \beta_4 largedisaster_{\tau-1}^i \\ + \nu^i + \nu_\tau + \varepsilon_\tau^i, \end{aligned} \tag{10}$$

where hdi_τ^i is the Human Development Index, $open_\tau^i$ is the sum of nominal imports and exports over GDP, $\ln pop_\tau^i$ is the natural logarithm of population used as a proxy for the size of the country-internal market, $largedisaster_\tau^i$ accounts for the effect of contemporaneous large domestic natural disasters and $largedisaster_{\tau-1}^i$ is the lag thereof. τ denotes five-year periods since the HDI is only available in five-year intervals. ν^i and ν_τ are country-specific and period-specific fixed effects respectively. They account for time-invariant country-specific characteristics and common period effects. ε_τ^i is the error term.

The assumption is that $open_\tau^i$ in equation (10) is likely to be correlated with the error term ε_τ^i, so $open_\tau^i$ is an endogenous explanatory variable. Estimating the relation with OLS will therefore yield biased and inconsistent estimates. One possible reason might be reverse causality, implying that countries that are more developed (i.e. countries that have a higher HDI) trade more. This might be the case because more developed countries have designed lower barriers to international trade over time. Another possible reason for reverse causality might be that more developed countries have stronger, well-organized institutions that support international trade and relationships to trade partners. For these reasons, the coefficient β_1 in equation (10) is likely to be biased upwards if the equation is estimated with OLS.

Omitted variable bias might also pose a problem when estimating equation (10) with OLS causing β_1 to be biased as well. It is beyond doubt that human development is probably not only determined by trade openness. Time-variant variables, such as institutional quality or the extent to which a country is democratic or autocratic, might be omitted in equation (10). Other possible omitted variables that might impact human development are infant mortality and government expenditure on health or government expenditure on education. Time-invariant variables that might influence human development might be geographic or historical characteristics, which can be controlled for due to the panel dimension of the data and the inclusion of country and period fixed effects. When is comes to omitted variable bias, the direction of the bias of β_1 might be upward or downward alike. Still, controlling for all conceivable omitted variables is almost impossible and would definitely go beyond the scope of thesis.

Instrumentation is able to deal with the issues of reverse causality and omitted variable bias and therefore instrumental variable estimation and 2SLS estimation are used as methods to analyze the present data set. The applied IV is instrument of Felbermayr and Gröschl (2013) for observed trade openness, introduced and explained in Section 4.2. First, the relation of income and trade openness is estimated using IV and 2SLS estimation in order to find out how instrument of Felbermayr and Gröschl (2013) performs in the present data set. Second, the instrument is used to estimate the relation of human development, the HDI being the dependent variable, and trade openness. Since the HDI captures three different dimensions (health, education and income), it is

decomposed in the sensitivity analysis in order to obtain closer insights on the impact of trade openness on human development.

4.3.2. First Stage

The first stage, corresponding to the second stage introduced in Section 4.3.1., has to include all explanatory variables that are included in the second stage and specifies as

$$\begin{aligned} open_{\tau}^{i} = \beta_1 predictedopen_{\tau}^{i} + \beta_2 predictedopen_{\tau-1}^{i} + \beta_3 \ln pop_{\tau}^{i} \\ +\beta_4 largedisaster_{\tau}^{i} + \beta_5 largedisaster_{\tau-1}^{i} + \nu^{i} + \nu_{\tau} + \varepsilon_{\tau}^{i}, \end{aligned} \tag{11}$$

where $open_{\tau}^{i}$ is observed trade openness (the endogenous explanatory variable from the second stage), $predictedopen_{\tau}^{i}$ is the preferred variant of the instrument[6] of Felbermayr and Gröschl (2013) and $predictedopen_{\tau-1}^{i}$ is the lag thereof, used as a second instrument as the lag is exogenous in the same way as the contemporaneous instrument. $largedisaster_{\tau}^{i}$ and $\beta_5 largedisaster_{\tau-1}^{i}$ account for the effect of contemporaneous and lagged large domestic natural disasters, respectively. As in the second stage, the first stage also includes country and period fixed effects, ν^{i} and ν_{τ}, to control for observed and unobserved heterogeneity. ε_{τ}^{i} is the error term.

There are two important points that need to be mentioned at this stage. Due to restrictions on data availability, two different time periods, a long one, 1960 to 2008, and a shorter one, 1976 to 2008, are used in the 2SLS estimation. As will be shown later, using data averaged over five-year intervals, the preferred variant of the instrument generally performs better in the longer time period; in the shorter time period, using five-year averages, the preferred instrument does not perform very well. The reason might be that the instrument contains important data and information for years that are missing in the shorter time period. Therefore, an alternative variant of the instrument of of Felbermayr and Gröschl (2013) and data cumulated over five-year intervals are used for the shorter time period. The results show that the IV strategy works better this way for the shorter time period. As results from the two different time periods are not directly compared but are rather interpreted and assessed independently (since they individually explore certain topics and since first stage diagnostics improve substantially), this drastic step seems legitimate. It is explicitly reported in the regression tables, which instrument is used and whether averaged or cumulated data are used.

The assumption is that trade openness has a lagged effect on human development. Therefore, five-year intervals are constructed in a way, that the HDI finds itself at the

[6] of Felbermayr and Gröschl (2013) obtain the preferred variant of the instrument from PPML fixed effects regression using exogenous large-scale natural disasters. Exogenous natural disasters are natural disasters in *foreign* countries.

end of a five-year interval in order to account for the lag[7]. The analysis has shown, that for the shorter time period, data averaged over five-year intervals leads to weak instruments. Using middle years (i.e. HDI of 1980 corresponds to data from 1980) yields better results, but using data cumulated over five-year intervals delivers the best first stage diagnostics for the shorter time period.

5. Income and Trade Openness

Before investigating the impact of trade openness on human development, the present section revisits of Felbermayr and Gröschl (2013) and replicates their findings, however, in a slightly different setup. This is done in order to assess the validity and quality of the methods applied to the data set that has been created for this thesis.

5.1. First Stage

Table 3 reports the first stage regressions of the 2SLS analysis using the three different country samples introduced earlier. The fixed effects within estimator is applied to five-year averages of the data and the preferred variant of the instrument is used. The major difference to the analysis of of Felbermayr and Gröschl (2013) is the different time period. of Felbermayr and Gröschl (2013) study the time period of 1950 to 2008; the data set used in this thesis covers the maximum time period of 1960 to 2008. This is due to restrictions on data availability. Nevertheless, the instrument performs well in this setup as the first stage diagnostics show. The estimated coefficients of predicted trade openness are significant at the 1% level in all three samples, which implies that predicted trade openness and observed trade openness are correlated; the instrument is relevant.

Following of Felbermayr and Gröschl (2013), the one period lag of predicted trade openness is also used as an IV for observed trade openness. The lag of predicted trade openness can be used as an additional instrument because predicted trade openness is strictly exogenous to income[8] and so will be the lag of predicted trade openness consequently. The lag is, however, only included in the MRW and MRW Intermediate samples and excluded in the full country sample because the sample including all countries is strongly unbalanced. In the present case, the one period lag of predicted trade openness is significant at the 5% level; it has been significant at the 1% level in the analysis conducted by of Felbermayr and Gröschl (2013) though.

The partial R^2 reported in Table 3 denotes the marginal contribution of the instrument in explaining the variation in the dependent variable. For columns (1) and (2) the

[7]For example, the HDI in 1980 corresponds to the five-year interval of 1976 to 1980.

[8]This is since the instrument has been constructed to satisfy the exogeneity condition.

partial R^2 is satisfactory while it is surprisingly high in column (3). of Felbermayr and Gröschl (2013) report similar values for the partial R^2 for the MRW and MRW Intermediate samples; for the full country sample, however, they report a partial R^2 of only 0.04, which is noticeably lower than the one reported in the present analysis.
Another first stage diagnostic to assess the instrument's performance is the F-Test on the excluded instrument. For all three samples, the values of the F-Test are above the Stock and Yogo (2005) critical values. Therefore, the weak instrument hypothesis can be rejected at the 10% level for all three samples. In the case of of Felbermayr and Gröschl (2013)), the weak instrument hypothesis is rejected at the 10% level only for the MRW and MRW Intermediate samples; rejection of the null hypothesis for the full country sample is possible only at the 20% level.
In contrast to the results reported by of Felbermayr and Gröschl (2013), population and lagged large natural disasters have no significant effect on observed trade openness in the present analysis. One exception is the coefficient of population in the MRW sample; it is significant at the 10% level, having a different sign than the coefficient reported by of Felbermayr and Gröschl (2013) though. The other exception is the coefficient of lagged large disasters in the full country sample. It has the same sign and level of significance as the coefficient reported by of Felbermayr and Gröschl (2013).
In general, the results reported in the present section are similar to the ones reported by of Felbermayr and Gröschl (2013) in regards to the signs and significance levels of predicted trade openness and the lag thereof. Same applies to the diagnostics to assess the IV's performance. There are, however, differences in regards to population and lagged large disasters. These differences are likely to be due to the shorter period covered by the present data set. It seems like the additional years of the data set employed by of Felbermayr and Gröschl (2013) contain relevant data and information that is missing in the present analysis.

Table 3: First stage income section (per capita GDP) (1960-2008; fixed-effects estimates, 5-year averages)

Dependent variable: Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)			
	(1) MRW	(2) MRW I	(3) Full
Predicted openness	0.669***	0.608***	0.619***
	(0.0894)	(0.0537)	(0.137)
Lagged predicted openness	0.198**	0.233**	
	(0.0912)	(0.112)	
ln population	9.280*	5.644	-7.300
	(5.372)	(6.435)	(7.645)
Large disasters	0.422	0.554	1.462**
	(0.567)	(0.567)	(0.595)
Lagged large disasters	1.038*	0.958	0.354
	(0.606)	(0.654)	(0.635)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	819	638	1252
R^2	0.526	0.533	0.249
Partial R^2	0.213	0.193	0.627
F-Test on excluded instrument	41.10	89.62	20.54

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

5.2. Second Stage

This section reports the results obtained from the second stage of the 2SLS analysis using the instrument of of Felbermayr and Gröschl (2013) for predicted trade openness as an instrument for observed trade openness. Table 4 compares the results obtained from using OLS and 2SLS estimation. Columns (1), (3) and (5) report the 2SLS results; columns (2), (4) and (6) report the results obtained from OLS estimation. Columns (1) and (2) employ the MRW sample, columns (3) and (4) the MRW Intermediate sample and columns (5) and (6) use the full country sample.

Table 4: Second stage income section (per capita GDP) (1960-2008; fixed-effects estimates, 5-year averages)

Dependent variable: ln real GDP per capita in PPP terms Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.00938***	0.00382***	0.00974***	0.00473***	0.00752***	0.000937
	(0.00193)	(0.00136)	(0.00139)	(0.00140)	(0.00246)	(0.000776)
ln population	-0.832***	-0.799***	-0.694***	-0.670***	-0.540***	-0.602***
	(0.124)	(0.116)	(0.107)	(0.104)	(0.128)	(0.118)
Large disasters	-0.00131	-0.00214	-0.00897	-0.00898	0.0329**	0.0439***
	(0.0142)	(0.0139)	(0.0143)	(0.0140)	(0.0154)	(0.0156)
Lagged large disasters	0.0109	0.0108	0.0106	0.00989	0.0298**	0.0282**
	(0.0136)	(0.0119)	(0.0150)	(0.0126)	(0.0119)	(0.0122)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	819	819	638	638	1252	1252
Countries	94	94	72	72	162	162
R^2	0.449	0.512	0.585	0.634	0.264	0.467
Partial R^2	0.213		0.193		0.627	
F-Test on excluded instrument	41.10		89.62		20.54	
Stock and Yogo weak ID test	19.93		19.93		16.38	
Hansen p-value	0.25		0.40			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

The results will not be interpreted in detail at this point as the analysis of of Felbermayr and Gröschl (2013) is more comprehensive covering a longer time period and employing a richer data set. The most important fact here is, that the analysis presented in this thesis does confirm their results. Table 4 reports a significant positive effect of trade openness and a significant negative effect of population on real per capita GDP. It is worth mentioning though that of Felbermayr and Gröschl (2013) found a positive effect of trade openness on real per capita GDP that is smaller than coefficients reported by earlier research (Frankel and Romer 1999). One possible reason being that, in contrast to Frankel and Romer (1999), they are able to include country and period fixed effects in order to control for observed and unobserved time-invariant country and period characteristics since they use panel data.

In the present analysis, there are discrepancies in the signs and significance levels of large disasters and lagged large disasters. In the full country sample for both, 2SLS

and OLS estimation, disasters tend to increase real GDP per capita. of Felbermayr and Gröschl (2013) report significant negative coefficients for lagged large disaster for the MRW and MRW Intermediate samples and a significant positive effect of large disasters in the full country sample in contrast. As before, the present discrepancies may be attributed to the different time period used in the present data.
R^2 and partial R^2 are comfortably high in all regressions and samples, as are the values of the F-Test on the excluded instrument, as noted in the previous section. Having more instruments than endogenous explanatory variables to estimate the coefficients significantly, it is possible to run a test of overidentifying restrictions. The overidentifying restrictions test, whether the instruments are valid instruments (uncorrelated with the error term and correctly excluded from the second stage equation). Under the null hypothesis that all instruments are valid, the null hypothesis fails to reject for the MRW and the MRW Intermediate samples as the p-values are 0.25 and 0.40, respectively.

6. Human Development and Trade Openness

6.1. First Stage

Table 5 reports the first stage results using the alternative instrument in order to account for the shorter time period (1976 to 2008) and the arising issue of weak instruments. The fixed effects within estimator is applied to data cumulated over five-year intervals. Columns (1), (2) and (3) employ the MRW, MRW Intermediate and the full country samples, respectively.
Predicted trade openness is significant at the 1% level and positive in all three samples, whereas lagged predicted openness in not significant in neither of the samples. The other variables population, large disasters and the lag thereof are not significant in neither of the samples as well. R^2 and partial R^2 are comfortably high in all three samples. The weak instrument hypothesis is rejected with the second most stringent criterion for the MRW and MRW Intermediate samples; rejection of the weak instrument hypothesis is possible at the most stringent criterion for the full country sample. Rejection of the weak instrument hypothesis corresponds to the Stock and Yogo (2005) critical values. Additionally, the values of the F-Test are all above the threshold of ten advocated by Staiger and Stock (1997).

Table 5: First stage human development section (HDI) (1976-2008; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)			
	(1) MRW	(2) MRW I	(3) Full
Predicted openness	0.654***	0.654***	0.816***
	(0.146)	(0.170)	(0.127)
Lagged predicted openness	0.00275	-0.127	
	(0.216)	(0.292)	
ln population	1.343	0.894	4.108
	(2.702)	(2.809)	(3.632)
Large disasters	-1.870	-2.002	-0.815
	(1.210)	(1.223)	(0.726)
Lagged large disasters	0.265	0.365	0.496
	(0.458)	(0.546)	(0.706)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	526	412	823
R^2	0.373	0.429	0.423
Partial R^2	0.258	0.245	0.766
F-Test on excluded instrument	14.83	17.53	41.30

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

6.2. Second Stage

Table 6 reports the second stage regressions employing the alternative instrument and using data cumulated over five-year intervals. Columns (1), (3) and (5) report the results obtained from 2SLS estimation, while columns (2), (4) and (6) report the OLS results. The MRW sample is employed in columns (1) and (2), the MRW Intermediate sample in columns (3) and (4) and the full country sample in columns (5) and (6). The second stage covers the same time period as the first stage. But there is a reason why the time period is denoted as 1976 to 2008 in Table 5, but 1976 to 2010 in Table 6. The last five-year interval in the data spans from 2006 to 2010. Data for the instrument are

only available until 2008 and data on the other variables are only used until 2008. The HDI from the Human Development Report 2015, however, is only available for 2010 and not for 2008. So the last five-year interval is shorter than the others in a sense using the HDI of 2010 and data for the instrument and the other variables from 2006 to 2008. This phenomenon occurs in other regressions too, as for some other variables data are also only available in five-year intervals.

Table 6: Second stage human development section (HDI) (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.0000957	-0.0000241	0.0000331	-0.0000161	0.0000459*	0.0000100
	(0.0000617)	(0.0000281)	(0.0000563)	(0.0000357)	(0.0000261)	(0.0000141)
ln population	-0.00223*	-0.00253***	-0.00271***	-0.00288***	-0.000915*	-0.00110*
	(0.00112)	(0.000963)	(0.000999)	(0.000967)	(0.000468)	(0.000560)
Large disasters	0.000191	-0.0000218	-0.000119	-0.000208	0.000195	0.000191
	(0.000329)	(0.000283)	(0.000275)	(0.000238)	(0.000126)	(0.000125)
Lagged large disasters	-0.000536	-0.000474	-0.000565	-0.000537	0.000458	0.000478
	(0.000545)	(0.000586)	(0.000544)	(0.000560)	(0.000397)	(0.000391)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	526	526	412	412	823	823
Countries	93	93	72	72	160	160
R^2	0.820	0.834	0.863	0.865	0.840	0.843
Partial R^2	0.258		0.245		0.766	
F-Test on excluded instrument	14.83		17.53		41.30	
Stock and Yogo weak ID test	11.59		11.59		16.38	
Hansen p-value	0.79		0.68			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

The present analysis does not find a significant effect of observed trade openness on the HDI in literally all regressions and samples. Column (5) is an exception, employing the full country sample and using 2SLS estimation. The effect is significant at the 10% level but only marginal in size. It is not necessarily that trade openness does not have an effect on human development but it might be that in the present context the true contribution of trade openness to the determination of the HDI failed to be revealed. A

reason might be the fact that the HDI is a composite measure of several dimensions of human development, expressed on a scale from zero to one. Therefore, it might be that the effects of trade openness on the individual dimensions cancel out each other or that trade openness does not explain a sufficient amount of variation in the individual dimensions. Davies and Quinlivan (2006), in contrast, report a significant positive effect of trade on the HDI, operating in a panel framework and using generalized methods of moments (GMM) and IV estimation.

Similar to of Felbermayr and Gröschl (2013), who report a significant negative effect of population size, the present analysis also finds a significant negative effect of population size on the HDI, the effect being marginal though. The coefficients imply that with increasing population size the HDI score deteriorates. Large disasters and lagged large disasters have no significant effect in either of the regressions and samples.

Again, an overidentifying restrictions test may be computed, as two instruments are used in the present analysis. Under the null hypothesis that all instruments are valid, the null hypothesis fails to reject for the MRW and the MRW Intermediate samples as the p-values are 0.79 and 0.68, respectively. Since the full country sample is unbalanced, only contemporaneous predicted trade openness is used as an instrument for observed trade openness and so a test of overidentifying restrictions may not be computed for the full country sample, as a minimum of two instruments is required to do so.

The presented results are robust and the instrument performs in an acceptable manner, as the first stage diagnostics reported in Section 6.1. show. It is worth mentioning that the outstandingly high within R^2 is no reason to be particularly jubilant as it originates from the inclusion of period dummies, which explain a major part of the variation by themselves. In IV estimation, the R^2 is not very useful, as explained in Section 4.1. This is the reason why the partial R^2 instead is used to assess the instrument's relevance.

Alternative second stage regressions, employing the preferred instrument and using data averaged over five-year intervals or middle years, may be found in the Appendix' human development section (see Tables 23 and 24 in Section B.1. of the Appendix). Neither of the results are satisfactory though, which is why a closer look is taken at the relationship of the HDI and trade openness in the upcoming sensitivity analysis.

7. Sensitivity Analysis: Decomposing the HDI

7.1. The Human Development Index and its Components

Before exploring the relationship of the HDI's components and trade openness individually, it may be useful to investigate the relation of the HDI and its components

itself in order to assess the quality and validity of the present data set. Regressing (applying the fixed effects within estimator to five-year averages of the data) the HDI on its components, life expectancy at birth, years of schooling and per capita GNI, yields expected significance levels and signs for the coefficients on life expectancy and year of schooling in all three usual samples employed. The coefficient on per capita GNI, however, is insignificant in all three samples. Table 7 shows the corresponding regression output.

Table 7: The HDI and its components (1976-2010; fixed-effects estimates, 5-year averages)

Dependent variable: Human Development Index			
	(1) MRW	(2) MRW I	(3) Full
Life expectancy	0.00567***	0.00572***	0.00590***
	(0.000343)	(0.000382)	(0.000310)
Years of schooling	0.0208***	0.0209***	0.0205***
	(0.00190)	(0.00196)	(0.00186)
ln GNI per capita	-0.000114	-0.000255	0.000408
	(0.000584)	(0.000413)	(0.00102)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	376	302	521
Countries	83	66	120
R^2	0.964	0.969	0.951

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
Years of schooling denote the mean of the sum of mean and expected years of schooling.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Examining the partial correlation of the HDI and its components in Table 8 yields similar results. While life expectancy and years of schooling each correlate strongly with the HDI, per capita GNI does not. Per definition (as explained in Section 3.1.), the HDI and per capita GNI are expected to be positivley correlated. A possible reason for this odd result might be that the present data on per capita GNI are subject to measurement error.

Table 8: Partial correlation of the HDI, life expectancy at birth, years of schooling and ln GNI per capita.

Variables	Partial R^2
Life expectancy	0.666
Years of schooling	0.760
ln GNI per capita	0.083

Conducting the same procedure but using per capita GDP instead of per capita GNI, delivers slightly different results. A regression (again applying the fixed effects within estimator to data averaged over five-year intervals) of the HDI on life expectancy, years of schooling and per capita GDP reports significant positive coefficients for all three variables in all three samples as shown in Table 9.

Table 9: The HDI and its components (1976-2010; fixed-effects estimates, 5-year averages)

Dependent variable: Human Development Index			
	(1) MRW	(2) MRW I	(3) Full
Life expectancy	0.00534***	0.00522***	0.00538***
	(0.000320)	(0.000293)	(0.000301)
Years of schooling	0.0182***	0.0182***	0.0176***
	(0.00161)	(0.00154)	(0.00139)
ln GDP per capita	0.0318***	0.0319***	0.0355***
	(0.00513)	(0.00561)	(0.00504)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	398	316	561
Countries	86	69	129
R^2	0.970	0.976	0.967

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
Years of schooling denote the mean of the sum of mean and expected years of schooling.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

A similar picture arises when investigating partial correlation in Table 10: life expectancy, years of schooling and per capita GDP as well are positivly correlated with the HDI. It is well understood that the HDI and its components are likely to be subject

to multicollinearity but that is meant to be. The present section set out to proof the exact thing.

Table 10: Partial correlation of the HDI, life expectancy at birth, years of schooling and ln GDP per capita.

Variables	Partial R^2
Life expectany	0.562
Years of schooling	0.814
ln GDP per capita	0.654

Per capita GNI and per capita GDP are closely related, since per capita GNI equals per capita GDP plus net income received from abroad. Section 5.2. has already confirmed the significant and robust positive effect of observed trade openness on per capita GDP. Therefore, the fact that the present data on per capita GNI do not correlate with the HDI is not too disappointing. Nevertheless, for reasons of completeness, a regression using per capita GNI as the dependent variable is reported in the income section in the Appendix (see Table 32 in Section B.3.). In the following sections of the sensitivity analysis, closer attention is paid to the HDI's other dimensions health (life expectancy at birth) and education (years of schooling), since the income dimension has been already comprehensively examined in Section 5.

7.2. Life Expectancy at Birth

The health dimension of the HDI is represented by life expectancy at birth, which enters the HDI as an individual index. Table 11 reports the first stage regressions employing the longer time period from 1960 to 2008 applying the fixed effects within estimator to five-year averages of the data. As before, columns (1), (2) and (3) employ the MRW, MRW Intermediate and the full country samples, respectively. Since the first stage reported here is similar to the one reported in Section 5.1, a comprehensive analysis will not be done at this point. The important fact is, that predicted trade openness and lagged predicted trade openness have a significant positive effect on observed trade openness, the partial R^2 has a value that is satisfactory and the values of the F-Test on the excluded instrument are all well above the Stock and Yogo (2005) critical values and the Staiger and Stock (1997) threshold of ten.

Table 11: First stage health section (life expectancy at birth) (1960-2008; fixed-effects estimates, 5-year averages)

Dependent variable: Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)			
	(1) MRW	(2) MRW I	(3) Full
Predicted openness	0.669***	0.608***	0.628***
	(0.0894)	(0.0539)	(0.123)
Lagged predicted openness	0.198**	0.233**	
	(0.0912)	(0.112)	
ln population	9.024*	5.550	-9.849
	(5.303)	(6.360)	(6.796)
Large disasters	0.427	0.553	1.523**
	(0.567)	(0.567)	(0.621)
Lagged large disasters	1.023*	0.956	0.271
	(0.607)	(0.655)	(0.677)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	822	639	1288
R^2	0.526	0.533	0.254
Partial R^2	0.213	0.193	0.621
F-Test on excluded instrument	41.16	89.35	26.04

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 12 reports the results from the corresponding second stage regression. Columns (1), (3) and (5) report the estimates obtained from 2SLS, while OLS estimates are reported in columns (2), (4) and (6). Columns (1) and (2) employ the MRW sample, columns (3) and (4) the MRW Intermediate sample and columns (5) and (6) the full country sample. The fixed effects within estimator is applied to five-year averages of the data and the preferred instrument is used since data are available for the longer time period (1960 to 2008).

Observed trade openness does not have a significant impact on life expectancy at birth in any of the samples and regressions. Population, though, has a positive effect on life expectancy in the MRW Intermediate and full country samples for both 2SLS and OLS

estimation. Large disasters tend to increase life expectancy in the full country sample for both 2SLS and OLS estimation.

Table 12: Second stage health section (life expectancy at birth) (1960-2008; fixed-effects estimates, 5-year averages)

Dependent variable: Life expectancy at birth Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	-0.0338	0.00143	-0.0461	0.00198	-0.0105	0.00284
	(0.0252)	(0.0140)	(0.0322)	(0.0173)	(0.0191)	(0.00518)
ln population	2.471	2.266	3.557*	3.324*	4.002***	4.167***
	(1.548)	(1.478)	(2.063)	(1.943)	(1.066)	(1.066)
Large disasters	-0.00796	-0.00290	-0.0655	-0.0655	0.197**	0.173*
	(0.165)	(0.165)	(0.160)	(0.157)	(0.0940)	(0.0887)
Lagged large disasters	-0.0115	-0.0105	-0.0464	-0.0400	0.00649	0.0118
	(0.198)	(0.194)	(0.190)	(0.188)	(0.123)	(0.122)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	822	822	639	639	1288	1288
Countries	94	94	72	72	162	162
R^2	0.677	0.687	0.701	0.720	0.685	0.689
Partial R^2	0.213		0.193		0.621	
F-Test on excluded instrument	41.16		89.35		26.04	
Stock and Yogo weak ID test	19.93		19.93		16.38	
Hansen p-value	0.18		0.29			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

The results are robust since predicted openness and observed openness are correlated in the first stage as the significant coefficients and the partial R^2 confirm. F-Test values are also above the respective critical values and thresholds. The null hypothesis that the instruments are valid fails to reject for the MRW and MRW Intermediate samples (see p-values of 0.18 and 0.29, respectively). Concluding, trade openness does not have a significant impact on life expectancy at birth, the results being robust.

7.3. Years of Schooling

Years of schooling represent the education dimension of the HDI and are calculated by taking the mean of the sum of mean years of schooling and expected years of schooling. While data on mean years of schooling are available for the time period of 1960 to 2008, data on expected years of schooling are not. This is why years of schooling cover only the shorter time period of 1976 to 2010. Regressions using either mean years of schooling or expected years of schooling exclusively may be found in the education section in the Appendix (see Tables 30 and 31 in Section B.2. of the Appendix).
First stage results applying the fixed effects within estimator to data cumulated over five-year intervals and using the alternative instrument in the time period of 1976 to 2008 are reported in Table 13. Observed openness and predicted openness are positively correlated, as the significant coefficients show. The coefficients on the lag of predicted openness are not significant as are the coefficients on lagged large disasters. Large disasters, though, tend to decrease years of schooling in the MRW and MRW Intermediate samples, while they are insignificant in the full country sample. The partial R^2 confirms relevance of the instrument and correlation between observed openness and predicted openness in all samples. The value of the F-Test for the MRW sample is below the Staiger and Stock (1997) threshold of ten, while the values of the F-Test have satisfactory values for the MRW Intermediate and the full country samples.

Table 13: First stage education section (years of schooling) (1976-2008; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)			
	(1) MRW	(2) MRW I	(3) Full
Predicted openness	0.509***	0.521***	0.835***
	(0.168)	(0.187)	(0.140)
Lagged predicted openness	-0.0465	-0.209	
	(0.248)	(0.320)	
ln population	0.209	-0.0603	3.986
	(3.021)	(3.186)	(4.291)
Large disasters	-1.910*	-2.116*	-0.820
	(1.139)	(1.172)	(0.750)
Lagged large disasters	0.318	0.442	0.419
	(0.478)	(0.599)	(0.718)
Fixed Effects			
Country	Yes	Yes	Yes
Period	Yes	Yes	Yes
N	516	409	757
R^2	0.336	0.394	0.414
Partial R^2	0.245	0.227	0.792
F-Test on excluded instrument	9.49	15.30	35.60

Note: Country clustered standard errors in parentheses.
Constant and fixed effects not reported in order to save space.
Years of schooling denote the mean of the sum of mean and expected years of schooling.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Second stage results for years of schooling as the dependent variable are reported in Table 14. As usual, columns (1), (3) and (5) reports 2SLS results, while columns (2), (4) and (6) report results obtained from OLS estimation. Columns (1) and (2) employ the MRW sample, columns (3) and (4) the MRW Intermediate sample and columns (5) and (6) the full country sample.

As before, when the HDI and life expectancy had been the dependent variables, observed trade openness does not have a significant effect on years of schooling. Population is significantly negatively associated with years of schooling in the MRW sample. All other estimates are insignificant.

The results are robust, as confirmed by the partial R^2 and the values of F-Test on the excluded instrument. Testing for overidentifying restrictions, the null hypothesis that the instruments are valid fails to reject for the MRW and MRW Intermediate samples (see p-values of 0.84 and 0.82, respectively).

Table 14: Second stage education section (years of schooling) (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Years of schooling Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.00476	-0.00137	0.0172	0.00310	-0.00330	-0.00159
	(0.0189)	(0.00491)	(0.0213)	(0.00637)	(0.00547)	(0.00212)
ln population	-0.737**	-0.755**	-0.325	-0.377	-0.0535	-0.0442
	(0.293)	(0.292)	(0.306)	(0.298)	(0.113)	(0.100)
Large disasters	-0.00937	-0.0203	0.00747	-0.0183	-0.0244	-0.0242
	(0.0683)	(0.0562)	(0.0755)	(0.0580)	(0.0409)	(0.0402)
Lagged large disasters	0.00427	0.00722	-0.00662	0.00134	0.0160	0.0152
	(0.0667)	(0.0641)	(0.0709)	(0.0644)	(0.0446)	(0.0443)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	516	516	409	409	757	757
Countries	87	87	69	69	132	132
R^2	0.908	0.909	0.936	0.939	0.916	0.916
Partial R^2	0.245		0.227		0.792	
F-Test on excluded instrument	9.49		15.30		35.60	
Stock and Yogo weak ID test	8.75		11.59		16.38	
Hansen p-value	0.84		0.82			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. *Years of schooling* denote the mean of the sum of mean and expected years of schooling.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Employing the preferred instrument and data averages over five-year intervals, a significant negative effect of trade openness on years of schooling is found. The results are not robust though as the first stage diagnostics show.

Decomposing years of schooling into its components, a different picture emerges. Table 30 in the Appendix's education section (Section B.2.) employs mean years of schooling as the dependent variable and reports a significant positive effect of observed trade openness on mean years of schooling. In contrast, Table 31 in the same section in

the Appendix employs expected years of schooling as the dependent variable and reports no significant effect of observed trade openness on expected years of schooling. Employing panel data of 102 countries and 45 years, Blanchard et al. (2015) report a negative relation of growth in less skill-intensive exports and educational attainment and a positive relation of growth in skill-intensive exports and schooling.
It needs to be mentioned that the results obtained in the regression using expected years of schooling are not robust since the instrument performs weakly. This is probably due to the usage of data averaged over five-year intervals in the short period of 1976 to 2010. Employing data cumulated over five-year intervals instead drastically improves the first stage diagnostics but the significant negative effect of observed trade openness on expected years of schooling vanishes. It seems like mean and expected years of schooling are combined in a single variable, the opposing effects seem to cancel each other out.

7.4. Further Sensitivity Checks

The Appendix contains a whole range of variations of regressions that try to confirm the robustness of the previously reported results. To save space and for reasons of redundancy, first stage regressions are not reported in the Appendix. It suffices to mention that the preferred instrument performs well when using data averaged over five-year intervals and the time period of 1960 to 2008. The alternative instrument is used for the shorter time period of 1976 to 2010 and when data cumulated over five-year intervals are employed in order to avoid the problematic issue of weak instruments and non-robust estimates. First stage diagnostics are still reported in the second stage regression tables.
For instance, the human development section of the Appendix contains a regression that includes the polity index as an additional control variable (see Table 25 in the Appendix Section B.1.). The results obtained from this regression confirm the results reported in Section 6.: Observed trade openness has no significant effect on the HDI while population size has a negative one, the results being robust. Table 25 also reports significant negative coefficients for the Polity Index, implying that the more autocratic a country the lower the HDI.
Using different samples, selecting for geographic regions, human development levels or income levels do not disclose any unexpected insights on the relation of trade openness and the HDI so far. Interestingly, selecting for OECD and non-OECD member countries, a significant positive, though marginal, effect of trade openness on the HDI is reported for non-OECD member countries (see Table 28 in the Appendix Section B.1.).

8. Conclusion

The question that has been posed at the beginning of this thesis has been, whether trade opennes has an effect on human development, measured by the Human Development Index. Operating in a panel setup and employing an instrument for observed trade openness in order to deal with endogeneity and omitted variables bias, the analysis does not find a significant effect of trade openness on the HDI. Estimates on trade openness in regressions employing the HDI's components as dependent variables remain insignificant in the majority of cases. Yet, a significant positive relation of trade openness and per capita GDP is confirmed. The fact that the present analysis does not find a significant effect of trade openness on the HDI does not necessarily mean that there is no such effect at all. This thesis choses a rather narrow focus by employing the HDI as the dependent variable in its main regressions. The HDI as a measure for human development is far from being perfect. This is since the HDI itself only allows a narrow analysis of human development including soley three dimensions, trying to capture the extensive dimension of human development. Beyond doubt, there are by far more aspects that need to be considered in order to be able to see a fuller picture. Inequality, sustainability, poverty and empowerment are just a few of many more aspects to be considered in detail in future research.

The present analysis only scratches on the surface in another sense as well. In the limited amount of time and space, the sheer variety of different specifications and modifications one could think of when assessing the relationship of trade openness and human development are not fully exploited. Including different control variables and investigating the impact of trade on human development in more specific samples, regions or time periods might be a beginning. The ambition of this thesis is to give an insight on the potential for further research in the area of human development and trade openness confirming some previously found results and giving rise to new open questions on this topic.

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Appendices

A. Descriptives

A.1. Summary statistics of data sets

Table 15: Summary statistics of MRW sample 1960 to 2008.

Variable	Obs	Mean	Std. Dev.
ln GDP per capita	932	8.156	1.332
Life expectancy	940	61.107	12.449
Mean years of schooling	870	5.26	3.285
Observed openness	916	46.35	31.169
Predicted openness	916	46.301	29.56
Lagged predicted openness	823	44.099	27.577
ln population	940	16.286	1.297
Large disasters	940	.252	.861
Lagged large disasters	846	.235	.828

Table 16: Summary statistics of full country sample 1960 to 2008.

Variable	Obs	Mean	Std. Dev.
ln GDP per capita	1405	8.274	1.314
Life expectancy	1620	62.621	11.381
Mean years of schooling	1320	5.781	3.288
Observed openness	1397	55.171	39.06
Predicted openness	1397	55.405	35.262
Lagged predicted openness	1236	52.316	33.128
ln population	1620	15.535	1.824
Large disasters	1620	.215	1.072
Lagged large disasters	1458	.193	.95

Table 17: Summary statistics of MRW Intermediate sample 1960 to 2008.

Variable	Obs	Mean	Std. Dev.
ln GDP per capita	718	8.538	1.243
Life expectancy	720	64.763	11.125
Mean years of schooling	690	6.035	3.157
Observed openness	711	47.63	32.133
Predicted openness	711	47.568	30.618
Lagged predicted openness	639	45.309	28.539
ln population	720	16.473	1.318
Large disasters	720	.303	.975
Lagged large disasters	648	.283	.938

Table 18: Summary statistics of MRW sample 1976 to 2010.

Variable	Obs	Mean	Std. Dev.
HDI	605	.598	.189
ln GDP per capita	651	8.3	1.378
ln GNI per capita	596	8.98	2.861
Life expectancy	651	64.034	11.647
Years of schooling	429	8.55	3.485
Mean years of schooling	609	5.993	3.213
Expected years of schooling	459	10.519	4.024
Observed openness	645	51.292	33.902
Predicted openness	645	52.254	32.379
Lagged predicted openness	553	49.785	30.499
Alternative instrument	645	52.319	32.343
Lagged alternative instrument	553	49.827	30.458
ln population	651	16.464	1.275
Large disasters	651	.306	.99
Lagged large disasters	558	.318	1.024
Polity Index	621	7.967	6.714
WTO	651	.852	.349
OECD	651	.246	.431

Table 19: Summary statistics of MRW Intermediate sample 1976 to 2010.

Variable	Obs	Mean	Std. Dev.
HDI	475	.653	.166
ln GDP per capita	504	8.695	1.272
ln GNI per capita	466	9.433	3.064
Life expectancy	504	67.542	10.11
Years of schooling	344	9.435	3.178
Mean years of schooling	483	6.815	3.005
Expected years of schooling	359	11.627	3.591
Observed openness	499	52.801	34.939
Predicted openness	499	53.899	33.547
Lagged predicted openness	428	51.381	31.567
Alternative instrument	499	53.997	33.533
Lagged alternative instrument	428	51.426	31.525
ln population	504	16.63	1.298
Large disasters	504	.366	1.115
Lagged large disasters	432	.38	1.154
Polity Index	488	6.648	6.431
WTO	504	.862	.339
OECD	504	.318	.466

Table 20: Summary statistics of full country sample 1976 to 2010.

Variable	Obs	Mean	Std. Dev.
HDI	939	.623	.172
ln GDP per capita	1057	8.428	1.327
ln GNI per capita	949	9.082	2.709
Life expectancy	1120	65.394	10.313
Years of schooling	633	9.022	3.267
Mean years of schooling	924	6.576	3.191
Expected years of schooling	763	10.912	3.618
Observed openness	1042	60.932	39.723
Predicted openness	1042	62.545	37.098
Lagged predicted openness	883	59.324	35.093
Alternative instrument	1042	62.559	36.989
Lagged alternative instrument	883	59.327	35.032
ln population	1120	15.703	1.806
Large disasters	1120	.27	1.211
Lagged large disasters	960	.276	1.242
Polity Index	908	9.103	7.069
WTO	1120	.667	.462
OECD	1120	.166	.371

A.2. Samples and Countries

Table 21: Full, MRW and MRW Intermediate samples listing the countries included, respectively, if appropriate data are available.

Full	**MRW**	**MRW Intermediate**
Albania		
Algeria	Algeria	Algeria
Angola	Angola	
Argentina	Argentina	Argentina
Armenia		
Australia	Australia	Australia
Austria	Austria	Austria
Azerbaijan		
Bahamas		
Bahrain		
Bangladesh	Bangladesh	Bangladesh
Barbados		
Belarus		
Belgium	Belgium	Belgium
Belize		
Benin	Benin	
Bolivia	Bolivia	Bolivia
Bosnia and Herzegovina		
Brazil	Brazil	Brazil
Brunei Darussalam		
Bulgaria		
Burkina Faso	Burkina Faso	
Burundi	Burundi	
Cambodia		
Cameroon	Cameroon	Cameroon
Canada	Canada	Canada
Cape Verde		
Central African Republic	Central African Republic	
Chad	Chad	
Chile	Chile	Chile
China		
Colombia	Colombia	Colombia

Continued on next page

Table 21 – *Continued from previous page*

Full	**MRW**	**MRW Intermediate**
Comoros		
Congo, Dem. Rep.	Congo, Dem. Rep.	
Congo, Rep.	Congo, Rep.	
Costa Rica	Costa Rica	Costa Rica
CÃ´te d'Ivoire	CÃ´te d'Ivoire	CÃ´te d'Ivoire
Croatia		
Cuba		
Cyprus		
Czech Republic		
Denmark	Denmark	Denmark
Djibouti		
Dominican Republic	Dominican Republic	Dominican Republic
Ecuador	Ecuador	Ecuador
Egypt	Egypt	
El Salvador	El Salvador	El Salvador
Equatorial Guinea		
Estonia		
Ethiopia	Ethiopia	Ethiopia
Fiji		
Finland	Finland	Finland
France	France	France
Gabon		
Gambia		
Georgia		
Germany	Germany	Germany
Ghana	Ghana	
Greece	Greece	Greece
Guatemala	Guatemala	Guatemala
Guinea		
Guinea-Bissau		
Guyana		
Haiti	Haiti	Haiti
Honduras	Honduras	Honduras
Hungary		
Iceland		

Continued on next page

Table 21 – *Continued from previous page*

Full	**MRW**	**MRW Intermediate**
India	India	India
Indonesia	Indonesia	Indonesia
Iran		
Ireland	Ireland	Ireland
Israel	Israel	Israel
Italy	Italy	Italy
Jamaica	Jamaica	Jamaica
Japan	Japan	Japan
Jordan	Jordan	Jordan
Kazakhstan		
Kenya	Kenya	Kenya
Korea, Rep.	Korea, Rep.	Korea, Rep.
Kuwait		
Kyrgyzstan		
Laos		
Latvia		
Lebanon		
Libya		
Lithuania		
Luxembourg		
Macedonia		
Madagascar	Madagascr	Madagascar
Malawi	Malawi	Malawi
Malaysia	Malaysia	Malaysia
Maldives		
Mali	Mali	Mali
Malta		
Mauritania	Mauritania	
Mauritius	Mauritius	
Mexico	Mexico	Mexico
Moldova		
Mongolia		
Morocco	Morocco	Morocco
Mozambique	Mozambique	
Nepal	Nepal	

Continued on next page

Table 21 – *Continued from previous page*

Full	**MRW**	**MRW Intermediate**
Netherlands	Netherlands	Netherlands
New Zealand	New Zealand	New Zealand
Nicaragua	Nicaragua	Nicaragua
Niger	Niger	
Nigeria	Nigeria	Nigeria
Norway	Norway	Norway
Oman		
Pakistan	Pakistan	Pakistan
Panama	Panama	Panama
Papua New Guinea	Papua New Guinea	
Paraguay	Paraguay	Paraguay
Peru	Peru	Peru
Philippines	Philippines	Philippines
Poland		
Portugal	Potugal	Portugal
Qatar		
Romania		
Russia		
Rwanda	Rwanda	
Saint Lucia		
Saint Vincent and the Grenadines		
Samoa		
Sao Tome and Principe		
Saudi Arabia		
Senegal	Senegal	Senegal
Sierra Leone	Sierra Leone	
Singapore	Singapore	Singapore
Slovakia		
Slovenia		
Solomon Islands		
Somalia	Somalia	
South Africa	South Africa	South Africa
Spain	Spain	Spain
Sri Lanka	Sri Lanka	Sri Lanka
Sudan	Sudan	

Continued on next page

Table 21 – *Continued from previous page*

Full	**MRW**	**MRW Intermediate**
Suriname		
Sweden	Sweden	Sweden
Switzerland	Switzerland	Switzerland
Syria	Syria	Syria
Tajikistan		
Tanzania	Tanzania	Tanzania
Thailand	Thailand	Thailand
Togo	Togo	
Trinidad and Tobago	Trinidad and Tobago	Trinidad and Tobago
Tunisia	Tunisia	Tunisia
Turkey	Turkey	Turkey
Turkmenistan		
Uganda	Uganda	
Ukraine		
United Arab Emirates		
United Kingdom	United Kingdom	United Kingdom
United States	United States	United States
Uruguay	Uruguay	Uruguay
Uzbekistan		
Vanuatu		
Venezuela	Venezuela	Venezuela
Viet Nam		
Yemen		
Zambia	Zambia	Zambia
Zimbabwe	Zimbabwe	Zimbabwe

A.3. The Human Development Index from 1980 to 2010.

Table 22: HDI from 1980 to 2010 in five-year intervals.

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Afghanistan	0.228	0.273	0.297	0.321	0.334	0.399	0.448
Albania	0.625	0.623	0.624	0.619	0.656	0.695	0.722
Algeria			0.574	0.596	0.640	0.687	0.725
Andorra							0.823
Angola					0.390	0.449	0.509
Antigua and Barbuda							0.782
Argentina	0.675	0.694	0.705	0.731	0.762	0.775	0.811
Armenia			0.632	0.605	0.648	0.695	0.721
Australia			0.865	0.882	0.898	0.912	0.927
Austria	0.747	0.764	0.794	0.815	0.836	0.853	0.879
Azerbaijan				0.609	0.640	0.688	0.741
Bahamas					0.778	0.780	0.774
Bahrain	0.679	0.727	0.746	0.775	0.794	0.816	0.819
Bangladesh	0.338	0.356	0.386	0.424	0.468	0.505	0.546
Barbados	0.670	0.700	0.716	0.731	0.753	0.765	0.780
Belarus					0.683	0.723	0.786
Belgium	0.755	0.774	0.806	0.851	0.874	0.866	0.883
Belize			0.644	0.664	0.683	0.701	0.710
Benin	0.286	0.327	0.344	0.368	0.392	0.433	0.468
Bhutan							0.573
Bolivia			0.536	0.572	0.603	0.616	0.641
Bosnia and Herzegovina						0.697	0.710
Botswana	0.453	0.518	0.584	0.580	0.561	0.612	0.681
Brazil	0.547	0.576	0.608	0.648	0.683	0.702	0.737
Brunei Darussalam		0.755	0.782	0.805	0.819	0.836	0.843
Bulgaria	0.665	0.686	0.695	0.696	0.713	0.749	0.773
Burkina Faso						0.324	0.378
Burundi	0.230	0.276	0.295	0.295	0.301	0.328	0.390
Cabo Verde					0.572	0.594	0.629
Cambodia			0.364	0.386	0.419	0.491	0.536
Cameroon	0.405	0.436	0.443	0.432	0.437	0.456	0.486
Canada		0.827	0.849	0.861	0.867	0.892	0.903
Central African Republic	0.302	0.320	0.314	0.303	0.310	0.325	0.362

Continued on next page

Table 22 – *Continued from previous page*

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Chad					0.332	0.338	0.371
Chile	0.636	0.654	0.699	0.723	0.752	0.788	0.814
China	0.430	0.467	0.501	0.545	0.588	0.641	0.699
Colombia	0.557	0.573	0.596	0.629	0.654	0.679	0.706
Comoros						0.467	0.488
Congo	0.527	0.554	0.534	0.502	0.489	0.503	0.554
Congo (Dem. Rep. of the)	0.346	0.355	0.355	0.326	0.329	0.361	0.408
Costa Rica	0.613	0.623	0.652	0.682	0.704	0.723	0.750
Croatia			0.670	0.694	0.749	0.782	0.807
Cuba	0.627	0.664	0.675	0.653	0.685	0.730	0.778
Cyprus	0.668	0.703	0.733	0.784	0.800	0.830	0.848
Czech Republic			0.761	0.785	0.821	0.847	0.863
CÃ´te d'Ivoire	0.376	0.382	0.389	0.390	0.398	0.415	0.444
Denmark	0.758	0.776	0.799	0.830	0.862	0.902	0.908
Djibouti				0.355	0.365	0.408	0.453
Dominica					0.694	0.706	0.723
Dominican Republic		0.570	0.596	0.627	0.655	0.676	0.701
Ecuador	0.603	0.631	0.645	0.665	0.674	0.698	0.717
Egypt	0.453	0.507	0.546	0.583	0.622	0.646	0.681
El Salvador		0.488	0.522	0.566	0.603	0.638	0.653
Equatorial Guinea					0.526	0.563	0.591
Eritrea						0.389	0.381
Estonia			0.726	0.719	0.780	0.824	0.838
Ethiopia					0.284	0.347	0.412
Fiji	0.578	0.576	0.631	0.648	0.678	0.694	0.717
Finland	0.744	0.762	0.783	0.815	0.857	0.869	0.878
France	0.721	0.741	0.779	0.825	0.848	0.867	0.881
Gabon	0.548	0.596	0.620	0.633	0.632	0.644	0.663
Gambia			0.330	0.351	0.385	0.417	0.441
Georgia					0.672	0.711	0.735
Germany			0.801	0.830	0.855	0.887	0.906
Ghana	0.415	0.427	0.456	0.473	0.485	0.511	0.554
Greece	0.714	0.741	0.759	0.772	0.799	0.853	0.867
Grenada							0.737
Guatemala	0.445	0.455	0.483	0.513	0.552	0.576	0.611

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Table 22 – *Continued from previous page*

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Guinea				0.290	0.323	0.358	0.388
Guinea-Bissau						0.393	0.413
Guyana		0.545	0.542	0.581	0.602	0.618	0.624
Haiti	0.357	0.397	0.417	0.422	0.442	0.455	0.471
Honduras	0.463	0.494	0.507	0.530	0.557	0.584	0.610
Hong Kong, China (SAR)	0.700	0.742	0.781	0.808	0.825	0.871	0.898
Hungary	0.700	0.711	0.703	0.740	0.769	0.802	0.821
Iceland	0.756	0.776	0.802	0.826	0.859	0.889	0.892
India	0.362	0.397	0.428	0.462	0.496	0.539	0.586
Indonesia	0.474	0.512	0.531	0.566	0.606	0.635	0.665
Iran			0.567	0.630	0.665	0.691	0.743
Iraq	0.548	0.537	0.572	0.552	0.606	0.630	0.645
Ireland	0.722	0.742	0.770	0.803	0.861	0.895	0.908
Israel	0.750	0.768	0.785	0.817	0.850	0.870	0.883
Italy	0.722	0.738	0.766	0.799	0.829	0.856	0.869
Jamaica	0.648	0.650	0.671	0.691	0.700	0.729	0.727
Japan	0.769	0.791	0.814	0.838	0.857	0.874	0.884
Jordan	0.595	0.618	0.623	0.688	0.705	0.733	0.743
Kazakhstan			0.690	0.664	0.679	0.746	0.766
Kenya	0.453	0.465	0.473	0.459	0.447	0.482	0.529
Kiribati						0.575	0.588
Korea (Rep. of)	0.622	0.680	0.731	0.781	0.821	0.858	0.886
Kuwait	0.701	0.732	0.715	0.752	0.804	0.795	0.809
Kyrgyzstan			0.615	0.562	0.593	0.614	0.634
Laos	0.345	0.370	0.397	0.425	0.462	0.501	0.539
Latvia			0.692	0.670	0.727	0.806	0.811
Lebanon						0.730	0.756
Lesotho	0.436	0.469	0.493	0.483	0.443	0.437	0.472
Liberia					0.359	0.352	0.405
Libya	0.636	0.657	0.679	0.707	0.731	0.751	0.756
Liechtenstein						0.888	0.902
Lithuania			0.730	0.701	0.754	0.806	0.827
Luxembourg	0.719	0.752	0.779	0.805	0.851	0.880	0.886
Madagascar					0.456	0.478	0.504
Malawi	0.278	0.278	0.284	0.334	0.340	0.355	0.420

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Table 22 – *Continued from previous page*

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Malaysia	0.569	0.611	0.641	0.681	0.723	0.731	0.770
Maldives					0.603	0.638	0.683
Mali	0.199	0.207	0.233	0.268	0.313	0.366	0.409
Malta	0.705	0.713	0.729	0.741	0.766	0.802	0.824
Mauritania		0.362	0.373	0.417	0.442	0.466	0.488
Mauritius	0.549	0.575	0.619	0.647	0.674	0.722	0.756
Mexico	0.601	0.634	0.648	0.670	0.699	0.722	0.746
Micronesia (Federated States of)					0.603	0.622	0.638
Moldova			0.652	0.594	0.597	0.649	0.672
Mongolia	0.524	0.552	0.578	0.553	0.589	0.649	0.695
Montenegro						0.750	0.792
Morocco	0.396	0.434	0.457	0.488	0.528	0.574	0.611
Mozambique	0.238	0.212	0.218	0.241	0.300	0.358	0.401
Myanmar	0.334	0.359	0.352	0.391	0.425	0.478	0.520
Namibia			0.578	0.588	0.556	0.569	0.610
Nepal	0.279	0.325	0.384	0.416	0.451	0.480	0.531
Netherlands	0.787	0.799	0.829	0.861	0.877	0.891	0.909
New Zealand	0.793	0.805	0.820	0.855	0.874	0.895	0.905
Nicaragua	0.478	0.484	0.495	0.523	0.565	0.595	0.619
Niger	0.190	0.199	0.214	0.232	0.257	0.289	0.326
Nigeria						0.467	0.493
Norway	0.811	0.828	0.849	0.883	0.917	0.931	0.940
Oman						0.744	0.795
Pakistan	0.353	0.380	0.399	0.424	0.444	0.495	0.522
Palau					0.743	0.759	0.767
Palestine, State of						0.658	0.670
Panama	0.626	0.648	0.656	0.684	0.714	0.733	0.761
Papua New Guinea		0.334	0.353	0.398	0.424	0.452	0.493
Paraguay	0.551	0.564	0.579	0.604	0.623	0.646	0.668
Peru	0.577	0.600	0.613	0.643	0.677	0.691	0.718
Philippines	0.557	0.565	0.586	0.598	0.623	0.640	0.654
Poland	0.689	0.701	0.713	0.740	0.786	0.805	0.829
Portugal	0.645	0.676	0.710	0.759	0.782	0.792	0.819
Qatar	0.729	0.752	0.754	0.783	0.809	0.837	0.844
Romania			0.703	0.690	0.706	0.751	0.785

Continued on next page

Table 22 – *Continued from previous page*

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Russian Federation			0.729	0.697	0.717	0.750	0.783
Rwanda	0.299	0.320	0.244	0.232	0.333	0.391	0.453
Saint Kitts and Nevis							0.739
Saint Lucia					0.683	0.691	0.730
Saint Vincent and the Grenadines					0.674	0.697	0.711
Samoa	0.571	0.584	0.621	0.617	0.649	0.679	0.696
Sao Tome and Principe	0.452	0.453	0.455	0.471	0.491	0.519	0.544
Saudi Arabia			0.690	0.717	0.744	0.759	0.805
Senegal	0.325	0.353	0.367	0.368	0.380	0.422	0.456
Serbia			0.714	0.694	0.710	0.741	0.757
Seychelles					0.715	0.736	0.743
Sierra Leone	0.268	0.285	0.262	0.263	0.299	0.344	0.388
Singapore			0.718	0.773	0.819	0.841	0.897
Slovakia			0.738	0.750	0.763	0.793	0.827
Slovenia			0.766	0.782	0.824	0.857	0.876
Solomon Islands					0.446	0.482	0.494
South Africa			0.621	0.654	0.632	0.613	0.643
South Sudan							0.470
Spain	0.702	0.725	0.756	0.803	0.827	0.845	0.867
Sri Lanka	0.571	0.597	0.620	0.645	0.679	0.712	0.738
Sudan			0.331	0.365	0.400	0.432	0.465
Suriname						0.692	0.707
Swaziland	0.473	0.504	0.536	0.532	0.496	0.496	0.525
Sweden	0.786	0.797	0.815	0.856	0.897	0.892	0.901
Switzerland	0.809	0.815	0.831	0.846	0.888	0.904	0.924
Syria	0.516	0.549	0.553	0.574	0.586	0.633	0.639
Tajikistan			0.616	0.539	0.535	0.579	0.608
Tanzania		0.371	0.369	0.367	0.392	0.448	0.500
Thailand	0.502	0.539	0.572	0.611	0.648	0.684	0.716
Macedonia						0.697	0.738
Timor-Leste					0.469	0.505	0.600
Togo	0.403	0.382	0.404	0.408	0.426	0.438	0.459
Tonga	0.607	0.639	0.650	0.669	0.671	0.693	0.713
Trinidad and Tobago	0.669	0.673	0.673	0.684	0.717	0.753	0.772
Tunisia	0.486	0.536	0.567	0.607	0.654	0.688	0.714

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Table 22 – *Continued from previous page*

Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Turkey	0.492	0.540	0.576	0.604	0.653	0.687	0.738
Turkmenistan							0.666
Uganda	0.285	0.307	0.308	0.319	0.393	0.430	0.473
Ukraine			0.705	0.662	0.668	0.713	0.732
United Arab Emirates			0.726	0.763	0.797	0.822	0.828
United Kingdom	0.738	0.753	0.773	0.837	0.865	0.890	0.906
United States	0.826	0.841	0.859	0.876	0.883	0.897	0.909
Uruguay	0.664	0.667	0.692	0.711	0.742	0.756	0.780
Uzbekistan					0.594	0.625	0.655
Vanuatu						0.572	0.589
Venezuela	0.628	0.632	0.635	0.659	0.673	0.716	0.757
Viet Nam	0.463	0.479	0.475	0.530	0.575	0.616	0.653
Yemen			0.400	0.413	0.441	0.475	0.496
Zambia	0.418	0.409	0.403	0.412	0.433	0.490	0.555
Zimbabwe	0.437	0.498	0.499	0.465	0.428	0.411	0.461

B. Regressions

B.1. Human Development Section: Alternative Regressions

Table 23: Second stage human development section (1976-2010; fixed-effects estimates, 5-year averages)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.000589	-0.000123	0.000902	-0.0000184	-0.0000556	0.0000159
	(0.00108)	(0.000133)	(0.00144)	(0.000169)	(0.000428)	(0.0000698)
ln population	-0.0286	-0.0171	-0.0348	-0.0204	-0.0156	-0.0146
	(0.0264)	(0.0196)	(0.0321)	(0.0223)	(0.0129)	(0.0114)
Large disasters	-0.000171	-0.000910	-0.000838	-0.00189	0.000405	0.000373
	(0.00203)	(0.00141)	(0.00240)	(0.00124)	(0.000628)	(0.000639)
Lagged large disasters	-0.00122	-0.00159	-0.00135	-0.00176	0.00304	0.00304
	(0.00272)	(0.00298)	(0.00245)	(0.00281)	(0.00199)	(0.00198)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	526	526	412	412	823	823
Countries	93	93	72	72	160	160
R^2	0.809	0.832	0.829	0.863	0.841	0.841
Partial R^2	0.127		0.112		0.684	
F-Test on excluded instrument	0.89		1.98		3.61	
Stock and Yogo weak ID test	7.25		7.25		5.53	
Hansen p-value	0.25		0.40			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 24: Second stage human development section (1976-2010; fixed-effects estimates, middle years)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	-0.0000571	0.00000803	0.000301	0.0000753	-0.0000857	-0.0000790
	(0.000580)	(0.000176)	(0.000576)	(0.000206)	(0.000335)	(0.0000870)
ln population	-0.0588***	-0.0592***	-0.0614**	-0.0575***	-0.0330**	-0.0329**
	(0.0206)	(0.0203)	(0.0234)	(0.0213)	(0.0155)	(0.0144)
Large disasters	0.00197**	0.00200**	0.00199**	0.00188**	0.00213***	0.00213***
	(0.000984)	(0.000968)	(0.000912)	(0.000884)	(0.000415)	(0.000365)
Lagged large disasters	-0.00123	-0.00123	-0.00150*	-0.00150*	-0.0000443	-0.0000432
	(0.000907)	(0.000898)	(0.000801)	(0.000809)	(0.000893)	(0.000896)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	507	507	400	400	744	744
Countries	91	91	71	71	150	150
R^2	0.794	0.794	0.847	0.850	0.807	0.807
Partial R^2	0.043		0.033		0.670	
F-Test on excluded instrument	7.04		1.86		7.51	
Stock and Yogo weak ID test	7.25		7.25		6.66	
Hansen p-value	0.41		0.93			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 25: Second stage human development section with Polity Index (1976-2010; fixed-effects estimates, cumulated over 5 year intervals)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.0000934	-0.0000272	0.0000289	-0.0000188	0.0000460*	0.00000824
	(0.0000585)	(0.0000294)	(0.0000496)	(0.0000368)	(0.0000259)	(0.0000148)
ln population	-0.00259**	-0.00293***	-0.00302***	-0.00320***	-0.000915**	-0.00111**
	(0.00113)	(0.000957)	(0.000957)	(0.000943)	(0.000462)	(0.000556)
Polity Index	-0.000177*	-0.000198**	-0.000182*	-0.000190*	-0.0000568	-0.0000760
	(0.000102)	(0.0000994)	(0.000109)	(0.000112)	(0.0000739)	(0.0000733)
Large disasters	0.000140	-0.0000808	-0.000181	-0.000270	0.000193	0.000188
	(0.000297)	(0.000247)	(0.000243)	(0.000213)	(0.000126)	(0.000127)
Lagged large disasters	-0.000575	-0.000518	-0.000608	-0.000583	0.000459	0.000481
	(0.000493)	(0.000528)	(0.000491)	(0.000504)	(0.000392)	(0.000384)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	526	526	412	412	823	823
Countries	93	93	72	72	160	160
R^2	0.823	0.837	0.866	0.868	0.841	0.843
Partial R^2	0.258		0.245		0.766	
F-Test on excluded instrument	13.99		16.27		41.94	
Stock and Yogo weak ID test	11.59		11.59		16.38	
Hansen p-value	0.72		0.64			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 26: Second stage geographic regions (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)								
	(1) EAP 2SLS	(2) EAP OLS	(3) LAC 2SLS	(4) LAC OLS	(5) MENA 2SLS	(6) MENA OLS	(7) SSA 2SLS	(8) SSA OLS
Observed openness	0.0000639	0.0000298	0.0000715	0.0000446**	0.000276	0.0000699*	0.0000443	-0.0000748*
	(0.0000371)	(0.0000379)	(0.0000741)	(0.0000173)	(0.000189)	(0.0000341)	(0.000112)	(0.0000376)
ln population	-0.000692	-0.00106	-0.00223***	-0.00231***	-0.000225	-0.000356	-0.00224	-0.00374**
	(0.00129)	(0.00118)	(0.000488)	(0.000547)	(0.000219)	(0.000387)	(0.00193)	(0.00142)
Large disasters	0.000174	0.000164	-0.00152*	-0.00150*	-0.000254	-0.0000741	0.00432	0.00400
	(0.000201)	(0.000175)	(0.000824)	(0.000869)	(0.00130)	(0.000744)	(0.00362)	(0.00375)
Lagged large disasters	0.000584**	0.000571***	0.000556	0.000620	0.00182	0.00332**	-0.00000676	-0.000488
	(0.000213)	(0.000191)	(0.000770)	(0.000833)	(0.00142)	(0.00116)	(0.00287)	(0.00292)
Fixed Effects								
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	109	109	159	159	95	95	186	186
Countries	20	20	29	29	19	19	38	38
R^2	0.905	0.908	0.935	0.936	0.859	0.921	0.705	0.724
Partial R^2	0.367		0.294		0.228		0.470	
F-Test on excluded instrument	18.78		2.41		3.73		13.27	
Stock and Yogo weak ID test	11.59		7.25		7.25		11.59	
Hansen p-value	0.16		0.12		0.71		0.85	

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

EAP denotes the East Asia and Pacific region, *LAC* the Latin America and Carribean region, *MENA* the Middle East and North Africa region and *SSA* the Subsaharan Africa region, respectively.

Table 27: Second stage income levels (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)				
	(1) High 2SLS	(2) Upmid OLS	(3) Lowmid 2SLS	(4) Low OLS
Observed oenness	-0.00000805	-0.000344	0.0000808	0.000123
	(0.0000834)	(0.000539)	(0.0000978)	(0.0000772)
ln population	-0.0000316	0.00466	-0.000423	-0.00272*
	(0.000167)	(0.00785)	(0.00118)	(0.00142)
Large disasters	-0.000490***	0.00896	-0.000677	0.000399*
	(0.000155)	(0.0180)	(0.000982)	(0.000219)
Lagged large disasters	-0.000728***	-0.00699	0.000332	0.000554**
	(0.000116)	(0.00711)	(0.000471)	(0.000266)
Fixed Effects				
Country	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes
N	124	56	142	246
Countries	30	23	41	60
R^2	0.895	0.627	0.891	0.776
Partial R^2	0.412	0.226	0.276	0.420
F-Test on excluded instrument	2.87	0.17	4.92	11.11
Stock and Yogo weak ID test	7.25	7.25	7.25	8.75
Hansen p-value	0.08	0.75	0.71	0.49

Note: Country clustered standard errors in parentheses.

Constant and fixed effects not reported to save space.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

High denotes the high income group, *Upmid* the upper middle income group, *Lowmid* the lower middle income group and *Low* the low income group, respectively.

Table 28: Second stage OECD and non-OECD countries (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Human Development Index Dependent variable (first stage): Observed trade openness (opendots) Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)				
	(1) OECD 2SLS	(2) OECD OLS	(3) non-OECD 2SLS	(4) non-OECD OLS
Observed openness	0.0000127	-0.0000717	0.0000660*	0.0000139
	(0.000167)	(0.0000436)	(0.0000386)	(0.0000162)
ln population	-0.00116	-0.00188***	-0.00102*	-0.00128*
	(0.00187)	(0.000644)	(0.000539)	(0.000688)
Large disasters	-0.000482***	-0.000542***	0.0000904	0.0000868
	(0.000162)	(0.000130)	(0.000147)	(0.000151)
Lagged large disasters	-0.000992***	-0.00102***	0.000913***	0.000965***
	(0.000124)	(0.000111)	(0.000146)	(0.000179)
Fixed Effects				
Country	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes
N	155	155	644	644
Countries	30	30	134	134
R^2	0.931	0.933	0.833	0.839
Partial R^2	0.234		0.338	
F-Test on excluded instrument	1.84		10.57	
Stock and Yogo weak ID test	7.25		8.75	
Hansen p-value	0.79		0.22	

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.
$OECD$ denotes OECD member countries and $non-OECD$ contries that are no members of OECD, respectively.

B.2. Education Section: Alternative Regressions

Table 29: Second stage education section (years of schooling) (1976-2010; fixed-effects estimates, 5-year averages)

Dependent variable: Years of schooling Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	-0.0254**	-0.00376	-0.0230**	-0.00301	-0.0267	-0.0000827
	(0.0124)	(0.00276)	(0.0112)	(0.00436)	(0.0201)	(0.00223)
ln population	0.257	-0.114	-0.336	-0.492	-0.505	-0.350
	(0.564)	(0.473)	(0.483)	(0.456)	(0.494)	(0.317)
Large disasters	-0.0917**	-0.0628*	-0.103***	-0.0731**	-0.0541	-0.0416
	(0.0378)	(0.0325)	(0.0339)	(0.0308)	(0.0360)	(0.0272)
Lagged large disasters	-0.00756	0.0117	-0.0111	0.00336	0.0455*	0.0375*
	(0.0655)	(0.0575)	(0.0622)	(0.0551)	(0.0272)	(0.0202)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	341	341	273	273	501	501
Countries	86	86	69	69	129	129
R^2	0.782	0.833	0.808	0.840	0.713	0.828
Partial R^2	0.114		0.107		0.750	
F-Test on excluded instrument	2.83		2.48		2.25	
Stock and Yogo weak ID test	7.25		7.25		5.53	
Hansen p-value	0.26		0.20			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. *Years of schooling* denote the mean of the sum of mean and expected years of schooling.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 30: Second stage education section (mean years of schooling) (1960-2010; fixed-effects estimates, 5-year averages)

Dependent variable: Mean years of schooling Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (preferred IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.0179***	0.00581**	0.0187***	0.00653**	0.0118**	0.00247
	(0.00418)	(0.00285)	(0.00320)	(0.00294)	(0.00552)	(0.00193)
ln population	-0.422	-0.357	0.0171	0.0871	0.215	0.0961
	(0.419)	(0.420)	(0.463)	(0.469)	(0.300)	(0.305)
Large disasters	-0.0383	-0.0392	-0.0422	-0.0426	0.00579	0.0219
	(0.0383)	(0.0384)	(0.0342)	(0.0345)	(0.0193)	(0.0186)
Lagged large disasters	-0.0519	-0.0531	-0.0680**	-0.0696*	-0.0248	-0.0285
	(0.0340)	(0.0426)	(0.0305)	(0.0391)	(0.0253)	(0.0286)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	765	765	612	612	1084	1084
Countries	87	87	69	69	132	132
R^2	0.854	0.866	0.865	0.877	0.850	0.860
Partial R^2	0.207		0.191		0.738	
F-Test on excluded instrument	40.31		86.77		22.64	
Stock and Yogo weak ID test	19.93		19.93		16.38	
Hansen p-value	0.16		0.24			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 31: Second stage education section (expected years of schooling) (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: Expected years of schooling Dependent variable (first stage): Observed trade openness (opendots) Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	0.0103	-0.00167	0.0395	0.00824	-0.0129	-0.00399
	(0.0317)	(0.0101)	(0.0418)	(0.0138)	(0.00981)	(0.00332)
ln population	-0.784	-0.803	-0.0521	-0.126	-0.160	-0.115
	(0.562)	(0.557)	(0.435)	(0.437)	(0.207)	(0.187)
Large disasters	-0.0766	-0.0984	-0.0331	-0.0890	-0.0648	-0.0644
	(0.124)	(0.108)	(0.147)	(0.113)	(0.0823)	(0.0789)
Lagged large disasters	0.102	0.111	0.0254	0.0518	0.0575	0.0515
	(0.146)	(0.140)	(0.169)	(0.151)	(0.0953)	(0.0934)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	552	552	427	427	912	912
Countries	93	93	72	72	160	160
R^2	0.898	0.898	0.928	0.932	0.908	0.909
Partial R^2	0.263		0.231		0.742	
F-Test on excluded instrument	11.22		17.41		27.38	
Stock and Yogo weak ID test	8.75		11.59		16.38	
Hansen p-value	0.86		0.64			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

B.3. Income Section: Alternative Regressions

Table 32: Second stage income section (per capita GNI) (1976-2010; fixed-effects estimates, cumulated over 5-year intervals)

Dependent variable: ln GNI per capita in PPP terms Dependent variable (first stage): Observed trade openness Instruments: Predicted trade openness and lagged predicted trade openness (alternative IV)						
	(1) MRW 2SLS	(2) MRW OLS	(3) MRW I 2SLS	(4) MRW I OLS	(5) Full 2SLS	(6) Full OLS
Observed openness	-0.00594	-0.00442	-0.00660	-0.00631	-0.00115	0.000147
	(0.00758)	(0.00467)	(0.00758)	(0.00612)	(0.00242)	(0.00171)
ln population	-0.0604	-0.0581	-0.0944	-0.0937	0.0236	0.0306
	(0.0743)	(0.0682)	(0.0957)	(0.0888)	(0.0580)	(0.0584)
Large disasters	0.00425	0.00703	0.00688	0.00739	0.0116	0.0116
	(0.0192)	(0.0142)	(0.0200)	(0.0172)	(0.00772)	(0.00750)
Lagged large disasters	0.00969	0.00850	0.0146	0.0143	0.0182**	0.0176**
	(0.0102)	(0.0102)	(0.0127)	(0.0133)	(0.00850)	(0.00755)
Fixed Effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
N	500	500	393	393	792	792
Countries	85	85	67	67	141	141
R^2	0.035	0.037	0.052	0.052	0.025	0.027
Partial R^2	0.271		0.234		0.777	
F-Test on excluded instrument	10.78		16.50		32.54	
Stock and Yogo weak ID test	8.75		11.59		16.38	
Hansen p-value	0.38		0.81			

Note: Country clustered standard errors in parentheses. Constant and fixed effects not reported to save space. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Statutory Declaration

I declare that I have authored this thesis independently, that I have not used other than the declared sources/resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

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date (signature)