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Good for Living? On the Relationship between Globalization and Life Expectancy

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Summary. — This paper analyzes the relationship between three dimensions (economic, social, and political) of globalization and life expectancy using a panel of 92 countries covering the 1970–2005 period. Using different estimation techniques and sample groupings, we find that economic globalization has a robust positive effect on life expectancy, even when controlling for income, nutritional intake, literacy, number of physicians, and several other factors. The result also holds when the sample is restricted to low-income countries only. In contrast, political and social globalization have no such robust effects.

Key words — globalization, health, life expectancy, development

1. INTRODUCTION

Globalization typically refers to the process by which different economies and societies become more closely integrated, and concurrent with increasing worldwide globalization, there has been much research into its consequences. A recent volume by Dreher, Gaston, and Martens (2008) summarizes several empirical findings on the effects of globalization on growth, taxation and government spending, within-country inequality, de-unionization, and the environment. Little is known, however, about the effects of globalization on physical health. To our knowledge, no published study has so far examined empirical evidence on the relation between a broad measure of globalization and objective health. Tsai (2007), however, come close when finding a positive relation between globalization and the Human Development Index (HDI).

Studies of the determinants of population health suggest there are several channels by which globalization may affect health. Many relate to the movement of goods and services, such as the availability of imported pharmaceuticals and changes in relative prices. As a result, the limited literature on the relationship between globalization and health typically adopts an economic perspective and focuses on the health effects of increased trade openness or economic freedom (Bussmann, 2009; Owen & Wu, 2007; Stroup, 2007). Globalization, however, could also affect health through, for example, life style change, faster spread of contagious diseases, and altered international relations. Analyzing the health effects of increasing internationalization therefore requires distinguishing between different dimensions of globalization. Given the numerous potential channels at work, it is also essential to control for possible mediating factors in the globalization–health relationship.

This paper analyzes the relationship between globalization and an objective and easily quantifiable measure of health: life expectancy at birth. We examine the health effects of economic, social, and political globalization by using the index of globalization developed by Dreher (2006), called the KOF-index. [1]

Figure 1 plots the relation between the composite KOF Index (which assigns a value of 0–100, indicating the level of globalization of each country) and life expectancy at birth in 2000. The scatterplot depicts a positive, non-linear relationship. We examine the robustness of this relationship, and how it varies between types of globalization and different levels of development, by constructing a 92-country panel covering the 1970–2005 period. We control for demographic structure and four factors repeatedly found to influence life expectancy, that is, public health measures (such as health care availability or sanitation), education, nutrition, and GDP *per capita*. Using different estimation techniques, we find that economic globalization has a strong and robust positive effect on life expectancy. Using a procedure by which we gradually exclude high-income-country observations from our sample and rerun the estimation, we find evidence that the positive effect of economic globalization is present also in a low-income context.

The paper continues as follows. The next section reviews recent research into the determinants of life expectancy and discusses how these might be influenced by globalization.

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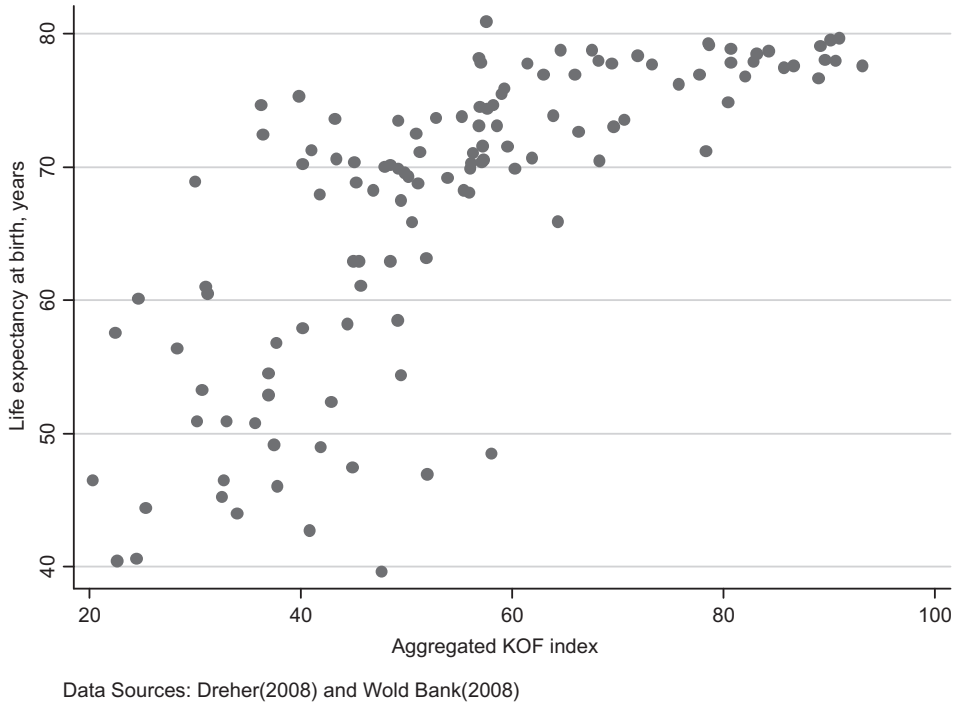

Figure 1. *The cross-country correlation between life expectancy and globalization, 2000.*

Section 3 discusses the methodological choices and describes the data, while Section 4 presents the empirical analysis, including several robustness checks. Section 5 summarizes our results and presents some ideas for further research.

2. BACKGROUND

(a) *Disentangling the effects of globalization on health*

As discussed by Arribas, Pérez, and Tortosa-Ausina (2009), the progress of globalization has many facets, because of the range of interactions it involves. We can roughly distinguish three different dimensions of globalization. *Economic* globalization refers to the exchange of goods and services and investment flows across countries and regions of the world. *Social* globalization refers to how the interaction between countries can influence norms and cultural values. Finally, *Political* globalization refers to the trend for countries to become more integrated at a political level.

Several studies examine variations in life expectancy across countries; recent studies include Kabir (2008), Cutler, Deaton, and Lleras-Muney (2006), Fayissa and Gutema (2005), and Husain (2002), while an older study is Grosse and Perry (1982). Four broad factors repeatedly found to be significantly and positively related to life expectancy are nutritional status, education, public health measures, and income. Most studies focus on less-developed countries where factors such as water sanitation and literacy are crucial determinants (as demonstrated by Grosse & Perry, 1982). In contrast, dietary and nutritional factors often explain variations within developed countries. For example, Shaw, Horrace, and Vogel (2005) examine 29 OECD countries, 1960–1999, and find positive effects for the *per capita* consumption of pharmaceuticals, fruits and vegetables, and butter; moreover, consumption of alcohol and tobacco generally has the expected negative sign.

A major point of disagreement in the literature is the relative importance of income in determining life expectancy, some studies finding no effect and other studies finding small or large positive effects. [2] There are several possible explanations for this discrepancy. According to standard economic theory, income is only instrumentally important by enabling purchasing power that can be used to consume, for example, food, safety measures, health care, and vaccinations, which in turn affect health. Thus, when more control variables are added to a regression on life expectancy, the coefficient for income will decrease. Furthermore, the degree to which countries spend their income on health-improving consumption is likely to differ, and, to some degree, income can be spent on areas likely having negative health effects, such as the military or fast food.

Theory makes ambiguous predictions regarding the health impact of globalization. First, if globalization is positively related to GDP *per capita*, it will be beneficial for life expectancy. Such an effect may occur through the static effects of trade liberalization or because globalization is good for economic growth, as found by Dreher (2006). [3] Second, globalization may positively affect education levels, including literacy. For example, the possibility of working abroad may increase the education premium and thus strengthen education incentives, as suggested by Stark (2004). In addition, social globalization via tourism and information flows may increase literacy levels.

Third, a possible mechanism by which globalization can affect public health is by improving access to new technologies for water sanitation, medical treatment, and pharmaceuticals. In developed countries, medical technologies and new drugs have been shown important for gains in life expectancy (Lichtenberg, 2003). A potential problem is that pharmaceuticals invented in industrial countries are usually not affordable to most people in developing countries. However, Papageorgiou, Savvides, and Zachariadis (2007) show that pharmaceutical R&D is highly concentrated in a small group of ten countries that export these goods to the rest of the world, and using a cross-section of 63 technology-importing countries, they argue that technology diffusion through medical exports is an important contributor

to improved life expectancy. If globalization contributes to such technology diffusion, this may play a role in less developed countries.

Fourth, globalization may affect nutritional intakes both directly, through increased availability of imports, and indirectly, because relative prices change when an economy becomes more open. Furthermore, social globalization may lead to changes in lifestyle and dietary habits that have health consequences. Medez and Popkin (2004) note that the structure of dietary intakes is rapidly changing in less-developed countries around the world, converging towards a "Western diet" high in saturated fats and sugar, which might affect health negatively. Yach, Wipfli, Hammond, and Glantz (2007) note that waves of cultural interaction have also extended the mass consumption of "bads," such as tobacco, in turn increasing the spread of non-infectious diseases. On the other hand, Deaton (2004) emphasizes that closer integration facilitates the transmission of health-related knowledge.

While many mechanisms discussed above suggest that globalization positively affects life expectancy, there are several complicating factors. One possible negative link is the faster and geographically broader spread of infectious diseases such as HIV and the H5N1 avian influenza virus (Kawachi & Wamala, 2007). However, political globalization may allow governments to react faster and with greater coordination to counter emerging heath threats. Another potentially negative health effect of globalization is the stress effect of having more choices and more available information. While economists typically expect more choices to be welfare enhancing, Schwartz (2004), for example, has argued that an excessive range of choices causes stress and regret, making us less happy.[4] Cutler *et al.* (2006) note that cumulative distress leads to increased probability of disease, particularly cardiovascular disease.

Globalization and health may be also be negatively related through the effect of globalization on income distribution. Recent studies by Dreher and Gaston (2008) and Bergh and Nilsson (2008) suggest that economic globalization increases within-country income inequality, and there is also some evidence that income inequality negatively affects individual health—as recently shown by Karlsson, Nilsson, Lyttkens, and Leeson (2010).[5]

Another important factor may be that even if globalization increases GDP *per capita*, it does so by changing the structure of the economy; structural adjustment can be painful for those in the labor force who must switch jobs, which in turn might affect health. Furthermore, some aspects of globalization, such as trade, may also affect the environment and thereby health (Owen & Wu, 2007).

Finally, globalization might affect government size and, for example, social spending, in turn affecting health. Economic theory suggests two opposite scenarios: the race to the bottom hypothesis (Sinn, 1997), according to which economies compete, for example, by lowering taxes, and the compensation hypothesis (Katzenstein, 1985; Lindbeck, 1975; Rodrik, 1998), according to which open economies develop larger welfare states.[6]

To summarize, few of the possible links between globalization and health are theoretically unambiguous, a situation that calls for empirical examination.

(b) *Related research*

Owen and Wu (2007) analyze a panel of 219 countries using observations in five-year intervals from 1960 to 1995. They find that increased economic openness, that is, (exports + imports)/GDP, is associated with lower rates of infant mortality and higher life expectancies, especially in developing countries. Their findings also indicate that some of the positive correlation between trade and health can be attributed to knowledge spillovers.[7] In contrast, using a panel of 134 countries containing annual data from 1970 to 2000, Bussmann (2009) fails to find evidence that economic integration improves health care provision, proxied by female life expectancy. This result might be explained by Bussmann's use of annual data for trade/GDP, with female life expectancy being interpolated for missing years. As trade/GDP fluctuates from year to year, and changes in health outcomes likely evolve over a number of years, this specification is unlikely to capture any effects from trade on life expectancy.

Stroup (2007) uses panel data and finds evidence that the economic freedom index (Gwartney, Lawson, & Norton, 2008) is positively linked to life expectancy and other welfare outcomes. As well, Ovaska and Takashima (2006) examine the effects of economic freedom and trade on self-reported levels of happiness and life satisfaction, using a cross-country sample of 68 countries in the 1990s. They found that economic growth had robust positive effects on life expectancy, and that in many cases economic freedom also had considerable positive impact.

Three of the four related studies include controls for income and education in their estimations. The exception is Stroup (2007), where the only explanatory variable competing with economic freedom is an index of political rights, which to some extent makes it problematic to evaluate the effect of globalization. None of the studies controls for nutritional intake or public health measures such as physicians *per capita*.

Finally, Tsai (2007) finds a positive relationship between the KOF Index of Globalization and the Human Development Index (HDI), but more so in developed than developing countries. The data cover 112 countries in three waves (i.e., 1980, 1990, and 2000) and exclude developing countries with populations less than one million. The interpretation of Tsai's results is complicated by the fact that the HDI is a composite measure, aggregating life expectancy, adult literacy, combined primary, secondary, and tertiary school enrolment, and GDP *per capita* (PPP US$).[8]

3. METHODS AND DATA

(a) *Methods*

To examine the relationships of interest we specify an equation that relates globalization to population health and to a set of control variables:

$$health_{it} = \alpha + X_{it-1}\beta_1 + V_{it-1}\beta_2 + Z_{it}\beta_3 + \varepsilon_{it} \quad (1)$$

where X is a vector for the types of globalization believed to affect health. Since the impact of closer integration on health is unlikely to be instant, these variables are lagged: average globalization in 1970–73 is consequently used to explain average life expectancy in 1974–77. This specification also reduces the bias from potentially reverse causality between globalization and health. V and Z are vectors for additional covariates that can be classified as potential *mediators* through which globalization influences population health, and as *exogenous factors* affecting population health but not themselves influenced by globalization. Importantly, the inclusion of a mediator as a regressor should reduce the estimated effect of globalization on population health.

In Eqn. (1), ε is an error term. Ordinary least squares (OLS) regression assumes error processes to have the same variance and to be independent of each other. In the presence of non-spherical errors, the estimated coefficients are consistent, but standard errors are not efficient and are likely biased. By means of correction, robust standard errors of the fixed-effect (FE) OLS estimator can be estimated in case of heteroscedasticity and autocorrelation within panels.[9] However, because globalization means greater integration between economies, increasing inter-country linkages imply that errors may be contemporaneously correlated across countries. We therefore estimate the relationship using a panel-corrected standard errors (PCSE) procedure, allowing for disturbances that are heteroscedastic and contemporaneously correlated across countries, as recommended by Beck and Katz (1995) and used for example by Wibbels (2003).[10] Estimations correct for first-order autocorrelation, by treating the AR(1) process as specific to each country. From Monte Carlo experimentation, Reed and Ye (2009) recommend using this estimator when the discussed non-spherical errors are present, the number of units is greater than the number of periods, and the primary concern is accurate inference. To control for potential unobserved heterogeneity, the specifications include country dummies, capturing stable differences between countries in population health status, and period dummies, capturing the influence of health shocks in multiple countries at the same time.

Following Wiggins (2001), we also estimate the relationship by OLS fixed effects regression, using a variant of the White estimator of robust standard errors adjusting for clustering over country. This estimator yields consistent estimates of the covariance matrix under general conditions of heteroscedasticity and autocorrelation within panels.[11] All FE estimations include period dummies.

(b) *Data*

Using several data sources, we create a panel dataset for the 1970–2005 period. The dependent variable and indicator of population health refer to *Life expectancy at birth.* This is the average number of years newborns would live, assuming that current levels and patterns of mortality remain constant over their lifetimes. The measure refers to the whole population in each country and comes from the World Development Indicators (World Bank, 2008). Information on life expectancy at birth is also available for men and women separately, and we use this information in the sensitivity analysis.

Our globalization indicator is the *KOF Index* (Dreher, 2006; updated in Dreher *et al.*, 2008), which measures *economic globalization* (e.g., using trade flows and trade restrictions), *social globalization* (e.g., using tourism and outgoing telephone calls), and *political globalization* (e.g., using number of embassies and membership in international organizations). Details about the index and its components can be found in Table A1 in Appendix. We use the index both as a composite measure, in which the three dimensions of globalization are equally weighted together, and in a disaggregated format. In either case, the index takes values between 0 and 100, higher values indicating more globalization. To capture the non-linearity between globalization and life expectancy, we log these indices.

The selection of additional control variables is mainly informed by the discussion in Section 2(a). To indicate the level of economic development, the specifications include country *log real GDP per capita* (PPP adjusted) from Heston, Summers, and Aten (2006). We use data on the log average years of *education* in the population over 15 years old (Barro & Lee, 2000), *nutritional status*, measured by log average national calorie intake per day *per capita* (FAO, 2009), and the log number of *physicians per 1000 people* (World Bank, 2008). These controls are all conservatively assumed to relate positively to life expectancy. To capture economic and demographic structure, we correct for the *urban share of the population* and national *dependency ratio* in our specifications (World Bank, 2008). The latter refers to the number of young (age < 15) and old (age > 64) as a share of the working-age population.

To test the robustness of our results, we include several control variables. *Government consumption* as a share of GDP (World Bank, 2008) is included to check whether globalization affects government size in a way that changes its effect on life expectancy. We also examine how the results change when including *Gini* coefficients for net income (taken from Solt, 2008). We further test our results using the globalization index developed by the Centre for the Study of Globalization and Regionalisation at Warwick university (*the CSGR Index*), available for the period 1982–2004, and covering roughly the same countries as the KOF Index.[12] Finally, we follow Tsai (2007) and include the growth of the urban population as a proxy for *instability* and rapid social change.

The initial sample is an unbalanced panel consisting of 121 countries for which the composite *KOF Index* is available together with nine periods: 1970–73, 1974–77, 1978–81, 1982–85, 1986–89, 1990–93, 1994–97, 1998–2001, and 2002–05. The observations are period averages, except for the average years of education, which is only available for particular years.[13] Due to missing data, the effective sample is smaller than the population of possible observations. To ease interpretation of how additional covariates affect the results, we do not allow the sample size to vary across tested specifications. The final sample refers to 92 countries (28 high-income, 41 middle-income, and 23 low-income countries) and more than 600 observations.

Table 1 presents summary statistics on the variables of interest. The standard deviation of life expectancy at birth (female, male, and total) indicates great variation between countries. The same is true with respect to globalization. A list of countries included and a correlation matrix for all explanatory variables can be found in Appendix.

Before running estimations, we perform various diagnostic tests. First, using the Hadi method, we do not detect any outliers. Second, examining pairwise correlations between variables reveals a close relationship between some of the indicators (see Table A3 in Appendix), which might inflate standard errors. However, examining the variance inflation factor (VIF) suggests no incidence of multicollinearity. Individual figures range from 3.6 (urban) to 6.5 (GDP *per capita*), which is below the critical value of 7.

A Hausman specification test suggests that an FE model matches the data better than does a random-effects model, but a random-effects model is also run as a sensitivity test. Moreover, period dummies are jointly significant in the specifications and thus should be included. We also assess the presence of serial correlation using a test derived by Wooldridge (2002). The null hypothesis of no serial correlation is strongly rejected, which supports the clustering at the panel level and the AR correction.

4. RESULTS

(a) *Baseline estimations*

Table 2 presents estimation results for the relationship between globalization and life expectancy, controlling for

Table 1. *Summary statistics*

Variable	Mean	Std. Dev.	Min	Max	*n*	*N*	Source
Life expectancy at birth (years)	65.84	10.47	27.72	81.86	92	608	World Bank (2008)
Life expectancy at birth (years, female)	68.23	11.13	29.63	85.44	92	608	World Bank (2008)
Life expectancy at birth (years, male)	63.55	9.91	25.89	78.45	92	608	World Bank (2008)
Globalization—KOF[a]	3.77	0.43	2.54	4.53	92	608	Dreher *et al.* (2008)
Economic globalization—KOF1[a]	3.81	0.46	2.05	4.56	88	583	Dreher *et al.* (2008)
Social globalization—KOF2[a]	3.57	0.58	1.90	4.56	91	604	Dreher *et al.* (2008)
Political globalization—KOF3[a]	3.85	0.54	0.76	4.59	92	608	Dreher *et al.* (2008)
GDP *per capita* (PPP)[a]	8.28	1.19	5.46	10.53	92	608	Heston *et al.* (2006)
Years of education (population 15+)[a]	1.59	0.65	−1.34	2.49	92	608	Barro and Lee (2000)
Years of education (population 15+, female)[a]	1.44	0.81	−2.32	2.49	92	608	Barro and Lee (2000)
Years of education (population 15+, male)[a]	1.71	0.56	−1.34	2.50	92	608	Barro and Lee (2000)
Number of physicians (per 1000 people)[a]	−0.55	1.43	−4.17	1.61	92	608	World Bank (2008)
Nutritional status (avg. calorie intake *per capita*)[a]	7.88	0.19	7.38	8.23	92	608	FAO (2009)
Dependency ratio	0.71	0.19	0.35	1.14	92	608	World Bank (2008)
Urban population	52.40	23.82	4.07	98.27	92	608	World Bank (2008)
Government consumption	20.18	8.06	2.47	67.54	92	608	Heston *et al.* (2006)
Net income Gini coefficient	37.80	9.59	20.95	63.11	79	448	Solt (2008)
Urban population growth	0.05	0.06	−0.08	0.45	92	608	World Bank (2008)
Globalization—CSGR[a]	0.304	0.20	0.05	0.89	75	331	Lockwood and Redoano (2005)
Economic globalization—CSGR[a]	0.134	0.47	0.05	0.36	84	385	Lockwood and Redoano (2005)
Social globalization—CSGR[a]	0.107	0.16	0.00	0.76	83	382	Lockwood and Redoano (2005)
Political globalization—CSGR[a]	0.344	0.19	0.10	0.92	100	495	Lockwood and Redoano (2005)
Low-income country	0.23	0.42	0	1	92	608	World Bank (2008)
Middle-income country	0.46	0.50	0	1	92	608	World Bank (2008)
High-income country	0.31	0.46	0	1	92	608	World Bank (2008)

[a] Indicates that the variable is logged.

Table 2. *Globalization and life expectancy. Dependent variable: life expectancy at birth*

	PCSE	PCSE	PCSE	PCSE	FE	FE	FE	FE
KOF ($t-1$)	1.661**				3.266			
	[0.732]				[3.475]			
KOF1 ($t-1$)		2.702***				4.473**		
		[0.756]				[2.098]		
KOF2 ($t-1$)			0.572				1.804	
			[0.300]				[1.968]	
KOF3 ($t-1$)				−1.181				−2.094*
				[0.800]				[1.119]
GDP *per capita* ($t-1$)	0.867**	0.834	0.832*	1.248**	0.884	0.196	0.753	1.082
	[0.449]	[0.616]	[0.445]	[0.622]	[1.623]	[1.723]	[1.737]	[1.465]
Dependency	−4.388**	−2.944	−5.102**	−4.809*	−2.332	−1.874	−2.884	−5.365
	[2.189]	[2.474]	[2.344]	[2.483]	[5.117]	[5.168]	[5.593]	[4.562]
Observations	608	583	604	608	608	583	604	608
Number of countries	92	88	91	92	92	88	91	92
R^2 (within)	0.998	0.997	0.997	0.997	0.448	0.452	0.433	0.448

PCSE: Estimations include country dummies and period dummies; panel-corrected standard errors in brackets. R^2 statistics include influences of country dummies.
FE: Estimations with country and period fixed effects; robust standard errors in brackets.
* Denotes statistical significance at 10% level.
** Denotes statistical significance at 5% level.
*** Denotes statistical significance at 1% level.

development level and demographic structure. Regressions using panel-corrected standard errors (PCSE) suggest that the composite *KOF Index* is positively related to life expectancy. From testing the components of the index separately (columns 2–4), it appears that this result is driven by economic globalization. In baseline estimations, we find no significant relationship between social or political globalization and life expectancy. As expected, the effect of GDP *per capita* is positive while a high dependency ratio is negatively related to life expectancy.

Fixed-effect (FE) estimations support the finding that economic globalization has a positive health effect. However, there is also evidence that *political* globalization has a negative health effect, indicating that countries with a greater number of diplomatic contacts and more involved in the international community have lower average life expectancies. We will return to this result in the sensitivity analysis.

Table 3 shows how the results change when including additional control variables using PCSE estimation. [14] The positive

Table 3. *Including additional control variables. Dependent variable: life expectancy at birth*

	1	2	3	4	5	6	7	8
KOF ($t-1$)	1.406	1.950**						
	[0.923]	[0.902]						
KOF1 ($t-1$)			2.771***	3.372***				
			[0.774]	[0.752]				
KOF2 ($t-1$)					−0.240	0.685		
					[0.569]	[0.621]		
KOF3 ($t-1$)							−1.454*	−1.543*
							[0.776]	[0.804]
GDP *per capita* ($t-1$)	1.073**	−0.182	0.805	−0.705	0.931*	−0.098	1.289**	−0.143
	[0.518]	[0.635]	[0.589]	[0.555]	[0.521]	[0.636]	[0.609]	[0.610]
Dependency	−4.469**	−1.561	−2.821	−0.626	−5.156**	−2.136	−4.569**	−3.116
	[2.070]	[2.534]	[2.486]	[2.736]	[2.281]	[2.659]	[2.325]	[2.286]
Urban share of population	0.008	0.042	0.024	0.050	0.046*	0.048	0.019	0.050
	[0.025]	[0.035]	[0.029]	[0.033]	[0.026]	[0.035]	[0.028]	[0.034]
Average year of education	−0.206	−0.701	−0.477	−0.855	1.257	−0.470	1.292	0.615
	[1.091]	[1.164]	[1.142]	[1.184]	[0.803]	[1.225]	[0.808]	[0.897]
Physicians		1.000**		0.978**		0.983**		0.803**
		[0.395]		[0.408]		[0.382]		[0.341]
Nutrition		11.34***		11.02***		11.43***		11.25***
		[3.192]		[3.121]		[3.279]		[3.161]
Observations	608	608	583	583	604	604	608	608
Number of countries	92	92	88	88	91	91	92	92
R^2	0.998	0.997	0.998	0.997	0.997	0.997	0.997	0.997

Estimations include country dummies and period dummies; panel-corrected standard errors in brackets.
R^2 statistics include influences of country dummies.
* Denotes statistical significance at 10% level.
** Denotes statistical significance at 5% level.
*** Denotes statistical significance at 1% level.

association between economic globalization and life expectancy remains significant across all specifications. The magnitude of the effect is rather stable, with a coefficient estimate of approximately 3, suggesting that a 10% increase in economic globalization increases life expectancy by 0.3 years. This result confirms the findings of Owen and Wu (2007) that more economic openness is associated with higher life expectancy. Regarding the social dimension of globalization, we find no significant effect on life expectancy. For political globalization we find some evidence of a negative relationship.

As expected, a greater number of physicians *per capita* and a larger *per capita* calorie intake have strong and robust positive effects on life expectancy. On the other hand, neither the average education level of the population nor the share of people living in urban areas is significantly associated with longevity. The former result is unexpected if schooling provides people with skills relevant to health outcomes. Still, the same result appears in a related study by Ovaska and Takashima (2006). One interpretation is that it is the quality of learning that is important to health, not how many people from the same cohort graduate at a particular level.[15]

Relating to the discussion of the relative importance of income to population health, it appears that the coefficient estimates of GDP *per capita* become insignificant when adding more covariates to the model. The non-positive effect of average income on life expectancy corresponds to the findings of some related studies (Ovaska & Takashima, 2006; Owen & Wu, 2007) and confirms the results of Pritchett and Summers (1996), who estimate the effect of income on life expectancy in a panel of countries. Moreover, the demographic structure indicator loses significance when including additional control variables.

(b) *Sensitivity analysis*

Table 4 lists the PCSE regression coefficient estimates of the aggregate globalization indices and significant sub-indices for several sensitivity tests, all including the complete set of control variables. We first confirm that our results hold when running a *random effect model*, thus also using variation between countries to estimate coefficients. As the number of countries is much higher than the number of time-periods, a random effects model will put a lot of weight on cross-country variation.

Next, we examine robustness to the *adding of various covariates*. We first control for within-country net income Gini coefficients, an exercise that significantly reduces the number of observations. With this specification and sample, there is evidence that the social dimension of globalization has a positive effect on life expectancy, and unlike the claims in, for example, Wilkinson (1996) we find that income inequality correlates with good health status. Including information on *government consumption* leaves the relationship between dimensions of globalization on life expectancy unchanged compared to baseline estimations. Following Tsai (2007), we control for the influence of instability and rapid change on health by including *urban population growth*. The urbanization rate is not significantly associated with life expectancy and inclusion does not alter previous findings. Next, we confirm that, despite their high degree of colinearity, including *all globalization dimensions simultaneously* in one specification does not change main results.

Another type of robustness test addresses the *timing of effects*. Testing the assumption that the impact of globalization on health is contemporaneous by not lagging the globalization index one 4-year period, reveals that political globalization has

Table 4. *Sensitivity analysis*

Variation	Composite KOF index	Significant components			Comments
Baseline model	1.950**	KOF1 ($t-1$)	3.372***	[0.752]	Baseline estimates
	[0.902]	KOF2 ($t-1$)	0.685	[0.621]	Corresponds to the results in Table 3
		KOF3 ($t-1$)	−1.543*	[0.804]	
Random effects (RE) model	3.057**	KOF1 ($t-1$)	2.969***	[0.978]	Average years of education positive and significant
	[1.546]	KOF2 ($t-1$)	1.837**	[0.855]	
		KOF3 ($t-1$)	−1.273**	[0.627]	
Controlling for income inequality	2.628**	KOF1 ($t-1$)	3.195***	[0.909]	Income inequality positive and significant except when controlling for social globalization Reduced sample: 79 countries, 448 observations
	[1.028]	KOF2 ($t-1$)	1.178**	[0.514]	
		KOF3 ($t-1$)	−1.278**	[0.544]	
Controlling for government consumption	2.075**	KOF1 ($t-1$)	3.377**	[0.715]	Government consumption negative and insignificant
	[1.050]	KOF3 ($t-1$)	−1.466**	[0.744]	
Controlling for urban population growth	2.321**	KOF1 ($t-1$)	3.279***	[0.713]	Urbanization rate positive and insignificant
	[1.054]	KOF3 ($t-1$)	−1.518**	[0.725]	
All sub-indices of globalization together in the same specification		KOF1 ($t-1$)	3.141***	[0.946]	
		KOF3 ($t-1$)	−1.119**	[0.542]	
Using non-lagged globalization and non-lagged GDP *per capita*	0.765	KOF1	2.757***	[0.696]	GDP *per capita* insignificant
	[1.164]				
Panel using 8-year averages instead of 4-year average	3.120*	KOF1 ($t-1$)	4.596***	[1.267]	
	[1.861]	KOF3 ($t-1$)	−2.633***	[0.841]	
Replacing KOF index with CSGR globalisation index	0.298	Economic	2.704**	[1.061]	Composite index refers to the overall CSGR index Social and political globalization insignificant
	[0.285]				
Replacing life expectancy with female life expectancy	2.497**	KOF1 ($t-1$)	3.473***	[0.769]	Average years of education refers in this case to average years of education in female population
	[1.136]	KOF3 ($t-1$)	−1.472*	[0.771]	
Replacing life expectancy with male life expectancy	1.321	KOF1 ($t-1$)	3.203***	[0.6899]	Average years of education refers in this case to average years of education in male population
	[0.987]	KOF3 ($t-1$)	−1.586**	[0.675]	
Excluding countries with high prevalence of HIV (5 countries)	2.266***	KOF1 ($t-1$)	1718***	[0.625]	Botswana, Namibia, South Africa, Zambia and Zimbabweall have an estimated prevalence of HIV of +15% in the adult population Dependency negative and significant. Education positive and significant
	[0.651]				
Only including stable democracies	3.299***	KOF1 ($t-1$)	2.806***	[0.850]	Sample consists of the 25 countries with a Polity-IV Index equal to or larger than 7 over the whole time period
	[0.952]	KOF2 ($t-1$)	1.301**	[0.617]	
Countries never colonized (17 countries)	0.787	KOF1 ($t-1$)	2.250**	[1.017]	
	[1.283]	KOF3 ($t-1$)	−2.277**	[0.934]	
Civil law colonies (32 countries)	1.506				Coefficient on KOF1 and KOF2 positive, but not significant
	[1.403]				
Common law colonies (26 countries)	3.606*	KOF1 ($t-1$)	1.881*	[1.083]	
	[1.933]	KOF2 ($t-1$)	5.401***	[1.8899]	
Excluding sub-Saharan African countries (23 countries)	1.713***	KOF1 ($t-1$)	1.568***	[0.4799]	Estimations exclude countries with very high and high adult prevalence of HIV
	[0.532]	KOF2 ($t-1$)	0.639**	[0.325]	
Excluding Latin American countries (23 countries)	2.380*	KOF1 ($t-1$)	2.727***	[0.913]	
	[1.296]				
Excluding East Asian countries (10 countries)	1.999	KOF1 ($t-1$)	3.535***	[0.761]	
	[1.221]	KOF3 ($t-1$)	−1.903**	[0.8399]	

Estimations include country dummies and period dummies; panel-corrected standard errors in brackets.
* Denotes statistical significance at 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at 1% level.

no immediate negative effect on health status, but a significant simultaneous relationship between economic globalization and life expectancy remains. Notably, the magnitude of the coefficient indicates that the health benefit of economic globalization is greater when the process is allowed to work for some years. This interpretation is confirmed when we change the

panel from 4-year periods to *8-year periods*, an exercise that increases the size of estimated coefficients.

A third set of sensitivity tests involves *replacement of variables*. We first replace the KOF Index with the globalization index developed by the Centre for the Study of Globalization and Regionalisation at Warwick university (*the CSGR-index*), and again economic globalization is positive and significant. Running separate regressions using *female and male life expectancy*, indicates that globalization is actually more beneficial to women than to men, contrary to the findings in Bussmann (2009).

A fourth type of sensitivity assessment examines if our baseline results change when *excluding various groups* of countries. First, we exclude the five countries in our sample with the *highest prevalence of HIV*, where life expectancy has decreased over the 1990–2005 period. Doing so renders the effect of political globalization insignificant while the effect of economic globalization remains. Next, we limit the sample to *stable democracies only,* defined as having a polity-IV-score of at least 7 during the entire period.[16] This renders all globalization coefficients positive, with significance for economic and social globalization. Though not shown, including countries with lower polity-IV-score decreases the coefficient on political globalization, suggesting that the negative effect in the full sample may be driven by autocracies. We next test if the benefits from globalization exist also in *former colonies*. Using the classification of countries recently employed by Joireman (2004), we find that the effect of the aggregate index is greater in former colonies with common law, where we also find a big positive effect of social globalization. In colonized countries with civil law, we find no significant effects. We have also compared all colonized countries with countries never colonized, in which case the positive effect of economic globalization is bigger and more significant in former colonies.

Finally, we exclude three geographic groups of countries. Excluding *East Asian countries* has little effect, keeping the effect of economic globalization significant and positive and that of political globalization significant and negative. Excluding *Latin American countries*, renders a situation in which political globalization does not reduce life expectancy. The negative influence of the political dimension of globalization also disappears when excluding the *Sub-Saharan African countries* from the analysis. Excluding Sub-Saharan Africa also reveals a positive effect of social globalization, suggesting that social integration and personal cross-border contacts generally improve population health, but not in Sub-Saharan Africa. Most likely, this effect is caused by HIV/AIDS.

To summarize, the positive effect of economic globalization on life expectancy is very robust. Increasing economic interaction with other countries is important in improving average health outcomes. Conversely, the negative relationship between political globalization and health can potentially be explained by many factors: It might be, for example, an autocracy-effect, an HIV-effect or a Latin-America-effect (or a combination of these). Closer examination of the data reveals that many countries in Latin America have experienced decreasing political globalization, increasing economic globalization, and increasing life expectancy since the 1970s—possibly an effect of what Biglaiser (2002) calls "the internationalization of Chicago's economics in Latin America."[17]

(c) *Distinguishing between levels of development*

The relationship between globalization and life expectancy may well differ between rich and poor countries. For one thing, Cutler *et al.* (2006) note that the mortality pattern is very different: in low-income countries, 30% of all deaths occur before age 4, while the corresponding proportion in high-income countries is 0.9%. For another, high-income countries have more deaths caused by cancer and cardiovascular disease, while low-income countries have more deaths from respiratory infections and HIV/AIDS. This suggests that even small improvements in knowledge, nutrition, and access to pharmaceuticals may have large positive health effects in low-income countries. Finally, the sensitivity analysis indicated a negative relationship between political integration and health in (some) low- and middle-income countries.

We first examine the relationship between globalization and life expectancy for countries with low GDP *per capita* in 1970. These 47 countries are kept in the sample regardless of whether they remained poor throughout the period or whether they moved up the income *per capita* ladder. As shown in Table 5, both economic and social globalization seem to increase life expectancy under these circumstances. The size of the effect of economic globalization is about the same as in the full sample. Notably, there is in this case no negative relationship between political globalization and life expectancy. The results confirm the initial finding that public health measures and nutrition matter to longevity. In fact, the magnitude of the positive impact of higher calorie intake is greater in this setting than when using the full sample.

A standard approach when examining whether coefficients vary with income level is to include interaction terms. For example, Owen and Wu (2007) find a negative multiplicative effect, suggesting that trade openness has a greater effect in low-income countries, using this technique. As noted by Braumoeller (2004), multiplicative interaction terms make it

Table 5. *Globalization and life expectancy: low-income countries in 1970*

	(1)	(2)	(3)	(4)
KOF ($t-1$)	2.621*			
	[1.467]			
KOF1 ($t-1$)		2.601***		
		[0.852]		
KOF2 ($t-1$)			1.525**	
			[0.763]	
KOF3 ($t-1$)				−0.948
				[0.851]
GDP	1.211	0.851	1.066	1.131
per capita ($t-1$)	[0.825]	[0.875]	[0.697]	[0.813]
Dependency	0.813	3.657	0.599	1.519
	[4.280]	[4.949]	[4.242]	[4.095]
Urban share of population	0.0188	0.0408	0.0239	−0.0643
	[0.0620]	[0.0564]	[0.0644]	[0.0659]
Average years of education	−0.785	−1.394	−0.614	−0.783
	[1.287]	[1.328]	[1.405]	[0.942]
Physicians	1.500***	1.544***	1.460***	1.149**
	[0.501]	[0.551]	[0.487]	[0.536]
Nutrition	15.54***	15.07***	15.90***	16.70***
	[4.222]	[4.324]	[4.192]	[4.655]
Observations	307	282	303	307
Number of countries	47	43	46	47
R^2	0.994	0.993	0.993	0.994

Estimations include country dummies and period dummies; panel-corrected standard errors in brackets.
R-square statistics include influences of country dummies.
* Denote statistical significance at 10% level.
** Denotes statistical significance at 5% level.
*** Denotes statistical significance at 1% level.

harder to interpret other coefficients in the model, and the use of interaction terms assumes a simple linear relationship between (in our case) the effect of globalization and income. Including interaction terms between dimensions of globalization and income, both globalization coefficients and interactions terms are insignificant, suggesting that there is no simple linear relationship between size of globalization coefficient and income.[18] To get a better understanding of how the globalization–health relationship varies with income level, we estimate the globalization coefficients repeatedly while excluding observations from the highest-income countries, one-by-one, and re-estimate the equation.

Figures 2–4 demonstrate how the coefficient estimates and panel-corrected standard errors (for a 95% confidence interval) of economic, social, and political globalization vary as we gradually move from full sample to focusing only on the observations from the lowest-income countries.[19] The graph shows that little happens to the different globalization estimates as we gradually restrict the full sample by excluding all observations from countries with incomes higher than approximately 4000 PPP dollars. The relationship is insignificant at lower GDP levels, but when we focus only on the lowest-income countries in our sample, the effect is actually positive and significant. A similar pattern holds for social globalization, except that the effect in most regressions is not significantly different from zero.

Political globalization, however, is negative and often borderline significant until we exclude countries with incomes higher than approximately 3000 PPP dollars. Below this level, the effect is actually sometimes positive and significant. However, we know from the sensitivity analysis that the effects of political globalization are likely driven by just a few countries, explaining the sudden jumps in the curve occurring when observations from these countries are excluded.

In general, the shape of the coefficient curves in Figures 2–4 reveals a globalization–health relationship that varies with income level in a way too complex to be captured by interaction effects or sample divisions only.

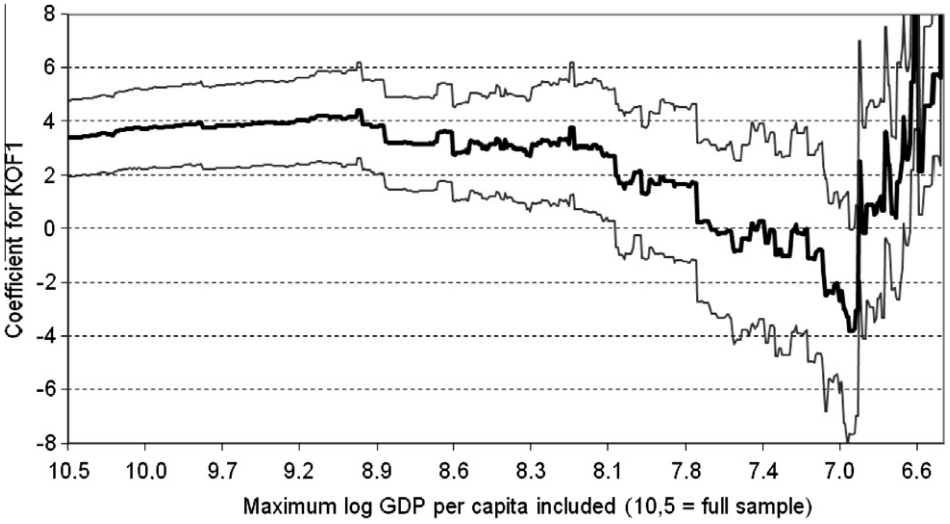

Figure 2. *The effect of economic globalization on life expectancy when excluding high income observations.*

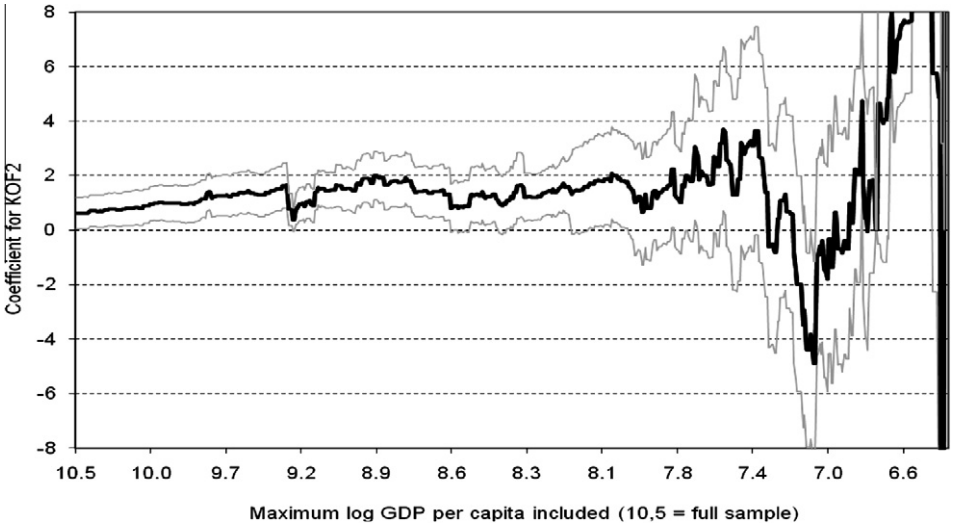

Figure 3. *The effect of social globalization on life expectancy when excluding high income observations.*

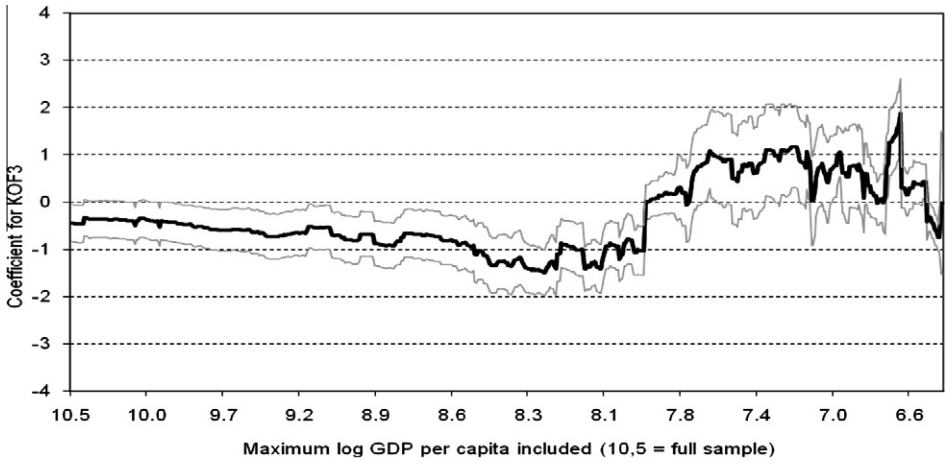

Figure 4. *The effect of political globalization when excluding high income observations.*

5. CONCLUSIONS

Examining the relationship between three dimensions of globalization and life expectancy, the most robust finding is a positive relationship between economic globalization and life expectancy. To put the size of the estimated effect into perspective, note that Uganda, for example, increased its KOF value for economic globalization from 22 to 46 (almost two standard deviations) over the 1970–2005 period, thereby increasing life expectancy by two to three years, according to our estimates. This effect is about as great as a one-standard-deviation increase in nutritional intake, which increases life expectancy by roughly two years. [20] Such calculations are only for illustrative purposes, but they do indicate that the effects are economically and politically relevant.

In addition to the main result, our analysis generates several additional findings worthy of further examination. First of all, we find no evidence that our main result is driven by developed countries. In fact, excluding the observations from countries with the highest income increases the estimated effect of economic globalization on health until all observations with income higher than 7300 PPP dollars are excluded. After that, the effect decreases and is sometimes insignificant, though in the poorest part of our sample, the effect is again positive, and both economically and statistically significant.

Second, we have found that the effect of social globalization is less robust and often not significant. This may indicate that social globalization is less important, but it is also possible that the effect varies between different types of social globalization, or between different countries, as suggested in the sensitivity analysis.

Third, we have found that whenever significant, the effect of political globalization is negative. Our sensitivity checks suggest that this effect might be driven by autocracies in the sample, but the influence of HIV or other geographic factors are probably also important. It might be worth examining if the effects of globalization vary systematically with the degree of democracy as our sensitivity tests suggest they do.

A fourth finding that merit further investigation is the different effect of globalization on life expectancy in colonized and colonizing countries. Colonized common law countries seem particularly prone to benefit from globalization, and the discussion in Joireman (2004) suggest that protection of property rights may be a part of the explanation.

Finally, our choice of dependent variable separates this paper from the mainstream debate concerning the consequences of globalization, in which the effect on GDP levels and growth has attracted much attention. However, especially when it comes to the effects of globalization in low-income countries, we should acknowledge that there are substantial measurement problems in GDP data. We do not claim that life expectancy data are free from measurement errors, but we do argue that the effects of globalization on development are better understood by examining its effect on a range of different dependent variables, such as trust, literacy, infant mortality and poverty. Returning to the title of this paper, we believe the results motivate a bold conclusion: For economic globalization, evidence suggest it is, indeed, good for living.

NOTES

1. The acronym KOF comes from Konjunkturforschungsstelle, the institute where the index is published and can be downloaded: http://kof.ethz.ch/. We have used the 2008 version.

2. For example, Soares (2007) argues that increases in life expectancy during 1960–2000 were largely independent of improvements in income.

3. Note, however, that the empirical link between globalization and growth is debatable and depends on how globalization is measured (*cf.* Lee Ha, Ricci Luca, & Rigobon, 2004; Rodriguez & Rodrik, 2000).

4. Reviewing Schwartz's book, Veenhoven (2005) claims it to be "persuasive at first sight," but adds that "a closer look shows the evidence to be flimsy" (p. 94).

5. Note however that the often-noted negative correlation between income inequality and health as described by, for example, Wilkinson (1996) is likely to be a statistical artifact caused by the non-linear relationship between individual income and health, as explained by Gravelle (1998).

6. Recent empirical evidence, however, cast doubt on both the race to the bottom hypothesis (Dreher et al., 2008) and the compensation hypothesis (Kim, 2007). Moreover, empirical evidence on the relationship between government size and population health is inconclusive (Bjørnskov, Dreher, & Fischer, 2007; Tsai, 2007) is inconclusive.

7. Their results imply that a one-standard-deviation increase in the log of openness for a country in the lowest quintile of real GDP is associated with a drop of approximately seven infant deaths per 1000 (a reduction in average infant mortality of approximately 8%). The increase in female (male) life expectancy associated with a one-standard-deviation increase in log openness is 1.39 (0.84) years.

8. An obvious problem in Tsai's (2007) study is that *per capita* income is used as both an explanatory variable and as part of the HDI. This is addressed by the author in a footnote, where it is also reported that "economic globalization generated significantly favorable impacts on life expectancy, and all but political globalization measures produced positive impact on infant mortality" (p. 124).

9. Using the Stata command "xtreg, fe," FE estimates are robust to disturbances being heteroscedastic if using the robust option. In the case of heteroscedasticity and autocorrelation within panels, one should use the "cluster()" option (Hoechle, 2007; Wiggins, 2001).

10. We use the Stata command "xtpcse."

11. The FE estimator cannot correct for contemporaneous correlation. Moreover, the FE and PCSE estimators differ in that the former is asymptotic in the number of panels while the latter is asymptotic in the number of periods.

12. The CSGR Index is highly correlated with the KOF Index in all dimensions but one: In the CSGR Index, economic globalization is only measured using flow-variables (as opposed to also including policy variables such as tariff rates), and the index aims to correct for differences in country size, population and whether the country is land-locked or not.

13. Data on the average number of years of schooling are reported on a five-year basis from 1960 to 2000. In this study, we linearly interpolate for intervening years. In the final period, "average years of education" refers to the average number of years of schooling in period $t - 1$. Regression results are robust to the exclusion of the final period.

14. Results are confirmed using FE estimation, not shown but available from the authors upon request.

15. Though not shown, we have verified that our results are robust to using alternative education data from Lutz, Goujon, Samir, and Sanderson (2007).

16. The Polity-IV Index (http://www.systemicpeace.org/polity/polity4.htm) classifies countries on a scale from −10 to 10, where countries with scores from −10 to −6 are autocracies and countries with scores higher than 6 are democracies.

17. Biglaiser (2002) analyzes how US government-supported training of Latin American economists at the University of Chicago translated into general support for economically liberal reforms in many Latin American countries.

18. In our case, adding an interaction term turns the coefficients of the lower-order terms into conditional effects, measuring the effect of types of globalization when GDP *per capita* equals zero.

19. Figures 2–4 do not include coefficient estimates based on the 40 observations from countries with the lowest GDP *per capita*.

20. Assuming a coefficient for economic globalization of approximately 3–4, and a nutrition coefficient of 11 (taken from Tables 3 and 4).

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APPENDIX A

See Tables A1, A2, A3.

Table A1. *The KOF index of globalization*

A. Economic Globalization
(i) Actual Flows
Trade (percent of GDP)
Foreign direct investment, flows (percent of GDP)
Foreign direct investment, stocks (percent of GDP)
Portfolio investment (percent of GDP)
Income payments to foreign nationals (percent of GDP)
(ii) Restrictions
Hidden import barriers
Mean tariff rate
Taxes on international trade (percent of current revenue)
Capital account restrictions
B. Social globalization
(i) Data on personal contacts
Outgoing telephone traffic
Transfers (percent of GDP)
International tourism
Foreign population (percent of total population)
International letters (*per capita*)
(ii) Data on information flows
Internet hosts (per 1000 people)
Internet users (per 1000 people)
Cable television (per 1000 people)
Trade in newspapers (percent of GDP)
Radios (per 1000 people)
(iii) Data on cultural proximity
Number of McDonald's restaurants (*per capita*)
Number of Ikeas (*per capita*)
Trade in books (percent of GDP)
(C) Political globalization
Embassies in country
Membership in international organizations
Participation in UN Security Council missions

Table A2. *Sample coverage*

Low-income countries
Bangladesh, Benin, Burundi, Central African Republic, *Chad*, Congo, Dem. Rep., *Cote d'Ivoire*, Ghana, Guinea-Bissau, Haiti, India, Kenya, *Madagascar*, Malawi, Mali, *Myanmar*, Nepal, Niger, Nigeria, Pakistan, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Uganda, Zambia, Zimbabwe

Middle-income countries
Albania, Algeria, Argentina, *Belize,* Bolivia, Botswana, Brazil, *Bulgaria*, Cameroon, Chile, China, Colombia, Congo, Rep., Costa Rica, *Croatia*, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, *Gabon*, Guatemala, Guyana, Honduras, Hungary, Indonesia, Iran, Islamic Rep., Jamaica, Jordan, *Latvia*, *Lithuania*, Malaysia, Mauritius, Mexico, *Morocco*, *Namibia*, Nicaragua, Panama, Paraguay, Peru, Philippines, Poland, *Romania*, *Russian Federation*, *Slovak Republic,* South Africa, Sri Lanka, Syrian Arab Republic, Thailand, Tunisia, Turkey, *Ukraine*, Uruguay, Venezuela RB

High-income countries
Australia, Austria, *Bahamas,* Barbados, Belgium, Canada, Cyprus, *Czech Republic*, Denmark, *Estonia*, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Kuwait, *Luxembourg*, Malta, Netherlands, New Zealand, Norway, Portugal, *Slovenia*, Spain, Sweden, Switzerland, Trinidad and Tobago, *United Arab Emirates*, United Kingdom, United Sates

Countries in italics are only included in the regressions in the sensitivity analysis when we allow the sample size to vary across specifications.

Table A3. *Correlation matrix*

	KOF1	KOF2	KOF3	GDP *per capita*	Dep.	Urban population	Avg. years of education	Physicians	Nutrition	Income inequality	Government consumption	Urb. . rate	Economic (CSGR)	Social (CSGR)	Political (CSGR)
KOF1	1														
KOF2	0.84	1													
KOF3	0.25	0.37	1												
GDP *per capita*	0.76	0.84	0.39	1											
Dependency	−0.61	−0.65	−0.41	−0.77	1										
Urban population	0.65	0.70	0.42	0.77	−0.66	1									
Average years of education	0.68	0.79	0.53	0.84	−0.79	0.72	1								
Physicians	0.65	0.69	0.45	0.79	−0.76	0.73	0.81	1							
Nutrition	0.65	0.64	0.48	0.76	−0.71	0.66	0.75	0.75	1						
Income inequality	−0.29	−0.40	−0.43	−0.48	0.63	−0.35	−0.59	−0.59	−0.57	1					
Government consumption	0.07	0.01	−0.16	−0.08	0.20	−0.18	−0.14	−0.04	−0.16	−0.12	1				
Urbanization rate	−0.45	−0.44	−0.28	−0.49	0.44	−0.42	−0.48	−0.55	−0.41	0.32	−0.02	1			
Economic globalization (CSGR)	0.45	0.33	0.12	0.29	−0.36	0.23	0.21	0.18	0.25	−0.15	−0.21	0.37	1		
Social globalization (CSGR)	0.75	0.87	0.35	0.83	−0.62	0.57	0.73	0.64	0.62	−0.51	−0.04	0.40	0.28	1	
Political globalization (CSGR)	0.31	0.40	0.91	0.39	−0.40	0.37	0.57	0.29	0.48	−0.26	−0.39	0.32	0.28	0.26	1