11

The Redirection of Civilization*

> Cultures do not exist as simply static "differences" to be celebrated but compete with one another as better and worse ways of getting things done.
>
> – Sowell 1996: 378

The theory of emancipation derives its description of human empowerment from a single evolutionary principle: the utility ladder of freedoms. Accordingly, human empowerment is a development that elevates societies on the utility ladder of freedoms. Two theses of the theory address separate aspects of causality in this ascension. The sequence thesis addresses the *endogenous* causation of human empowerment, that is, the dominant flow of impact among its three elements: action resources, emancipative values and civic entitlements. Specifically, the sequence thesis suggests that, as expanding action resources increase the objective utility of freedoms, growth in freedoms' subjective valuation and in their legal guarantees follow subsequently, giving rise to emancipative value and to civic entitlements. Chapters 4, 8 and 9 provided conclusive evidence in support of this sequence.

In contrast to the sequence thesis, the source thesis addresses the *exogenous* causes of human empowerment. Exogenous causality refers to the original source of human empowerment, which cannot itself be an element of the process. Since we have not yet dealt thoroughly with the exogenous causes of human empowerment, this chapter examines the source thesis. The source thesis posits that human empowerment originates in a particular environmental condition. This condition harbors two natural forms of existential security and

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existential autonomy, both of which bestow on freedoms an initial utility that is otherwise lacking. I identify this environmental condition in what I call the *cool-water condition* (CW condition).

The CW condition is a combination of (1) moderately cold climates, (2) continuous rainfall over all seasons, and (3) permanently navigable waterways. Why is this condition significant? First, colder temperatures with mild seasonal frost kill microbes and, thus, diminish infectious diseases (Jones 1987; Landes 1998). Colder temperatures also decelerate soil depletion, which improves land productivity (Masters & Wiebe 2000; Easterly & Levine 2003). Second, continuity of rainfall over the seasons further improves land productivity and, combined with colder temperatures, keeps water sources healthier (Dell, Jones & Olken 2011). Moreover, colder temperatures greatly diminish physical exhaustion from work, which is conducive to labor productivity (Deschenes & Greenstone 2007; Graff Zivin & Neidell 2010). Third, availability of permanently navigable waterways is a lubricant of economic exchange and democratizes market access (Gallup & Sachs 2000).

In combination, colder temperatures, continuous rainfall, and navigable waterways generate the CW condition. Under this condition, soil is arable without irrigation and small farming households in the possession of an iron plow and an ox can work large sections of land on their own. There is not much need of community support and no need of extended families with many children to provide armies of land laborers. No central power can monopolize access to water as a means to control people under the CW condition (Jones 1987; Landes 1998; Solomon 2011).

As concerns the situation of ordinary people, the CW condition embodies an original form of existential security, "disease security," as well as an original form of existential autonomy, "water autonomy." Building on recent breakthroughs in sociobiological theory by Fincher, Thornhill, Murray and Schaller (2008), I define disease security as a low natural incidence of communicable diseases (see also Thornhill, Fincher & Aran 2008). The idea of "water autonomy," by contrast, is foreshadowed in the work of Wittfogel (1957) and has been rediscovered by Midlarsky and Midlarsky (1999), yet little attention has been paid to it since then. Water autonomy simply means equal, easy, and permanent access to safe and clean water for all people on a given territory.

Using geographic data from Gallup, Mellinger, and Sachs (2010) and historic estimates of development from Maddison (2007) and Vanhanen (2003), I demonstrate that the CW regions of our planet score exceptionally high on disease security and, by definition, have a high degree of water autonomy. Next, I demonstrate that the base process of human empowerment – mass scale technological advancement[1] – began to accelerate to its industrial pace first in the CW regions and remains until today closely linked with an area's

[1] The qualification "mass scale" is intended to indicate the development of technologies that are used by wide population segments, not just the elites.

original disease security and water autonomy. Applying *unified growth theory* (Galor 2011), I identify the mechanism that mediates the impact of a society's original disease security and water autonomy on its technological advancement today: the upgrading of the workforce's value. With higher existential security and autonomy, it is rewarding to reallocate time from maximizing fertility to improving skills. As a result, the size of the workforce is kept small while its quality improves. For employers, this means that the factor costs for labor are high. Once rising urban markets increase labor demand, costly labor establishes an incentive to search for technologies that save labor (Landes 1998). I analyze these mechanisms in a path model that demonstrates a flow of impact along the following sequence: geographical conditions dating back to prehistoric times → disease security and water autonomy dating back to historic times → fertility control in recent time → technological advancement today.

As Chapter 4 has shown, technological advancement on a mass scale is the base process of human empowerment from which emancipative values and civic entitlements follow. Hence, by identifying the environmental root cause of technological advancement, we provide an exogenous explanation of the complete human empowerment process.

However, I also demonstrate that the advantages of high disease security and water autonomy did not begin to surface before 1450–1500 CE. The reason for the delay is that these advantages need vibrant urban markets to come to fruition, and no mature urban civilization emerged in CW regions before this time. The causes of the late maturation of CW regions are two-fold. First, given their large migratory distance from the human origin in East Africa, CW regions were populated later than the original, semiarid areas of civilization in the Middle East, India, China, and Southeast Europe. The larger migratory distance also means a larger diffusion distance from the original centers of agriculture and urbanity in the Middle East. Second, CW regions embody a delay factor that postpones the abandonment of the foraging lifestyle. Ironically, the delay factor originates precisely in the higher initial utility that the CW regions bestow on freedoms: this utility discourages an early abolition of the free foraging lifestyle. As a consequence, the full-scale adoption of surplus agriculture is delayed. So is the flourishing of urban civilization because it needs surplus agriculture to feed urban populations. But once this initial postponement is overcome, the CW condition turns into an accelerator of technological advancement for the same reason: the higher utility of freedoms under this condition. In the context of markets, water autonomy creates derivative autonomies, such as autonomy in marketing one's ideas, skills, and produce – the engine of technological advancement. The latter two points are demonstrated by evidence from the Standard Cross-Cultural Sample, an anthropological dataset of the lifestyles of historic populations around the world (Divale 2004).

Finally, I present evidence for what I call the *contagion thesis*. Human empowerment is breaking free from its confinement to the CW condition, and globalization is the reason for its detachment from this particular environmental condition. There are still more than enough places in the world where people continue to live in poverty and oppression. Yet global communications are tearing down the veil of ignorance that used to shield rulers from mass expectations for a better life. As these expectations diffuse, human empowerment begins to globalize. The following sections flesh out these arguments and present the evidence. The chapter closes with a summary of key points.

1. THE COOL-WATER CONDITION AS AN EXOGENOUS CAUSE

We have seen broad evidence showing that human empowerment starts from action resources and that emancipative values as well as civic entitlements follow subsequently. Hence, if we can explain expanding action resources, we explain the entire human empowerment process.

Throughout this book, it turned out that all three types of action resources – material means, intellectual skills, and connective opportunities – expand through mass scale technological advancement. Hence, the question of the exogenous causes of action resources boils down to the causes of mass scale technological advancement.

If the causes we are searching for are to be truly exogenous, they must not be human achievements. Otherwise, we continue to explain human achievement in one domain with human achievement in another domain. In this case, we remain entrapped in endogeneity and fail to explain human achievement in the first place. Clearly, the requirement for exogeneity eliminates institutions and ideologies from the list of possible root causes.

Now, if one thinks of the causes that are most indisputably exogenous to any type of human achievement, environmental conditions are an obvious candidate (Diamond 1997; Landes 1998; Nolan & Lenski 1999; Olsson & Hibbs 2005). But are there any links between environmental conditions and indicators of development? Indeed, there are such links. For instance, Gallup and Sachs (2000) document strong correlations across the globe between a society's per capita gross domestic product (GDP) and its territory's navigable waterways. Likewise, productivity and prosperity of societies around the world increase alongside falling annual mean temperatures and continuous rainfall over all seasons (Masters & Wiebe 2000; Deschenes & Greenstone 2007; Graff Zivin & Neidell 2010). A recent longitudinal study by Dell, Jones, and Olken (2011) shows that even small fluctuations in temperature and rainfall over time have an immediate impact on growth and prosperity, controlling for potentially confounding factors.

Apparently, the advantageous environmental condition consists in the combination of cool temperatures with continuous seasonal rain and permanently navigable waterways – the CW condition. This combination is prevalent in certain geographic zones. Using the Koeppen-Geiger climate classification, these features are prevalent in zones categorized as "temperate: no dry season" and "cold: no dry season" (Peel, Finlayson, & McMahon 2007).[2] Gallup, Mellinger, and Sachs (2010) provide data indicating the fraction of every society's inhabitable territory located in the various climate zones of the Koeppen-Geiger classification. Calculating on this basis the fraction of each society's CW territory,[3] this fraction correlates at r = 0.70 with societies' technological advancement in 2005 (p < 0.001; N = 134). Worldwide, the fraction of a society's CW territory explains roughly 50 percent of the cross-national variation in technological advancement. Indeed, the technologically most advanced populations are highly concentrated in our planet's CW territories: Western Europe, the coastal areas of North America, Japan and South Korea, Southeast Australia, New Zealand, Uruguay, and the cape region of South Africa.

Despite climatic fluctuations, the *big pattern* with regard to which territories on the globe are hotter and which colder and which are dryer and which rainier can be considered as more or less constant over the last couple of centuries (Peel, Finlayson & McMahon 2007; Kuhle 2011). Hence, the CW-environment describes a condition that is temporally very remote; it is definitely older than the explosive development that humanity experiences since just a couple of centuries (Landes 1998). The CW condition is, thus, *perfectly exogenous* to the technological achievements of today, of past decades and even of recent centuries. The very exogeneity of the CW condition eliminates all ambiguity concerning the possible causal direction in the strong connection between the CW condition and technological advancement. The possibility that the connection exists because technological advancement has produced the CW condition can be excluded with certainty. The causal arrow can only run from the CW condition to technological advancement. This still leaves us with uncertainty about the intervening mechanism that explains the strong connection, but there is no ambiguity about its direction.

Civilization matured considerably earlier outside the world's CW territories. Indeed, millennia before urban civilization emerged in CW territories, it existed in the Oriental band from the Middle East to China (Jones 1987; McNeill 1990; Levine 2001; Modelski 2003; Goldstone 2009). But despite millennia of urban culture, none of the Oriental civilizations pioneered the scientific technology explosion that set the stage for the Industrial Revolution (Hall 1989). Instead, this happened where urbanity matured latest: Western Europe and Japan – the only two urban civilizations in CW territories in preindustrial times (Jones 1987; McNeill 1990; Powelson 1997). These observations raise two questions:

[2] These are known as zones cf and df in the Koeppen-Geiger scheme.

[3] To be precise, I calculate for each society the fraction of its habitable territory in cold or temperate and wet zones that it has in excess of the fraction in hot and dry zones, based on the Koeppen-Geiger as detailed in Appendix 11 (www.cambridge.org/welzel). Data are taken from Gallup, Mellinger, and Sachs (2010).

1. What makes societies in CW areas prone to technological advancement once they have reached urban maturity?
2. Why did societies in CW areas reach urban maturity late?

Paradoxically, the answer to both questions lies in the same factor: the initial utility of freedoms under CW conditions. Technological advancement requires time investments in innovation and the marketing of ideas. More such time is available when people are existentially secure because then they need to spend less time for making things safe. Likewise, people have more time for innovation and marketing when they are existentially autonomous because then they are less preoccupied with executing the orders of authorities. If these assumptions are correct, the link between technological advancement and the CW condition exists because this condition harbors some original form of existential security and autonomy.

Indeed, CW territories embody two original forms of security and autonomy: disease security and water autonomy. Because of that, freedoms have higher initial utility in CW areas and people in these areas are more prone to freedoms. This explains both the delayed advancement and its subsequent acceleration in CW areas. Since foraging is a freer lifestyle than agriculture, and because people in CW areas are more prone to freedoms, these people stick to foraging as long as possible. This decelerates the emergence of surplus agriculture and urban markets. But once the delay is overcome and urban markets begin to flourish, the initial utility of freedoms turns into an accelerator that makes more time available for innovation and marketing. The following sections evidence these propositions.

2. EVIDENCING THE COOL-WATER EFFECT

First, let's look at the two original forms of existential security and autonomy: disease security and water autonomy. Disease security means a low natural incidence of communicable diseases. Using historic disease data from Murray and Schaller (2010), disease security correlates across the globe at $r = 0.73$ ($N = 165$; $p < .001$) with the fraction of a society's CW territory. This relationship is not explained by the fact that CW societies are richer and have better health provision for this reason: although CW societies are richer, the CW condition favors disease security independently from prosperity.[4]

Disease security correlates with the CW condition because the lower temperature of CW zones hampers parasites. But disease security does not reflect

[4] After controlling for per capita GDP in 1995 (or some other year), the association between the fraction of the area in cold-temperate and rainy zones and disease security drops from $r = 0.74$ to a partial r of 0.60 but remains positive and highly significant ($p < 0.001$; $N = 156$). The partial r for per capita GDP is 0.22. This shows that the historic data on disease security primarily indicate an area's *natural* disease incidence, much more than disease security achieved through prosperity in recent times. The measure is *not* endogenous.

another signature feature of CW zones: continuous rainfall. Is there something about this feature that accounts for the CW zones' propensity to accelerated technological advancement? I suggest the responsible factor is *water autonomy*: equal, easy, and permanent access to safe and clean water for all individuals on a territory.

Autonomous access to water cancels a historic route to despotism: control over people through irrigation management (Wittfogel 1957; Jones 1987; McNeill 1990; Midlarsky & Midlarsky 1999; Solomon 2011; Bentzen, Kaarsen, & Wingender 2012).[5] Giving rulers less control over their subjects, water autonomy is the source of subsequent autonomies once commercial urban centers emerge – including autonomy in market access, in skill allocation, and in profit acquisition (Powelson 1997; Landes 1998). With these autonomies, people can reap the benefits of their creativity, which is a stimulus for innovation – the source of technological advancement.

To create a precise measure of the CW condition, I calculate the fraction of a society's inhabitable area in CW zones that exists in excess of the fraction in dry and hot zones, according to the Koeppen-Geiger classification (data from Gallup et al. 2010). If all area is in the CW zone and none in the dry and hot zones, the score is 1.0. If none of the area is in the CW zone and all is in dry and hot zones, the score is 0. If all area is in neither zone or in both zones to equal parts, the score is 0.50. However, these area proportions still show considerable variation in (a) the amount of continuous rainfall as well as (b) in the abundance of permanently navigable waterways. Hence, I use a weighting procedure to factor in this uncovered variation. In this way, I obtain a very fine-grained version of the ultimate *cool-water index* (CWI). It varies between 0 for the complete absence of the CW features to 1.0 for their maximal presence. The CWI is, at the same time, a measure of water autonomy. The exact steps of the index construction are detailed in Appendix 11 (www.cambridge.org/welzel).

Figure 11.1 illustrates the astonishingly strong effect of the CWI on technological advancement in 2005. If we refer to both disease security and the CWI, these two natural endowments explain fully 90 percent of the cross-regional variance and 74 percent of the cross-national variance in contemporary technological advancement around the world ($N = 139$). But, even though the two are intertwined, the impact of the CWI is considerably stronger than that of disease security. Under mutual control, the CWI accounts for 72 percent of the global cross-regional variance and 45 percent of the cross-national variance in technological advancement, compared to 18 and 14 percent accounted for by disease security. This justifies a focus on the outstanding impact of the CWI. The obvious questions are how far this impact reaches back in time and what mechanism explains it.

[5] Even though Wittfogel's (1957) thesis that irrigation predated bureaucracy is contested, it is beyond doubt that large-scale irrigation facilitates power concentration. Conclusive evidence presented by Bentzen, Kaarsen, and Wingender (2012) confirms this point.

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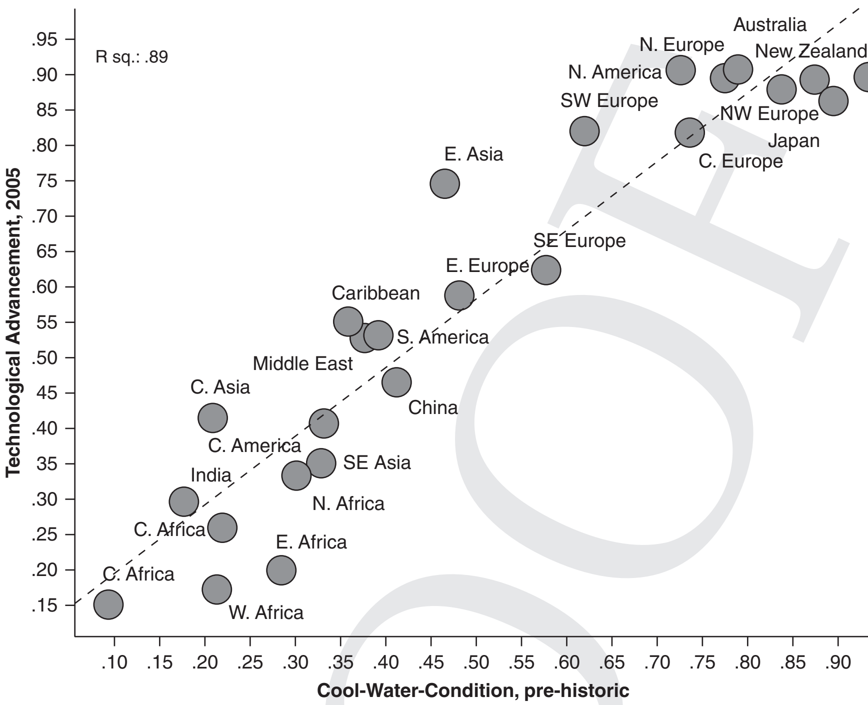

FIGURE 11.1 The Impact of the Cool-Water Condition on Technological Advancement. Data are available for 142 societies. For better readability, they are summarized into twenty-five global regions. Note that the global cross-regional variation accounts for 75 percent of the cross-national variance in water autonomy and 81 percent of the cross-national variance in technological advancement. Across all 142 societies, water autonomy accounts for 73 percent of the variation in technological advancement (see Figure 3.5). For more descriptive details and data documentation, see Appendix 11 (www.cambridge.org/welzel).

The direct indicator of technological advancement used for contemporary times is not available for historic times. Hence, to explore the impact of water autonomy on technological advancement over historic periods, we must use reasonable proxies for technological advancement. Figure 11.2 uses as an indicator of technological advancement the proxy from Vanhanen (2003) introduced in Chapter 4. This proxy combines data on a society's literacy and urbanization rates. The proxy is available decennially going back to the decade 1850–60. In each decade, measures are available for all independent states at the time. For periods before 1850, I use as an alternative proxy Maddison's (2007) per capita income estimates for thirty-one exemplary territories from around the world. Missing data for intermediate time points are interpolated as detailed in Appendix 11 (www.cambridge.org/welzel). For every decade from 1500 to 2010, I correlate these proxies for technological advancement with

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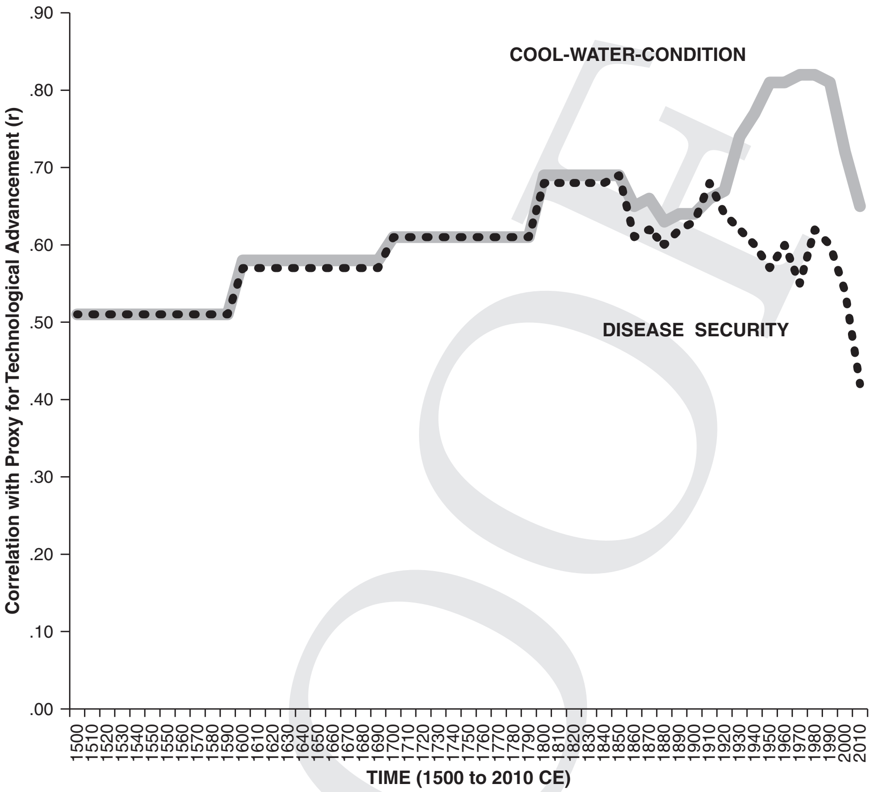

FIGURE 11.2 The Impact of Disease Security and the Cool-Water Condition on Technological Advancement over Time and across the World (from the beginning of the modern era until today).

For the decades from 1850 to 2000, the diagram uses the proxy of technological advancement introduced in Chapter 4, based on data from Vanhanen (2003) on urbanization and literacy rates. For the decades from 1500 until 1850, Maddison's (2007) estimates of per capita incomes for 31 exemplary countries from around the world are used instead of Vanhanen's urbanization and literacy estimates. For 2010, per capita gross domestic product (GDP) in purchasing power parities from the World Bank's (2010) World Development Indicators Series is used. Number of societies covered by data varies over time. For more descriptive details and data documentation, see Appendix 11 (www.cambridge.org/welzel).

the CWI (and disease security). Since the CWI indicates features of the natural environment that exist prior to the technological advancement of recent decades and centuries, I interpret these correlations as reflecting the impact of the CWI on technological advancement. Figure 11.2 traces the impact of the CWI to the origin of the modern era: the rise of urban capitalism in the age of European Humanism around 1500 CE.

Despite some fluctuation, Figure 11.2 shows that the impact of the CWI on the technological advancement of the world's nations and territories is consistently high all the way from 1500 to 2010 – albeit with a recent dip that I address at the end of this chapter.

The CW condition is a natural endowment for which no prior human cause exists, and its impact on technological advancement is evident since the beginning of the modern era. This suggests that this condition is indeed a root cause of technological advancement.

3. EXPLANATIONS OF THE COOL-WATER EFFECT

There must be causes that are more proximate to technological advancement – causes that explain the impact of the CW condition. To sort out which causes these might be, Table 11.1 correlates contemporary technological advancement with a variety of potential causes looming prominently in the development literature. Table 11.2 uses multivariate regressions to examine which of these potential causes absorbs the technological impact of the CW condition. Arguably, the potential cause that absorbs most of the technological impact of the CW condition explains why that impact exists.

Since recently, an increasing number of scholars suggest genetic factors as a source of differences in development (Hatemi & McDermott 2012). Societal variation in the frequency of two genes calls particular attention: the $\text{Val}^{108/158}$Met polymorphism of the catechol-o-methyltransferase (COMT) gene, and the long-allelic version of the 5-HTTLPR gene. Both genes affect the human reward system by influencing the emission of stimulating hormones: dopamine in the case of the COMT gene; serotonin in the case of the HTTLPR gene. Data from the *allele frequency database* (ALFRED) at Yale University seem to suggest that both genes exist in different frequencies in different populations (cf., alfred.med.yale.edu). What is more, both genes are linked with traits that supposedly stimulate innovation and experimentation – the driving activities of technological advancement. In the case of the COMT gene, there is a positive link with two of the Big Five personality traits that supposedly encourage innovation and experimentation: "openness" and "extraversion." Likewise, the demographic prevalence of the COMT gene shows a negative link with the personality trait that supposedly discourages innovation and experimentation: "neuroticism" (Stein, Fallin, Schork, & Gelernter 2005; Wichers et al. 2008).[6] In the case of the HTTLPR gene, there is a positive link of its long-allelic version with cultural individualism – a trait that supposedly stimulates innovation and experimentation (Chiao & Blizinski 2010).

Since the CW condition bestows initial utility on freedoms, innovation and experimentation are rewarding activities under this condition. Possibly, then, the

[6] The other two traits are "agreebleness" and "conscientiousness." For the definition and measurement of the Big Five personality traits, see Matthews, Deary, and Whiteman (2003).

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TABLE 11.1 *Testing the Predictive Power of the Cool-Water Condition on Technological Advancement against Alternative Predictors (bivariate correlations).*

PREDICTORS of Technological Advancement	CORRELATION with Technological Advancement 2005	*N* (societies)
• Fertility Control, 1980	0.87***	141
• Cool Water, historic	0.84***	142
• State Integrity, 2000	0.78***	143
• Civic Entitlements, 2000	0.73***	130
• Disease Security, historic	0.72***	143
• Order and Stability, 2000	0.71***	143
• Cultural Individualism, 1990s	0.70***	84
• Consanguinity (logged)	−0.70***	66
• Val$^{108/158}$Met COMT Gene	0.52***	50
• Democratic Tradition, until 2000	0.51***	151
• White Settler Mortality, historic	−0.44***	108
• Cultural Looseness, 1990s	0.40**	33
• Continuous Peace, post WWII	0.36***	142
• State Antiquity Index	0.36***	121
• % Muslims, 1990s	−0.33***	142
• % Protestants, 1990s	0.31***	140
• Time since Neolithic Revolution	0.28***	138
• Long-allele 5-HTTLPR Gene	0.27*	46
• % Catholics, 1990s	0.19**	142
• Neuroticism (Big 5), 1990s	0.18†	44
• Extraversion (Big 5), 1990s	0.16†	44
• Openness (Big 5), 1990s	−0.02†	44

Entries are correlation coefficients (*r*). Included are all societies with available data on the respective variables.
Significance levels (two-tailed): † $p \geq .100$, * $p < .100$, ** $p < .050$, *** $p < .005$
For documentation of data and variables, see Appendix 11 (www.cambridge.org/welzel).

CW condition establishes a selective advantage for genes favoring the traits that encourage innovation and experimentation. If so, the technological impact of the CW condition should be largely absorbed either by the demographic prevalence of the respective genes or by the prevalence of their supposedly favored traits. To see if this is the case, I control in separate regressions the effect of the CW condition on technological advancement for the demographic prevalence of the Val$^{108/158}$Met COMT gene, the long-allelic HTTLPR gene, and these genes' presumably favored traits: openness, extraversion, and neuroticism, as well as individualism. Data for demographic variation in the COMT gene are from Inglehart et al. (forthcoming), data for the HTTLPR gene from Chiao and Blizinski (2010). Data for demographic variation in personality types are from Schmitt et al. (2012) and data for cultural individualism from Hofstede (2001 [1980]) and from Suh, Diener, Oishi, and

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TABLE 11.2 *Testing the Predictive Power of the Cool-Water Condition on Technological Advancement against Alternative Predictors (multivariate regressions).*

	Simultaneous EFFECTS on Technological Advancement 2005			
Alternate PREDICTORS	**Cool Water Controlling for Disease Security and Alternate Predictor**	**Disease Security Controlling for Cool Water and Alternate Predictor**	**Alternate Predictor Controlling for Cool Water and Disease Security**	***N***
• Fertility Control	0.41***	0.28***	0.61***	131
• State Integrity	0.52***	0.33***	0.47***	138
• Civic Entitlements	0.63***	0.29***	0.36***	127
• Long-allele 5-HTTLPR Gene	0.68***	0.37**	0.57***	48
• Order and Stability	0.59***	0.29***	0.38***	138
• Cultural Individualism	0.66***	0.17†	0.34***	81
• State Antiquity Index	0.69***	0.35***	0.34***	123
• Cultural Looseness	0.79***	0.19†	0.32*	31
• Democratic Tradition	0.62***	0.39***	0.30***	137
• Consanguinity (logged)	0.66***	0.32**	–0.25*	67
• Neuroticism (Big 5)			0.25†	
• Openness (Big 5)	0.51***	0.36**	0.03†	48
• Extraversion (Big 5)			0.00†	
• White Settler Mortality	0.70***	0.32***	–0.21**	105
• Time since Neolithic Revolution	0.70***	0.35***	0.22**	132
• % Muslims			–0.12†	
• % Protestants	0.67***	0.36***	0.02†	136
• % Catholics			0.05†	
• Continuous Peace	0.67***	0.36***	0.09†	137
• Val$^{108/158}$Met COMT Gene	0.72***	0.17†	0.17†	49

Entries are partial correlation coefficients to indicate each predictor's partial explanatory power over technological advancement. Each line represents a separate regression of technological advancement simultaneously on the cool-water (CW) condition, disease security, and one of the alternate predictors shown in the left-hand column. Example: in the first line, the coefficient 0.41 indicates the partial effect of the CW condition, 0.28 that of disease security, and 0.61 the one of fertility control.

Tests for heteroskedasticity (White test), influential cases (DFFITs), and multicollinearity (variance inflation factors) reveal no violation of ordinary least squares (OLS) assumptions in any regression series. Significance levels (two-tailed): $^{\dagger}p \geq .100$, $^{*}p < .100$, $^{**}p < .050$, $^{***}p < .005$

Gray-shaded coefficients show the strongest effect for each regression. For detailed description of variables and data sources, see Appendix 11 (www.cambridge.org/welzel).

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Triandis (1998). Appendix 11 (www.cambridge.org/welzel) provides more detailed descriptions and replication data.

Additional cultural traits that supposedly affect technological advancement include "cultural looseness," and consanguinity, as well as Protestantism and Islam. Cultural looseness measures how much a society tolerates deviating behavior. Following Gelfand et al. (2011), from whom I take data on the demographic prevalence of cultural looseness, this trait should stimulate innovation and experimentation; hence, it should be conducive to technological advancement. Consanguinity relates to a marriage pattern that keeps the marriage circle narrow in preferring (distant) relatives over nonrelatives. According to Woodley and Bell (2012), from whom I take estimates of the demographic prevalence of consanguinity, the effect on technological advancement is expected to be negative. In line with the literature, Protestantism is expected to have a positive effect on technological advancement (Lal 1998), whereas Islam's effect should be negative (Kuran 2004). I take data on the proportion of Protestants and Muslims per society from the Quality of Governance Database (Quality of Governance Institute 2012). If the expectations about the effects of these cultural traits on technological advancement are correct, any one of them should largely absorb the technological impact of the CW condition.

Another set of factors discussed in the development literature relates to long-lasting institutional path dependencies. These include the timing of the Neolithic Revolution (Putterman 2008) and "state antiquity," a measure of the historic endurance of functioning state orders (Bockstette, Chanda, & Putterman 2002). The proponents of these measures argue that the longer the Neolithic Revolution and a functioning state date back in a society's history, the more time this society had to expand its stock of knowledge, which should be visible in technological progress today. Thus, it is quite possible that the technological effect of the CW condition is absorbed by these factors.

A colonial pattern with a lasting influence on development has been identified by Acemoglu, Johnson, and Robinson (2001). These authors claim that where the "white settler mortality" was high, development was hampered, whereas it was boosted where the white settler mortality was low. Acemoglu, Johnson, and Robinson justify this thesis with an institutional argument: development depends on "inclusive institutions." These institutions evolved in Western Europe and were transplanted only to those colonial areas where a low "white" mortality allowed Europeans to settle in large numbers: temperate or cold areas outside the tropics. Conversely, in tropical areas where a high 'white' mortality hindered large-scale European settlement, smaller numbers of European colonizers came to extract natural resources. Finding physical work insufferable, European rent-seekers forced indigenous people and slaves imported from Africa to work on plantations and in mines. Tropical areas were, thus, left with a legacy of "labor-repressive" institutions – a manifest hindrance to human capital formation (Engerman & Sokoloff 1997).

The thesis that development favors democracy is one of the most researched topics in political science, mostly with confirmatory results (Teorell 2010). The opposite thesis, however, that democracy also favors development has produced conflicting evidence (Krieckhaus 2004). Yet, as Gerring et al. (2005) show, most results are misleading because they test an immediate effect of democracy on development, ignoring that the impact of democracy lies in its *long-term* endurance. Thus, they claim that the democratic tradition shows a pronounced effect on development. Possibly, then, the democratic tradition absorbs the effect of the CW condition on technological advancement.

Other institutional factors that might mediate the technological effect of the CW condition include contemporary qualities of the state. Thus, I measure "state integrity"' by a low incidence of corruption among the office holders in a society, using the *control of corruption* index from the World Bank's quality of governance project (Kaufman, Kraay, & Mastruzzi 2008). From the same data source, I use the *political stability and absence of violence index* to measure order and stability in more recent times. Then I measure "continuous peace," using Gleditsch et al.'s (2002) *armed conflict dataset*. The variable indicates for each society the number of armed conflicts in which it has been involved since the end of World War II. The most strongly emphasized factor among institutional economists refers to civic entitlements that guarantee universal freedoms. These entitlements provide what North et al. (2009) call "open access orders" or what Acemoglu and Robinson (2012) label "inclusive institutions." To examine if civic entitlements absorb the technological impact of the CW condition I use the citizen rights index described in Chapter 8.

Finally, I introduce a variable labeled "fertility control," which is simply the inverse of a society's fertility rate. The variable is informed by *unified growth theory* (Galor 2011). From the viewpoint of this theory, low fertility indicates that people sacrifice their demographic productivity for their economic productivity. The evidence strongly supports this interpretation: low levels of fertility associate strongly with high levels of education, which is an investment in one's economic productivity.[7] Theoretically, the pronounced polarity between low fertility/high education, on the one hand, versus high fertility/low education on the other, reflects opposite strategies of life time investment: a *quality-building* strategy versus a *quantity-breeding* strategy (Becker & Barro 1988; Guinnane 2008). The breeding strategy is a time investment in demographic productivity; the building strategy is a time investment in economic productivity. And while a breeding strategy supplies cheap mass labor, a building strategy generates

[7] The correlations between a society's fertility rate and the average person's mean years of schooling in this society are: $r = -0.80$ ($p < 0.001$; $N = 91$) in 1960; $r = -0.86$ ($p < 0.001$; $N = 93$) in 1970; $r = -0.85$ ($p < 0.001$; $N = 97$) in 1980; $r = -0.82$ ($p < 0.001$; $N = 98$) in 1990; $r = -0.78$ ($p < 0.001$; $N = 94$) in 2000. Controlling the fertility-education nexus for per capita GDP, the partial correlation between fertility and education drops to –0.58 in 1970, –0.56 in 1980, –0.62 in 1990, and –0.61 in 2000 but remains highly significant ($N = 76, 80, 82, 82$; $p < 0.001$ at all time points, respectively).

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a workforce of limited size but high quality. Clearly, keeping fertility under control is the basis of the building strategy. According to unified growth theory, the transition from quantity-breeding to quality-building is necessary to enter an era of mass scale technological advancement (Boserup 2011 [1970]; Blumberg 2004; Galor 2011). The reason is obvious: once the rise of urban markets increases labor demand while cheap mass labor is in short supply, labor is costly. High labor costs combined with an increasing demand for labor encourages technological advancement to save labor costs (Jones 1987; Landes 1998).

There is indeed evidence that the two pre-industrial CW civilizations – Western Europe and Japan – had later marriages and lower fertility than other urban civilizations *already in preindustrial times*. For Western Europe, the evidence is documented in Hajnal (1983), Laslett (1989) and Hartman (2004), for Japan in Kiyoshi (1999) and Bentley, Ziegler, and Streets-Salter (2010). In both CW civilizations, women did not marry before their early to mid-twenties, practiced fertility control before marriage, and marriage was tied to establishing one's own household–a pattern known as "neolocal" household formation. The neolocal pattern required a premarital period of accumulating savings, equipment, and skills.[8]

Table 11.1 shows *uncontrolled* effects on technological advancement for each of the variables that potentially mediate the technological impact of the CW condition. Table 11.2 shows these variables' *partial* effects on technological

[8] A late average age of women's first marriage is a strong indicator of low fertility: the percentage of women in a society married below the age of twenty correlates at $r = 0.71$ ($N = 158$; $p < 0.001$) with the fertility rate (data taken from Gapminder at www.gapminder.org). Hence, evidence showing that the two civilizations in CW areas – Western Europe and Japan – had later marriages before preindustrial times is important. It lends credibility to my argument that water autonomy establishes an incentive for lower fertility once urban markets flourish. The evidence indeed exists. Based on an examination of forty-five studies, Flinn cited in Hajnal (1982) calculates a mean age of first marriage for women in Northwestern Europe over the preindustrial era of twenty-five years, with a standard deviation of six years. This corresponds with Hajnal's (1982) estimate of a female average marriage age of twenty-three for the preindustrial period in Northwestern Europe. For other preindustrial urban civilizations, from Eastern and Southern Europe to the Middle East, India, and China, Hajnal estimates much lower marriage ages, usually in the late teens. His estimate for China, for instance, is 17.5 years. Japan lies in between the Western and non-Western pattern. Kiyoshi (1999: 132) reports a female marriage age of 20.2 years at the beginning of the Tokugawa period in around 1600, followed by a continuous rise throughout the Tokugawa period – a period that brought an increasing economic florescence of urban centers. Figures for the year 1800 confirm the pattern of late marriages in the West, early marriages in the East, and Japan in between: the figures are seventeen years for India, eighteen years for Egypt, nineteen years for Russia and China, twenty-one years for Japan, and twenty-three years for the United States and the United Kingdom (data taken from Gapminder at www.gapminder.org). Historic fertility estimates support the argument that water autonomy favored fertility control already in preindustrial times. For the year 1800 (a time before industrialization picked up speed in most societies), estimates for the number of born children per women are as follows: 4.0 Denmark; 4.1 Japan; 4.4 France: 5.5 China and Italy; 6.0 India; 6.7 Bangladesh, Pakistan, and Russia; 6.8 Mexico; 6.8 Zimbabwe; 7.2 Ethiopia; and 7.3 Iran. Hence, at beginning of the industrial age, fertility in urban civilizations is only low in the West and Japan.

advancement, controlling for the CW condition and disease security. These can be compared with the partial effects of the CW condition and disease security further to the left. Comparing the partial effects, we see how much of the technological impact of the CW condition and disease security is absorbed and how much is untouched by each of the other variables.

In Table 11.1, all variables – except the COMT gene and the Big Five personality traits – show a significant effect on technological advancement in the expected direction. Among the variables measured for more than a hundred societies, the largest uncontrolled effect on technological advancement derives from fertility control ($r = 0.87$), followed by the CW condition ($r = 0.84$), state integrity ($r = 0.78$), civic entitlements ($r = 0.73$), disease security ($r = 0.72$), order and stability ($r = 0.71$), the democratic tradition ($r = 0.51$), white settler mortality ($r = -0.44$), state antiquity ($r = 0.36$), and continuous peace ($r = 0.36$). Thus, only fertility control trumps the uncontrolled impact of the CW condition on technological advancement.

Controlling each of these variables' effects for the impact of the CW condition and disease security, the effect sizes drop considerably in the case of most variables. For instance, the effect of state integrity drops from $r = 0.78$ to $r_{\text{partial}} = 0.47$ and that of the democratic tradition from $r = 0.51$ to $r_{\text{partial}} = 0.30$. For all variables, except fertility control, the partial effect on technology is *much weaker* than that of the CW condition, which withstands the control of every other variable. The partial effect of disease security withstands all controls except two: controlling for cultural individualism or cultural looseness, disease security no longer shows a significant effect on technological advancement. Accordingly, the technological impact of disease security is entirely mediated by its effect on these two cultural traits.[9] And even though the technological impact of disease security is recognizable, it is always considerably below that of the CW condition.

Two of the most prominent variables in the development literature show a largely diminished or completely insignificant effect once we control for the CW condition: Protestantism and the white settler mortality. In fact, these variables' technological effects are largely explained by the CW condition. Protestantism and the institutions of white settlers evolved *exclusively* in societies where the CW condition is pronounced, and this is the reason why these factors seem to have a strong effect on technological advancement. Once we control for the CW condition, the apparent effect largely diminishes or vanishes.

Another variable of recent prominence is the timing of the Neolithic Revolution. As Putterman (2008) and Easterly, Comin, and Gong (2010) argue, an early adoption of agriculture means a developmental head start. Since development is path-dependent and self-perpetuating, the advantage that societies obtain from this head start should be visible until today in technological advancement. While the

[9] This finding evidences an important side strand of causality: disease security favors looser cultures that allow for more diversity. More diversity in turn generates an intellectual climate conducive to experimentation and innovation – the engines of technological advancement.

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uncontrolled regression of technological advancement on the timing of the Neolithic Revolution supports this view, after controlling for the CW condition, an earlier transition to agriculture shows only a weak effect on technological advancement today. Hence, the effect of an early transition to agriculture is largely conditional: it depends on its connection with the CW condition.

The only variable that seriously diminishes and clearly exceeds the technological impact of the CW condition is fertility control: under mutual controls, the technological impact of the CW condition amounts to an r_{partial} of 0.41, whereas that of fertility control amounts to an r_{partial} of 0.61. This suggests that the CW condition favors technological advancement mainly because it enhances fertility control.

This conclusion rests on the assumption that fertility control is not itself endogenous to technological development. Some scholars might question this assumption. The reason is that technological advancement produces prosperity (Romer 1990), and it has been argued that fertility declines because of rising prosperity (Becker 1981; Becker & Barro 1988). If this is correct, fertility control is a consequence of technological advancement and not a cause of it. In this case, fertility control could not explain the impact of the CW condition on technological advancement.

The two-stage least-squares regressions in Table 11.3 test this possibility, using per capita GDP to measure prosperity based on the same year as fertility control. In the first stage, we instrument fertility control with the CW condition, disease security, and per capita GDP. The results of this regression show that fertility control is more strongly determined by the CW condition than by per capita GDP. The three instruments explain 69 percent of the cross-national variance in fertility control. Of these 69 percent, only 5 percent are accounted for by per capita GDP.[10] Because disease security is insignificant, the CW condition accounts for most of the remaining 64 percent of explained variance in fertility control. In version B of this first-stage regression, we instrument fertility control only with the CW condition and disease control, leaving out per capita GDP. We explain almost the same amount of variance: 63 percent. In the second stage, we use the two instrumented versions of fertility control – each one at a time – to predict technological advancement in 2005. The version in which fertility control is instrumented without per capita GDP explains just 5 percentage points less variance in technological advancement than does the version in which fertility control is instrumented under the inclusion of GDP. In short, there is very little endogeneity of fertility control to prosperity. Nevertheless, in the subsequent analyses, we will use a measure of fertility control from which we eliminate the small influence of prosperity.

As far as one can tell, the cross-national fertility differences found in 1980 are not only representative for this particular time. Instead, they partly reflect differences reaching back to preindustrial times. Indeed, the numbers in footnote 7 document similarity in the fertility pattern between 1800 and later times in at least one critical point: Japan and the West are at the forefront of low fertilities.

[10] The partial correlation coefficient of GDP/p.c. is 0.23, so the partial *r* squared is 0.05.

TABLE 11.3 *Examining the Developmental Endogeneity of Fertility Control (two-stage least-squares regressions).*

	STAGE 1(Fertility Control 1980 is DV)		STAGE 2 (Technological Advancement 2005 is DV)	
PREDICTORS	**Version A**	**Version B**	**Version A**	**Version B**
• Constant	0.21(5.70)***	0.15(5.19)***	−0.12(−3.28)***	−0.11(−2.55)***
• Cool Water, historic	0.62(6.08)***	0.68(9.13)***		
• Disease Security, historic	0.12(1.06)†	0.28(3.29)***		
• GDP/p.c. (indexed), 1980	0.22(2.21)**			
• Expected Fertility Control			1.11(18.65)***	1.10(16.19)***
Adjusted R^2	0.69	0.63	0.81	0.76
N (societies)	96	96	84	84

Entries are unstandardized regression coefficients with their T values in parentheses.

Tests for heteroskedasticity (White test), influential cases (DFFITs), and multicollinearity (variance inflation factors) reveal no violation of ordinary least squares (OLS) assumptions.

In the first stage, cool water and disease security dating back to historic times as well as gross domestic product (GDP)/p.c. in 1980 (version B without the latter) are used as instruments to calculate expected scores of fertility control in 1980. In the second stage, these expected scores are used to predict technological advancement in 2005.

Significance levels (two-tailed): $^{\dagger} p \geq .100$, $^{*}p < .100$, $^{**}p < .050$, $^{***}p < .005$

In fact, in 1800 these are the only areas with low fertilities, reflecting the exceptionally strong presence of the CW condition.

All this suggests that the CW condition encourages the transition from breeding strategies to building strategies. From the viewpoint of the utility ladder of freedoms, this is indeed highly plausible.

The CW condition grants water autonomy: equal, easy, and permanent access to safe and clean water. As an original form of existential autonomy, water autonomy is the source of derivative autonomies, including autonomy in market access – once commercial urban centers emerge (Jones 1987; Landes 1998; Midlarsky & Midlarsky 1999; Solomon 2011). With existential autonomies, building skills is a time investment into one's market value. For this reason, marrying early to breed many children is a time investment with high opportunity costs. Once urban markets flourish, the subsequent autonomies deriving from water autonomy strongly encourage fertility control and skill formation. And people had fairly effective means to control fertility even in preindustrial times, provided this was the prevalent preference (Lipsey, Carlaw, & Bekar 2005).

The historic pattern seems to confirm this proposition. Late medieval Western Europe and Japan were the only two civilizations with high water autonomy to reach urban maturity in preindustrial times (see Figure 11.1). All other Eurasian civilizations, from Eastern and Southern Europe to the Middle East to India and China, as well as the urban Amerindian civilizations, show a much weaker presence of the CW condition than do Japan or Western Europe. Accordingly, Powelson (1997) finds that Western Europe and Japan are the only two preindustrial civilizations that did not develop *coercive feudalism*. Instead, they established *contractual feudalism* – a form of feudalism that acknowledges the autonomies of farmers, village communities, and corporations. In both Western Europe and Japan, this pattern was linked with late marriages, fertility limitation by means of monogamy and taboos on out-of-wedlock sex, an emphasis on skill formation over the prolonged premarital period and "neolocal" instead of "patrilocal" household formation after marriage (Hartman 2004; Bentley et al. 2010).

4. THE GREAT REDIRECTION OF CIVILIZATION

The explosive acceleration of technological advancement in modern time started with the scientific revolution in the fifteenth century (Braudel 1993; Landes 1998; Goldstone 2009). Before this turning point, we find a strikingly different pattern. This is evident from Figure 11.3. The diagram examines Maddison's (2007) historic per capita income estimates for thirty-one exemplary territories around the world: the assumption is that territories with higher per capita incomes are richer because they have developed more productive technologies. Under this premise, Figure 11.3 is a powerful illustration that global history takes a sharp turn around 1500 CE: the strong positive correlation between the CW condition and development literally leaps out, reversing a negative correlation that goes all the way back to the year 1 (Appendix 11 [www.cambridge.org/welzel] gives a detailed documentation of the correlation pattern). The switch in the signs of the correlations in 1500 coincides with the late achievement of urban maturity in the two CW civilizations: Western Europe and Japan.[11] Since then, the CW civilizations' technological advancement accelerated exponentially, and European settlement transplanted technological advancement to other, unurbanized CW areas outside Eurasia – hence the increase in the magnitude of the correlations until 1900.

The dotted line in Figure 11.4 plots over time the correlation between a country's per capita income and its migratory proximity to the human origin in East Africa (see Appendix 11 [www.cambridge.org/welzel]). The migratory proximity is a rough indicator of how early modern humans arrived on a given territory: the more proximate the territory, the earlier the arrival of humans. Interestingly, the correlation of income with the earliness of human arrival is the exact mirror image of its correlation with the CW condition: it is moderately

[11] To be more precise, Japan's urban florescence started some hundred years later than that of Western Europe, around 1600, when the Tokugava period began.

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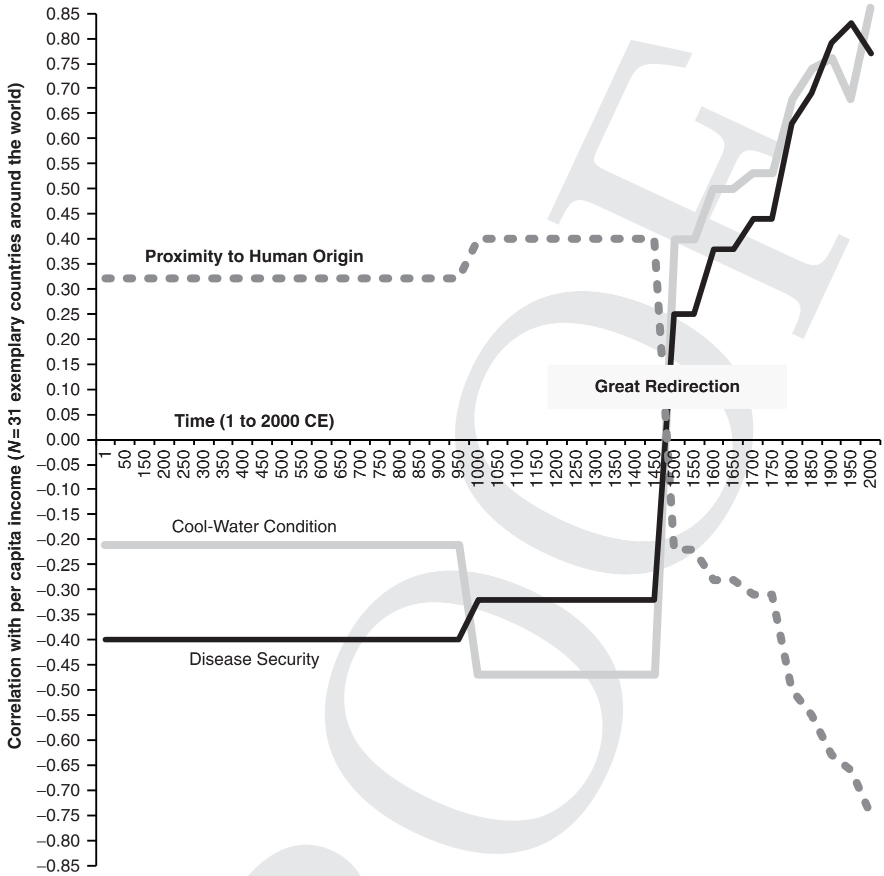

FIGURE 11.3 The Impact of Disease Security and the Cool-Water Condition on per capita Incomes over Time and across the World (before and after the Great Redirection). Diagram uses Maddison's (2007) historic estimates of per capita incomes for 31 exemplary countries from around the world. The diagram shows the trend after interpolating missing data for periods with no estimates. For more descriptive details and data documentation, see Appendix 11 (www.cambridge.org/welzel).

positive from the year 1 to the year 1500 when it reverses itself dramatically into a strongly negative correlation that persists until today.

Does our theory explain this turn in history? It does if one keeps in mind that the link between the CW condition and development is conditional: it depends on flourishing urban capitalism – a condition not prevalent before the fifteenth century in Western Europe and not before 1600 in Japan, the only urban CW civilizations of preindustrial times (Jones 1987; McNeill 1990; Powelson 1997; Bentley et al. 2010). Other CW areas – including the coastal zones of North America, the South of South America, the

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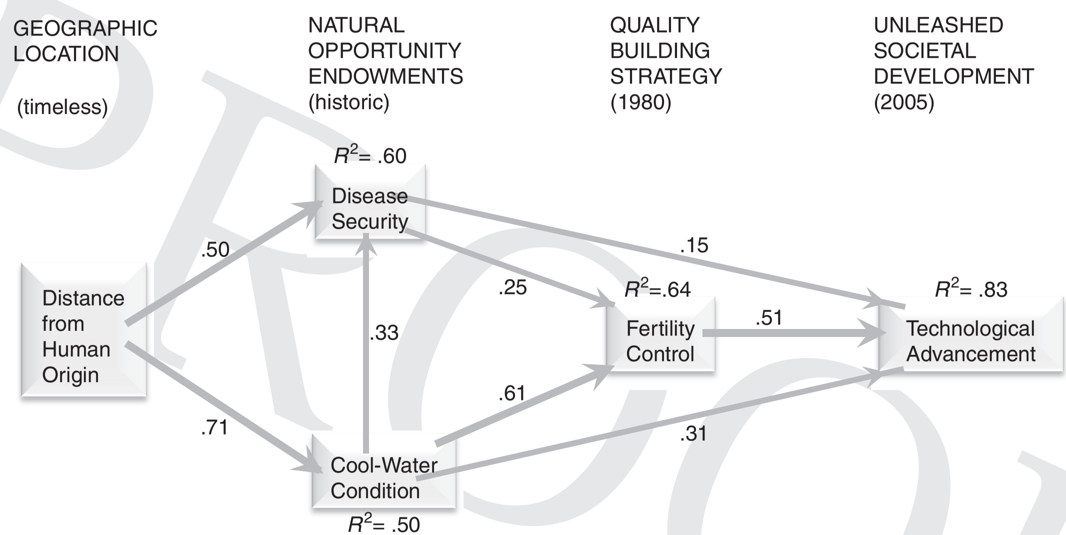

FIGURE 11.4 Causal Flow from Prehistoric Environmental Conditions to Current Technological Advancement (source thesis).
Entries are partial correlation coefficients, calculated with AMOS 19.01. Units of observation are national societies: *N* is 127, including all societies with available data on each variable. Fertility Control in this model is *exogenous* to prosperity: it is the residuals in fertility control not predicted by per capita gross domestic product (GDP) in the same year. Goodness-of-fit measures: GFI .94, NFI .97, IFI .97, CFI. 97. All effects are significant at the .001-level. To inspect the data matrix for the 127 societies included in this analysis, see Appendix 11 (www.cambridge.org/welzel).

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Southeast of Australia and New Zealand – did not reach the mature urban stage of civilization until Europeans colonized these areas. What explains the belatedness of urban civilization in Eurasian CW areas and its absence in outer-Eurasian CW areas before European settlement?

The explanation probably lies in the migratory distance of the CW areas from the origin of modern humans in East Africa, in combination with a delay factor linked to water autonomy that slows down the transition from foraging to agriculture in CW areas. As a matter of fact, a society's score on the CWI correlates at $r = 0.71$ ($p = .000$; $N = 158$) with its migratory distance from the human origin in East Africa, indicating that inhabited areas with the most prominent CW condition are most distant from the origin of humanity. For this reason, modern humans arrived much later in these areas than in others. Hence, the clock of technological advancement started much later there than in areas with low water autonomy. The CW areas' greater migratory distance also meant greater diffusion distance from the early centers of agriculture and urbanization in the Middle East. As a consequence, the diffusion of surplus agriculture and urban life reached the CW areas late.

Besides migratory distance, there are reasons to believe that the CW condition itself embodies a delay factor as concerns the transition from foraging to agriculture. If so, the CW condition lowers technological advancement until the agrarian transition and the emergence of markets, but greatly accelerates it thereafter. We return to this point later. In combination, the evidence points to three conclusions:

1. The breakthrough into the era of accelerated technological advancement happened in CW areas because the breakthrough needed a level of existential security/autonomy that these areas naturally harbor.
2. The breakthrough was recent because the CW areas' migratory distance and an inherent delay factor led to late urban maturation in these areas.
3. Both the delay factor and the accelerated development after its overcoming originate in the same CW feature: the high utility that these areas' conditions bestow on freedoms.

5. PINPOINTING THE ORIGIN: THE SOURCE THESIS

These reflections and insights integrate into a theory that is complete in the sense that it traces human empowerment over various stages from its origin to its outcome. To begin with, areas harboring original forms of existential security and autonomy are placed in large migratory distance from the human origin in East Africa and in large diffusion distance from the earliest centers of agriculture and urbanity in the Middle East. Partly for this reason and because of an inherent delay factor, urban civilization occurred late in the CW areas. Once that happened, however, the original form of existential autonomy became the source of derivative forms of existential autonomy, including autonomy in marketing one's skills. Existential autonomies in an emerging market economy further increase

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the utility of freedoms. Consequently, people have an incentive to focus their life on quality building rather than on quantity breeding. In other words, ordinary people limit fertility and invest time in their own and their children's skills. Another reason for limited fertility is the high disease security in areas with high water autonomy: higher disease security brings lower infant mortality, which reduces the birth rate needed to sustain the workforce.[12] The quality building strategy is further encouraged by the fact that rain-fed grain farming demands fewer laborers per unit of cultivated land than does irrigation-managed agriculture, especially rice cultivation. As a consequence of the quality-building strategy, there is no abundance of cheap labor. Once, however, the flourishing of urban markets increases labor demands, a scarcity of cheap labor stimulates investment in technologies that save costly labor. The result is larger investments in technological knowledge – the modern progress engine.

This reasoning suggests three testable propositions:

1. Since prehistory, areas with water autonomy and disease security prevail in large migratory distance from the human origin in Africa.
2. Coming to fruition late in history, disease security and water autonomy encourage quality-building strategies that persist since premodern times and are visible in fertility control at early points in contemporary time.
3. Fertility control at earlier points in contemporary time shows a positive impact on technological advancement in recent time.

The path analysis across 130 nations in Figure 11.4 strongly confirms each of these propositions – with respect to *contemporary* technological advancement. However, the evidence is not limited to technological advancement as it stands nowadays. Instead, Figure 11.2 showed that the technological impact of the CW condition goes back all the way to the origin of the Great Redirection: it is a persistent feature since this turn in human history, although there are recent signs of a slow fading of the CW condition's technological impact. I address this point in the last section of this chapter.

6. FROM EXPLOITATION TO EMANCIPATION

Before the modern technology era, development differed sharply on two accounts. First, technological advancement was much slower (Nolan & Lenski 1999; Morris 2010). Second, technological advancement did not empower common people; on the contrary, it increased state capacities to exploit people

[12] Indeed, disease security explains at least 40 percent of the cross-national variation in infant mortality, in every year from 1985 to 2005 across 175 societies. Controlling for a society's per capita GDP of the same year, disease security still explains some 12 percent of the cross-national differences in infant mortality. The effect is highly significant and, of course, negative: higher disease security comes with lower infant mortality. The partial effect of per capita GDP accounts for 11 percent of the cross-national variation in infant mortality.

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(Diamond 1997). Indeed, while states continuously increased their control over people, quality of life on a mass scale showed no real improvement until the modern technology era. As Maddison's (2007) estimates suggest, fifteen centuries of agrarian civilization brought little recognizable improvement in the life expectancies and per capita incomes of ordinary people. Galor (2011) characterizes the premodern agrarian centuries as the long Malthusian epoch in which material improvements were mostly eaten up by population growth.

Both features of the premodern era – the slowness of development and its exploitative nature – were a consequence of low water autonomy in early civilizations. As Wittfogel (1957) acknowledged, early Eurasian civilizations from the Middle East to India and China evolved as "hydraulic societies": their agrarian systems were based on large-scale irrigation infrastructure involving canals, dams, dikes, locks, pumps, pipes, bridges, and other complex architectural features – all of which require central coordination of cheap mass labor (Landes 1998; Solomon 2011). Within such a setting, people's access to water resources is elite-controlled: they have low water autonomy. Confirming this suggestion, the left-hand diagram of Figure 11.1 shows that the score on the CWI is 0.41 for China, 0.36 for the Middle East, and 0.17 for India. The African predicament is fully visible here, with a CWI score of 0.09 for Central Africa. This compares to 0.88 for both Japan and Western Europe (and the emphasis is indeed on *Western* Europe: the CWI scores for Southern and Eastern Europe are 0.57 and 0.48, respectively). With low water autonomy, the agrarian surplus depends on collective irrigation management. The control over mass labor needed to sustain large-scale irrigation favors despotism (Wittfogel 1957; Jones 1987; Midlarsky & Midlarsky 1999; Solomon 2011). A new study using global quantitative evidence across nations and over time strongly confirms this point (Bentzen, Kaarsen, & Wingender 2012).

At times, despotic regimes encourage technological advancement, yet only as long as it does not threaten despotism (Goldstone 2009). Until the Great Redirection, technological advancement in the Middle Eastern, Indian, and Chinese empires was ahead of Europe and Japan: these empires were farther advanced in mathematics, medicine, and astronomy; they invented porcelain, gun powder, silk, paper, printing, and the compass. What is more, the Chinese empire initiated large-scale naval operations almost a hundred years before the Europeans did. However, as Goldstone (2009) notes, at some point, each of these empires reverted to dogmatism, thus suffocating the innovative thrust. To sustain despotism, the empires did not allow research and inquiry to break free from dogmatic control. For instance, it has been argued that after 1433 CE, the Chinese empire took seafaring under strict control to prevent the merchant class from growing too independent (Jones 1987; Hall 1989; Solomon 2011).

As Western Europe and Japan reached the mature urban stage, civilization took hold where natural conditions gave rulers less control over people. Rulers had to acknowledge personal autonomies, autonomous social entities, and autonomous social sectors and territories (Powelson 1997). Under these conditions,

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the key activity driving development – intellectual inquiry – was freed from political control (Jones 1987; McNeill 1990). This happened earlier in Western Europe than in Japan because Western Europe reached the stage of flourishing urban capitalism more than a hundred years before Japan (Modelski 2003). Japan also lacked the innovative impulses that Western Europe obtained from its system of competing states (Jones 1987; Hall 1989; Landes 1998; Goldstone 2009). Nevertheless, Japan was the first non-European civilization to emulate the Western technology explosion. Among the non-European urban civilizations, Japan was best situated in terms of people's water autonomy and the derivative autonomies that follow once urbanization sets in.

7. THE INITIAL DELAY OF COOL-WATER AREAS

The CW areas in Eurasia and even more so those outside Eurasia are located in large migratory distance from the early centers of surplus agriculture and urban life, which spread along the ancient civilization belt from the Middle East to China. From a diffusionist point of view, migratory distance is a plausible reason for the delayed maturation of urban civilization in the Eurasian CW areas, as well as its absence in the non-Eurasian CW areas before European settlement. In addition to the migratory distance, I suggest that the belated urban maturation of the CW areas is also linked to a delay factor inherent to the CW condition itself. Ironically, that delay factor turned into an acceleration factor once the initial delay was overcome. Let me explain.

Some societies in history did not abandon the foraging lifestyle because agriculture is impossible under certain conditions. This is true of polar and subpolar regions, as well as steppes and deserts. In some other habitats, the transition is possible but not urgent (unless enforced from outside) because the richness of the flora, fauna, and water resources are benign to the foraging lifestyle. Notably, this is true of tropical rainforests and the initially forested CW areas (Fernandez-Armesto 2002.

The weaker urge to adopt agriculture is important when one considers what anthropology reveals about humans' preferred choice between foraging and agriculture. Agriculture did not improve the quality of the human diet; actually, there is evidence for a slightly negative effect on life expectancy (Blumberg 2004). In addition, agriculture meant a transition to a rigid work schedule and the sacrifice of individual freedoms for collective discipline under the authority of overlords (Nolan & Lenski 1999). For a self-aware being with a desire for freedom, this is indeed a sacrifice (Deci & Ryan 2000; Maryanski & Turner 1992; Turner & Maryanski 2008). As Veenhoven (2010) speculates, human life satisfaction probably deteriorated in the transition from foraging to agriculture. Consequently, humans would make the transition only if overpopulation, climatic change, or other exogenous events *forced* them to do so. Hence, in environments where the transition could be delayed, it indeed was.

If these assumptions are correct, we should see that – among societies of about the same age – the foraging lifestyle is preserved longer under the CW condition than otherwise. But we should also see that, among societies with an equal persistence of foraging, the CW condition is conducive to market exchange, which is an engine of development. All else being equal, the CW condition should encourage market exchange because the existential autonomies that the CW condition embodies turn markets into a greater opportunity than in settings with lesser autonomies.

If we had data on human societies throughout recorded history, from different places at different times and on different levels of subsistence, we could test these assumptions. Fortunately, a suitable data source exists: the Standard Cross-Cultural Sample founded by Murdock and White (1969) and enriched since then with ethnographic descriptions by hundreds of anthropologists (Ember & Ember 1998; Divale 2004). The units of observation are 186 local populations across the world, each of which "reproduces a specific way of life" (Divale 2004). Local populations are drawn from all inhabited continents and all levels of subsistence, from foraging to industrialization. The time range is from 1750 BCE for the Babylonians, 110 CE for the Romans, 1530 CE for the Incas, to 1930 for the Irish, and 1950 for the Japanese. Most of the studied populations are historic and therefore at the preindustrial level of subsistence. Many of these populations no longer exist, and a large proportion of them practiced a foraging lifestyle, including the !Kung Bushmen, the Tuareg, Lapps, Mongols, Inuit, Hurons, Maoris, and Yanomamo. Hence, the Standard Cross-Cultural Sample covers conditions typical of most of human history, rather than our very recent industrial and postindustrial past. The data are, thus, suited to test some of the effects of water autonomy for their temporal and spatial universality.

The Standard Cross-Cultural Sample measures basic lifestyle variables, from marriage patterns to child-rearing habits to subsistence technology and political organization. Most of these variables are ordinal 4- or 5-point scales, measured in a coding scheme in which 1 indicates the absence and 4 or 5 the complete presence of the property of interest.[13] The codings are based on expert judgments of ethnographic records or archeological evidence. The subjective element certainly involves considerable measurement error, but the Standard Cross-Cultural Sample provides a detailed documentation of coding standards and is widely acknowledged in anthropology as the most important source of systematic data on societal differences across space and time.

The Standard Cross-Cultural Sample also includes climatic information that allows us to measure the CW condition by combining the prevalence of mild and cooler temperatures with the continuity of precipitation. Besides the CW condition, other variables of interest include the age of a society, disease security, the extent of reliance on foraging, the urbanization rate (proxied by population density), the

[13] As always, I have transformed every variable into a range from minimum 0 to maximum 1.0, with intermediate positions as fractions.

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level of state formation, and the extent of market exchange, as well as the sexes' reproductive autonomy and an emphasis on individual self-reliance and excellence as personal qualities. Appendix 11 (www.cambridge.org/welzel) provides a documentation of the data I take from the Standard Cross-Cultural Sample.

As before, a society's score on the CWI correlates positively with its disease security ($r = 0.45$; $p < 0.001$; $N = 180$) and negatively with its migratory distance from the origin of humanity ($r = -0.58$; $p < 0.001$; $N = 179$) as well as its age ($r = -0.31$; $p < 0.001$; $N = 179$). Thus, areas with high water autonomy are more benign for two reasons: by definition, they provide easy and equal access to water resources, but they also harbor fewer sources of disease. On the other hand, these areas are more distant from the origin of humanity and constitute younger habitats for this reason.

In every human habitat, societies initially followed a foraging lifestyle. As time passed, pressures to abandon foraging and adopt agriculture accrued, yet these pressures accrued to different degrees, depending on a habitat's ecological conditions. With high water autonomy, the pressures were lower because the richness of the fauna, flora, and water resources is less easily depleted. Still, time should diminish a society's reliance on foraging.[14] Hence, controlling for the CW condition, the time since modern humans live in a habitat should show a negative partial effect on foraging. The path model in Figure 11.5 confirms this expectation: the effect of human habitat age on a society's reliance on foraging amounts to $r_{partial} = -0.30$ ($p < 0.005$; $N = 63$).

At the same time, societies in equally old habitats should show a stronger continuation of foraging if the CW condition is more strongly pronounced. Accordingly, controlling for human habitat age, the CW condition should show a positive partial effect on foraging. This expectation, too, is confirmed by the path model in Figure 11.5: the effect of a society's CW condition on its reliance on foraging amounts to $r_{partial} = 0.36$ ($p < 0.005$; $N = 63$).

In other words, CW societies quit foraging later because (a) these societies were younger and because (b) their higher water autonomy delays the transition. Since subsequent stages of development – including urbanization and state formation – follow from the abandonment of foraging, CW societies were late bloomers.

But once CW societies abandon foraging and begin to settle around urban markets, one of their key tendencies turns out to be advantageous: from water autonomy follow derivative autonomies, including autonomy in marketing one's skills and products, which is conducive to market exchange as soon as markets emerge. Confirming this assumption, the path model in Figure 11.5 shows that, at similar levels of urbanization, the CW condition is conducive to market exchange, showing a partial effect of $r_{partial} = 0.27$ ($p < 0.005$; $N = 63$).

[14] One reason is the continuous diffusion of agriculture after its invention. This made it more likely that, with the passage of time, extant foraging societies were exposed to agrarian societies in their neighborhood and forced into competition with them.

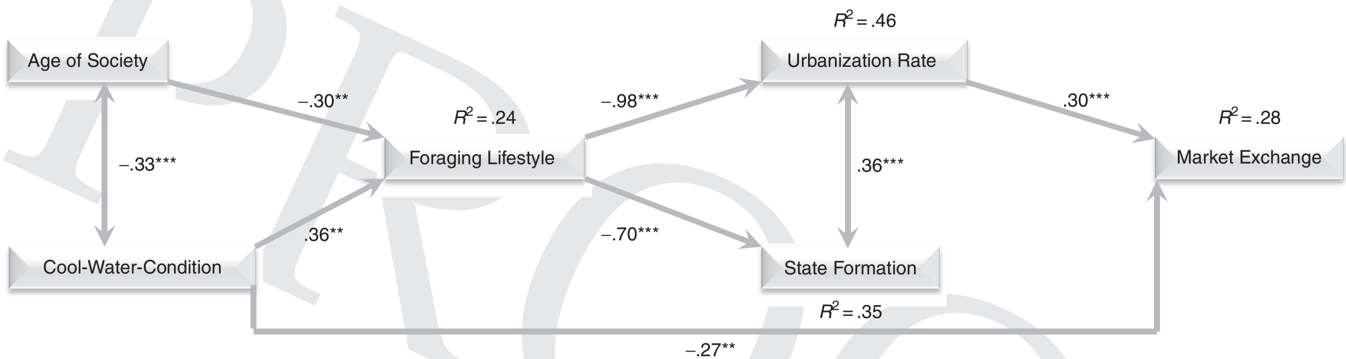

FIGURE 11.5 The Initial Delay and Subsequent Acceleration of Development by the Cool-Water Condition (the anthropological record). Entries are standardized path coefficients, calculated with AMOS 19.01. Number of observations (*N*) is sixty-three societies from the Standard Cross-Cultural Sample (including all societies for which every variable is available). Model is recursive. Goodness-of-fit measures: GFI .95; IFI .96; CFI .96; NFI .91. Urbanization Rate is proxied by Population Density. Exactly which variables from the Standard Cross-Cultural Sample are used here is documented in Appendix 11 (www.cambridge.org/welzel). Included Societies spread all over the world and existed from 1700 BCE to 1930 CE, covering some 3,500 years of history.

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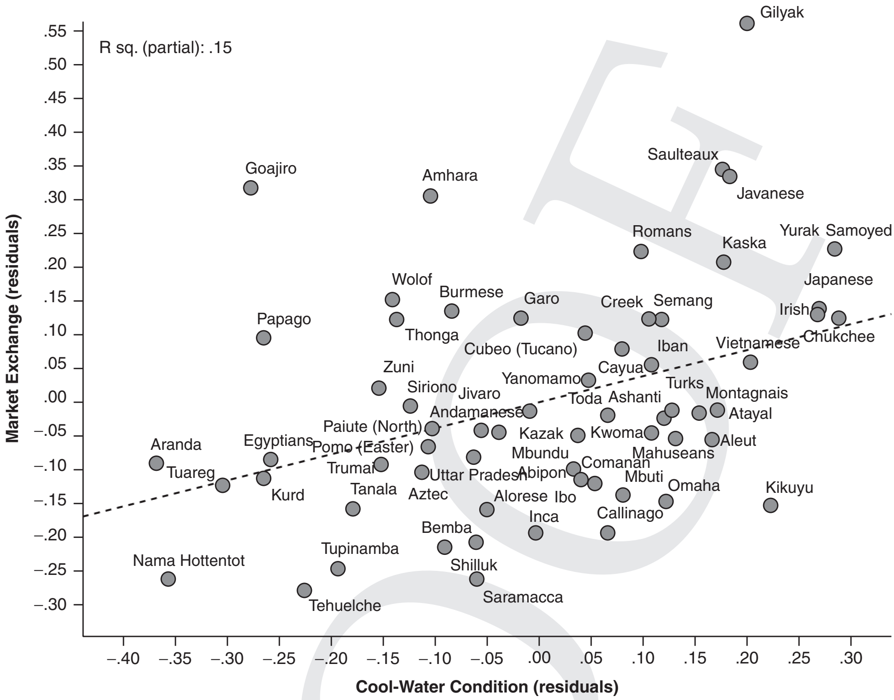

FIGURE 11.6 The Historic Impact of the Cool-Water Condition on Market Exchange (controlling for age of society).
Data Coverage: All societies from the Standard Cross-Cultural Sample with valid data on the respective variables.

Figure 11.6 visualizes the partial effect of the CW condition on market exchange. Even though the effect is only moderately strong, its significance is all the more noteworthy because it surfaces across societies of a truly remarkable diversity in both space and time, ranging from the Aztecs in 1500 CE to the Japanese in 1950. Consider, for instance, two societies at the upper right end of the regression line: a typical Japanese community in 1950 and a typical Irish community in 1930. These two populations are of different cultural background in two different places at different times. Yet, controlling for their age and other factors, their CW condition is equally strong – and so is their degree of market exchange. Or consider two societies at the lower left end of the regression line: the Nama Hottentot in sub-Saharan Africa, as they lived in 1860, and the Aranda in Central Australia, as they lived in 1900. Again, the two populations are of different cultural background in two different places at different times. Yet, controlling for their age and other factors, their CW condition is equally weak – and so is their degree of market exchange. Of course, across space and time, the CW condition explains only a portion of the differences in market exchange. Yet, it is a significant proportion.

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Could these findings be a result of selection bias? This is indeed a possibility because the inclusion of societies for which measures on all variables of interest exist reduces the Standard Cross-Cultural Sample from initially 186 to 63 societies. For this reason, the results of this analysis must to be taken with a serious note of caution. Still, it remains true that the available evidence from the anthropological record confirms what the theory suggests. Moreover, we can exclude selection bias on the values of our main independent and dependent variable as a source of error. Comparing the means, medians and standard deviations in the CW condition and market exchange between the societies included in the path model and the excluded ones, no significant differences exist.

Given that market exchange is a chief engine of technological advancement, the anthropological record confirms my explanation of the historical paradox of the CW areas' belated but explosive development: water autonomy delays the abandonment of a foraging lifestyle and hence delays the emergence of cities and markets, but once they emerge water autonomy accelerates technological advancement.

The proposition that further autonomies follow from water autonomy can be subjected to additional tests. To do so, I look at the impact of the CW condition on the sexes' reproductive autonomy and the emphasis on self-reliance and individual excellence as personal qualities, under control of population density or state formation (depending on whichever has the stronger effect). The idea that water autonomy nurtures derivative autonomies implies that, throughout history, in societies with a stronger CW condition the sexes had more reproductive autonomy and emphasized self-reliance and individual excellence more. Reproductive autonomy measures to what extent women's and men's agreement is needed for marriage and to what extent household formation is oriented toward the monogamous, neolocal nuclear family. An emphasis on self-reliance and individual excellence as personal qualities is measured by the emphases on these qualities in the education of children.

Figure 11.7 illustrates the partial effects of water autonomy on these two variables: as expected, the effects are significantly positive and moderately strong (in the case of self-reliance and individual excellence) or strong (in the case of reproductive autonomy). However, even a relatively weak partial effect is remarkable, if it is significant, because what we see here are effects that seem to *persist* throughout our history. Operating over a longer period of time, even a relatively weak effect accumulates to large differences in outcomes.

8. EXPLOITATIVE AND EMANCIPATORY CIVILIZATIONS

With the breakthrough into the age of science, development not only accelerated; its logic diverted from perfecting human exploitation into advancing human empowerment. This diversion gave rise to an entirely new configuration of civilization. Compared to this new configuration, all previous configurations were *exploitative* in character: their main purpose was to sustain the well-being of a small, hereditary elite (Diamond 1997).

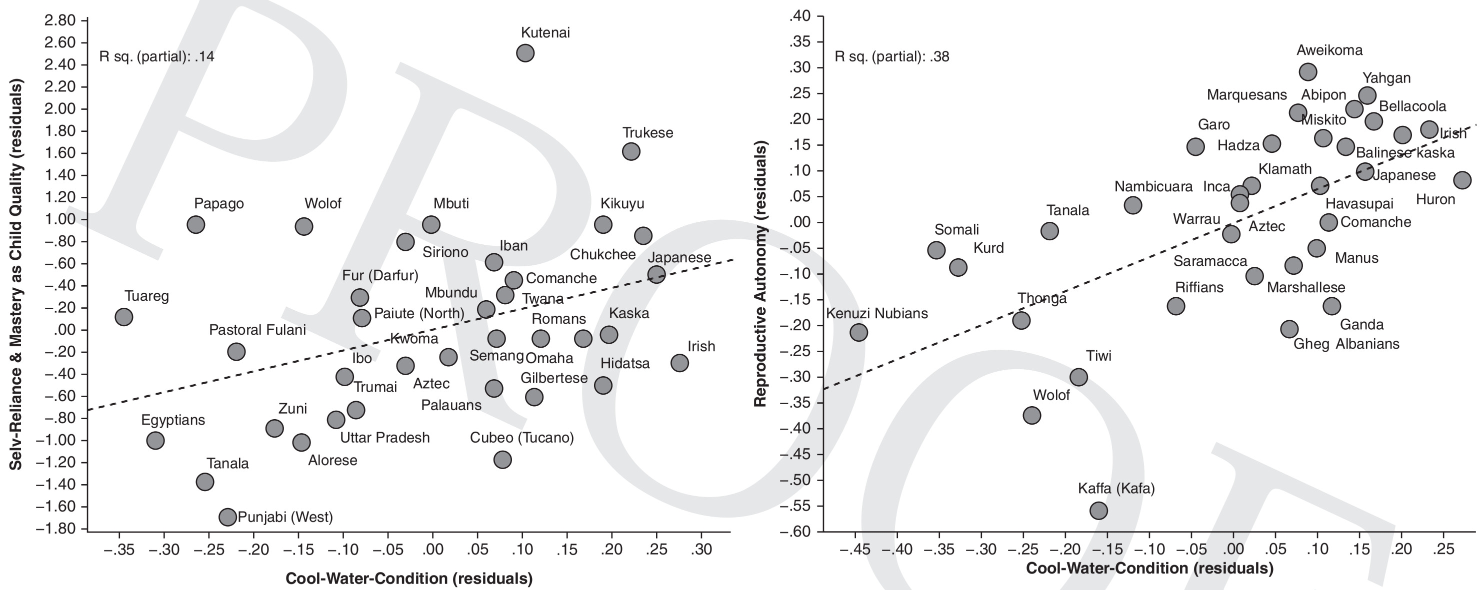

FIGURE 11.7 The Historic Impact of the Cool-Water Condition on Family Formation Patterns (controlling for state formation und urbanization).
Left-hand Diagram: Partial relationship is statistically significant at the .001 level and controlled for state formation.
Right-hand Diagram: Partial relationship is statistically significant at the .001-level and controlled for population density.
Data Coverage: All societies from the standard Cross-Cultural Sample with valid data on the respective variables.

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North, Wallis, and Weingast (2009) describe the new configuration in institutional terms, characterizing it as an "open access order." Acemoglu and Robinson (2012) likewise describe the new configuration in institutional terms, focusing on its "inclusive institutions." Fukuyama (2012) has similar things in mind when pinpointing "adaptive institutions" as the key characteristic of the new configuration. These characterizations are without doubt insightful. Yet, couching the new configuration in institutional terms focuses on the symptoms. In my eyes, the best characterization of the new configuration lies in its spirit, which is inherently emancipatory: it is the idea of liberating people from external domination over their lives, giving them equal opportunities to pursue happiness and focusing the purpose of government on the well-being of the people.

The emancipatory sprit originates in a natural environment, manifest in the CW condition, that bestows existential autonomies on people. These autonomies enabled and encouraged people to mobilize resistance against oppression. From this resistance emerged a *contractual order* with *consensual institutions*, which range from (1) voluntary marriage to (2) market organization to (3) political representation. The key principle of consensual institutions is agreement. The agreement principle derives from the bargaining power with which existential autonomies endow people. The existential autonomies harbored by the CW condition made universal freedoms useful and desired and this happened before the contractual order framed these freedoms legally. Consensual institutions (or open, inclusive, and adaptive institutions– whatever terms we use) evolve as consequences, not causes, of existential autonomies at the grassroots of society. The purpose of these institutions is to certify utilities and values that are in place *before* their certification. Where institutional guarantees of freedoms are effective, the reason is not the quality of these guarantees themselves. The true reason why guarantees work is that the utility of these guarantees is already widely valued.

By contrast, where the absence of the CW condition makes peasants dependent on centrally organized water supply, *coercive institutions* emerged and gave rise to *patriarchal orders*, the opposite of contractual orders. Coercive institutions include (1) pre-arranged marriages with patrilocal household formation instead of voluntary marriages with neolocal household formation, (2) rent seeking economies with repressive labor relations instead of market economies with contractual labor relations, and (3) patronage and confiscation instead of representation in return for taxation in the political realm. Such patriarchal orders characterize the exploitative configuration of civilization.

The emancipatory configuration of civilization began to take shape after 1500 CE and differs on every account from the exploitative configuration that prevailed until then. To simplify things, this contrast is captured by the schematized juxtaposition in Figure 11.8.

Let's briefly summarize Figure 11.8. If intensive agriculture is adopted in CW areas, a *rain-watered type* of agrarian system evolves. This type of agriculture favors a distinct organization of economic activities. The key point about rain-

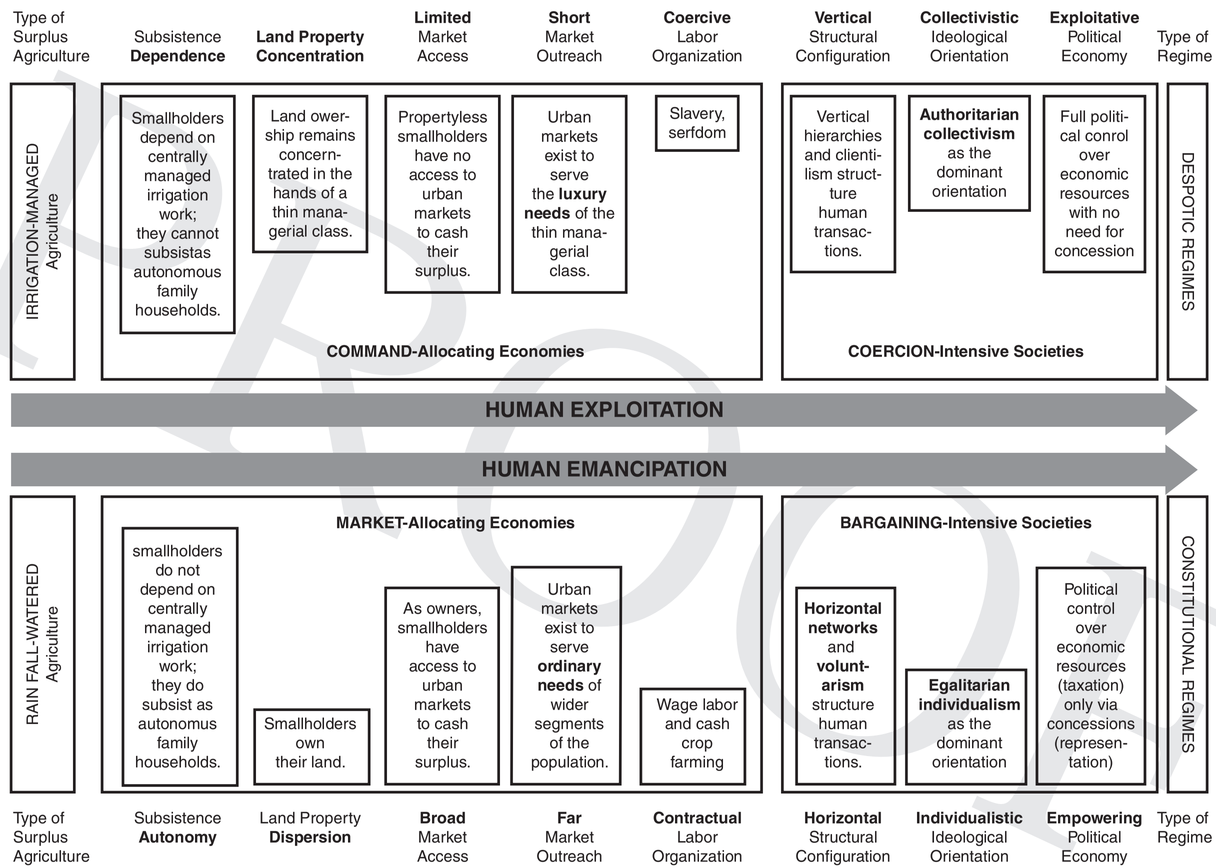

FIGURE 11.8 Juxtaposing the Emancipatory and Exploitative Configurations of Civilization.

watered agriculture is that smallholders are *existentially autonomous* because they can cultivate land on their own. Existential autonomy orients people toward entitlements and motivates them to fight for these entitlements. Eventually, this emancipatory spirit contributes to a wider dispersion of property titles on land. Landowning smallholders have economic agency because they can access urban markets to sell their surplus. Milder forms of contractual feudalism leave more surplus in the hands of the smallholders (Powelson 1997).

In this setting, a greater proportion of surplus is market allocated. Markets are more widely accessed and have greater outreach, serving the needs of common people. Market allocation increases the incentive to produce surplus and to invest in productivity-increasing technology. Consequently, the surplus eventually grows larger. Thus, richer and more sizeable urban populations emerge.

The commercial exchange networks of far-reaching urban markets provide the infrastructure for a civil society with autonomous actors who have the resources, skills, and motivation to coordinate their actions for jointly valued goals. This generates civic agency. Civic agency bestows bargaining power on social actors against political authorities. If authorities try to access economic resources via taxation, they have to make concessions in the form of political representation. As rulers grant representation in return for taxation (a deal often enforced in liberal revolutions), a social contract is forged, documented in statutes and constitutions.

Thus, *market-allocating economies* create *bargaining-intensive societies*, which result in *constitutional regimes* with political authority consented and controlled by wider segments of the population. These features establish the contractual order with its consensual institutions.

Under a contractual order, human transactions are structured by *horizontal networks* and social bonds are forged on the basis of *voluntarism*. The dominant orientation in society is a *meritocratic* form of individualism that values each person equally by his or her merits. The emancipatory spark inspiring the contractual order operates in harmony with productive human motivations. Hence, it unleashes people's creative energies, which makes possible the explosion of ideas needed to trigger an Industrial Revolution.

The success of the emancipatory type of civilization resides in its *double regulatory strength*. The double regulatory strength consists in strong organizing capacities on the part of the state and strong mobilizing capacities on the part of the society. The symbiosis of the two is forged by a social contract that tailors the state's powers toward the well-being of its constituents.

On the time scale of history, it took long until the civilization process gave rise to the emancipatory configuration on the territorial scope of entire countries, and not just of city states.[15] To understand why time was a crucial factor one has to see that the emancipatory configuration evolved under the CW condition. This

[15] On the territorial scale of city states, elements of emancipatory civilization, such as citizen rights, occurred in nascent form earlier in history. Classic Athens, the Roman Republic, and the historic

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condition bestows autonomies on people and these autonomies motivate effective resistance against power concentrations. Thus, the formation of state capacities is blocked under the CW condition until state formation is pursued under the explicit recognition of people's autonomies. But this required the evolution of an encompassing mechanism of preference negotiation – a mechanism encompassing enough to aggregate the preferences of an entire country's population. The mechanism in question emerged from the principle "no taxation without representation." Taxation in return for representation allowed regulatory capacities to develop on two parallel paths: the organizing capacities of the state and the mobilizing capacities of society. Once this regulatory co-evolution was in motion, the emancipatory type of civilization proved enormously successful. Its regulatory capacities quickly outperformed those known from exploitative forms of civilization on every account. This is particularly true of technological advancement – the ultimate source of a society's powers.

The explosion of technology that emerged from the emancipatory configuration of society allowed the West to rise to global dominance: Figure 11.9 provides a stylized depiction of this course of history. In the eras of colonialism and imperialism, the West itself became an exploiter of previously exploitative civilizations. But the West could not monopolize the spirit of emancipation. Instead, the spirit was turned against the West in the era of decolonization: the colonized societies claimed and asserted their right for liberation from Western domination. Since then, the spirit of emancipation is globalizing: as we saw in Chapter 2 (Figure 2.5), emancipative values are on the rise in every culture zone across the globe.

The rising spirit of emancipation does not equate to Westernization because the desire to live free from external domination is universally human. Ironically, the diffusion of the emancipatory spirit actually evidences a *de*-Westernization of the world. Because emancipative values evolve in response to better living conditions, their growth indicates that other societies are catching up. As this happens, the West's global dominance fades.

9. FADING NATURAL ADVANTAGES: THE CONTAGION THESIS

There is conclusive evidence that environmental conditions exert a powerful impact on the base process of human empowerment: technological advancement. Through their impact on technological advancement, environmental conditions indirectly affect the two consecutive elements of human empowerment:

republics in Northern India might be counted as examples. Yet, as long as this configuration did not emerge on the territorial scale of an entire nation, it could not compete with large empires. And as long as this was the case, it seemed as if the exploitative organization of society was superior to the emancipatory organization. For the longer period of civilized history, despotism seemed superior to freedom. The deceptive nature of this impression became obvious once emancipatory societies eventually emerged on the territorial scale of entire nations.

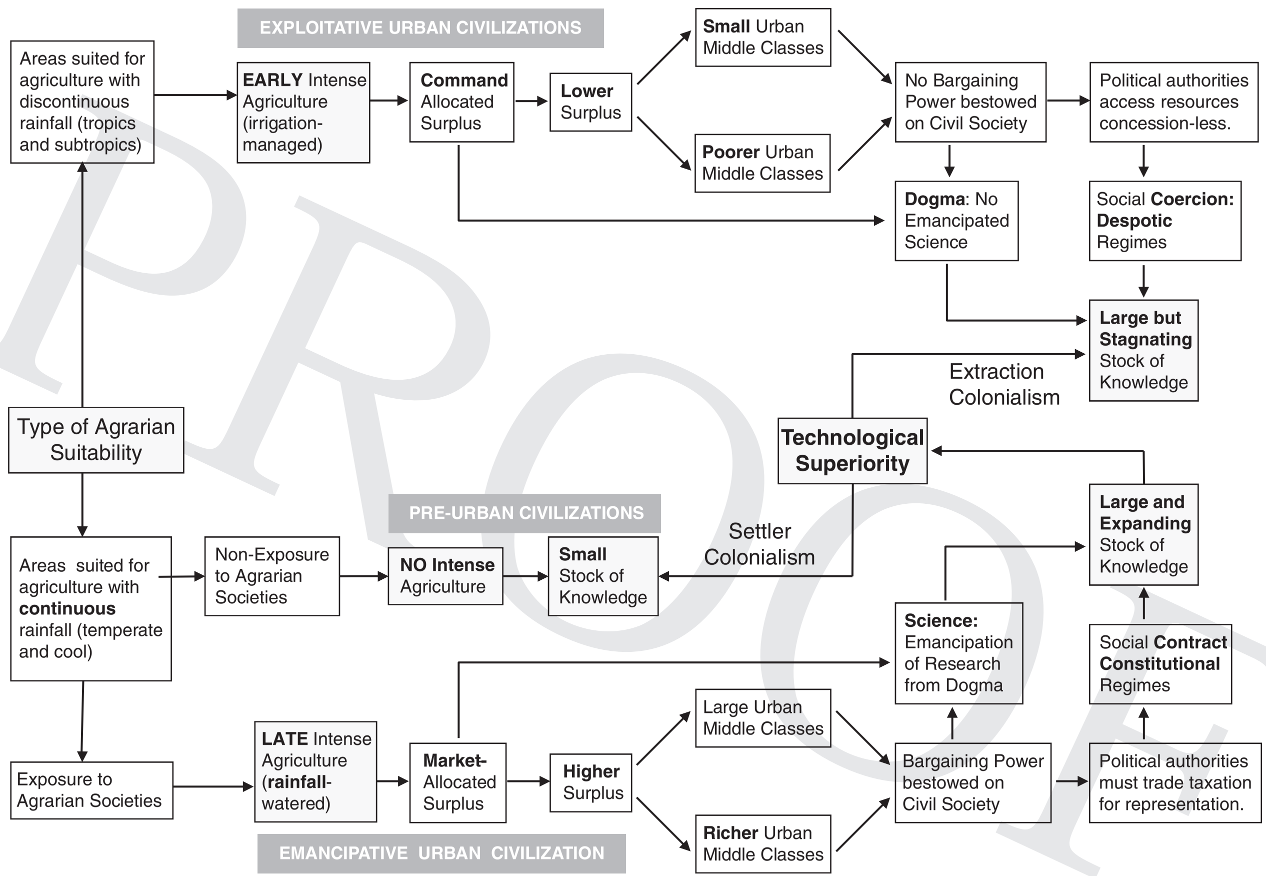

FIGURE 11.9 A Stylized Depiction of the History of Civilization.

emancipative values and civic entitlements. Hence, environmental conditions have been important for the entire human empowerment process. The industrial take-offs of Western Europe and Japan, together with European settlement in North America, Australia, and New Zealand, advanced human empowerment in all of the world's CW zones.

Now, many readers will ask "How great is a theory that leaves us with such a bleak, deterministic outlook?" Against this possible criticism, I want to point out that my theory is not deterministic but probabilistic. Certain natural endowments are givens, and they place societies within a possibility corridor from which they cannot escape. But this corridor can be broad, as Figure 3.5 has shown. The choices that societies make, some of them perhaps accidental, decide whether they move along the floor or the ceiling of their possibility corridors. What is more, and that could be another turn in history, there is accruing evidence that the determining power of natural endowments is shrinking, thus widening the possibility corridor for all societies. And I believe that global communications and the internet are responsible. Humans have always been programmed for social learning, but this potential was limited in social and geographic space. The internet is about to completely unlock this potential, which widens the choices that societies can make. Today, even people in backward areas can easily get a rough sense of how things are done in other places and how they are done better. And they can more easily connect with like-minded others to mobilize pressure for change. No question, there are still more than enough tyrants and corrupt power holders in this world, and their final days are not counted yet. But their lives become more difficult under rising popular pressures.

A symptom of this historic sea change is that life improvements decouple from advantageous natural endowments. Technological advancement, in particular. is becoming untied from its original limitation to CW areas. The emergence of India, a largely tropical society, to the forefront of information technology is a striking example. If this trend continues, we will observe an increasing dissociation of the human empowerment process from its previous confinements.

A sign that this decoupling is just about to happen is the weakening explanatory power of the CW condition. Since the 1980s, the CW condition shows a weakening impact on technological advancement: across the world, the explanatory power of the CW condition decreased from 67 percent in 1980 to 42 percent in 2010. Appendix 11 (www.cambridge.org/welzel) documents the evidence for this statement.

The regression analyses in Table 11.4 demonstrate why societies' progress in technological advancement is being decoupled from the CW condition. The covered period is 1980 to 2000. Since our direct measure for technological advancement is unavailable for the twenty-year time span covered in Table 11.4, I use the proxy for technological advancement from Vanhanen (2003) introduced earlier, combining a society's literacy and urbanization rate. From 1980 to 2000, all societies increase their score on this proxy. Yet, they progress to different degrees. The models explain this difference.

TABLE 11.4 *The Diminishing Impact of Natural Conditions and the Rising Impact of Globalization on Technological Advancement.*

PREDICTORS	DEPENDENT VARIABLE: Δ Technological Advancement[a] 1980–2000						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
• Constant	0.20 (7.45)***	0.09 (3.09)***	0.16 (4.25)***	0.15 (4.28)***	0.20 (6.94)***	0.11 (1.31)[n.s.]	0.17 (2.59)**
• Cool-Water Condition	−0.11 (−2.21)**	−0.17 (−3.64)***	−0.10 (−1.93)*	−0.07 (−1.26)[n.s.]	−0.12 (−2.33)**	−0.39 (−3.95)***	−0.44 (−5.87)***
• Δ Social Globalization[b]		0.69 (5.02)***				0.59 (2.25)**	0.47 (2.11)**
• Δ Economic Globalization[b]			0.15 (1.02)[n.s.]			0.09 (0.46)[n.s.]	0.22 (1.18)[n.s.]
• Δ Political Globalization[b]				0.24 (2.25)**		0.23 (1.27)[n.s.]	
• Δ Civic Entitlements					0.05 (0.99)[n.s.]		0.03 (0.43)[n.s.]
Adjusted R^2	0.06	0.32	0.03	0.11	0.06	0.35	0.42
N (societies)	65	62	61	63	61	62	57

Regression diagnostics for heteroskedasticity (White test), multicollinearity (variance inflation factors), and influential cases (DFFITs) reveal no violation of ordinary least squares (OLS) assumptions.

Significance levels: [n.s.] $p \geq .100$, * p .100, ** p .050, *** p .005

[a] Proxy measure: urbanization rate times literacy rate in 1980 and 2000, subtracting the former product from the latter.

[b] Dreher et al.'s (2008) globalization indices in 1980 and 2000, standardized into a range from minimum 0 to maximum 1.0 and subtracting the 1980 from the 2000 index.

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As is evident, the CW condition has a negative effect on progress in technological advancement: societies with a stronger CW condition exhibit higher levels of technological advancement since a long time, yet they make less additional progress since 1980. In other words, naturally disadvantaged societies are catching up: they are overcoming their disadvantage. Progressing global integration favors this process: societies that engage more in exchange with other societies make more progress in their technological advancement than do societies that engage less. This is obvious from the positive effects of the indicators for social, economic, and political globalization that I take from Dreher, Gaston, and Martens (2008).

Interestingly, the positive effect of globalization is stronger for social than for economic and political globalization. Social globalization measures cross-border exchange between people and global communications, including such things as tourism, phone conversations, letter correspondence and internet usage. By contrast, economic globalization is about the exchange of goods while political globalization measures commitment to international treaties. The stronger impact of social globalization on progressing technological advancement makes sense from a social learning point of view: learning to progress happens primarily through communications between people. Figure 11.10 visualizes the findings of Table 11.2 (Model 2), depicting the partial effects of the CW condition and rising social globalization under mutual control.

In line with these findings, a recent analysis demonstrates across some 180 nations that the impact of the CW condition on decennial growth rates in per capita GDP shrank monotonically from $b = 0.78$ for the decade 1960–70 to $b = 0.55$ for the decade 2000–10. Moreover, 56 percent of the shrinking impact of the CW condition is explained by a parallel rise in the world's mean globalization score (Welzel 2013).

KEY POINTS

As this chapter has shown, the source thesis of emancipation theory explains some striking patterns of human history. The thesis posits that the CW areas' naturally higher disease security and water autonomy bestow on freedoms more initial utility than elsewhere. CW areas are naturally located a few steps above on the utility ladder of freedoms. This leads to two paradoxical effects.

First, since foraging is a freer lifestyle than agriculture, the transition to agriculture was delayed in CW areas. Hence, societies in these areas were late developers: urban markets emerged later than in the old Oriental civilizations, and technological advancement lagged behind for a long time.

Second, once urban markets emerged they became more vibrant in CW areas because water autonomy creates derivative autonomies once markets are in place. These derivative autonomies continue to bestow further utility on freedoms in CW areas, which now turns out to be an accelerator of technological advancement. With autonomy in market access, ordinary people have an incentive to

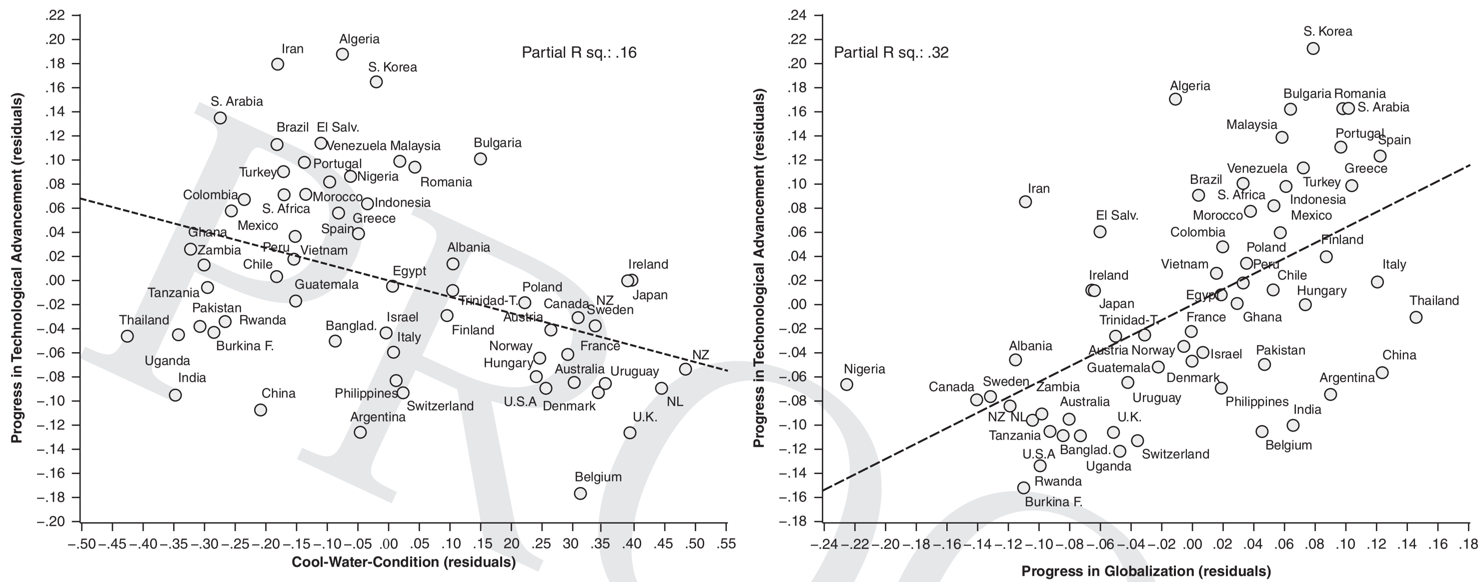

FIGURE 11.10 Diminishing Impact of Natural Conditions and the Rising Impact of Globalization on Technological Advancement.

Left-hand Diagram: Positive (negative) residuals on the horizontal indicate to what extent a society's cool-water (CW) condition is stronger (weaker) than one would expect knowing its progress in globalization. Positive (negative) residuals on the vertical axis indicate to what extent progress in a society's technological advancement is higher (lower) than one would expect knowing the society's progress in globalization. The relationship indicates that, if a society's CW condition is stronger than expected, its progress in technological advancement is lower than expected. Thus, controlling for progress in globalization, the CW condition negatively affects progress in technological advancement.

Right-hand Diagram: Positive (negative) residuals on the horizontal indicate to what extent a society's progress in globalization is higher (lower) than one would expect knowing its CW condition. Positive (negative) residuals on the vertical axis indicate to what extent progress in a society's technological advancement is higher (lower) than one would expect knowing the society's CW condition. The relationship indicates that, if a society's progress in globalization is higher than expected, its progress in technological advancement is higher than expected too. Thus, controlling for the CW condition, progress in globalization positively affects progress in technological advancement.

The two diagrams are partial regression plots from the same multivariate regression: the dependent variable is progress in technological advancement from 1980 to 2000, using the combined literacy and urbanization rates as a proxy. The independent variables are the CW index (which is without a specific time) and progress in a society's degree of globalization from 1980 to 2000, using Dreher, Gaston, and Martens' (2008) index of social globalization. All variables are standardized from minimum 0 to maximum 1.0. Progress is the difference in the technological advancement and globalization levels between 1980 and 2000, subtracting the former from the latter.

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avoid a quantity-breeding strategy and instead pursue a quality-building strategy in their reproductive behavior: they sacrifice demographic for economic productivity. This creates a less numerous but more valuable workforce. Rising labor demands in urban centers must, therefore, be met by technologies that save costly labor. The result is accelerated technological advancement.

As a consequence, action resources make their way into the hands of wider segments of the population. More widespread action resources further increase the utility of freedoms. In recognition of this, people adopt emancipative values. Inspired by emancipative values, people claim civic entitlements and take action on their behalf if rulers refuse to provide effective guarantees. Overwhelmed by popular solidarity, rulers eventually give in: civic entitlements are guaranteed and respected in practice. As this happens, a first full cycle of human empowerment is completed. Then the next cycle might start, creating more action resources, stronger emancipative values, and wider civic entitlements. Of course, exogenous shocks can stop human empowerment or even revert it at any point in time. But there is no preset inner limitation beyond which human empowerment could never advance. The reason for the absence of a preset limitation lies in the simple fact that, no matter how much we improve, the world will always be imperfect.

The human empowerment process started in the CW areas of Western Europe, it was emulated by the CW area of Japan, and it was transplanted by European settlement to the CW areas of Northern America and Australia as well as New Zealand. Hence, human empowerment is far advanced in all of the world's CW areas. However, in the era of globalization the human empowerment process begins to dissociate from the advantageous CW condition and to diffuse elsewhere. Human empowerment begins to globalize. This process de-Westernizes the world as the West's monopoly over human empowerment erodes. The next chapter deals with the sustainability challenge that the global diffusion of human empowerment poses. I will argue that human empowerment holds in itself the key to master the sustainability challenge.

PROOF