"Just Do Your Job": Obedience, Routine Tasks, and the Pattern of Specialization*

Filipe R. Campante† Davin Chor‡

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Abstract

We study the interplay between cultural attitudes and the economic environment, focusing on attitudes towards obedience in the workplace. We establish two key stylized facts: First, at the country level, an upward shift in workplace obedience over time is associated with more exporting in industries that feature a high routine task content ("Specialization Fact"). Second, at the individual level, the degree of "export-routineness" in the economic environment that respondents were exposed to in their formative years – but not in their adult years – shapes the pro-obedience attitudes that they carry with them into the workforce ("Obedience Fact"). Together, these two facts show that cultural attitudes on workplace obedience respond systematically to economic incentives, and that such a culture in turn shapes the subsequent pattern of industry specialization. We develop an overlapping generations model of human capital investment and cultural transmission, to understand how this aspect of culture and specialization patterns in the economy are jointly determined in the long run. In particular, the model demonstrates the possibility of an "obedience trap": countries may specialize in routine sectors (e.g., basic manufacturing) that foster a culture of obedience, at the expense of the development of more nonroutine and potentially more productive activities.

Keywords: Culture; Workplace Obedience; Routine Tasks; Education; Human capital; Specialization Patterns; Exports

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†Harvard Kennedy School, Harvard University and NBER. Address: 79 JFK Street, Cambridge, MA 02138, USA. Email: filipe_campante@harvard.edu

‡Department of Economics, National University of Singapore. Address: 1 Arts Link, AS2 #06-02, Singapore 117570. E-mail: davinchor@nus.edu.sg

1 Introduction

As a working hypothesis, the idea that cultural attitudes and beliefs help to shape economic outcomes has attracted longstanding attention and, more recently, formal empirical scrutiny.[1] It stands to reason that the economic environment would also influence the emergence and survival of certain attitudes and beliefs. In particular, cultural traits that are seen as advantageous in economic terms would in principle be more successfully transmitted through the population and across generations, while those that are very costly to hold on to would be less likely to persist. It follows that the evolution of culture in a society and the production structure of its economy ought to be studied jointly, to better understand the nature of this inter-dependence, and how it ultimately affects that society's developmental path.

In this paper, we study this interplay in the context of one specific cultural trait, namely attitudes towards obedience in the workplace. This reflects workers' overall disposition towards following instructions that are received in a work environment, as opposed to questioning them. Although a relatively under-studied trait, we argue that this aspect of cultural attitudes is nevertheless highly relevant for understanding broader economic outcomes, such as the pattern of production and specialization.

We start from the observation that attitudes towards workplace obedience matter for production outcomes, but that they affect the productivity of workers in distinct ways across different sectors or activities. On the one hand, some production tasks are enhanced by having a more obedient workforce. A factory assembly line, for example, would not be able to function properly if workers were to question each and every single procedure. Ngai and Chan (2012) colorfully describe how Chinese manufacturer Foxconn's production process "[does] not require 'skill' or thought; only strict implementation of instructions from management and mechanical repetition of each simple movement are required" (p.395). Workers are thus managed "through the principle of 'obedience, obedience, and absolute obedience' " (p.398).

On the other hand, production activities or tasks that involve creative or nonroutine thinking would instead be hindered if workers have a default tendency to conform to rules. For instance, it has been noted that innovative firms are ones in which "'rules' [exist], but managers [feel] free to challenge or ignore them" (Kanter 1983, p.144). Less innovative companies, in contrast, tend to be "dominated by tall hierarchies, [where] honoring the chain of command is a value" (p.76).[2] Starting from this set of observations, it follows that a broad culture of obedience in the workplace

[1] See the recent surveys by Guiso, Sapienza, Zingales (2006), Fernandez (2011), Nunn (2012), and Alesina and Giuliano (2015).

[2] As a further illustration of this point, consider the following perspective offered by a director of R&D at a medical device multinational located in Singapore: "Singaporeans (...) have a tremendous respect for authority. A similar team in the US would keep questioning and want to have a healthy dialogue every step of the way. (...) Singaporeans rarely revisit and question the purpose of a task. They have a great ability to translate something from requirement to developed product. They just get it done." The same executive went on to highlight the negative consequences of such conformity: "Ideas are seldom generated, as no incentives for creativity exist in the Singaporean education system. In three years of operation, our facility has not produced a single patent, and there is no record of new ideas." (From: http://sudhirtv.com/2013/05/17/why-has-singapore-failed-to-prepare-its-citizens-adequately-for-the-knowledge-economy/.)

would be more conducive in the former types of production activities (e.g., basic manufacturing) than in the latter (e.g., innovation-intensive sectors).

The first central finding of this paper establishes that pro-obedience attitudes indeed predict patterns of specialization at the country level. To operationalize such a test, we construct a time-varying aggregate measure of workplace obedience, using cohort variation from respondent data from the World Values Survey (WVS). We find strong evidence of a "Specialization Fact" when bringing together this measure with international trade data on industry-level exports, with the latter providing us a long time series that sheds light on how country specialization patterns have evolved. In particular, as a country shifts towards being (say) more obedient in its workplace attitudes, we find that this is associated with more specialization and exporting in industries that feature a higher degree of "cognitive routineness" (i.e., the attainment of pre-set limits and standards) in their task content, as coded up by Autor, Levy and Murnane (2003) from detailed occupational task descriptions. We will also show that this Specialization Fact is robust to including analogous controls for other determinants of comparative advantage that have featured regularly in the empirical trade literature, including country factor endowments (Romalis 2004) and institutional forces (c.f., Nunn and Trefler 2014), and that it even holds when we control for the possibility that country human capital could be associated with specialization in less routine industries.

Our second key contribution is to uncover a closely-related "Obedience Fact" that speaks to a feedback effect from past patterns of specialization on workplace obedience attitudes held at the individual level. To be precise, we find that educated individuals tend *ceteris paribus* to be less pro-obedience in their workplace attitudes, but this negative partial correlation is systematically weakened and even nullified if one's formative years were spent growing up in an economy that featured a high degree of routineness in its export mix ("export-routineness"). Interestingly, these obedience patterns are affected by the degree of export-routineness that an individual was exposed to in her childhood and adolescent years, but *not* by the corresponding exposure in adulthood. It moreover remains robust when controlling for the cohort-specific exposure to other past country conditions, such as income per capita or democracy. The results are further confirmed when using an instrumental variable for export-routineness, that seeks to leverage off variation in the export profile that each country-cohort was exposed to at different ages that is plausibly driven by demand conditions in the broader world market (rather than by technology or policy shocks stemming from within the country itself).

We view this empirical regularity as entirely in line with the earlier discussion on how economic conditions can affect the process of cultural transmission. In particular, the Obedience Fact is consistent with the interpretation that pro-obedience traits are transmitted through parents or the school system during an individual's formative years, in response to the incentive to build cultural traits that one anticipates will be rewarded subsequently in the workplace.

Drawing motivation from these two empirical facts, our third contribution is then to formally model and study the inter-dependence between specialization patterns and workplace obedience. Toward this end, we build an overlapping-generations model in which adults in each period choose

how much human capital to allocate between two sectors. This choice depends on the individual's attitudes towards obedience, as obedience is helpful in a routine ("Basic") sector but harmful in a nonroutine ("Complex") activity. In addition, each adult also chooses how much human capital to invest in her unique child, as well as the attitudes regarding workplace obedience to impart, following a standard model of cultural transmission along the lines of Bisin and Verdier (2001) or Tabellini (2008).[3]

The model provides a useful guide for thinking about the forces that govern the co-evolution of the structure of the economy and cultural attitudes towards obedience. Among its baseline predictions, the model delivers both the Specialization Fact and the Obedience Fact as natural implications of this interplay. What is more, the theory highlights a rich array of potential long-run outcomes relating to obedience, human capital, and specialization patterns, including the possibility of multiple equilibria should production in the nonroutine sector exhibit human capital externalities.

In particular, this raises the prospect of an "obedience trap": An economy can find itself in a high-obedience, low-human capital equilibrium, where production is skewed towards the routine sector. This reinforces the transmission of a high-obedience mindset, as well as relatively muted levels of human capital investment (if the routine sector is relatively less skill-intensive). However, this comes at the expense of the emergence of the nonroutine sector, even though an alternative low-obedience, high-human capital equilibrium also exists with the same underlying fundamental model parameters. This prospect is more than just a theoretical curiosity, since specialization in routine industries has been identified as an area of policy concern. The labor literature for example has shown strong evidence that routine tasks are more subject to replacement by computerization and technology, so that high-routine sectors have been associated with the phenomenon of labor market polarization (Autor and Dorn 2013; Goos and Manning 2007; Goos, Manning and Solomon 2014; Michaels, Natraj and Van Reenen 2014).

One interpretation of these features of the model is that cultural traits that are beneficial at certain stages of development may eventually become counter-productive.[4] Specifically, an economy that starts off with high productivity in the basic sector may develop cultural traits that are efficient in that context, but that eventually prevent it from developing more complex activities. This seems to capture the oft-stated concern regarding countries that, having succeeded in the early stages of industrialization, might fail to transition further, perhaps partly due to cultural forces.[5]

This paper relates to several strands of literature. The hypothesis that culture has a role to play

[3]See Bisin and Verdier (2011) for a survey of theoretical models of cultural transmission.

[4]This is reminiscent of the idea of "appropriate institutions" (Acemoglu 2006; Acemoglu, Aghion, and Zilibotti 2006), whereby institutional arrangements that are relatively efficient at particular stages of development cease to be so at later stages.

[5]For instance, in the words of Lee Kuan Yew: "East Asians, who all share a tradition of strict discipline, respect for the teacher, no talking back to the teacher and rote learning, must make sure that there is this random intellectual search for new technologies and products." (*Foreign Affairs*, March/April 1994). Similarly, the *Financial Times* (Jan 31, 2014) notes that while the Chinese government has stressed its desire to foster entrepreneurship and start-up businesses, "traditional Chinese culture, still influenced significantly by Confucian values such as 'obedience' [and] 'respect for authority' (...), is not naturally compatible with typical entrepreneurial values."

in explaining socioeconomic outcomes has a long vintage.[6] On the literature that has studied the interplay between culture and economic outcomes, we are in line with more recent contributions such as Alesina, Giuliano and Nunn (2013), and Giuliano and Nunn (2016), in showing how the emergence and prevalence of cultural traits are affected by the economic environment. Unlike most of these contributions, which focus on the persistence of traits in the very long-run far beyond the specific context in which they arose, we uncover an example of one specific cultural trait that can be affected by changes in economic conditions within the shorter horizon of one to two generations. In this, we are closer to papers such as Giuliano and Spilimbergo (2014), which show how cultural traits can be affected within an individual's lifetime. Still within this literature, we relate to contributions such as Greif and Tabellini (2010), Tabellini (2010), Campante and Yanagizawa-Drott (2015), and Gorodnichenko and Roland (2016), in studying how cultural traits matter from an aggregate economic perspective.

Our focus on obedience relates to the literature in sociology that has looked at the connections between obedience ("conformity") and occupational choices, and how the former gets transmitted across generations. Kohn's (1977) seminal contribution argued that "middle-class" occupations tend to be free of close supervision, whereas "working-class" occupations are more subject to standardization and direct supervision; consequently, the parenting styles of middle-class and working-class families place different degrees of emphases on fostering conformity. Our results illustrate how this can shape and be shaped by broader economic specialization patterns. Similarly, we relate to the literature in cultural psychology that has focused on the "tightness-looseness" dimension of different cultural environments. This alludes to "the strength of punishment and the degree of permissiveness in a social system" (Harrington and Gelfand 2014, p.7991). This literature has investigated the determinants of the evolution of cultural traits on this dimension, and their correlation with aggregate social outcomes (Gelfand et al. 2011; Harrington, Boski, and Gelfand 2015; Zou et al. 2009). Our findings build on and contribute to it, as the prevalence of an individual willingness to obey and conform to authority in the workplace should be closely connected to the social expectation of punishment for non-conformity.

On a separate vein, the empirical work that we undertake in this paper draws on approaches in the international trade literature. The regression model used to uncover the Specialization Fact is a workhorse specification for uncovering sources of comparative advantage (see the survey in Nunn and Trefler 2014). Beyond that, our approach speaks to the literature on trade in tasks (Grossman and Rossi-Hansberg 2008; Becker, Eckholm and Muendler 2013; Becker and Muendler 2016), by looking at the relationship between routine tasks and cultural traits.

Last but not least, we also engage the literature in labor economics that has documented the importance of the dimension of routine vs nonroutine tasks (Autor, Levy, Murnane 2003; Autor and Dorn 2013; Spitz-Oener 2006; Goos and Manning 2007; Goos, Manning and Salomons 2014; Michaels, Natraj and Van Reenen 2014; Deming 2016). Unlike those papers, we focus on how that dimension interacts with cultural attitudes.

[6] See for example Banfield (1958), Clark (1987), Putnam (1993), and Landes (1998).

The remainder of the paper is organized as follows. Section 2 documents the Specialization Fact, while Section 3 reports the Obedience Fact. Section 4 then develops the model of specialization and cultural transmission. Section 5 concludes and points to further lines of future work.

2 The "Specialization Fact"

We start by establishing that cultural attitudes towards workplace obedience are associated with the pattern of industrial specialization observed within countries. We hypothesize in particular that when the prevailing mindset of workers becomes more disposed towards following (rather than questioning) workplace instructions, this is associated with a shift in the production structure of the economy towards industries where the tasks performed are more routine in nature.

In what follows, we detail the empirical approach taken to uncover this Specialization Fact, based on data on the industry composition of each country's exports. Although the mechanism that we have in mind would in principle manifest itself directly in patterns of industrial output, such production data are difficult to obtain for a large panel of countries over time. Our approach is to turn instead to detailed international trade data to shed light on specialization patterns.

2.1 Data: Workplace Obedience

The first data requirement for this exercise is a measure on attitudes towards workplace obedience, across both countries and time. For this, we draw on the World Values Survey (WVS), a large and comprehensive survey project on social, cultural and political attitudes that is commonly used in social science research. The version of the WVS we use contains six waves (between 1981-2014), with a cumulative total of 229 surveys conducted in 97 countries/territories. A key feature of the WVS is that it adopts a common set of questions in each wave, even though the surveys are conducted by local teams in each country. The typical country survey in the WVS comprises at least 1,000 respondents aged 15 and above, based on a stratified random sampling procedure.

The WVS contains a module on the topic of "Work", from which we draw a measure of attitudes towards workplace obedience. Specifically, question C061 asks the following:

> "People have different ideas about following instructions at work. Some say that one should follow one's superior's instructions even when one does not fully agree with them. Others say that one should follow one's superior's instructions only when one is convinced that they are right. With which of these two opinions do you agree?"

The possible categorical response options are: "Follow instructions", "Depends", and "Must be convinced first", which we recoded to take on the values 2, 1 and 0 respectively. This yields a measure that is increasing in the respondent's propensity to obey workplace instructions, as opposed to questioning their rationale. We view the particular framing of this WVS question – explicitly placing it in the context of conduct in the workplace – as a useful feature that minimizes

ambiguity, as it directly solicits attitudes towards obedience in the workplace, rather than say within the family or in a school environment.[7] One shortcoming is that the workplace obedience question appears only in Waves 1-5 of the WVS, although as we will see, this will provide sufficient observations for us to work with. The countries for which responses on this question are reported span the range of both developed and developing economies (see Appendix Table 1).

To establish the Specialization Fact, the individual responses from the WVS need to be aggregated into a country-level measure of workplace obedience at each time t of interest. In what follows, we construct this for $t = 1985, 1990, \ldots, 2010$, in order to align the measure closely to the five-year birth-cohort windows that we will be adopting. A first simple approach to aggregating the responses would be to pool together individuals for each country c across all available WVS waves ($w = 1, 2, \ldots, 5$), and then take a simple average of the obedience scores for the subset of these respondents who would be of workforce age (say, between 25-64) in the year t of interest. This approach is however subject to a potential criticism: The workplace attitudes of an individual surveyed in wave w could reflect in part the influence of the contemporaneous economic environment. For example, if the economy were very oriented towards routine manufacturing industries during wave w, this could in turn raise pro-obedience tendencies particularly for workers employed in such industries. Likewise, if the WVS survey had been conducted in a recession year, workers might report a greater agreement with following workplace instructions out of heightened concerns over their job security. In order to more convincingly establish that there is an effect running from a culture of workplace obedience to country specialization patterns, one would want to correct for any such confounding effects that contemporaneous economic conditions might have on self-reported obedience at the individual level.

To do so, we adopt the view that there is a systematic component of an individual's attitudes towards workplace obedience that is specific to the country (c), birth-cohort (b), and gender (g) tuple that he/she belongs to, that is moreover orthogonal to the influence that economic conditions during his/her survey wave (w) might have on these same attitudes. The procedure described below seeks to extract this systematic component of workplace obedience for each (c, b, g) bin, after controlling for a large set of respondent characteristics, as well as survey country-wave (cw) dummies, to attempt to remove the influence of the prevailing economic environment on reported obedience. To implement this on the WVS data, we associate each respondent with his/her country (c), five-year birth cohort ($b = 1915, 1920, 1925, \ldots$), and self-reported gender ($g \in \{M, F\}$); note that we define b (as an example) to be 1960 for a respondent born in the window 1960-1964. We then consider the following regression model to explain the workplace obedience attitudes held by

[7] The WVS contains a separate question (A042) that asks respondents to identify whether they view obedience as an important quality for children. However, the manner in which this question was posed potentially opens it up to measurement error: respondents were asked to pick out up to five child qualities from a list of eleven, of which obedience was one of the options. The correlation between the workplace obedience question and a dummy variable for whether obedience in children was identified as important is 0.0426. Although this correlation is statistically significant, its low magnitude nevertheless suggests that the two measures are picking up different dimensions of cultural attitudes. (We will use the obedience in children measure later in robustness checks.)

respondent r surveyed in wave w:

$$ObedWork_{r,cbw} = \beta_0 + \beta_1 Educ_{r,cbw} + \beta_X X_{r,cbw} + D^g_{cb} + D_{cw} + \epsilon_{r,cbw}. \quad (1)$$

In the above, D^g_{cb} is a country-cohort-gender fixed effect that captures the component of workplace obedience specific to the (c, b, g) bin that is of interest to us. These are estimated while controlling for a host of respondent characteristics. Among these, we include education ($Educ_{r,cbw}$), which we will see is an especially robust and important correlate of workplace obedience at the individual level.[8] $X_{r,cbw}$ is a further vector of respondent variables, comprising full sets of dummies for the number of children, marital status, employment status, occupation, and the size of town of residence. In particular, the employment status and occupation dummies in principle help to control for the influence that the current job held by the respondent could have on his/her propensity to agree to a statement about following workplace instructions. Put otherwise, this allows us to interpret the D^g_{cb}'s as a country-cohort-gender specific component of workplace obedience that is estimated after holding these respondent characteristics (such as occupation) constant.[9] Last but not least, the regression contains survey country-wave fixed effects (D_{cw}), which control among other things for how prevailing economic conditions within the country might affect reported workplace attitudes. ($\epsilon_{r,cbt}$ denotes the idiosyncratic component of the respondent scores.)

Equation (1) is estimated using OLS on the pooled sample of respondents across all available countries. From this, we obtain the point estimates of the country-cohort-gender fixed effects, $\hat{D}^g_{cb}$'s, and then use these to compute the following weighted-average measure of workplace obedience in country c at time t:

$$AvgObedWork_{ct} = \sum_{(c,b,g)} \omega^g_{cbt} \hat{D}^g_{cb}. \quad (2)$$

Here, the ω^g_{cbt}'s are equal to the share of the population aged 25-64 in country c at time t that belong to the (c, b, g) bin, where the relevant population structure data are taken from Barro and Lee (2013).[10] Moving forward, the $AvgObedWork_{ct}$ variable in (2) will serve as our main measure of prevailing attitudes towards workplace obedience at the country level.

Several remarks are in order with regard to the construction of $AvgObedWork_{ct}$. First, we do find in practice that the country-cohort-gender fixed effects are relevant and important for explaining attitudes on workplace obedience. This is documented in Appendix Table 2, which reports successive OLS regressions similar to (1) that seek to explain this individual-level variation. The first column in this table runs a basic specification containing only respondent characteristics as explanatory variables, namely a gender dummy, education and the $X_{r,cbw}$ vector, but omitting both

[8] The education variable in the WVS provides for categorical responses ranging from 1 to 8, with 1 being "Inadequately completed elementary education", and 8 being "University with degree or upper-level tertiary certificate". Please see the Data Appendix for more detailed descriptions of these and other variables drawn from the WVS.

[9] The WVS does not contain information on industry of employment, so occupation and employment status are used instead to control for the influence that the respondent's current job may have on his/her workplace attitudes.

[10] We have also explored constructing this measure with the workforce age instead defined to be ages 15-64 (results available on request).

the D^g_{cb} and D_{cw} fixed effects. The overall R^2 obtained is a relatively low 0.0121. This increases markedly to 0.0771 in Column (2) once the D^g_{cb} fixed effects are added, so that the country-cohort-gender dimensions account for about five times as much variation in workplace obedience attitudes compared to the respondent characteristics *per se*. The share of variance explained rises to 0.0856 in Column (3) where the country-wave fixed effects are further included, this being the specification from (1) that we use to construct $AvgObedWork_{ct}$. Turning to the role of specific respondent characteristics, Appendix Table 2 also highlights the importance of education as a correlate, with more educated individuals being significantly less likely to agree with always following instructions in the workplace. (All standard errors are clustered conservatively at the country level.) This is an important partial correlation that we will build upon later. For each specification in the table, we also report in parentheses the p-values from F-tests for the joint significance of each of the sets of respondent-related dummy variables; these confirm that employment status and occupation in particular are highly relevant for explaining workplace obedience, hence confirming the importance of controlling for these characteristics explicitly.[11]

It is worth mentioning a further assumption implicit in equation (2), where the estimated country-cohort-gender fixed effects are averaged to form the country-level measure of obedience. When including both sets of D^g_{cb} and D_{cw} fixed effects in the regression in (1), note that one dummy variable will need to be dropped for each country c. In other words, these fixed effects can only be estimated subject to a choice of normalization within each country c. The upshot of this discussion is that one should focus on the within-country variation, since we cannot meaningfully interpret differences across countries in the estimated $\hat{D}^g_{cb}$'s. Separately, the $\hat{D}^g_{cb}$'s also need to be a valid reflection of prevailing workplace attitudes within each (c, b, g) bin at time t. This is arguably less of a concern in the context of our data setting, since the WVS surveys for which the obedience at work variable is available were undertaken between 1981-2008, which overlaps considerably with the years $t = 1985, 1990, \ldots, 2010$ on which the analysis for the Specialization Fact will be performed.

2.2 Data: Task and Industry Routineness

As described in the Introduction, a key premise of our empirical strategy is that a prevailing culture that encourages workplace obedience would have heterogeneous effects on production outcomes across industries. We describe in this subsection the measures of industry "routineness" that we adopt from the labor literature, and explain why these are well-suited to capture the extent to which production in an industry would benefit from a culture of following workplace instructions.

We draw on Autor, Levy, and Murnane (2003, ALM) for their measures of occupational and industry routineness. These are rooted in a task-based perspective of what constitutes an occupa-

[11] We do not control for the age of the respondent at the time of the survey. In principle, there is some variation within each birth-cohort in the age at which respondents were surveyed, especially if the respondents' were surveyed in different WVS waves. In practice however, when we run a regression of the cohort year b against a set of dummy variables for whether the respondent was aged 15-19, 20-24,..., 75 and over, at the time of survey, the resulting R^2 is a very high 0.94 even with no other explanatory variables; this increases to 0.98 when survey wave fixed effects are included. The cohort dummies are therefore highly collinear with the age dummies, and so we do not control for age separately when estimating (1).

tion. Based on task descriptions documented in the US Dictionary of Occupational Titles (DOTS), ALM code up indices of five dimensions of task content for a wide variety of occupations. These dimensions are respectively: (i) routine cognitive ($T^{r,c}$), relating to the "precise attainment of set limits, tolerances and standards"; (ii) nonroutine cognitive interactive ($T^{nr,c1}$), involving responsibility for "direction, planning, or control"; (iii) nonroutine cognitive analytic ($T^{nr,c2}$), related to mathematical skills of a range of difficulty levels; (iv) routine manual ($T^{r,m}$), on the need for finger dexterity; and (v) nonroutine manual ($T^{nr,m}$), on the need for eye-hand-foot coordination. (See Appendix Table 1 of ALM for the complete descriptions.) Each of these task-content indices is coded on a scale of 0-10 at the occupation level. We use the version based on the earlier 1977 edition of the DOTS, that ALM then aggregate to the industry level using information on occupational composition from the 1960 US Census Public Micro Samples, so that these measures capture pre-existing differences across industries in routine task-intensity prior to the time frame of our export data.

The ALM routineness indices were originally devised to provide an empirical handle on the extent to which occupations would be susceptible to replacement by technological advances and computerization. We will apply them in the present study towards a different purpose, to understand the interaction between industry routineness and a pro-obedience workplace culture. In particular, the description of the routine cognitive and routine manual categories ((i) and (iv) respectively) point to these as tasks in which workers need to be able to reliably implement a predefined set of procedures or standards, with minimal deviation, such as in production line assembly work. We therefore hypothesize that a workplace culture that encourages adhering to instructions would be complementary to the execution of such tasks. On the other hand, the nature of the nonroutine categories ((ii), (iii) and (v)) point to these as tasks in which explicit instructions for all contingencies are inherently harder to spell out, as would be the case for tasks that involve interaction with other people, or that require creative problem-solving ability. A workplace attitude of following rather than questioning instructions would in principle be less useful for such tasks.

Table 1 below illustrates how the different industries compare in terms of their routine and nonroutine task requirements on each of the five ALM dimensions. The ALM measures are available for a total of 142 industries, these being industry categories based on the US Census Industry Code (CIC) system.[12] For the purposes of this summary, Table 1 groups the industries broadly into "Agriculture, Mining and Construction", "Manufacturing", and "Services". Observe that the manufacturing sector ranks highest in terms of routine task content, on both manual and cognitive dimensions. It is also the least nonroutine of sectors, based on both the cognitive interactive and analytical criteria. At first glance therefore, it would appear that the manufacturing sector broadly conforms to the stereotype that it is composed of routine, repetitive tasks, although we should

[12]Specifically, we use the measures presented in the "Ind6090" codes in ALM. This is a coarser version of the US CIC system that aggregates various subsets of CIC industries, in order to allow for consistent cross-time comparisons to be made across industries. We adopt this "Ind6090" industry coding system throughout our empirical analysis. The more conventional US SIC codes can be mapped into this "Ind6090" classification on the basis of industry names and descriptions, so that industry-level variables (such as factor intensities) constructed for SIC codes can be easily mapped to the "Ind6090" codes. See the Data Appendix for details.

stress that there is considerable variation across industries within this sector that we will exploit in the regression analysis.

[TABLE 2 HERE]

In order to summarize the information across task dimensions more succinctly, we follow Autor and Dorn (2013) in constructing the following measures based on the difference between routine and nonroutine task content:

$$\begin{aligned} RTC_i &= \ln(T_i^{r,c}) - \ln(T_i^{nr1,c}) - \ln(T_i^{nr2,c}), \\ RTM_i &= \ln(T_i^{r,m}) - \ln(T_i^{nr,m}), \text{ and} \\ RT_i &= RTM_i + RTC_i. \end{aligned}$$

For each industry i, this yields measures of cognitive routineness (RTC), manual routineness (RTM), and overall routineness (RT) respectively. It is useful to note that cognitive and manual routineness measures do differ in meaningful ways. Across industries in the manufacturing sector, the correlation between RTC_i and RTM_i is actually slightly negative (-0.3449), while Appendix Table 3 shows that there are industries ranked in the top five most cognitively routine (e.g., Logging) that are nevertheless ranked among the least manually routine, and vice versa (e.g., Drugs). Bearing in mind the conceptual distinction between these two routineness measures, we will eventually focus on cognitive routineness in our empirical analysis, since the requirement to attain "set limits, tolerances, and standards" is closer to the notion of following workplace instructions. (In contrast, the manual routine concept of "finger dexterity" – the ability to use one's fingers "rapidly and accurately" – would arguably depend not just on the worker's willingness to follow instructions, but also on his/her physical condition.)

2.3 Workplace Obedience and Country Patterns of Specialization

We turn now to formally test how pro-obedience attitudes in the workplace predict specialization patterns across industries, as captured by export data.

We draw on the Feenstra et al. (2005) World Trade Flows dataset, which provides detailed product-level information on bilateral trade flows for the years 1962-2000; we have extended these years of coverage to include 2001-2014, by procuring UN Comtrade data for those additional years and processing these according to the Feenstra et al. (2005) protocols.[13] We then concorded these trade flows from their original Standard International Trade Classification (SITC) Rev 2 product codes into the CIC-based industry codes adopted by ALM (as documented in the Data Appendix), in order to facilitate merging with the industry routineness measures. In practice, we work with country-industry exports which have been averaged over five-year windows, i.e., 1990-1994, 1995-1999, ... 2010-2014; these are respectively associated with $t = 1990, 1995, \ldots, 2010$.

[13]The Stata code for cleaning the raw UN Comtrade Data into the World Trade Flows dataset format are made available by Rob Feenstra at: http://www.robertfeenstra.info/data/.

To establish the Specialization Fact, we run the following specification with log exports by country c in industry i at time t as the dependent variable:

$$\begin{aligned} \log(Export_{cit}) &= \alpha_0 + \alpha_1 AvgObedWork_{ct} \times RT_i + \sum_{\{l,m\}} \alpha_{lm} L_{l,ct} \times M_{m,i} \\ &\quad + D_{ct} + D_{ci} + \epsilon_{ict} \end{aligned} \tag{3}$$

The key effect of interest to us is the interaction coefficient, α_1, since this captures whether country attitudes that favor workplace obedience (as reflected in $AvgObedWork_{ct}$), are associated with a greater volume of exports in more routine (i.e., high RT_i) industries. To ensure that α_1 can be interpreted as this differential effect of workplace obedience across industries at various levels of routine task-intensity, we estimate the above with both country-time (D_{ct}) and country-industry fixed effects (D_{ci}). Since the industry routineness measures do not vary with time, the presence of the country-industry fixed effects means that α_1 will be estimated solely off within-country variation in attitudes towards workplace obedience, and how this affects patterns of specialization over time. We will later also present results based on other combinations of fixed effects (namely, country-time and industry fixed effects), to confirm that this within-country variation is what is crucial for our findings. Based on how the $AvgObedWork_{ct}$ variable was constructed, such within-country changes in prevailing attitudes towards workplace obedience would stem from changes over time in the age-gender structure of the workforce, namely the ω^g_{cbt} weights in equation (2). Not surprisingly, the absolute change in $AvgObedWork_{ct}$ across five-year windows in the data is typically small, consistent with the population structure and hence cultural attitudes evolving relatively slowly. But we shall see that this variation, in tandem with the differences in routineness across industries, is nevertheless sufficient to uncover a significant effect on α_1. (Appendix Table 4 reports summary statistics for $AvgObedWork_{ct}$ and all other variables in the Specialization Fact analysis.)

In practice, we estimate (3) using a one-period (i.e., five-year) lagged value of $AvgObedWork_{ct}$, to further alleviate concerns related to simultaneity between log exports and country workplace attitudes, although the results are similar when using contemporaneous country obedience. Separately, an underlying assumption in this empirical approach is that the RT_i variable constructed on the basis of information from one benchmark country (in this case, the US), is nevertheless a valid reflection of routine task-intensity in other countries. On this count, the use of a measure of RT_i based on the state of technology in the US in the 1960s is arguably more appropriate, given that our diverse sample (listed in Appendix Table 1) comprises a number of countries that were still at relatively early stages of development in the 1990s.[14]

The regression model in (3) takes guidance from a recent body of work in empirical trade that has used similar interaction terms to tease out sources of comparative advantage, by identifying whether

[14]Bear in mind also that any differences between RT_i and the actual industry routineness in other countries that can be attributed to classical measurement error would attenuate our estimates of α_1 and bias us away from obtaining significant findings.

certain country characteristics (e.g., factor endowments or institutions) facilitate specialization and hence exporting in industries that are dependent on such country conditions for production.[15] It is thus important to ascertain that the effect of country workplace obedience is robust to controlling for other forces that determine comparative advantage. These are denoted in (3) by the $L_{l,ct} \times M_{m,i}$ terms: Each of the $L_{l,ct}$'s is a country variable (e.g., the per worker capital stock), paired up with a relevant industry characteristic, $M_{m,i}$ (e.g., its capital intensity), in order to determine whether their interaction is important for explaining export patterns.

We report the key findings on the Specialization Fact in Table 2, starting with results based on the overall routineness measure, RT_i. Column (1) presents a basic regression in which only the workplace obedience interaction term has been included on the right-hand side with the country-year and country-industry fixed effects. The positive and significant estimate for α_1 confirms that as country attitudes become (say) more pro-obedience, this is associated with an increase in exporting in industries that are more routine task-intensive. (All standard errors reported are clustered by country.) This finding holds when restricting the sample to only manufacturing industries in Column (2), so that workplace obedience affects specialization patterns even just within the manufacturing sector.

The subsequent two columns check that this key result is robust to accounting for other conventional sources of comparative advantage. Column (3) controls for the classical Heckscher-Ohlin forces, namely how factor endowments can shape exporting in industries that rely intensively on the use of those factors. Following Romalis (2004), we include an interaction term between the country stock of physical capital per worker and an industry measure of capital-intensity, as well as a second interaction term between a measure of country human capital and industry skill-intensity.[16] Column (4) further accounts for two key institutional determinants of comparative advantage, namely country rule of law (Levchenko 2007, Nunn 2007, Costinot 2009) and financial development (Manova 2013). These are each interacted against a full set of industry dummies, to soak up the role of any characteristics that reflect an industry's dependence on the rule of law and deep financial institutions respectively. The estimates from these columns point to the relevance of Heckscher-Ohlin forces: An increase in the capital endowment prompts a shift towards exporting in more capital-intensive industries, with a similar effect observed too for the role of human capital. Importantly, country attitudes on workplace obedience continue to tilt exporting towards more routine industries, even when these additional forces that shape patterns of specialization are controlled for.

[TABLE 3 HERE]

We next separate the overall routineness index into its cognitive (RTC_i) and manual (RTM_i)

[15] This in turn draws on an earlier line of work, epitomized by Rajan and Zingales (1998), that used a similar empirical strategy to identify the effects of country conditions on growth at the industry level.

[16] The country endowment variables are drawn from the Penn World Tables, Version 9.0; a lagged five-year average for each window is used. The respective factor intensity measures are constructed as the log real capital stock per worker and the log ratio of non-production to total workers, based on the NBER-CES Dataset for US manufacturing industries. Please see the Data Appendix for more details related to the construction of these controls.

components. Of note, the effects we have uncovered appear to be driven by the cognitive dimensions of task content (Column (5)); the interaction coefficient in Column (6) for $AvgObedWork_{ct} \times RTM_i$ remains positive but is no longer statistically significant. This is in line with the earlier observation that an attitude of following instructions would be particularly beneficial for performing routine cognitive tasks, on the basis of their definition relating to the attainment of "set limits, tolerances or standards". In the rest of this paper, we therefore focus on the RTC_i measure, although it should be stressed that the results are very similar when using the overall RT_i measure instead.

It is clearly important to ask how large an effect a culture of workplace obedience can have on export patterns. For this purpose, focus on the Column (5) regression based on the RTC_i measure. The median within-country five-year change in $AvgObedWork_{ct}$ is -0.00723, so that country workplace attitudes in general tend towards becoming less obedient over time in our regression sample. Considering this median change, exports would be 0.7% lower in an industry that is one standard deviation more cognitively routine.[17] To provide some perspective, this change is smaller than the magnitude of the corresponding effects of country factor endowments: The median within-country change in physical capital stock in our regression sample is associated with a 3.0% higher volume of exports in an industry that is one standard deviation more capital-intensive. (For the role of country human capital, the analogous effect is 4.6%.)

The regression specification in (3) is already an exacting one, given the sets of fixed effects that are in use. Table 3 nevertheless demonstrates that the finding of a positive and significant effect on $AvgObedWork_{ct} \times RTC_i$ is robust under a series of further checks. We consider in Column (1) how country workplace obedience might interact with industry skill-intensity, as well as how the country skill endowment might interact with industry (cognitive) routineness, to affect export patterns. Given that the cross-industry correlation between RTC_i and skill-intensity is negative and fairly large (-0.83), this check is also useful as it confirms that the RTC_i term in the $AvgObedWork_{ct} \times RTC_i$ interaction is not simply picking up the effect of industry skill-intensity.[18]

[TABLE 3 HERE]

In Columns (2)-(7), we verify that these results are indeed driven by attitudes that are specific to workplace conduct, as opposed to other societal values that a broad culture of obedience might be correlated with. The auxiliary measures of country attitudes that we explore in these successive columns are constructed using an analogous procedure to that described for $AvgObedWork_{ct}$ in Section 2.1, by computing a weighted average of country-cohort-gender fixed effects obtained from regressing the surveyed attitude against a large set of respondent observables (following the specification in equation (1)).[19] Column (2) examines attitudes towards "independence" as a de-

[17] The standard deviation of RTC_i over manufacturing industries is 0.442. The coefficient estimate in Column (5) would then predict that exports would be lower by $100\% \times (1 - \exp\{2.3159 \times (-0.00723) \times 0.442\}) \approx 0.7\%$ when comparing industries that are one standard deviation apart in terms of cognitive routineness.

[18] Interestingly, the results from Column (1) indicate that a higher human capital endowment is associated with exporting in less cognitive routine industries.

[19] These respondent-level regressions are each run pooling together observations from all available waves (up to 6) of the WVS.

sirable quality in children (based on question A029 in the WVS), specifically whether this might affect specialization in cognitively more versus less routine industries. In Column (3), we turn to the possibility that the workplace obedience measure might be picking up whether the society in question is one that emphasizes the importance of "hard work" as a value to be inculcated in children (WVS question A030). Next, Column (4) controls for the degree to which individuals in a country view "work as a duty to society" (WVS question C039). Column (5) explores whether "workplace obedience" might instead be proxying for attitudes on "individualism" versus "collectivism", which Hofstede (2001) and more recently Gorodnichenko and Roland (2016) have argued are important for understanding differences in aggregate economic outcomes across countries. We do so by controlling for the extent to which individuals report seeing themselves "as an autonomous individual", as a proxy for pro-individualist attitudes (WVS question G023). Column (6) then examines whether our workplace obedience measure might be confounded by attitudes towards the importance of "obedience in children" instead (WVS question A042).[20]

The results from the above exercise provide a high degree of reassurance that workplace obedience is indeed distinct as a cultural trait in the manner in which it consistently correlates with specialization in more routine industries. The interaction term involving $AvgObedWork_{ct}$ and RTC_i remains positive and significant when each of the above alternative measures of country attitudes is interacted with RTC_i and included as an additional right-hand side control (Column (2)-(6)). The role of $AvgObedWork_{ct}$ even remains robust when all these auxiliary interaction terms are tested jointly in the same regression (Column (7)).[21] On a related note, in separate unreported results (available on request), we have checked that workplace obedience is not simply proxying for a country's overall level of development, by verifying the results even when adding a term involving country log GDP per capita interacted with RTC_i. The results are similarly robust when alternatively controlling for the interaction between a country's capital stock per worker and RTC_i, to control for the possibility that a country's ability to harness capital equipment and machinery could affect patterns of exporting across routine versus nonroutine industries.[22]

For the final set of checks in Table 4, we revert to the specification in Column (1) of Table 3. Our key findings hold even when we control for the five-year lagged dependent variable on the right-hand side (Column (1)). In the remaining two columns, we further clarify the sources of variation in the data that are responsible for this Specialization Fact. In Column (2), we estimate the regression using just the minimal set of fixed effects required to absorb the main effects of $AvgObedWork_{ct}$ and RTC_i, namely country-year and industry dummies. Though still positive, the loss of statistical

[20]The questions related to "independence", "hard work" and "obedience in children" are from the same broad set of WVS questions in which respondents are asked to identify five qualities out of a list of eleven that they view as important qualities for children. The measure of average attitudes towards obedience in children, $AvgObedChild_{ct}$, that we construct for use in Column (6) has a close to zero correlation (0.04) with $AvgObedWork_{ct}$.

[21]Note however that the number of countries that remain in the sample drops from 56 to 35 as the WVS questions on "work as a duty to society" and whether "I see myself as an autonomous individual" are available for fewer countries.

[22]The results also hold when controlling for $AvgObedWork_{ct}$ interacted with industry value-added (as a share of total shipments), to capture the possible role of omitted industry characteristics that might be correlated with value-added.

significance on the interaction coefficient between country obedience and industry routineness here highlights that the use of country-industry fixed effects in equation (3) is crucial for uncovering the relationship of interest. As it stands, the Specialization Fact is thus a finding that speaks to how within-country changes in workplace attitudes over time affect industry-level exports, rather than the cross-country pattern of specialization. Finally, Column (3) reports the results when industry-year dummies are further added to the Column (1) regression. The interaction term of interest is significant at the 5% level, even in this fully-saturated specification where all pairwise fixed effects for the country, industry and year dimensions in the data are used.[23]

[TABLE 4 HERE]

In sum, we have documented a systematic and robust Specialization Fact, that shows that prevailing country attitudes on workplace obedience do indeed matter for the industry composition and structure of the economy. In particular, shifts over time that leave the workforce less pro-obedience in their mindsets would be associated with an increase in exporting in industries that are less intensive in their use of (cognitive) routine skills.

3 The "Obedience Fact"

We turn our attention next to a natural follow-up question: How might the structure of economic activity – specifically, how oriented it is towards routine production activities – in turn shape the attitudes on workplace obedience that get transmitted over time within a country?

We return to the individual-level WVS data for this purpose. While the survey data is cross-sectional in nature in terms of when respondents are surveyed, the coverage across birth cohorts provides a rich source of variation in the conditions that the respondents were exposed to during their formative schooling years. The Obedience Fact that we uncover is based precisely on such variation: Although more education is associated with less agreement with following instructions at work, this tendency is weakened if the individual grew up in an economy that was especially oriented towards routine production activities.

3.1 Introducing "Export-Routineness"

Our empirical strategy requires a summary measure of the routine task-intensity of the economy that individuals were exposed to at various points of time in the past. We base this on the industry routineness measures introduced in Section 2.2, specifically RTC_i which we have argued reflects a

[23] Separately, we have considered a simpler alternative construction for the country measure of workplace obedience that adopts a population-weighted measure analogous to (2), but uses a simple average obedience score over all respondents in each (c, b, g) bin *in lieu* of the regression-corrected $\hat{D}^g_{cb}$'s. Under this alternative construction, we obtain marginally insignificant results for the interaction term with RTC_i. That said, the statistical significance of this effect is restored when we instrument this simpler measure of country obedience with $AvgObedWork_{ct}$, consistent with the interpretation that the former is a more noisy measure of prevailing country attitudes.

set of workplace tasks in which instructions and standards have to be followed closely. For each country and year for which trade data is available, we construct the "Export-Routineness" variable ($expRTC$) as the weighted average of RTC_i, where the weights used are proportional to the total country export value observed in the respective industries i. Thus, the higher is $expRTC$, the more the specialization pattern of the economy in question is oriented towards cognitive routine task-intensive industries.

We compute this export-routineness measure using the long export series from the World Trade Flows Database spanning 1962-2014. A five-year moving window average of $expRTC$ is taken, to smooth out year-to-year fluctuations in the annual data. In the regressions that follow, we associate WVS respondents to $expRTC$ values on the basis of their current country of residence.[24] For countries that experienced political transitions during the sample period, such as the former Soviet Republic or the Czech Republic, we adopt the $expRTC$ values of the pre-transition country (i.e., the former Soviet Union and Czechoslovakia respectively for these examples) as the past exposure measures for individuals from these nations.[25]

Figure 1 provides a first look at the export-routineness variable, to illustrate the variation present in this measure both across and within countries.[26] The USA and China both provide examples of countries in which export-routineness has been rising over time in the past fifty years. The sharp rise in the case of China coincides with the rise in its manufacturing exports, especially in routine industries such as textiles, apparel and footwear. But this trend also appears to have started tapering off in the early 2000s, reflecting a shift in the composition of China's exports towards less routine industries. In contrast, Great Britain provides a case where export-routineness has been on a moderate secular downward trend. For completeness, Figure 1 illustrates export-routineness constructed based on each of RT, RTC, and RTM. Within each country, these three measures exhibit some co-movement, although the shifts appear to be sharper on the cognitive compared to the manual dimensions of routineness.[27]

We now incorporate the $expRTC$ measure in the respondent-level regressions, in a manner that will allow us to uncover how exposure to a routine economic environment at an early age can systematically shape attitudes on workplace obedience. Recall from Section 2.1 (and Appendix Table 1) that individuals with a higher level of education are less likely to agree with always following instructions in the workplace. What we shall see is that one's past exposure to export-routineness can alter the strength of this negative partial correlation between education and pro-obedience

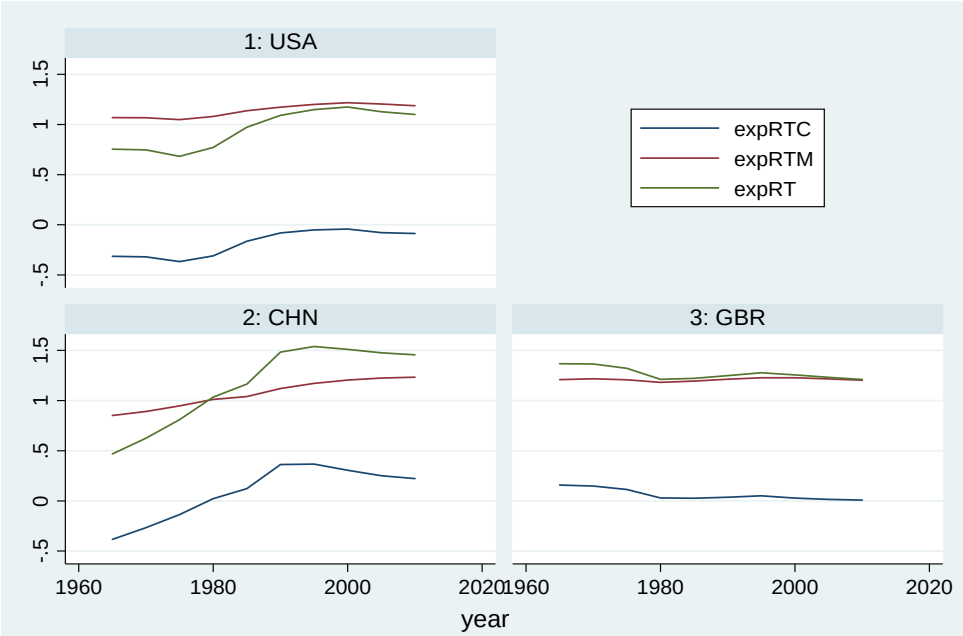
[24]The WVS unfortunately does not contain data on country-of-birth or migration status. To the extent that differences between country-of-birth and country-of-residence would introduce classical measurement error in the $expRTC$ values that are associated with respondents, this should bias the regressions that follow against finding significant results.

[25]The list of such transitions is documented in the Data Appendix. The results are robust to excluding the transition countries completely from the regression sample.

[26]More specifically, Figure 1 plots the five-year average value for each of the export-routineness measures over each five-year window, i.e., 1965-1969, 1970-1974,..., etc.

[27]The correlation between the five-year moving average measure of export-routineness based on RTC and that based on RTM is 0.59 (when pooled across all countries for which export data is available). The corresponding correlation between the RTC and RT versions of the measure is equal to 0.95, so that cognitive export-routineness tracks overall export-routineness very closely.

Figure 1: Export-Routineness over Time: Three Examples



attitudes. Consider first the following specification:

$$ObedWork_{r,cbw} = \beta_0 + \beta_1 Educ_{r,cbw} + \beta_2 Educ_{r,cbw} \times expRTCageA_{cb} + \beta_3 expRTCageA_{cb} + \beta_g Gender_{r,cbw} + \beta_X X_{r,cbw} + D_b + D_{cw} + \epsilon_{r,cbw}. \quad (4)$$

As in the earlier regression (1), the above seeks to explain attitudes towards workplace obedience as a function of respondent characteristics, including education ($Educ_{r,cbw}$). What is new here is that we also interact respondent education with a measure of his/her past exposure to export-routineness, as captured by the variable $expRTCageA_{cb}$. This is defined as the cognitive export-routineness that individuals in birth cohort b in country c experienced during the five-year window *when they were of age* A, where $A = 0, 5, 10, \ldots$, etc. As a reminder, we have adopted five-year birth cohorts throughout this empirical exercise, so that individuals born in say 1960-1964 are treated as being from the same cohort. To give a concrete example, the measure of $expRTCage10_{cb}$ for the cohort b born in the years 1960-1964 would then be the average value of $expRTC$ for country c during the window 1970-1974, this being the window in which the cohort turned age 10. The regression in (4) therefore interacts individual education with $expRTCageA_{cb}$, to understand how past $expRTC$ exposure at a particular age A might influence the relationship between education and workplace obedience attitudes.

The above specification includes a more basic set of fixed effects, to control for potential determinants of $ObedWork_{r,cbw}$ that are common to the birth cohort, D_b, or that reflect influences specific to the country during the WVS survey wave, D_{cw}. This implies that in (4) the interaction coefficient, β_2, will be estimated from the within-country-wave variation across individuals born in

different cohorts (to the extent that the latter is not already controlled for by the cohort effects D_b that are common across countries), as well as from the variation across individuals at different education levels. Among the auxiliary controls on the right-hand side, we include an indicator variable for whether the respondent was female ($Gender_{r,cbw}$), as well as sets of dummy variables for number of children and marital status (in the vector $X_{r,cbw}$). For all the regressions reported for the Obedience Fact, we do not include the employment status, occupation, and size of town dummies that were used as part of the earlier estimation of equation (1) in Appendix Table 2, since these are controls that are arguably more prone to endogeneity critiques (related to say the self-selection of more obedience-minded individuals into particular occupations). That said, the findings reported below are very similar even when the longer list of controls were to be included in the $X_{r,cbw}$ vector (results available on request).[28]

While (4) provides a baseline, we will supplement the analysis with a second specification:

$$\begin{aligned} ObedWork_{r,cbw} &= \beta_0 + \beta_1 Educ_{r,cbw} + \beta_2 Educ_{r,cbw} \times expRTCageA_{cb} \\ &\quad + \beta_X X_{r,cbw} + D^g_{cb} + D_{cw} + \epsilon_{r,cbw}. \end{aligned} \tag{5}$$

This latter regression follows (1) more closely, in controlling for a more comprehensive set of country-cohort-gender (D^g_{cb}) and country-wave (D_{cw}) fixed effects. The use of the D^g_{cb} dummies implies that the specification now controls for the level effect of any exposure to past conditions within each country that is specific to each cohort-gender bin, including (but not limited to) the effect of past export-routineness (i.e., $expRTCageA_{cb}$). In (5) therefore, the interaction effect of interest, β_2, will be estimated from within-country-wave variation, as well as from the variation across individuals at different education levels within each country-cohort-gender group.[29]

It is useful at this juncture to discuss what might undermine the interpretation of a causal relationship running from past export-routineness to individual attitudes on workplace obedience in the above specifications. Bear in mind first that the measure used for a country-cohort's exposure to a routine task-oriented economy ($expRTCageA_{cb}$) is plausibly exogenous from the perspective of any given individual. A more subtle reverse causality argument would instead posit that there could have been broad shifts affecting the cultural attitudes held by specific country-cohort groups (such as a surge in pro-obedience attitudes during a particular decade in a country's modernization experience), and that this could have prompted an increase in the expansion of schooling *and* a shift towards specialization in more routine industries at the same time. It might appear that such a mechanism could help to rationalize a positive effect on the interaction between individual education and $expRTCageA_{cb}$.

What is less clear however is how this could account for the later finding that it is $expRTC$ exposure experienced *only* at particular ages, specifically one's schooling years, that generates the

[28]The WVS unfortunately does not carry information on the respondent's parents, such as their education level or occupation, which in principle could be useful for understanding patterns of cultural transmission within the family.

[29]In terms of relating the estimation of (5) back to the earlier exercise in Section 2.1, note that the D^g_{cb}'s extracted previously to construct $AvgObedWork_{ct}$ should be viewed as the country-cohort-gender component of workplace obedience attitudes for the average respondent education level within each such bin.

positive interaction effect. It is precisely the timing of this effect in the context of the cohort structure exploited in the data that invites the interpretation that what is driving these patterns is a mechanism related to cultural transmission that takes place during an individual's formative years. (Under the proposed reverse causality story, one should in principle also expect to see a positive interaction effect involving export-routineness during an individual's workforce years.)

Notwithstanding the above arguments, we also seek to further allay concerns on causality by pursing an instrumental variables strategy. We construct an instrument for the export-routineness in country c at time t that seeks to isolate a source of variation in the observed export mix of country c that is plausibly driven by demand conditions external to the country. To do so, for each five-year window (say 1965-1969), we take the initial industry profile of the country's exports in the year prior to the start of the window (i.e., 1964), and infer a predicted set of export values for each of the subsequent five years (i.e., 1965, 1966,..., 1969) by assuming a growth rate equal to that observed for industry-level exports by the rest of the world. In other words, for each $t = 1965, 1970, \ldots, 2010$ and each $s = 1, 2, \ldots, 5$, we predict country c's exports in industry i and year $t + s$ using:

$$\widetilde{Exports}_{ci,t+s} = Exports_{ci,t-1} \times \frac{Exports_{-c,i,t+s}}{Exports_{-c,i,t-1}}. \tag{6}$$

Note that in the above, the subscript $-c$ refers to all countries in the world excluding c itself. We then take the weighted-average of the industry RTC_i measures for year $t + s$, using the predicted export values, $\widetilde{Exports}_{ci,t+s}$, as the weights rather than the actual exports; a simple mean of this is then taken over each five-year window, i.e., 1965-1969, 1970-1974,..., 2010-2014, to obtain our instrumental variable, $\widetilde{ExpRTC}_{ct}$, for export-routineness. Intuitively, the predicted export profiles that go into (6) to construct $\widetilde{ExpRTC}_{ct}$ would reflect forces related to world export demand, rather than pertaining to technology or policy shifts within country c itself. This would deliver a valid instrument for our purposes, to the extent that these world demand shifts do not directly influence workplace obedience attitudes within country c, other than through their effect on the routineness profile of the country's exports.

One last concern related to the interpretation of the interaction effect is that there could be other forces specific to the country-cohort that have been omitted from the regressions. In this regard, the more thorough specification in (5), with its use of country-cohort-gender fixed effects, helps to address the level effect of any such omitted variables on individual attitudes. However, one could still be worried that there are other country-specific or country-cohort-specific effects that might alter the nature of the relationship between individual education and workplace attitudes, and that omitting these from the regression could bias the estimate of β_2. In the checks that we run later, we will therefore also control for the interaction between individual education and a full set of country-wave dummies (i.e., $Educ_{r,cbw} \times D_{cw}$), to control for how country conditions contemporaneous to when the WVS survey was conducted might influence the relationship between education and workplace obedience attitudes. We will also further control for the interaction between education and cohort-specific exposure measures to other country conditions – such as the income per capita

and the exports to GDP ratio of the economy that one grew up in – to guard against omitted variables bias of this nature.

3.2 Past Export-Routineness and Attitudes towards Workplace Obedience

We proceed to report the findings on the Obedience Fact in this subsection. Table 5 presents the results from the more basic specification in (4). The successive columns correspond to separate regressions for $A = 0, 5, \ldots, 35$ respectively, to uncover the effect that exposure to export-routineness at various ages A has on attitudes towards workplace obedience.[30] Panel A in the table reports the ordinary least squares regressions, while Panel B reports the corresponding results when using $\widetilde{expRTC}$ – specifically that which cohort b in country c is exposed to at age A – as the instrumental variable.

Across all columns of Table 5, we obtain a negative and significant main effect of education, reconfirming the basic pattern that more educated individuals exhibit a lower propensity to agree with always following workplace instructions. Importantly, we also find that exposure to an economy with a highly cognitively routine production structure can dampen this negative correlation, and make more educated individuals more amenable to pro-obedience attitudes. In particular, the estimated coefficient of $Educ_{r,cbw} \times expRTCageA_{cb}$ is positive and significant at the 5% level for age 5, 10, 15, and 20 exposure (Columns (2)-(5)). This is true regardless of whether the estimation is by ordinary least squares (OLS) or by instrumental variables (IV).[31] The largest effects are obtained for age 5 and 10 experience with export-routineness, with the point estimates of the interaction coefficients decreasing and eventually becoming insignificant for exposure at progressively older ages all the way through age 35. (All standard errors are clustered by country.)

[TABLE 5 HERE]

These patterns are highly suggestive that cultural attitudes on appropriate behavior in the workplace are transmitted early on during an individual's life, for example through the family or through the schooling system, and a part of these attitudes persists into adult life until the age at which respondents were surveyed by the WVS. These attitudes that are passed on at a young age appear to be a response to the economic conditions that prevail at the time of transmission: The more oriented the economy was towards routine industries at that time, the more it would be associated with pro-obedience workplace attitudes even among those individuals who eventually attain higher levels of education. The patterns are also consistent with the findings that life experiences leave an especially strong mark on individual attitudes when they happen during one's so-called "formative years" (e.g., Giuliano and Spilimbergo 2014).

[30] Within countries, the export-routineness measure naturally exhibits persistence over time, so we do not include the $expRTCageA_{cb}$ measure at different ages simultaneously in the same regression.

[31] The IV regressions in Panel B deliver slightly larger point estimates, as would be expected in the presence of classical measurement error in the baseline export-routineness measures. We obtain healthy Kleinberger-Paap Wald F statistics in excess of 30 across all the IV specifications, which suggests that the issue of weak instruments is unlikely to be a major concern.

A natural question to pose at this juncture is whether the experience of growing up in a high-$expRTC$ economy can overturn the baseline negative relationship between education and obedience attitudes. The answer to this is yes, but only if one considers values of cohort exposure to export-routineness that are at the very right tail of its distribution. Take in particular the IV regression in Column (2), where the estimated interaction coefficient is at its largest. Given that the median in-sample value of $expRTCage5_{cb}$ is negative (-0.070), the overall effect of individual education is clearly still negative for exposure values around this median. It is only with exposure values that exceed the 99th percentile (0.631) that one cannot then statistically distinguish the overall effect of education (i.e., the $Educ_{r,cbw}$ coefficient plus 0.631 times the $Educ_{r,cbw} \times expRTCage5_{cb}$ coefficient) from zero. Separately, it may seem counter-intuitive that the estimated main effect of export-routineness on workplace obedience attitudes is negative and even significant in Columns (2)-(3). Note though that this pattern turns out not to be robust if we were to include further controls for past cohort exposure at age A to other country conditions, such as income per capita or openness (i.e., exports over GDP). In contrast, the positive and significant effect of the export-routineness interaction for exposure at a young age remains robust even when controlling for individual education interacted with cohort exposure to these other country conditions (results available on request).

We turn next in Table 6 to the specification in (5), that controls for the more extensive set of country-cohort-gender and country-wave fixed effects. Recall that relative to (4), this specification now exploits variation in workplace obedience attitudes across individuals with different education levels within the same country-cohort-gender bin. The findings obtained are nevertheless very similar to that in Table 5: We consistently obtain a negative level effect of education, together with a positive and significant effect between education and past experience of growing up in a routine task-intensive economy, specifically between the ages of 5-19. This conclusion is reached with either the OLS or IV regression estimators. Despite the more extensive set of fixed effects used, the point estimates all remain relatively stable compared to Table 5, indicating that the absence of country-cohort-gender level effects earlier in (4) was not unduly biasing the interaction effect of interest.

[TABLE 6 HERE]

In Table 7, we add to the right-hand side of (5) further controls in the form of interaction terms between individual education and a full set of country-wave fixed effects (i.e., terms of the form $Educ_{r,cbw} \times D_{cw}$).This controls for the possibility that there could be contemporaneous country-specific forces – such as the export-routineness of the economy at the time the WVS survey was conducted – that could influence the relationship between individual education and obedience attitudes. The results obtained are once again consistent with a cultural transmission interpretation: Exposure to export-routineness between the ages of 0-19 affects workplace attitudes (Columns (1)-(4)), but that after age 20 no longer matters in terms of statistical significance (Columns (5)-(8)). Interestingly, the largest effects are now found for age 0 exposure under OLS in Panel A, although the peak effect remains age 5 exposure under the IV regressions in Panel

B. (Bear in mind that the estimated education coefficient in this table loses its interpretation as the main effect of education, since this variable is collinear with the full set of $Educ_{r,cbw} \times D_{cw}$ interactions.)

[TABLE 7 HERE]

Table 8 confirms that the effects of export-routineness that have been uncovered thus far are specific to attitudes on obedience in the workplace, rather than within a family context. The regressions here are based on the specification from Table 7 (including education interacted with D_{cw} dummies), with the left-hand side replaced by an indicator variable for whether respondents viewed obedience in children as important (WVS question A042). In contrast with the earlier patterns reported for workplace obedience, we find no significant effects on the interaction terms between education and export-routineness at an early age.

[TABLE 8 HERE]

We have performed a series of further checks to stress-test this Obedience Fact. These are presented in Table 9, where for succinctness, we report only the interaction coefficient of interest for the succession of checks. (The instrumental variables specification used is that from Table 7, this being the most thorough specification which includes the $Educ_{r,cbw} \times D_{cw}$ terms as controls.) The first row verifies that very similar patterns are found when using a measure of export-routineness based on the overall *RT* index, rather than focusing on cognitive routine task-intensity *per se*. The second row of results drops the countries that experienced political transitions. In several of these cases, one ends up associating the export-routineness values from the same pre-transition country (e.g., the Soviet Union) to several post-transition states, but this does not appear to be unduly driving the finding of a significant interaction effect only for exposure at a young age to a routine task-intensive environment. In the third row, we confine the construction of the *expRTC* variable to manufacturing exports. The estimates here point to exposure to a routine manufacturing environment between the ages of 5 and 19 as important for shaping pro-obedience attitudes.[32]

[TABLE 9 HERE]

The exercise in the fourth row considers whether it is indeed exposure to export-routineness, as opposed to other salient characteristics about the industry composition of exports, that is driving the results. Here, we construct analogous measures of the skill-intensity and physical capital-intensity of the export profile at age A for individuals from country c and cohort b, and interact these with individual education for use as additional right-hand side variables. The factor intensity measures here are constructed using data from 1960-1969 from the US NBER-CES manufacturing dataset, so we also use the measures of export-routineness based only on manufacturing exports

[32] Although the point estimates for these interaction coefficients is substantially larger when using manufacturing export-routineness instead of overall *expRTC*, the standard deviation of manufacturing export-routineness is also about half that of overall *expRTC*. The quantitative implications for workplace obedience thus turn out to be very similar to that from the earlier regressions based on export-routineness for all exports.

in these regressions for consistency. Even with these additional right-hand side variables, the key export-routineness interaction terms remain significant at the 5% level for exposure between ages 5 through 19. In the last set of results in this table, we examine whether the findings are robust to controlling for cohort-specific exposure to other broader country conditions. The regressions here include respondent education interacted with: (i) country log income per capita; (ii) country openness (exports over GDP); (iii) log population; and (iv) the country democracy score (from the Polity IV dataset), where each of these variables is computed as an average during the five-year window when the respondent was age A, for $A = 0, 5, 10, \ldots$. The findings on the effect of export-routineness remains broadly similar: although the interaction coefficient between education and $expRTCageA_{cb}$ is now marginally insignificant for age 10 exposure, we continue to find a strong effect of age 15 exposure to export-routineness.

We view the Obedience Fact just reported in detail as complementary to the earlier Specialization Fact. Conceptually, the Specialization Fact establishes a link between workplace obedience attitudes within a country at time t to the contemporaneous pattern of industry specialization. In turn, the Obedience Fact speaks to how the pattern of specialization at time t affects the transmission of workplace obedience attitudes to the time-$(t+1)$ generation. These provide now the basis for thinking about a model in which both workplace obedience attitudes and specialization patterns co-evolve.

4 A Model of Endogenous Transmission of Workplace Obedience

In this Section, we develop an overlapping generations model of endogenous human capital investment and cultural transmission. The model provides a theoretical rationalization of the Obedience Fact, namely how growing up in an economy with a routine production structure affects the transmission of pro-obedience attitudes, as well as why this effect is one that runs through an interaction with individual human capital. Furthermore, the model will shed light on the nature of the long-run steady state outcomes that could emerge, including the possibility of an "obedience trap".

4.1 Setup

Consider a small-open economy that is composed of a unit measure of identical households. We adopt this perspective for the model given that the focus in the Specialization Fact is on how changes in workplace obedience attitudes within a country over time can affect the pattern of specialization. At any point t in time, each household is composed of one working adult and her unique descendant. Time is discrete, and each individual within the household lives for exactly two periods.

Households are indexed by $r \in [0, 1]$. We let $H_{rt} \geq 0$ denote the human capital that the working adult in household r at time t possesses. Note that this H_{rt} is an endowment from the adult's perspective, but it is an outcome of the human capital investment decision undertaken by

her parents in the preceding time period, $t-1$. Separately, we let θ_{rt} denote the degree of pro-obedience attitudes held by this individual, with a higher θ_{rt} corresponding to a greater propensity to follow (rather than question) workplace instructions. We will assume that θ_{rt} takes on values within a bounded connected subset of the real line, $\left[\underline{\theta}, \overline{\theta}\right]$. In what follows, we adopt the perspective of a representative individual who is a working adult at time t, and set up this individual's decision problem.

The economy in question features two homogeneous-good industries, this being arguably the simplest production setting in which one can distinguish between routine and nonroutine activities. Human capital is the only factor of production. The representative individual faces a decision over how to allocate her H_{rt} (or equivalently, her available units of labor effort) across these two industries. The first is a routine or "Basic" sector (denoted by subscript B), in which workplace obedience raises the productivity of each unit of human capital in the production process. For example, one can think of this as a basic assembly-line manufacturing sector, in which workers who are better at following instructions will be more productive. We therefore specify the following production function for this sector:

$$y_{Brt} = A_{Bt}(f(\theta_{rt})h_{Brt})^{\beta}, \quad 0 < \beta < 1, \tag{7}$$

where $h_{Brt} \in [0, H_{rt}]$ is the units of human capital allocated by the individual from household r to the Basic sector at time t. For simplicity, the output y_{Brt} from the individual's effort is assumed to accrue directly to her. In the above specification, workplace attitudes towards obedience, θ_{rt}, affect the effective units of human capital that the individual allocates to this sector. As B is the routine sector, we assume that: $f'(\cdot) > 0$ and $f''(\cdot) \leq 0$, so that pro-obedience attitudes raise a worker's effective human capital here, but at a (weakly) diminishing rate. The A_{Bt} term is a pure productivity shifter that reflects the current state of technology in the Basic sector.

Turning to the nonroutine or "Complex" sector (subscript C), this is an sector in which workplace obedience instead hinders and lowers the effectiveness of the worker's human capital. When the adult from household r applies $h_{Crt} \in [0, H_{rt}]$ units of her human capital to this sector, the amount of output she produces is given by:

$$y_{Crt} = A_{Ct}(g(\theta_{rt})h_{Crt})^{\gamma}\left(\int_{\tilde{r}\in[0,1]} g(\theta_{\tilde{r}t})h_{C\tilde{r}t}d\tilde{r}\right)^{1-\gamma}, \quad 0 < \gamma < 1. \tag{8}$$

Here, it is assumed that: $g'(\cdot) < 0$ and $g''(\cdot) \leq 0$, so that workplace obedience is detrimental to production outcomes in this sector.[33] Note that each individual's output depends not only on her

[33]For most of our results, a milder assumption – specifically, $f'/f > g'/g$ – will suffice. If we index sector B by $i = 1$ and sector C by $i = 2$, this is precisely the assumption that production output is log-supermodular in θ and i, namely that workplace obedience is relatively more complementary to human capital in the B compared to the C sector. The stronger assumption that $g' < 0$ is needed only for one particular result, that $\frac{d\theta}{dH} < 0$ – namely the correlation between obedience and human capital is negative – in an economy that features a very high level of nonroutineness (i.e., $\rho \longrightarrow 0$).

own human capital, but also on the aggregate amount of effective human capital that is channeled to sector C by all households in the economy, i.e., $\int_{\tilde{r}\in[0,1]} g(\theta_{\tilde{r}t})h_{C\tilde{r}t}d\tilde{r}$. This production function therefore incorporates the idea that nonroutine tasks feature a greater scope for human capital externalities when compared against routine tasks: The definition of "nonroutine cognitive" tasks in Autor, Levy and Murnane (2003) incorporates a dimension involving "direction, control, or planning", which requires interaction with other workers in performing such tasks, hence providing scope for cross-worker spillovers to emerge. In nonroutine industries where creative thinking and active questioning are required, such externalities could also arise from the cross-fertilization of ideas or from working in teams. Note that we have specified (8) so that in a symmetric equilibrium where all workers choose the same h_{Crt}, the production function features constant returns in the aggregate amount of human capital allocated to this sector; this will facilitate the tractability of the model moving forward. Once again, A_{Ct} is an aggregate productivity term associated with this sector.

In addition to the above labor allocation decision, the adult at time t also faces further choices over how much resources to invest to prepare her child for the workplace in time $t+1$. There are two components to this investment decision. First, the parent chooses how much human capital, $H_{r,t+1}$, to endow her child with. We denote the cost in monetary terms of this investment in the child's education by $\omega(H_{r,t+1})$, where we make the usual convexity and regularity assumptions: $\omega'(\cdot) > 0$, $\omega''(\cdot) > 0$, $\omega(0) = 0$, and $\lim_{H\longrightarrow\infty}\omega(H) = \infty$. Second, the parent also chooses what degree of pro-obedience workplace attitudes, $\theta_{r,t+1}$, to transmit to the next generation. Following the literature (c.f., Bisin and Verdier 2001, 2011), we adopt the view that the cultural transmission process incurs a cost on the parent, which in pecuniary terms is denoted by $\tau(\theta_{r,t+1} - \theta_{r,t})$. (This can be viewed as the value of the time spent ingraining specific values in the child.) Of note, this latter cost function satisfies: $\tau'(0) = 0$ and $\tau''(\cdot) > 0$. This transmission cost is therefore convex and increasing in the absolute distance between the attitudes of the parent and that which are to be passed on to the child. This feature introduces "inertia" in the cultural transmission process, so that though workplace attitudes can shift across generations, they do so in a way that exhibits a degree of persistence.

We can now write down the full decision problem of the representative individual at time t. In line with the overlapping generations structure of the model, each adult is concerned only with the expected present discounted value of income earned by herself and her time-$(t+1)$ descendent, net of the cost of investments made in the child's human capital and workplace obedience values:

$$\begin{aligned}\max_{h_{Brt},h_{Crt},H_{r,t+1},\theta_{r,t+1}} \quad & y_{Brt} + p_{Ct}y_{Crt} + \delta\mathbb{E}_t\left(y_{Br,t+1} + p_{C,t+1}y_{Cr,t+1}\right) \\ & \qquad -\omega(H_{r,t+1}) - \tau\left(\theta_{r,t+1} - \theta_{r,t}\right), \qquad (9) \\ \text{subject to:} \quad & h_{Brt} + h_{Crt} \leq H_{rt}.\end{aligned}$$

In the above, the B-good is set as the numeraire in each time period, while the price of the C-good at time t is denoted by $p_{C,t}$; this price is exogenous from the perspective of agents in this

small-open economy. We will further assume that the time-t decision-maker has expectations over the future state of technology in each sector and prices of the following form: $\mathbb{E}_t(A_{B,t+1}) = A_{Bt}$, $\mathbb{E}_t(A_{C,t+1}) = A_{Ct}$, $\mathbb{E}_t(p_{C,t+1}) = p_{Ct}$, and that these time-$(t+1)$ random variables are pairwise independent. There are two possible interpretations of these assumptions. First, these could reflect the actual stochastic properties of the random variables, so that the expectations adopted by the time-t decision-maker are entirely rational. Alternatively, the representative individual at time t may not have perfect knowledge of how sector productivities or prices will evolve, but instead myopically extrapolates the economic conditions at time t into the next period. This latter interpretation is consistent with what is termed "myopic altruism" in the cultural economics literature.[34]

4.2 Implications from the Model

We proceed to analyze the model, solving first the individual's decision problem spelled out in (9). To understand the aggregate outcomes that this implies for the economy, we will then focus on characterizing the model's symmetric steady states, namely in which: (i) all households are identical; and (ii) both $H_{r,t}$ and $\theta_{r,t}$ are constant over time. (In what follows, the r subscript is omitted unless there is cause for ambiguity.)

Inspecting the maximand in (9), one can see that the time-t labor allocation problem of the working adult is separable from the investment decisions that she makes for the next generation. Specifically, the problem in (9) can be broken down into two parts: (I) choosing h_{Bt} and h_{Ct} to maximize current period income $(y_{Bt} + p_{Ct}y_{Ct})$; and (II) choosing H_{t+1} and θ_{t+1} to maximize the expected next-period income of her child net of the costs of these investments $(\delta\mathbb{E}_t\left(y_{B,t+1} + p_{C,t+1}y_{C,t+1}\right) - \omega(H_{t+1}) - \tau\left(\theta_{t+1} - \theta_t\right))$.

We consider the problem in (I) first, namely the labor allocation decision over h_{Bt} and h_{Ct} in the current period. This is a relatively straightforward optimization problem, subject to the human capital constraint $h_{Bt} + h_{Ct} = H_t$; details of the derivations are written up in the Model Appendix. Bear in mind here that the individual adult takes the aggregate effort level in the C sector, $\widetilde{h_{Ct}} \equiv \int_{\tilde{r}\in[0,1]} g(\theta_{\tilde{r}t})h_{C\tilde{r}t}d\tilde{r}$, as given when performing this optimization. It is only after we derive the first-order condition that we then introduce the assumption of symmetry across households (i.e., $\theta_{\tilde{r}t}$, $h_{B\tilde{r}t}$, and $h_{C\tilde{r}t}$ respectively equal for all $\tilde{r} \in [0,1]$). These manipulations yield the following expressions for the allocation of human capital between the two industries at time t in the symmetric equilibrium:

$$h_{Bt} = \min\left\{\left(\frac{\beta}{\gamma}\frac{A_{Bt}}{p_{Ct}A_{Ct}}\frac{f(\theta_t)^\beta}{g(\theta_t)}\right)^{\frac{1}{1-\beta}},\ H_t\right\} \tag{10}$$

$$h_{Ct} = \max\left\{H_t - \left(\frac{\beta}{\gamma}\frac{A_{Bt}}{p_{Ct}A_{Ct}}\frac{f(\theta_t)^\beta}{g(\theta_t)}\right)^{\frac{1}{1-\beta}},\ 0\right\} \tag{11}$$

[34] For simplicity, we also assume that each household is not credit-constrained when bearing the costs of investing $H_{r,t+1}$ and $\theta_{r,t+1}$ in the next generation.

Of note, the model allows for the possibility of corner solutions. For a given level of H_t and θ_t, the above expressions imply that individuals will allocate all their human capital to the Basic sector when $A_B/(p_C A_C)$ is sufficiently large (so that the sector-B technology is sufficiently advanced relative to that in sector C), or when γ is small (so that individual effort in the Complex sector exhibits steep diminishing returns). Under either of these sets of circumstances, the economy features complete specialization in the Basic sector.

From (10) and (11), one can also quickly see that h_{Bt} is (weakly) increasing in θ_t, while the converse applies to h_{Ct}. (Recall that $f' > 0$ and $g' < 0$.) A stronger degree of pro-obedience workplace attitudes therefore leads to more labor effort being allocated to the Basic sector, as well as a corresponding decrease in that channeled to the Complex sector. In terms of what this implies for the structure of the economy, it will be useful to define: $\rho_t \equiv y_{Bt}/y_{Ct}$, this being the ratio of output in the routine relative to the nonroutine industries. Using the expressions in (10) and (11), it is straightforward to show that ρ_t is in fact increasing in θ_t, so that a more pro-obedience workplace culture will imply a higher degree of "routineness" in the economy. This implied pattern of production is entirely consistent with the Specialization Fact reported in 2.

Building on the above observations, we therefore consider two cases when examining possible long-run steady states below. These are respectively the case where the economy features complete specialization in the Basic sector, and a second case in which production is diversified across industries. We address the nature of the investment decisions in human capital and cultural transmission in turn for each of these cases. In what follows, we assume that A_B, A_C and p_C are all constant over time, so that the steady state will indeed feature a constant level of human capital and pro-obedience attitudes over each generation.[35]

Steady state with complete specialization in the Basic sector: Suppose that all working adults allocate their entire human capital to the B sector in the steady state. The decision problem that the representative adult faces over how much H_{t+1} and θ_{t+1} to invest in the next generation then reduces to:

$$\max_{H_{r,t+1},\theta_{r,t+1}} \quad \delta A_B \left(f(\theta_{t+1})H_{t+1}\right)^{\beta} - \omega(H_{t+1}) - \tau(\theta_{t+1} - \theta_t). \tag{12}$$

In the Appendix, we show that the first-order condition with respect to θ_{t+1} will imply that in steady state, each parent opts to transmit the highest possible level of obedience to her child, i.e., $\theta_{t+1} = \overline{\theta}$. Intuitively, with complete specialization in the Basic sector, pro-obedience workplace attitudes unambiguously raise the return to individual human capital, and this creates the incentive to transmit the highest degree of θ possible.

With the above property, the optimal level of human capital that the adult will invest in her child will then satisfy the following first-order condition (with respect to H_{t+1}):

$$\delta A_B f(\overline{\theta})^{\beta} \beta H_{t+1}^{\beta-1} = \omega'(H_{t+1}). \tag{13}$$

[35] This is an assumption that we plan to relax in future versions of the paper.

This equation yields a unique solution for H_{t+1}, given that $0 < \beta < 1$ and the early assumptions made regarding the properties of the human capital investment function (see the Appendix). Moreover, one can see that a higher δ or A_B will raise the level of human capital that is invested in the next generation.[36] We summarize this discussion of this steady state under complete specialization in the following:

Lemma 1 *Consider the symmetric steady state in which the economy is completely specialized in the Basic sector. Then, for all periods t, the workplace obedience attitudes transmitted satisfy* $\theta_{t+1} = \overline{\theta}$*, while the level of human capital invested in the next generation is given by the (unique) value of* H_{t+1} *that solves equation (13). All else equal, countries where households are more patient, or where the Basic sector is more productive, feature higher levels of human capital.*

The above result provides one rationalization for the development paths of countries such as the East Asian tigers, where it has been argued that high levels of economic output were accompanied by a high degree of obedience or discipline within the workforce. In our model, this would correspond to a case in which the productivity parameter A_B were large, so that the economy ends up being in a high-human capital, high-obedience steady state, with a high degree of specialization in industries where production is routine in nature.

It is also worth pointing out that the transition path to the above steady state is one in which individual household decisions raise both θ and H towards their steady-states values, with the economy being pushed towards an ever more complete degree of specialization in the Basic sector. At any point in this transition, any increase in human capital will be channeled predominantly towards production in the routine sector, and this in turn raises the incentive for parents to instill a greater degree of pro-obedience attitudes their children. In other words, this process of converging to the steady state features a complementarity between workplace obedience attitudes and human capital, in the sense that investments in θ and H are mutually reinforcing. As we will see below, this complementarity can be broken if one were to consider steady states that feature diversification across industries.

Steady state with diversified production: We turn then to the case in which individuals allocate a strictly positive amount of human capital to both industries in steady state. Under diversified production, the decision problem that each working adult faces at time t in terms of how much to invest in their child is now given by:

$$\max_{H_{r,t+1},\theta_{r,t+1}} \quad \delta\left(A_B\left(f(\theta_{t+1})h_{B,t+1}\right)^{\beta} + A_C\left(g(\theta_{t+1})h_{C,t+1}\right)^{\gamma}\widetilde{h_{C,t+1}}^{1-\gamma}\right) - \omega(H_{t+1}) - \tau(\theta_{t+1} - \theta_t). \tag{14}$$

Recall that: $\widetilde{h_{C,t+1}} \equiv \int_{\tilde{r}\in[0,1]} g(\theta_{\tilde{r},t+1})h_{C\tilde{r},t+1}d\tilde{r}$ reflects the spillovers from the aggregate level of human capital channelled to the C sector. Note that in (14), $h_{B,t+1}$ and $h_{C,t+1}$ are themselves

[36] For this scenario to be consistent with a steady state in which no labor is allocated to the C sector, the following condition needs to be satisfied: $\left(\frac{\beta}{\gamma}\frac{A_B}{p_C A_C}\frac{f(\overline{\theta})^{\beta}}{g(\overline{\theta})}\right)^{\frac{1}{1-\beta}} > H^{spec}$, where H^{spec} is the value of H_{t+1} that solves (13).

functions of H_{t+1} and θ_{t+1}, these being the levels of human capital that the child will optimally allocate between both industries at time $t+1$ when she is working. In solving the above investment problem, the parent at time t anticipates how her choice of $H_{r,t+1}$ and $\theta_{r,t+1}$ will in turn affect $h_{B,t+1}$ and $h_{C,t+1}$; this is explicitly taken into account when deciding upon the level of human capital and cultural attitudes to invest in her child.

To solve the above decision problem, we take the first-order conditions with respect to the two choice variables for the representative individual's problem, namely taking $\widetilde{h_{C,t+1}}$ as given, before imposing the symmetry assumption across households (see the Appendix for details). This algebraic manipulation yields:

$$\delta\gamma A_C g(\theta_{t+1}) H_{t+1} \left(\frac{\beta\rho}{\gamma+\beta\rho} \frac{f'}{f} + \frac{\gamma}{\gamma+\beta\rho} \frac{g'}{g} \right) = \tau' (\theta_{t+1} - \theta_t), \text{ and} \quad (15)$$

$$\delta\gamma A_C g(\theta_{t+1}) = \omega' (H_{t+1}). \quad (16)$$

Equation (15) is obtained from the first-order condition with respect to θ_{t+1}, so that it sheds light on the forces that affect the degree of pro-obedience attitudes invested in the child, taking the level of human capital H_{t+1} as given. On the other hand, equation (16) speaks to what affects the incentives to invest in human capital, taking θ_{t+1} as given. (Note that ρ is the ratio of output in the Basic relative to the Complex sector, as defined earlier.) While the optimal choice of θ_{t+1} and H_{t+1} is obtained by solving the above two equations simultaneously, it is nevertheless instructive to inspect each first-order condition in turn, to understand what shapes the incentives to invest in workplace obedience and in human capital respectively.

In particular, working with (15) yields the following result related to the endogenous transmission of pro-obedience attitudes:

Lemma 2 *Consider a symmetric steady state in which the economy is diversified in production between the Basic and Complex industries. Then, for all periods t, the workplace obedience attitudes transmitted, θ_{t+1}, satisfy equation (15). In particular, θ_{t+1} has the following properties:*

(i) $\frac{\partial\theta_{t+1}}{\partial H_{t+1}} < 0$ *in a neighborhood of* $\rho = 0$*;*

(ii) $\frac{\partial\theta_{t+1}}{\partial H_{t+1}} > 0$ *as* $\rho \longrightarrow \infty$*; and*

(iii) $\frac{\partial\theta_{t+1}}{\partial H_{t+1}}$ *is increasing in* ρ*.*

The above lemma describes how prevailing economic conditions, as summarized by the routineness ρ of the structure of production, systematically shape the incentives to transmit cultural attitudes that encourage workplace obedience. This affects specifically the relationship between transmitted attitudes and human capital: When the economy is very nonroutine in its output structure, a higher level of human capital is associated with a less obedient workplace culture. But this correlation is progressively reversed if the economy were instead to become more routine in its output composition. This result thus provides a theoretical rationalization for the Obedience Fact uncovered earlier in the WVS respondent data in Section 3. Intuitively, when ρ is small and the economy is

very nonroutine, any increment in human capital will be allocated by the working adult primarily to production in the Complex sector. As workplace obedience is detrimental to productivity in that sector, this then diminishes the incentives to pass on pro-obedience attitudes, resulting in a negative correlation between H_{t+1} and θ_{t+1}. The converse holds true when ρ is large, as any marginal increase in human capital will be channelled primarily to the Basic sector, in which obedience is a complementary attribute. The incentive will then be to raise transmitted workplace obedience on the margin, resulting in a positive correlation between H_{t+1} and θ_{t+1} when the economy is more routine in its output structure.

Turning to the other first-order condition in (16), we can make the following observation on the incentives to invest in human capital, H_{t+1}:

Lemma 3 *Consider a symmetric steady state in which the economy is diversified in production between the Basic and Complex industries. Then, the level of human capital investment H_{t+1} is decreasing in θ_{t+1}. Moreover, all else equal, countries where households are more patient, or where the Complex sector is more productive, tend to feature higher levels of human capital.*

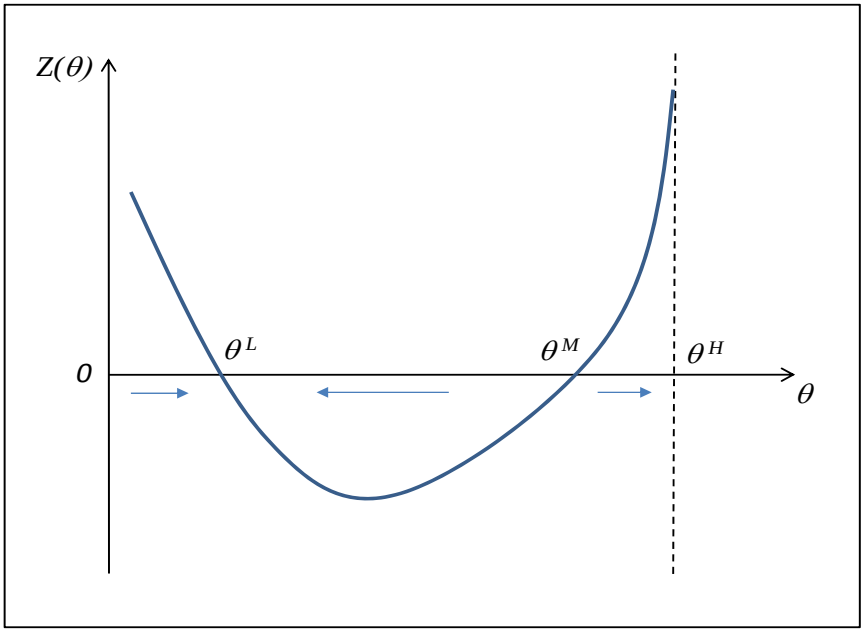
These properties are a quick consequence of (16), specifically the assumptions that $g' < 0$ and $\omega'' > 0$. Since the Basic sector features diminishing returns to human capital, whereas the Complex sector features constant returns in the aggregate, it is technological conditions in the latter sector (i.e., A_C) that are pivotal for shaping the incentives to accumulate human capital in any steady state that features diversified production. Note now that a higher θ_{t+1} would tilt the economy towards a relatively more routine production structure, and this in turn reduces the incentive to invest in H_{t+1} (since the B sector features diminishing returns to human capital). This thus provides a force towards breaking the strict complementarity between workplace obedience and human capital seen in the earlier complete specialization case.

Accordingly, this opens the door to a richer array of steady state outcomes, including the possibility of multiple equilibria. To see this, we solve (15) and (16) simultaneously to pin down the steady-state values of θ and H. (We refer to the steady-state values of the respective variables by removing the time subscript.) Setting $\theta_{t+1} = \theta_t = \theta$ in (15), and recalling that $\tau'(0) = 0$, the steady-state level of workplace obedience satisfies the equation: $Z(\theta) = 0$, where the function $Z(\theta)$ is defined by:

$$Z(\theta) \equiv \left(\frac{\beta\rho}{\gamma + \beta\rho} \frac{f'}{f} + \frac{\gamma}{\gamma + \beta\rho} \frac{g'}{g} \right). \tag{17}$$

In a symmetric steady state, one can show by direct substitution that: $\frac{\beta\rho}{\gamma+\beta\rho} = \left(\frac{\beta}{\gamma} \frac{A_B}{p_C A_C} \frac{f^\beta}{g} \right) \frac{1}{H}$ and $\frac{\gamma}{\gamma+\beta\rho} = 1 - \left(\frac{\beta}{\gamma} \frac{A_B}{p_C A_C} \frac{f^\beta}{g} \right) \frac{1}{H}$. Since (16) implies $H = (\omega')^{-1} (\delta\gamma A_C g(\theta))$, the right-hand side of (17) can indeed be written solely as a closed-form function of θ after substituting out all endogenous variables. Note that $Z(\theta)$ is in principle a non-linear function of θ, and one can readily provide examples where the equation $Z(\theta) = 0$ yields multiple solutions for the same set of parameter values. For concreteness, consider the simple functional forms: $f(\theta) = \theta$ and $g(\theta) = 1 - \theta$, where $\theta \in [0, 1]$, to describe how workplace obedience affects effective labor input in each sector, as well

Figure 2: An Illustration of Multiple Steady States in the Diversified Economy



as $\omega(H) = \frac{1}{2}\kappa H^2$ for the human capital cost function. Figure 2 sketches the behavior of $Z(\theta)$ under these function forms, for a scenario in which $\frac{A_B}{p_C A_C}$ lies in an intermediate range of values, i.e., neither sector has a particularly large technological advantage over the other.[37]

Figure 2 demonstrates that three steady states are possible. The first two of these correspond to the two roots of the equation $Z(\theta) = 0$ and are labeled $\theta = \theta^L$ and θ^M in the figure. Note from (15) that when $Z(\theta_{t+1}) < 0$, we have $\tau'(\theta_{t+1} - \theta_t) < 0$. The convexity of τ and the assumption that $\tau'(0) = 0$ then imply that $\theta_{t+1} - \theta_t < 0$, so that workplace obedience decreases over time for any $\theta_{t+1} \in (\theta^L, \theta^M)$. A similarly argument implies that transmitted workplace obedience will be increasing with time for initial values in the intervals $[0, \theta^L)$ and $(\theta^M, 1)$. These directions of motion mean that θ^L is a stable equilibrium, whereas θ^M is unstable. There is also a third possible steady state outcome, which is $\theta = 1$. To see this, recall that $\frac{\beta\rho}{\gamma+\beta\rho} = \left(\frac{\beta}{\gamma}\frac{A_B}{p_C A_C}\frac{f^\beta}{g}\right)\frac{1}{H}$. With the adopted functional forms for $f(\theta)$ and $g(\theta)$, we can see that this last expression is strictly increasing in θ and moreover tends to infinity as θ approaches 1. It follows that there exists a unique $\theta^H \in (0, 1)$, illustrated by the vertical dotted line in Figure 2, at which $\frac{\beta\rho}{\gamma+\beta\rho} = 1$. However, the direction of motion of θ implies that transmitted workplace obedience will keep increasing for any initial value above θ^M, and will in fact surpass θ^H and approach $\theta = 1$. (This is because $Z(\theta_{t+1}) > 0$ for any $\theta_{t+1} \in (\theta^M, 1)$.) When workplace obedience increases beyond θ^H, the economy moves from diversification back to the case of complete specialization in the Basic sector (as ρ tends to infinity). Thus, $\theta = 1$ is an alternative stable steady state outcome for an economy that commences from an initial situation with diversified production.

[37]The qualitative shape of $Z(\theta)$ is very similar for a wide range of values for the other deep parameters of the model, namely β, γ and δ.

To sum up the above discussion, there are two stable steady states corresponding to $\theta = \theta^L$ and $\theta = 1$. In light of the negative correlation between steady state human capital and workplace obedience implied by (16), we label these as the low-θ, high-H and the high-θ, low-H equilibria respectively. The latter equilibrium is one that we refer to as an "obedience trap": The predominant workplace mindset is one of following instructions, and this tilts the economy towards specialization in the Basic sector, at the expense of the development and expansion of the Complex sector.

Such reliance on the routine sector can be a cause for policy concern, given the relationships that have been established in the labor literature between routine task specialization and job market polarization (e.g., Autor and Dorn 2013; Goos, Manning and Solomon 2014). The occurrence of such an "obedience trap" can be mitigated were $p_C A_C$ to increase relative to A_B either for exogenous reasons (such as a large productivity shock to the Complex sector) or as a response to systematic policies (such as import protection for the Complex sector). With a lower value of $\frac{A_B}{p_C A_C}$, the $Z(\theta)$ curve in Figure 2 would shift vertically downwards to such an extent that it can end up assuming negative values for all $\theta \in [0, \theta^H)$. An economy that initially starts in a situation with diversified production would then transition unambiguously towards the low-obedience steady state, given that the Complex sector has become more productive; the high-θ, low-H steady state would be eliminated. (The converse would of course happen if instead it were the Basic sector that experienced a large productivity shock relative to the Complex sector, namely that the high-obedience steady state would emerge as the unique long-run outcome.)

5 Conclusion

We have established two basic empirical facts: Cultural attitudes towards workplace obedience are linked to increased specialization in routine sectors (the "Specialization Fact"). While educated individuals tend to be less pro-obedience in their workplace attitudes, this negative partial correlation is systematically weakened and even nullified if one's formative years were spent growing up in an economy that featured a high degree of routineness (the "Obedience Fact").

We then constructed a model of endogenous transmission of cultural attitudes toward obedience and human capital accumulation. This framework can generate both of our key facts as predictions, and it also allows us to consider the implications of this interplay between culture and patterns of specialization. In particular, in the presence of human capital externalities in the (skill-intensive) nonroutine sector, the possibility of multiple equilibria arises. The model thus generates a possible "obedience trap": countries may specialize in routine activities, thus inducing pro-obedience attitudes that in turn hinder the development of nonroutine sectors. The latter being relatively skill-intensive, this is accompanied by reduced human capital accumulation.

We have argued that this possibility is policy-relevant, especially if, as seems to be the case, routine tasks are more vulnerable to job replacement. It also underscores the concern displayed by policy makers and other observers, that pro-obedience cultural traits might make it hard for countries to transition from the early stages of industrialization, even though such traits were

helpful in those early stages. Finally, it suggests that policy interventions that shift the structure of the economy away from its comparative advantage, such as protection, could have redeeming features: they might allow the economy to break away from the obedience trap. A full consideration of the desirability of such interventions, as well as of the potential impact of this interplay between attitudes toward obedience and the productive structure of an economy on economic growth, is left for future research.

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Data Appendix

This Appendix documents details related to the datasets used and variables constructed for the empirical analysis.

A. World Values Survey

From the World Values Survey (WVS). The "Workplace Obedience" variable is based on question C061, as described in Section 2.1. The education variable is from question X025, where the eight response categories are: 1 = Inadequately completed elementary education; 2 = Completed elementary education; 3 = Incomplete secondary education: technical/vocational type; 4 = Complete secondary education: technical/vocational type; 5 = Incomplete secondary education: university-preparatory type; 6 = Complete secondary education: university-preparatory type; 7 = Some university without degree or lower-level tertiary certificate; 8 = University with degree or upper-level tertiary certificate.

The other respondent characteristics used are: gender (X001), age (X003), year of survey (S020), number of children (X011), marital status (X007), employment status (X028), size of town (X049), and occupational dummies (X036). For the number of children, a set of dummy variables is used corresponding to whether the respondent has 0, 1, 2,..., 7, or more than 8 children. For marital status, a dummy variable is used for each of the following categories: married; living together as married; divorced; separated; widowed; single/never married; living apart but steady relation; unreported/missing. For employment status, this is a indicator variable equal to 1 if the response is "Full time", "Part time", or "Self-employed"; it is equal to 0 if the response is "Retired", "Housewife", "Student", or "Unemployed"; the response "Other" is recoded as missing. For size of town, this is a set of dummy variables with eight categories ranging from "2,000 and less" to "500,000 and more". For the occupational dummies, this comprises eighteen separate categories, such as: "Employer/manager of establishment with 500 or more employed"; "Professional worker"; "Non-manual office worker"; "Skilled manual"; "Unskilled manual"; "Agricultural worker"; "Member of armed forces". A separate additional dummy is generated for unreported/missing data for each of the marital status, employment status, size of town, and occupation dummies.

Several other measures of cultural attitudes are also drawn from the WVS. The "Child Obedience" variable is a binary variable based on question A042. The importance of "independence" in children is a binary variable based on question A029. The importance of "hard work" in children is a binary variable based on question A030. The variable on "work is a duty to society" is from question C039; the responses are recoded from 1 ("Strongly disagree") to 5 ("Strongly agree"). Respondents' views on whether "I see myself as an autonomous individual" are from G023; the responses are recoded from 1 ("Strongly disagree") to 4 ("Strongly agree").

B. Exports

International trade data are originally from the UN Comtrade. These have been made available

for the years 1962-2000 by Feenstra et al. (2005) in the World Trade Flows dataset. We extended the years of coverage to include 2001-2014 using UN Comtrade data separately procured for these latter years, and running the Stata code posted by Rob Feenstra (http://www.robertfeenstra.info/data/) to process the raw Comtrade data into the World Trade Flows dataset format. These detailed bilateral trade flows are reported for Standard International Trade Classification (SITC) Rev 2 codes. Priority is given to values at the import dock; only when these are not available are values at the export dock used. From 1984-2000, the World Trade Flows dataset contain observations in which one of the reporting countries was from a list of 72 countries, as reported in Table 1 of Feenstra et al. (2005); these cover more than any 98% of world trade by value. This data constraint does not apply for 2001-2014, but we have checked that the findings are very similar when limiting the analysis to data from the same list of 72 reporting countries for these latter years.

A concordance was then performed from SITC Rev 2 to Standard Industrial Classification (SIC) 1987 four-digit industry codes, the latter being a classification system very close to the Census Industry Category codes in Autor, Lavy and Murnane (2003). The concordance weights were constructed using detailed customs-based data on US exports from 1989-2006 from Feenstra et al. (2002), in which SITC, SIC and HS codes were recorded with each observation. There is a complication arising from the fact that some SIC codes are excluded from use by US customs: Customs is unable to distinguish between physical specimens of goods from some groups of SIC codes, as the SIC code definitions are based on the process of manufacturing or method of preparation. In such circumstances, US customs chose a default "destination" code for these goods, and excluded the rest of the codes from use. We use Table 3 in Feenstra et al. (2002) to break up "destination" codes on the basis of the value of shipments observed in the NBER-CES Manufacturing dataset, to recover trade values for the "excluded" codes.

Finally, the SIC codes are mapped to the Census Industry Category (CIC) codes in Autor, Lavy and Murnane (2003), using a matching process based on industry names. There is often a high-level of agreement in the industry names used in the SIC and CIC systems. Two independent research assistants were asked to perform this name-matching process, and there was a high degree of agreement particularly for the manufacturing codes. ALM have devised a time-consistent version of the CIC system (Ind6090), by aggregating various subsets of CIC codes in later years, in order to get a consistent coding system from 1960-1990. The export data are mapped from SIC to this ALM Ind6090 coding system. There are a total of 141 Ind6090 industries, with 60 of these being from manufacturing.

In the individual-level regressions in Section 3, export data from pre-transition countries is associated with respondents from countries that subsequently experienced political transitions. The list of transition countries is: Azerbaijan, Armenia, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Lithuania, Latvia, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan (all from the former Soviet Union); Czech Republic and Slovakia (all from the former Czechoslovakia); Bosnia, Croatia, Slovenia, Macedonia, Serbia (all from the former Yugoslavia); Bangladesh (formerly part of Pakistan); North and South Yemen (treated as one entity throughout the analysis); and East and West Germany (treated as one entity throughout the analysis).

C. Country-level variables

Age Structure of the Population: From Barro and Lee (2013).

Physical Capital, Human Capital, Real GDP per capita: From the Penn World Tables, version 9.0. The real GDP per capita series used is the output-side measure of real GDP.

Rule of law: From the International Country Risk Group (ICRG) measure of "Law and Order". The original series is monthly, on a scale of 0-6. A simple average is taken to obtain the annual index for each country; years with less than 12 months of reporting are dropped.

Financial development: From the Financial Development and Structure Dataset, November 2013 update. The key variable used is private credit from deposit banks and other financial institutions, divided by GDP.

Total population, Openness: From the World Bank's World Development Indicators.

Democracy: From the Polity IV dataset (Marshall and Jaggers 2014). We use the democracy score, which is on a scale of 0 to 10. Observations scored as -66, -77, and -88 in the original data (to reflect periods of foreign interruption or domestic transition) are dropped.

D. Industry-level variables

Factor intensities: From the NBER-CES Manufacturing Dataset. Physical capital intensity is the log value of real capital per worker. Skill intensity is the log number of nonproduction workers over total employment. Data for four-digit SIC industries are summed up to the relevant ALM CIC industry codes, where the latter is the industry coding system in which the "Specialization Fact" regressions are run. Average values over 1980-1989 are used.

Model Appendix

This Appendix documents the details of the derivations and proofs from the model in Section 4.

Labor allocation problem at time t: The decision problem is given by:

$$\max_{h_{Bt},h_{Ct}} \quad A_{Bt}(f(\theta_t)h_{Bt})^{\beta} + p_{Ct}A_{Ct}(g(\theta_t)h_{Ct})^{\gamma}\widetilde{h_{Ct}}^{1-\gamma}$$
$$\text{subject to:} \quad h_{Bt} + h_{Ct} \leq H_t.$$

(Note that we have dropped the respondent subscript r.) Substituting the labor constraint into the maximand, one can see that the first-order condition reduces to: $\beta\frac{y_{Bt}}{h_{Bt}} = \gamma\frac{y_{Ct}}{h_{Ct}}$. Defining $\rho_t \equiv \frac{y_{Bt}}{y_{Ct}}$, it follows that:

$$h_{Bt} = \frac{\beta\rho_t}{\gamma+\beta\rho_t}H_t, \text{ and} \tag{18}$$
$$h_{Ct} = \frac{\gamma}{\gamma+\beta\rho_t}H_t. \tag{19}$$

Next, substitute the expressions in (18) and (19) back into the production functions in (7) and (8), and then plug these into the definition of ρ_t. After some simplification, we have:

$$\frac{\rho_t^{1-\beta}}{(\gamma+\beta\rho_t)^{\gamma-\beta}} = \frac{A_{Bt}}{A_{Ct}}\frac{f^{\beta}}{g^{\gamma}}\frac{\beta^{\beta}}{\gamma^{\gamma}}H_t^{\beta-\gamma}\widetilde{h_{Ct}}^{\gamma-1}.$$

Applying now the symmetry assumption across households, we have: $\widetilde{h_{Ct}} = g\frac{\gamma}{\gamma+\beta\rho_t}H_t$. Using this expression into the above, and simplifying yields: $\frac{\beta\rho}{\gamma+\beta\rho} = \left(\frac{\beta}{\gamma}\frac{A_B}{p_C A_C}\frac{f^{\beta}}{g}\right)\frac{1}{H}$. This can then be substituted into (18) and (19), from which the expressions for h_{Bt} and h_{Ct} reported in equations (10) and (11) in the main text follow. The min and max operators in these latter equations is to accommodate the possibility of corner solutions.

Steady state with complete specialization: Under complete specialization in the Basic sector, output in the Complex sector $y_{C,t+1}$ is equal to zero and all human capital H_{t+1} is allocated to the B sector. The decision problem for the time-t parent over how much θ_{t+1} and H_{t+1} to invest in her child then given by (12) in the main text. In a steady state, $\theta_{t+1} = \theta_t$, so that $\tau'(\theta_{t+1} - \theta_t) = \tau'(0)$. It follows from (12) that it is optimal to raise θ to its maximum value $\overline{\theta}$, since output in the Basic sector is increasing in θ.

Replacing θ_{t+1} by $\overline{\theta}$ in (12), the first-order condition for H_{t+1} reported in equation (16) in the main text follows immediately. An increase in either δ or A_B implies that $H_{t+1}^{1-\beta}\omega'(H_{t+1})$ must increase. Since $\omega'' \geq 0$, H_{t+1} will rise as well, as stated in Lemma 1.

Steady state with diversified economy: Recall that the decision problem facing the time-t adult over how much to invest in her child is given by (14). Note that the adult anticipates that the child will set $h_{B,t+1} = \frac{\beta\rho_{t+1}}{\gamma+\beta\rho_{t+1}}H_{t+1}$ and $h_{C,t+1} = \frac{\gamma}{\gamma+\beta\rho_{t+1}}H_{t+1}$ in the next time period, bearing

in mind that we are in a diversified economy. Substituting these expressions into (14), and taking the first-order condition with respect to θ_{t+1}, one obtains:

$$\begin{aligned}&\frac{A_B}{A_C}\beta\left(f\frac{\beta\rho_{t+1}}{\gamma+\beta\rho_{t+1}}H_{t+1}\right)^{\beta}\left(\frac{f'}{f}+\frac{\gamma}{\gamma+\beta\rho_{t+1}}\frac{1}{\rho_{t+1}}\frac{d\rho_{t+1}}{d\theta_{t+1}}\right)\\&\quad+\gamma\left(g\frac{\gamma}{\gamma+\beta\rho_{t+1}}H_{t+1}\right)^{\gamma}\left(\frac{g'}{g}-\frac{\beta\rho_{t+1}}{\gamma+\beta\rho_{t+1}}\frac{1}{\rho_{t+1}}\frac{d\rho_{t+1}}{d\theta_{t+1}}\right)\widetilde{h_{C,t+1}}^{1-\gamma} \;=\; \frac{1}{\delta A_C}\tau'.\end{aligned}$$

In a symmetric steady state, recall that: $\widetilde{h_{C,t+1}}=g\frac{\gamma}{\gamma+\beta\rho_{t+1}}H_{t+1}$. We now make use of this fact in the above. The equation in (15) follows after some algebraic simplification.

Turning to the first-order condition with respect to $H_{r,t+1}$, direct differentiation of (14) yields:

$$\begin{aligned}&\frac{A_B}{A_C}\beta\left(f\frac{\beta\rho_{t+1}}{\gamma+\beta\rho_{t+1}}H_{t+1}\right)^{\beta}\left(\frac{\gamma}{\gamma+\beta\rho_{t+1}}\frac{H_{t+1}}{\rho_{t+1}}\frac{d\rho_{t+1}}{dH_{t+1}}+1\right)H_{t+1}^{\beta-1}\\&\quad+\gamma\left(g\frac{\gamma}{\gamma+\beta\rho_{t+1}}H_{t+1}\right)^{\gamma}\left(-\frac{\beta\rho_{t+1}}{\gamma+\beta\rho_{t+1}}\frac{H_{t+1}}{\rho_{t+1}}\frac{d\rho_{t+1}}{dH_{t+1}}+1\right)H_{t+1}^{\gamma-1}\widetilde{h_{C,t+1}}^{1-\gamma} \;=\; \frac{1}{\delta A_C}\omega'.\end{aligned}$$

Next, substitute in the expression for $\widetilde{h_{C,t+1}}$ under symmetry into the above. The equation in (16) follows after some algebraic simplification. (Note that there is no need to directly derive an expression for $\frac{d\rho_{t+1}}{d\theta_{t+1}}$ or $\frac{d\rho_{t+1}}{dH_{t+1}}$ in the above manipulations, as all the relevant terms involving these derivatives cancel out in the simplification steps.)

For Lemma 2, we totally differentiate (15) taking ρ as given from the perspective of the individual. This yields:

$$\left(\frac{\beta\rho}{\gamma+\beta\rho}\left(\frac{f''g}{f}+\frac{f'g'}{f}-\frac{(f')^2g}{f^2}\right)+\frac{\gamma}{\gamma+\beta\rho}g''-\frac{1}{\delta A_C\gamma H}\tau''\right)\partial\theta_{t+1} \;=\; -\frac{1}{H}\left(\frac{\beta\rho}{\gamma+\beta\rho}\frac{f'g}{f}+\frac{\gamma}{\gamma+\beta\rho}g'\right)\partial H_{t+1}.$$

The derivative assumptions that we have made allow us to sign the coefficient of the term in $\partial\theta_{t+1}$ to be unambiguously negative. It follows that the sign of $\frac{\partial\theta_{t+1}}{\partial H_{t+1}}$ will inherit the sign of $\left(\frac{\beta\rho}{\gamma+\beta\rho}\frac{f'g}{f}+\frac{\gamma}{\gamma+\beta\rho}g'\right)$. In a neighborhood of $\rho=0$, this is clearly negative since $g'<0$. Conversely, as $\rho\longrightarrow\infty$, this is clearly positive, since $g'>0$. As for the third part of the lemma, one can see that $\left(\frac{\beta\rho}{\gamma+\beta\rho}\frac{f'g}{f}+\frac{\gamma}{\gamma+\beta\rho}g'\right)$ is increasing in ρ for any given value of θ_{t+1}. It follows that $\frac{\partial\theta_{t+1}}{\partial H_{t+1}}$ is increasing in ρ.

Table 1
Task Routineness by Broad Sectors

	Agriculture, Mining & Construction	Manufacturing	Services
Routine cognitive	4.84 (1.90)	5.87 (0.81)	4.00 (1.57)
Nonroutine cognitive, interactive	2.23 (1.81)	1.44 (0.37)	2.24 (0.90)
Nonroutine cognitive, analytical	3.05 (0.94)	2.97 (0.52)	3.76 (0.82)
Routine manual	3.61 (0.43)	3.98 (0.27)	3.74 (0.56)
Nonroutine manual	2.06 (0.45)	1.32 (0.33)	1.14 (0.76)

Note: Each of the task routineness measures is based on the 1977 DOT coding using 1959 US Census industry weights, as constructed by Autor, Levy & Murnane (2003). Each index takes values from 0-10. For each column, a simple average of each routineness measure is taken over the industries within each broad set of sectors, with the standard deviation reported in parentheses. For "Agriculture, Mining & Construction", this comprises industries on the Autor, Levy & Murnane (2003) Ind6090 CIC codes ranging from 16 to 66; for "Manufacturing", this comprises codes ranging from 100 to 392; and for "Services", this comprises codes ranging from 400 to 901.

Table 2
"Specialization Fact": Workplace Obedience and Country-Level Patterns of Specialization

Dependent variable:	Log (Exports$_{cit}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Routineness measure:	Overall	Overall	Overall	Overall	Cognitive	Manual
AvgObedWork$_{ct}$ × Routineness$_i$	1.6272***	6.0259***	2.7235***	2.8525**	2.3159**	1.3901
	[0.3905]	[1.0639]	[1.0068]	[1.1513]	[1.1392]	[2.1144]
Phy. Capital Stock$_{ct}$ × Capital Intensity$_i$			0.1852***	0.1847***	0.1923***	0.1958***
			[0.0583]	[0.0599]	[0.0613]	[0.0596]
Human Capital Stock$_{ct}$ × Skill Intensity$_i$			1.2669***	1.0783***	1.0572***	1.2337***
			[0.2385]	[0.2489]	[0.2643]	[0.2376]
Rule of Law$_{ct}$ × Industry$_i$ dummies?	N	N	N	Y	Y	Y
Financial Devt$_{ct}$ × Industry$_i$ dummies?	N	N	N	Y	Y	Y
Country-year (ct) dummies?	Y	Y	Y	Y	Y	Y
Country-industry (ci) dummies?	Y	Y	Y	Y	Y	Y
Observations	19,589	17,063	16,194	15,016	15,016	15,016
No. of countries	58	58	58	56	56	56
R^2	0.9500	0.9523	0.9579	0.9611	0.9611	0.9610

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is log exports at the country-industry level averaged over each five-year window (1990-1994 through 2010-2014), where the industry classification follows the Ind6090 CIC codes from Autor, Levy and Murnane (2003). The AvgObedWork measure is a population-weighted average of the estimated country-cohort-gender fixed effects, as described in Section 2.1. The industry routineness measure used in Columns (1)-(4) is the overall RT measure, while Columns (5) and (6) respectively use the cognitive routineness (RTC) and manual routineness (RTM) measures. All columns include country-year and country-industry fixed effects. Columns (4)-(6) further include country measures of rule of law and financial development, each interacted against a full set of industry dummies.

Table 3
"Specialization Fact": Controlling for the role of other country cultural variables

Dependent variable:	Log (Exports$_{cit}$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Routineness measure:	RTC	RTC	RTC	RTC	RTC	RTC	RTC
AvgObedWork$_{ct}$ × Routineness$_i$	3.9934**	4.0005**	3.9886**	2.6850*	6.1099***	4.0590**	4.9082***
	[1.6524]	[1.6703]	[1.7241]	[1.4632]	[1.9292]	[1.7064]	[1.6689]
Phy. Capital Stock$_{ct}$ × Capital Intensity$_i$	0.1693***	0.1694***	0.1612**	0.1464**	0.1118**	0.1683***	0.1220**
	[0.0606]	[0.0607]	[0.0606]	[0.0611]	[0.0533]	[0.0605]	[0.0550]
Human Capital Stock$_{ct}$ × Skill Intensity$_i$	0.6234*	0.6234*	0.6215*	1.0185**	0.7897*	0.6229*	1.0780**
	[0.3556]	[0.3557]	[0.3555]	[0.3907]	[0.3997]	[0.3556]	[0.3974]
Human Capital Stock$_{ct}$ × Routineness$_i$	-0.6397**	-0.6416**	-0.5340*	-0.2531	-0.5444	-0.6045*	0.1176
	[0.2857]	[0.2928]	[0.3115]	[0.3496]	[0.3652]	[0.3044]	[0.3829]
AvgObedWork$_{ct}$ × Skill Intensity$_i$	3.2694	3.2695	3.2684	3.0904	5.9220***	3.2689	5.0541***
	[1.9564]	[1.9570]	[1.9565]	[2.0264]	[1.7640]	[1.9566]	[1.7328]
Indepedence$_{ct}$ × Routineness$_i$		0.1106					4.5302*
		[2.0167]					[2.2401]
Hard Work$_{ct}$ × Routineness$_i$			3.2894**				0.3165
			[1.4940]				[2.3127]
Work as a Duty$_{ct}$ × Routineness$_i$				0.9151			1.9450**
				[0.6832]			[0.7418]
Individualism$_{ct}$ × Routineness$_i$					-0.1594		-0.6702
					[0.8903]		[0.9558]
AvgObedChildren$_{ct}$ × Routineness$_i$						-1.5597	-3.1126
						[3.0084]	[3.0372]
Rule of Law$_{ct}$ × Industry$_i$ dummies?	Y	Y	Y	Y	Y	Y	Y
Financial Devt$_{ct}$ × Industry$_i$ dummies?	Y	Y	Y	Y	Y	Y	Y
Country-year (ct) dummies?	Y	Y	Y	Y	Y	Y	Y
Country-industry (ci) dummies?	Y	Y	Y	Y	Y	Y	Y
Observations	15,016	15,016	15,016	11,256	10,842	15,016	9,669
No. of countries	56	56	56	41	40	56	35
R^2	0.9612	0.9612	0.9612	0.9661	0.9687	0.9612	0.9712

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is log exports at the country-industry level averaged over each five-year window (1990-1994 through 2010-2014), where the industry classification follows the Ind6090 CIC codes from Autor, Levy and Murnane (2003). The AvgObedWork measure is a population-weighted average of the estimated country-cohort-gender fixed effects, as described in Section 2.1. The industry routineness measure used in all columns is the cognitive routineness (RTC) measure. All columns include country-year and country-industry fixed effects, as well as country measures of rule of law and financial development, each interacted against a full set of industry dummies.

Table 4
"Specialization Fact": Additional Specifications

Dependent variable:	Log ($Exports_{cit}$)		
	(1)	(2)	(3)
Routineness measure:	Cognitive	Cognitive	Cognitive
$AvgObedWork_{ct} \times Routineness_i$	3.2413***	0.1503	3.7827**
	[1.0379]	[0.4476]	[1.5761]
Phy. $Capital\ Stock_{ct} \times Capital\ Intensity_i$	0.1305***	0.2498***	0.0407
	[0.0443]	[0.0818]	[0.0818]
Human $Capital\ Stock_{ct} \times Skill\ Intensity_i$	0.2082	0.5265**	-0.2827
	[0.2524]	[0.1978]	[0.6041]
Human $Capital\ Stock_{ct} \times Routineness_i$	-0.8323***	0.2205	-0.1288
	[0.2039]	[0.1792]	[0.5703]
$AvgObedWork_{ct} \times Skill\ Intensity_i$	2.9464**	-0.1560	4.2076**
	[1.2396]	[0.4358]	[1.9151]
Log ($Exports_{ci,t-1}$)	0.2989***		
	[0.0243]		
Rule of $Law_{ct} \times Industry_i$ dummies?	Y	Y	Y
Financial $Devt_{ct} \times Industry_i$ dummies?	Y	Y	Y
Country-year (ct) dummies?	Y	Y	Y
Country-industry (ci) dummies?	Y	N	Y
Industry (i) dummies?	N	Y	N
Industry-year (it) dummies?	N	N	Y
Observations	14,857	15,016	15,016
No. of countries	56	56	56
R^2	0.9670	0.8170	0.9641

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is log exports at the country-industry level averaged over each five-year window (1990-1994 through 2010-2014), where the industry classification follows the Ind6090 CIC codes from Autor, Levy and Murnane (2003). The AvgObedWork measure is a population-weighted average of the estimated country-cohort-gender fixed effects, as described in Section 2.1. The industry routineness measure used in all columns is the cognitive routineness (RTC) measure. Column (1) includes country-year and country-industry fixed effects; Column (2) controls instead for country-year and industry fixed effects; Column (3) includes country-year, country-industry and industry-year fixed effects. All columns further include country measures of rule of law and financial development, each interacted against a full set of industry dummies.

Table 5
"Obedience Fact": How Export Routineness Shapes Workplace Obedience Attitudes

Dependent variable:	Importance of obedience in the workplace							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExpRTC exposure at:	Age 0	Age 5	Age 10	Age 15	Age 20	Age 25	Age 30	Age 35
A: OLS								
$Education_r$	-0.0197***	-0.0202***	-0.0207***	-0.0216***	-0.0236***	-0.0247***	-0.0253***	-0.0254***
	[0.0047]	[0.0043]	[0.0040]	[0.0035]	[0.0032]	[0.0031]	[0.0030]	[0.0029]
$Educ_r \times ExpRTCexposure_{cb}$	0.0099	0.0151**	0.0155***	0.0133**	0.0110**	0.0076	0.0039	0.0040
	[0.0080]	[0.0062]	[0.0056]	[0.0052]	[0.0053]	[0.0061]	[0.0056]	[0.0064]
$ExpRTCexposure_{cb}$	-0.0162	-0.0978**	-0.0863*	-0.0419	-0.0542	-0.0540	-0.0281	-0.0102
	[0.0595]	[0.0479]	[0.0484]	[0.0386]	[0.0435]	[0.0438]	[0.0407]	[0.0406]
Observations	50,500	65,202	78,812	90,115	99,231	106,403	112,784	111,173
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0636	0.0624	0.0639	0.0637	0.0647	0.0659	0.0665	0.0666
B: Instrumental Variables								
$Education_r$	-0.0206***	-0.0196***	-0.0206***	-0.0212***	-0.0237***	-0.0250***	-0.0258***	-0.0257***
	[0.0046]	[0.0046]	[0.0041]	[0.0036]	[0.0032]	[0.0031]	[0.0030]	[0.0029]
$Educ_r \times ExpRTCexposure_{cb}$	0.0073	0.0172**	0.0165***	0.0161***	0.0132**	0.0086	0.0046	0.0035
	[0.0084]	[0.0069]	[0.0061]	[0.0057]	[0.0055]	[0.0064]	[0.0060]	[0.0066]
$ExpRTCexposure_{cb}$	-0.0050	-0.0974*	-0.0929*	-0.0635	-0.0377	-0.0525	-0.0414	-0.0089
	[0.0785]	[0.0590]	[0.0494]	[0.0462]	[0.0398]	[0.0446]	[0.0490]	[0.0418]
Observations	49,911	64,721	77,576	87,689	96,620	103,498	109,557	108,115
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0634	0.0623	0.0636	0.0627	0.0644	0.0660	0.0662	0.0661
Kleinberger-Paap Wald F-stat	35.64	55.54	49.37	61.00	42.25	44.01	46.87	45.64
Additional controls:	All columns: Dummies for Gender, Number of children, Marital status							
Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
Cohort (b) dummies?	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is the response provided to WVS question C061 on one's propensity to follow instructions in the workplace. Each successive column tests for whether the cognitive routineness of exports (expRTC) that the respondent was exposed to in the five-year window where he/she turned age A (where A=0, 5, 10 etc.) affects attitudes towards workplace obedience. All columns include survey country-wave and respondent birth cohort fixed effects, as well as a full set of dummies for gender, number of children, and marital status. Panel A performs the estimation via OLS, while Panel B uses an instrumental variable for expRTC in which the export profile that each cohort was exposed to is predicted using the lagged export profile of the country and industry export growth rates in the rest of the world.

Table 6
"Obedience Fact": With country-cohort-gender fixed effects

Dependent variable:	Importance of obedience in the workplace							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExpRTC exposure at:	Age 0	Age 5	Age 10	Age 15	Age 20	Age 25	Age 30	Age 35
A: OLS								
$Education_r$	-0.0198***	-0.0204***	-0.0207***	-0.0220***	-0.0239***	-0.0247***	-0.0250***	-0.0250***
	[0.0049]	[0.0046]	[0.0042]	[0.0036]	[0.0033]	[0.0033]	[0.0031]	[0.0030]
$Educ_r \times ExpRTCexposure_{cb}$	0.0110	0.0143**	0.0159***	0.0111*	0.0078	0.0053	0.0011	-0.0002
	[0.0077]	[0.0068]	[0.0057]	[0.0062]	[0.0058]	[0.0066]	[0.0064]	[0.0069]
Observations	50,497	65,199	78,809	90,112	99,228	106,399	112,779	111,169
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0727	0.0719	0.0740	0.0740	0.0756	0.0775	0.0785	0.0792
B: Instrumental Variables								
$Education_r$	-0.0208***	-0.0199***	-0.0207***	-0.0215***	-0.0241***	-0.0250***	-0.0256***	-0.0253***
	[0.0048]	[0.0048]	[0.0042]	[0.0038]	[0.0034]	[0.0032]	[0.0031]	[0.0030]
$Educ_r \times ExpRTCexposure_{cb}$	0.0081	0.0159**	0.0164***	0.0150**	0.0083	0.0057	0.0021	0.0007
	[0.0084]	[0.0073]	[0.0060]	[0.0061]	[0.0066]	[0.0070]	[0.0067]	[0.0070]
Observations	49,907	64,717	77,572	87,685	96,616	103,494	109,552	108,111
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0725	0.0718	0.0737	0.0729	0.0752	0.0775	0.0783	0.0785
Kleinberger-Paap Wald F-stat	417.67	632.30	759.42	1065.59	855.48	944.84	856.88	737.31
Additional controls:	All columns: Number of children, Marital status							
Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
Cty-cohort-gender (cbg) dummies?	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is the response provided to WVS question C061 on one's propensity to follow instructions in the workplace. Each successive column tests for whether the cognitive routineness of exports (expRTC) that the respondent was exposed to in the five-year window where he/she turned age A (where A=0, 5, 10 etc.) affects attitudes towards workplace obedience. All columns include survey country-wave and country-cohort-gender fixed effects, as well as a full set of dummies for number of children and marital status. Panel A performs the estimation via OLS, while Panel B uses an instrumental variable for expRTC in which the export profile that each cohort was exposed to is predicted using the lagged export profile of the country and industry export growth rates in the rest of the world.

Table 7
"Obedience Fact": With education interacted by country-wave fixed effects

Dependent variable:	Importance of obedience in the workplace							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExpRTC exposure at:	Age 0	Age 5	Age 10	Age 15	Age 20	Age 25	Age 30	Age 35
A: OLS								
$Education_r$	0.0220***	0.0190***	0.0081***	0.0085***	0.0069***	0.0031***	0.0016***	0.0014
	[0.0024]	[0.0025]	[0.0024]	[0.0016]	[0.0008]	[0.0004]	[0.0006]	[0.0012]
$Educ_r \times ExpRTCexposure_{cb}$	0.0304***	0.0234***	0.0176**	0.0119**	0.0060	0.0017	-0.0043	-0.0063
	[0.0060]	[0.0071]	[0.0073]	[0.0057]	[0.0048]	[0.0050]	[0.0060]	[0.0071]
Observations	50,501	65,203	78,813	90,116	99,232	106,403	112,784	111,173
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0774	0.0762	0.0780	0.0777	0.0791	0.0811	0.0819	0.0827
B: Instrumental Variables								
$Education_r$	0.0188***	0.0229***	0.0086***	0.0101***	0.0070***	0.0031***	0.0016**	0.0011
	[0.0041]	[0.0027]	[0.0026]	[0.0017]	[0.0011]	[0.0004]	[0.0006]	[0.0013]
$Educ_r \times ExpRTCexposure_{cb}$	0.0224**	0.0344***	0.0192**	0.0178***	0.0062	0.0015	-0.0030	-0.0045
	[0.0104]	[0.0076]	[0.0077]	[0.0062]	[0.0071]	[0.0059]	[0.0071]	[0.0077]
Observations	49,907	64,717	77,572	87,685	96,616	103,494	109,552	108,111
No. of countries	65	65	65	65	65	65	65	65
R^2	0.0771	0.0760	0.0777	0.0768	0.0788	0.0811	0.0816	0.0820
Kleinberger-Paap Wald F-stat	87.72	152.61	143.33	191.98	165.17	215.20	222.41	236.97
Additional controls:	All columns: Number of children, Marital status							
Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
Cty-cohort-gender (cbg) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
$Educ_r \times$ Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is the response provided to WVS question C061 on one's propensity to follow instructions in the workplace. Each successive column tests for whether the cognitive routineness of exports (expRTC) that the respondent was exposed to in the five-year window where he/she turned age A (where A=0, 5, 10 etc.) affects attitudes towards workplace obedience. All columns include survey country-wave and country-cohort-gender fixed effects, respondent education interacted with country-wave fixed effects, as well as a full set of dummies for the number of children and marital status. Panel A performs the estimation via OLS, while Panel B uses an instrumental variable for expRTC in which the export profile that each cohort was exposed to is predicted using the lagged export profile of the country and industry export growth rates in the rest of the world.

Table 8
How Export Routineness (Does Not) Shape Attitudes towards Obedience in Children

Dependent variable:	Importance of obedience in children							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExpRTC exposure at:	Age 0	Age 5	Age 10	Age 15	Age 20	Age 25	Age 30	Age 35
A: OLS								
$Education_r$	0.0182***	0.0074***	0.0044***	0.0044***	0.0020***	-0.0030***	-0.0052***	-0.0067***
	[0.0015]	[0.0007]	[0.0006]	[0.0006]	[0.0004]	[0.0001]	[0.0003]	[0.0006]
$Educ_r \times ExpRTCexposure_{cb}$	-0.0008	-0.0020	-0.0006	-0.0000	-0.0004	0.0021	0.0029	0.0059*
	[0.0038]	[0.0019]	[0.0017]	[0.0024]	[0.0026]	[0.0024]	[0.0023]	[0.0031]
Observations	139,849	168,467	194,805	217,188	234,840	240,762	237,117	222,164
No. of countries	93	94	94	94	95	95	95	95
R^2	0.1697	0.1697	0.1689	0.1694	0.1694	0.1684	0.1662	0.1636
B: Instrumental Variables								
$Education_r$	0.0186***	0.0077***	0.0044***	0.0047***	0.0020***	-0.0030***	-0.0054***	-0.0065***
	[0.0022]	[0.0011]	[0.0008]	[0.0006]	[0.0004]	[0.0001]	[0.0003]	[0.0006]
$Educ_r \times ExpRTCexposure_{cb}$	0.0001	-0.0012	-0.0004	0.0012	-0.0010	0.0019	0.0042	0.0048
	[0.0056]	[0.0030]	[0.0023]	[0.0024]	[0.0029]	[0.0027]	[0.0028]	[0.0033]
Observations	138,163	166,334	191,639	212,893	230,139	235,700	231,725	217,114
No. of countries	93	93	94	94	95	95	95	95
R^2	0.1692	0.1695	0.1685	0.1693	0.1694	0.1686	0.1668	0.1640
Kleinberger-Paap Wald F-stat	132.86	132.55	141.84	179.95	240.75	384.75	399.81	367.86
Additional controls:	All columns: Number of children, Marital status							
Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
Cty-cohort-gender (cbg) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
$Educ_r \times$ Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is based on WVS question A042, and is an indicator variable for whether obedience was selected as an important quality for children. Each successive column tests for whether the cognitive routineness of exports (expRTC) that the respondent was exposed to in the five-year window where he/she turned age A (where A=0, 5, 10 etc.) affects attitudes towards workplace obedience. All columns include survey country-wave and country-cohort-gender fixed effects, respondent education interacted with country-wave fixed effects, as well as a full set of dummies for the number of children and marital status. Panel A performs the estimation via OLS, while Panel B uses an instrumental variable for expRTC in which the export profile that each cohort was exposed to is predicted using the lagged export profile of the country and industry export growth rates in the rest of the world.

Table 9
"Obedience Fact": Robustness

Dependent variable:	Importance of obedience in the workplace							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ExpRTC exposure at:	Age 0	Age 5	Age 10	Age 15	Age 20	Age 25	Age 30	Age 35
Instrumental Variables								
				Overall Export Routineness (RT)				
$Educ_r \times ExpRTexposure_{cb}$	0.0172**	0.0242***	0.0123*	0.0129***	0.0060	0.0032	0.0007	-0.0020
	[0.0075]	[0.0055]	[0.0064]	[0.0048]	[0.0054]	[0.0043]	[0.0055]	[0.0060]
				Drop transition countries				
$Educ_r \times ExpRTCexposure_{cb}$	0.0231**	0.0352***	0.0205**	0.0192***	0.0119**	0.0047	-0.0023	-0.0067
	[0.0106]	[0.0072]	[0.0080]	[0.0060]	[0.0054]	[0.0057]	[0.0074]	[0.0076]
				Manufacturing Exports Only				
$Educ_r \times ExpRTCexposure_{cb}$	-0.0121	0.0740**	0.0688***	0.0391**	-0.0178	-0.0296*	-0.0162	0.0065
	[0.0421]	[0.0304]	[0.0239]	[0.0197]	[0.0144]	[0.0158]	[0.0199]	[0.0197]
				Controlling for $Educ_r \times$ Country-Cohort Exposure to Export Skill- and Capital-Intensity				
$Educ_r \times ExpRTCexposure_{cb}$	0.0180*	0.0378***	0.0189**	0.0183***	0.0104	0.0031	-0.0062	-0.0139**
	[0.0106]	[0.0076]	[0.0079]	[0.0070]	[0.0082]	[0.0070]	[0.0081]	[0.0070]
				Controlling for $Educ_r \times$ Country-Cohort Exposure to Income per capita, Openness, Population, Democracy				
$Educ_r \times ExpRTCexposure_{cb}$	0.0305	0.0361*	0.0170	0.0381***	0.0173*	-0.0035	-0.0116	-0.0236**
	[0.0318]	[0.0212]	[0.0135]	[0.0093]	[0.0096]	[0.0096]	[0.0095]	[0.0093]
Additional controls:	All columns: Dummies for Number of children, Marital status							
Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
Cty-cohort-gender (cbg) dummies?	Y	Y	Y	Y	Y	Y	Y	Y
$Educ_r \times$ Country-wave (cw) dummies?	Y	Y	Y	Y	Y	Y	Y	Y

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is the response provided to WVS question C061 on one's propensity to follow instructions in the workplace. Each successive column tests for whether the cognitive routineness of exports (expRTC) that the respondent was exposed to in the five-year window where he/she turned age A (where A=0, 5, 10 etc.) affects attitudes towards workplace obedience. All columns include survey country-wave and country-cohort-gender fixed effects, respondent education interacted with country-wave fixed effects, as well as a full set of dummies for the number of children and marital status. All columns use the instrumental variable for expRTC in which the export profile that each cohort was exposed to is predicted using the lagged export profile of the country and industry export growth rates in the rest of the world. Only the coefficient on the interaction term between respondent education and expRTC exposure at age A is reported.

Appendix Table 1
The Workplace Obedience Measure: List of Available Countries/Territories

Albania (ALB)	Germany (DEU)	Puerto Rico (PRI)
Algeria (DZA)	Guatemala (GTM)	Romania (ROM)
Argentina (ARG)	Hong Kong (HKG)	Russia (RUS)
Armenia (ARM)	Hungary (HUN)	Saudi Arabia (SAU)
Australia (AUS)	India (IND)	Serbia (SRB)
Azerbaijan (AZE)	Indonesia (IDN)	Singapore (SGP)
Bangladesh (BGD)	Iran (IRN)	Slovakia (SVK)
Belarus (BLR)	Japan (JPN)	Slovenia (SVN)
Bosnia-Herzegovina (BIH)	Jordan (JOR)	South Africa (ZAF)
Brazil (BRA)	Korea (KOR)	Spain (ESP)
Bulgaria (BGR)	Kyrgyzstan (KGZ)	Sweden (SWE)
Canada (CAN)	Latvia (LVA)	Switzerland (CHE)
Chile (CHL)	Lithuania (LTU)	Taiwan (TWN)
China (CHN)	Macedonia (MKD)	Tanzania (TZA)
Croatia (HRV)	Mexico (MEX)	Turkey (TUR)
Czech Republic (CZE)	Moldova (MDA)	Uganda (UGA)
Dominican Republic (DOM)	Morocco (MAR)	Ukraine (UKR)
Egypt (EGY)	New Zealand (NZL)	United States (USA)
El Salvador (SLV)	Nigeria (NGA)	Uruguay (URY)
Estonia (EST)	Norway (NOR)	Venezuela (VEN)
Finland (FIN)	Peru (PER)	Vietnam (VNM)
Georgia (GEO)	Philippines (PHL)	Zimbabwe (ZWE)

Notes: List of 66 countries/territories in which WVS question C061 on following instructions in the workplace was asked in at least one survey-wave. The "Specialization Fact" regressions in Tables 2-4 contain fewer countries due to the lack of information on physical and human capital endowments for a small number of countries. The "Obedience Fact" regressions in Tables 5-7 contain one less country (65), as there is no information on respondent education for HRV in the WVS.

Appendix Table 2
What Explains Attitudes towards Workplace Obedience? A Baseline

Dependent variable:	**Following Instructions in the workplace (0-2)**		
	(1)	(2)	(3)
$Gender_r$ (1=Female; 0=Male)	-0.0291***	---	---
	[0.0099]		
$Education_r$	-0.0240***	-0.0216***	-0.0202***
	[0.0043]	[0.0033]	[0.0029]
Country-cohort-gender (cbg) dummies?	N	Y	Y
Country-wave (cw) dummies?	N	N	Y
	Additional controls: with p-value of test of joint significance		
Dummies for number of children?	Y (0.0315)	Y (0.2095)	Y (0.2227)
Dummies for marital status?	Y (0.0000)	Y (0.1886)	Y (0.0000)
Dummies for size of town	Y (0.0582)	Y (0.1683)	Y (0.2135)
Dummies for employment status?	Y (0.0803)	Y (0.0169)	Y (0.0028)
Dummies for occupation?	Y (0.0000)	Y (0.0000)	Y (0.0000)
Observations	125,709	125,625	125,625
No. of countries	65	65	65
R^2	0.0121	0.0771	0.0856

Notes: Standard errors are clustered by country; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. The dependent variable is the response provided to WVS question C061 on one's propensity to follow instructions in the workplace. Column 1 contains only respondent characteristics as explanatory variables, while Column 2 adds country-cohort-gender fixed effects and Column 3 further adds country-survey wave fixed effects. Each column includes full sets of dummy variables for number of children, marital status, size of town, employment status, and occupation of the respondent. The p-value from a test for the joint significance of each of these sets of dummy variables is reported, where the null hypothesis is that all the respective dummy variable coefficients are equal to zero.

Appendix Table 3
The Five Most and Least Routine Manufacturing Industries

	Cognitive (RTC)		Manual (RTM)
Five Least Routine		Five Least Routine	
Not specified food industries (122)	-0.869	Logging (230)	-0.039
Drugs (181)	-0.613	Dairy Products (101)	0.428
Guided missiles, space vehicles, and parts. Ordnance, and Aircraft and parts (362)	-0.374	Cement, concrete, and gypsum, and plaster products (251)	0.619
Plastics, synthetics, and resins; Soaps and cosmetics; Agricultural Chemicals; Industrial and miscellaneous chemicals (346)	-0.311	Sawmills, planing mills, and millwork (231)	0.620
Newspaper publishing and printing (171)	-0.305	Beverage (120)	0.774
Five Most Routine		Five Most Routine	
Logging (230)	1.079	Not specified food industries (122)	1.451
Apparel and accessories, except knit (151)	1.080	Engine and turbines; Construction and material handling machines; metalworking machinery; machinery, except electrical, n.e.c.; etc. (176)	1.474
Footwear, except rubber and plastic (221)	1.141	Drugs (181)	1.519
Yarn, thread, and fabric mills (142)	1.308	Newspaper publishing and printing (171)	1.644
Knitting mills (132)	1.410	Printing, publishing, and allied industries except newspapers (172)	1.766

Note: Based on the Ind6090 CIC codes from Autor, Levy and Murnane (2003). The table lists the five most and least routine manufacturing industries, for the cognitive and manual routineness measures respectively.

Appendix Table 4
Summary Statistics: "Specialization Fact" Exercise

	25th percentile	Median	50th percentile	Mean	Std. Dev.
Country variables					
ObedWork (simple average)	1.764	1.940	2.088	1.923	0.222
AvgObedWork (pooled regression)	-0.212	0.013	0.141	-0.023	0.239
AvgObedWork (cty-by-cty regression)	-0.019	-0.004	0.016	-0.002	0.037
Log Physical Capital per Worker	10.203	11.185	11.959	10.970	1.229
Human Capital	1.982	2.625	3.104	2.548	0.646
Log Real GDP per worker	9.431	10.183	10.829	10.056	0.947
Rule of Law	3	4	5	4.019	1.374
Private Credit over GDP	18.710	35.771	74.494	51.173	43.281
AvgObedChild (pooled regression)	-0.145	-0.028	0.095	-0.026	0.174
Industry variables					
Overall routineness (RT)	1.136	1.399	1.690	1.301	0.735
Cognitive routineness (RTC)	0.077	0.321	0.580	0.229	0.655
Manual routineness (RTM)	0.988	1.120	1.273	1.071	0.325
Overall routineness (RT, manuf. only)	1.255	1.419	1.703	1.462	0.431
Cognitive routineness (RTC, manuf. only)	0.101	0.325	0.581	0.333	0.439
Manual routineness (RTM, manuf. only)	1.031	1.127	1.289	1.129	0.277
Physical capital intensity	3.618	3.982	4.467	4.048	0.745
Skill intensity	-1.646	-1.427	-1.101	-1.375	0.405
Value-added over shipments	0.393	0.455	0.553	0.464	0.130

Notes: Based on the regression samples from Tables 2-4. The country variables are summarized over all country-year observations in the sample, while the industry variables are summarized over all 67 Ind6090 CIC industries (59 of which are in manufacturing).