HHS Public Access
Author manuscript
Soc Forces. Author manuscript; available in PMC 2018 September 01.

Published in final edited form as:
Soc Forces. 2017 September 1; 96(1): 215–238. doi:10.1093/sf/sox044.

Globalization and Contemporary Fertility Convergence

Arun S. Hendi
Duke University

Abstract

The rise of the global network of nation-states has precipitated social transformations throughout the world. This article examines the role of political and economic globalization in driving fertility convergence across countries between 1965 and 2009. While past research has typically conceptualized fertility change as a country-level process, this study instead employs a theoretical and methodological framework that examines differences in fertility between pairs of countries over time. Convergence in fertility between pairs of countries is hypothesized to result from increased cross-country connectedness and cross-national transmission of fertility-related schemas. I investigate the impact of various cross-country ties, including ties through bilateral trade, intergovernmental organizations, and regional trade blocs, on fertility convergence. I find that globalization acts as a form of social interaction to produce fertility convergence. There is significant heterogeneity in the effects of different cross-country ties. In particular, trade with rich model countries, joint participation in the UN and UNESCO, and joining a free trade agreement all contribute to fertility convergence between countries. Whereas the prevailing focus in fertility research has been on factors producing fertility declines, this analysis highlights specific mechanisms—trade and connectedness through organizations—leading to greater similarity in fertility across countries. Globalization is a process that propels the spread of culturally laden goods and schemas impinging on fertility, which in turn produces fertility convergence.

Introduction

The past half century produced immense changes in global organization, including rapid growth in international trade, regional integration, and participation of nation-states in intergovernmental organizations (IGOs) and agreements. Globalization forged links between individuals, communities, and nation-states, which in turn increased the cross-border flows of goods, services, information, technologies, and people. These new connections generated social change by bringing communities on opposite ends of the global network into contact with foreign concepts and cultures. This intensification of cross-national exchange led to the diffusion of many beliefs and practices, including the adoption of international standards (Guler, Guillén, and Macpherson 2002), democracy (Torfason and Ingram 2010; Wejnert

Correspondence to: Arun S. Hendi, Duke University Population Research Institute and Department of Sociology, Department of Sociology, Duke University, 276 Soc/Psych Building, Box 90088, 417 Chapel Dr., Durham, NC 27708-0088. Telephone: +302-690-7612; arun.hendi@duke.edu.

Supplementary Material
Supplementary material is available at *Social Forces* online, http://sf.oxfordjournals.org/.

2005), cultural practices (Kaufman and Patterson 2005), higher education (Schofer and Meyer 2005), and market-oriented reforms (Henisz, Zelner, and Guillén 2005).

Over this same time period, we also witnessed dramatic changes in fertility, with the majority of developing nations undergoing transitions from high to low fertility (McNicoll 1992). Much of the research on fertility has focused on how within-country changes drive fertility declines. The large body of work arising out of the modernization paradigm has documented the negative association between indicators of socioeconomic development and fertility (Hirschman 1994; McNicoll 1992; Notestein 1945). But globalization also has effects: the structure of the global economy and polity patterns the uptake of norms and schemas impinging on fertility. The extant literatures on networks and globalization have explored the pathways between the world polity and the adoption of national population policies (Barrett 1995; Barrett, Kurzman, and Shanahan 2010; Meyer 2000; Meyer et al. 1997); smaller networks (e.g., village gossip networks) and how they shape the development of local fertility norms (Kohler, Behrman, and Watkins 2001); and the adoption of family-oriented policies (Castles 2003). However, researchers have not yet examined the impact of political and economic globalization on fertility itself.

This paper contributes by examining how globalization structures fertility change across countries. Where prior studies have focused on changes in countries over time, I consider changes between and among pairs of countries that constitute the global network. In particular, I examine how trade between pairs of countries or joint membership in regional and intergovernmental organizations may act as mechanisms for fertility convergence. This approach can be generalized beyond fertility outcomes to study how exchange partners influence their neighbors. In both the theoretical framing and empirical analyses, I operationalize concepts from the Theory of Conjunctural Action introduced by Johnson-Hanks et al. (2011). The findings suggest that contemporary fertility convergence is partly driven by the normative diffusion of schematic and material structures through the global network of international organizations and trade. Bilateral trade, IGO ties, and regional trade blocs, three institutional arrangements seemingly irrelevant for fertility, thus structure fertility convergence across countries.

Fertility and Global Institutional Structure

Following the Second World War, nation-states throughout the world began to experience fertility declines. While developed Western countries had long since begun their fertility transitions, this was a new phenomenon for non-Western European countries and what we now call the developing world (Bongaarts and Watkins 1996). Demographers, sociologists, and economists were quick to notice the declines and theorized that the standard set of demographic transition theories offered the most likely explanation: these countries were modernizing and developing economically, and this transition to modernity in turn led to fertility declines (Notestein 1945). The 1970s and 1980s, however, introduced doubt. Fertility scholars began to suspect that the intersection of ideational and structural variables played a greater role than previously thought (Caldwell 1976; Mauldin and Berelson 1978; Watkins 1986, 1987). The general consensus among fertility scholars today is that classical socioeconomic and rational choice theories of fertility failed to account for the onset of fertility declines, producing inconsistent results at best (see Cleland and Wilson [1987]; Mason [1997]). Variables indexing development explained only part of the fertility declines. New theoretical frameworks stressed the role of ideational factors in explaining family change.

Theoretical models of diffusion, ideational fertility, and social interaction hold that individuals, communities, and nation-states interact with each other, spreading information, ideas, and technology regarding contraception and fertility ideals (Bongaarts and Watkins 1996; Knodel and van de Walle 1979; Thornton 2005). Diffused ideas and technologies are received and reinterpreted, gaining new meaning in different contexts and impelling or constraining actions pertaining to fertility choice. Studies have stressed the role of information and mass media in shaping thoughts regarding family limitation (Westoff and Koffman 2011).

Recently, these frameworks were unified by Johnson-Hanks et al. (2011) in their Theory of Conjunctural Action (TCA). TCA explains variation in fertility and family variables by considering the intersection of virtual and perceptible structures. The primary building blocks of TCA are “schemas” and “materials.” Schemas are unobserved mental maps or scripts, defined as “ways of perceiving and acting through which we make sense of the world and motivate our actions” (Johnson-Hanks et al. 2011, p. 2). They are created and altered over time through interaction, perception, and comprehension in a path-dependent process. Schemas thus reflect the social, psychological, and physical environments in which individuals and populations are embedded. Materials are “the objects, performances, and organizations that sediment schemas in the perceptible world” (p. 8). They instantiate schemas by introducing and enforcing them in the realm of social action. Structure is thus formed and reshaped by the interaction of existing schemas with the introduction of new material elements.

In the context of global fertility change, schemas are macro structures that emerge at the nation-state level. Nation-states are the domain of national culture and institution-building, so schemas reflect the symbolic elements, beliefs, and institutions of the nation-state. Schemas can change in the course of social interaction (Boli and Thomas 1999; Meyer et al. 1997; Thornton et al. 2012). Throughout the latter half of the twentieth century, nation-states were confronted with a series of conjunctures wherein they faced the prospect of increased interaction with other countries. Nation-states interact on the global stage through exposure to material elements like consumer goods, media, and national institutional arrangements. These material elements may directly affect family size, as in the case of contraceptive technology and family planning programs. But material exchange can also affect family size through its impact on schematic structures, which in turn are reflected in policy and social action. One example is the importation of foreign films and advertisements that depict two-child families. While these media may not directly cause people to have a certain family size, they can act through normative change to affect how people perceive family structure. Thus, in societies where family size was not a conscious consideration (i.e., it was “left up to God”), material exchange can reshape how people think about fertility and family limitation (van de Walle 1992). A second example deals with changing understanding of the life course: completing high school or college has become normative in many countries due to schematic change, and this in turn has led to delayed marriage and lower fertility.

Global institutions are the primary links between nation-states and thus are prime candidates for channels of social interaction and schematic diffusion. The global network refers to the set of nation-states, which are nodes in the network, connected to each other through various institutions and organizations embodying these institutions, including trade, regional blocs, and intergovernmental organizations and agreements. There is also a spatial aspect to the network—countries with similar characteristics like income or shared language are considered to be closer to each other. One can think of the global network as being embedded in a multidimensional space of characteristics of the countries (Berry, Guillén, and Hendi 2014). Participation in global institutions and the characteristics of nation-states are constantly evolving, path dependent, and mutually dependent. Increasing connectedness in the global network can result in greater exchange of materials and schemas that impinge on fertility. For example, figure 1 plots the total fertility rate and trade as a percentage of GDP for the whole world over the past half century, showing that not only do the two variables follow similar trajectories, but the concavities of the two graphs change at similar points in time. Changes in the intensity of trade occur at roughly the same times as changes in the intensity of the global fertility decline.

The logic of global capitalism and globalization more broadly have sustained interaction between nation-states built in, so diffusion of schemas through globalization is understood to be a long-term phenomenon. Thus, as nation-states become increasingly connected to the global network, their fertility rates become more similar to those of the nation-states to which they are connected. Globalization structures the global network, and thus determines which schemas and materials get taken up and where.

Trade, IGOs, and Regional Trade Blocs

The central question in this article is whether increased connectedness between two countries results in the convergence of their fertility rates. Convergence resulting from increased connectedness operates net of variables indexing development, like GDP per capita and trade openness. Thus this article employs a theoretical and methodological framework that seeks to capture the effect of connectedness net of such variables. We start with the axiom that connectedness is embodied in material exchange.

One specific vehicle for material exchange at the nation-state level is bilateral trade (Bongaarts and Watkins 1996). Bilateral trade is the exchange of goods and services across national borders. Modern macroeconomic theories predict that trade results in increasing fertility differentials between countries. Galor and Mountford (2006), for example, argue that countries respond to gains from trade differently, with some reinvesting in human capital and economic growth and others in population growth. This results in a delayed demographic transition for the latter group, thus producing divergence in fertility rates between the two types of countries. Conflict theories also predict divergence—for example, world-systems theory predicts that trade dependency concentrates women's employment in low-wage and informal labor markets, thus increasing the incentive for childbearing

(London 1988). These theories do not allow for trade to act as anything other than a driver of economic change—it has no social meaning.

By contrast, the TCA perspective would argue that beyond its pure economic effects, trade is a vehicle for the transmission of schematic structures embodied in material elements. Foreign goods and services often carry with them *normative* implications. A television show produced in a foreign country, for example, may depict families with two children or with mothers who work in the formal sector. A dubbed television program is therefore not only a form of entertainment—it can sometimes serve as a model of social, economic, or demographic behavior. Because trade is experienced at the micro level, its effects are direct and personal, compared to other forms of global interaction. Goods are not acultural. They come embedded with ideas that get reinterpreted in the receiving country context (McCracken 1986). These ideas embodied in materials need not be directly related to fertility. Images of mass consumption may have few direct connections with fertility, but in a developing country context they may produce fertility reductions because of perceived incompatibilities between high fertility and consumption of luxury goods. These indirect effects can eventually feedback to shape schemas. Even seemingly innocuous forms of trade might have an effect on fertility. Johnson-Hanks et al. (2011) provide the example of a sedan that can only accept two child car seats. Importing sedans may decrease the likelihood of a family having more than two children because of the limit to the number of children that can be seated in a sedan. In turn, this material element may fuel a feedback effect through normative change, causing transformations in national schemas that impinge on fertility. Normative change predicated on schematic diffusion leads to convergence. TCA thus produces the following generic prediction:

> *Hypothesis 1: Increased trade between two nation-states results in decreased differences in their fertility rates.*

This generic prediction, however, can be refined. Not all social interaction resulting from trade is created equally—interaction with more powerful or authoritative actors may produce greater adoption of schemas than interaction with weaker actors (Johnson-Hanks et al. 2011). This proposition has its origins in observations of elites made by demographers starting in the 1970s (Caldwell 2001; Luke and Watkins 2002; Mauldin and Berelson 1978; Nortman 1972). To a great extent, elites control the construal of schemas within nation-states. They live in globally connected cities, consume and produce images and stories in the mass media, control or manage industries, and are generally at the top of their countries' status hierarchies. Elites have become more connected to and cognizant of the global network over the past half century, and have thus adopted the goals and broad policies associated with socioeconomic development. In addition to pressuring the state and broader society for the enactment of prescriptions like the adoption of democracy and capitalism, national elites actively pursue policies to reduce fertility as a mode of development, for personal gain, and to procure foreign aid (Barrett and Tsui 1999; Luke and Watkins 2002). Elites in poorer countries look to rich countries as models. In the eyes of these elites, the fact that rich countries have low fertility legitimizes the script that fertility declines are a pathway to development. Fertility reductions and accompanying schemas are thus seen by national elites and ordinary citizens as necessary for gaining legitimacy on the world stage and for transitioning from being less to more developed (Thornton 2005; Thornton et al. 2012).

The specific actions of elites, including decreasing their own family size, increasing access to education and healthcare services, supporting family planning programs, and influencing media content, may differ across contexts, but what is relevant is the desire to develop and any type of related action. Performances, services, and consumption goods imported from rich countries carry with them schemas that impinge on fertility. For example, television programs imported from rich countries may become popular among the young and propagate schemas regarding living arrangements. Young single adults and married couples develop aspirations to live independently of their parents. The accompanying independence from parents may liberate young married couples from traditional gender roles and expectations, including women staying at home and early childbearing.

Globalization in the form of greater trade with rich countries increases the relevance of actors and actions external to the nation-state by amplifying their effect on national elites and ordinary citizens. From this perspective, as nation-states become increasingly connected to the global network through trade, they adopt the schemas and institutional forms of their rich and powerful trading partners. "Rich" in this context is a proxy for elite status among nation-states. These countries endorse fertility decline as a mode of development, dominate the attention space on the world stage, and possess and circulate norms relating to lower fertility. These norms are embedded in the goods and services originating from rich countries, which in turn are exported and thus spread ideas about lower fertility. The trade effect is independent of the effect of greater wealth leading to more trade—that is, the effect on fertility of greater trade with rich countries is net of GDP per capita. This refinement of Hypothesis 1 thus predicts:

> *Hypothesis 2: If a non-rich nation-state increases its imports from a rich nation-state, its fertility rate will move closer to the fertility rate of the rich nation-state.*

Regional trade blocs are organizations consisting of geographically proximate countries and are formed to increase trade and mutual understanding among member states. Trade blocs reduce tariffs and barriers to capital and labor flow among member states. In effect, they can divert trade by incentivizing trade with bloc members above trade with states outside the bloc (Krugman 1991). This results in social interaction becoming concentrated within the trade bloc relative to social interaction with nation-states outside the bloc. From the perspective of TCA, trade bloc formation would lead to increased material exchange and diffusion of fertility-related schemas within the bloc, thus reducing the differences in fertility rates between member countries. Global institution-building in the form of trade bloc formation results not only in increased within-bloc trade, but also in greater integration of policies relating to national economies. For example, trade blocs in Europe, the Caribbean, West and Central Africa, South America, Arabia, Southeast Asia, and Central America all allow for some form of visa-free travel, resulting in greater movement of people and ideas. Many of these blocs also instituted agreements that called for joint bargaining in global forums on matters of trade and defense. Trade blocs today are not only attempts to enhance trade, but they are also often efforts to increase solidarity and enforce regional scripts. They impose cohesion through normative influence. The third hypothesis is thus:

> *Hypothesis 3: If a nation-state joins a trade bloc, its fertility will move closer to the fertility of the members of the bloc.*

Similar to how the effect of trade on schematic change is asymmetric, some types of trade blocs may be more effective at promoting schematic diffusion than others. Trade blocs differ qualitatively from one another. Some blocs are free trade areas and allow for the free flow of goods and services, while common markets may additionally allow for the free movement of capital and labor. Still other trade blocs form monetary unions, sharing the same currency and monetary policy across member countries. One implication of TCA and theories of ideational fertility is that institutional structures that allow for greater material exchange have greater potential for affecting schemas. Free trade is thus the property of trade blocs most likely to result in schematic diffusion. While allowing for the free flow of labor and capital has the potential to intensify communication between labor migrants and their host countries, qualitative and historical accounts have shown otherwise (Castles and Miller 2009; Piore 1979). In practice, common markets act as attractors for cheap, unskilled labor, where the labor migrants tend to be exploited and segregated from the native population. Thus, common markets would not add much to schematic exchange, and may even lead to the opposite: divergence driven by reinforcement of current schemas. Common currencies and monetary policies also are not theorized to substantially increase schematic exchange. One possibility is that shared currency may help culturally unify members of the bloc, leading to greater uniformity in the types of goods consumed. Together, these arguments lead to the following prediction:

> *Hypothesis 4: Free trade is the most important trade bloc property for producing uniformity in fertility rates within regional trade blocs. Common markets and monetary unions will have weaker or no effects on uniformity of fertility within blocs.*

A third mechanism for the diffusion of fertility-related behaviors is communication through intergovernmental organizations, or IGOs. One key element of TCA is identity, or the perpetuation of a self-narrative, and its development through social interaction. Meyer (2000) describes identity and models of actor-hood in the global system of nation-states. From this perspective, IGOs help construct and communicate a common world culture among member states. Actors in this approach are nation-states. The rise of the global network was accompanied by widespread acceptance of global scripts for different dimensions of social, political, and economic life. Individuals and organizations both internal and external to the nation-state are theorized to compel actors to adopt legitimated models of actorhood, thus leading to conformity along cultural and policy dimensions.

In the context of fertility, positive assessments of low fertility derive from “common models of socioeconomic development” wherein limiting population growth is perceived as a necessary part of the path to development. Barrett (1995) describes the role of population experts who act through organizations like the United Nations (UN) to actively pursue fertility reductions in pre-transition societies. Fertility management is one of the UN Population Fund’s key goals (UN Population Fund 2012). IGOs have sponsored major conferences—Bucharest in 1974, Mexico City in 1984, and Cairo in 1994—all built on the idea that population growth and high fertility are impediments to development. These fertility and population growth goals were later coded as goals for women's empowerment. While the adopted models of actorhood may not correspond directly to actions aimed at achieving the outcome of lower fertility, fertility declines may still occur through associated mechanisms precipitated by the broader acceptance of these models. Models of later marriage or higher education may lead to delayed age at first birth, which in turn would drive down total fertility. The widespread adoption of higher education may reduce family size and is itself fostered by the world-culture spread through world polity ties. We therefore expect nation-states that are connected to each other through common membership in IGOs to participate in greater material and schematic exchange relating to these scripts, thus producing isomorphism through normative change. Fertility convergence directly follows from the IGOs' perpetuation of these scripts. This sets up the final hypothesis:

> *Hypothesis 5: The formation of IGO connections between a pair of nation-states will result in a lesser difference between the two countries' fertility rates.*

Much like the fertility effect of participation in a trade bloc depends on the properties of the bloc, the formation of IGO connections between countries may be weaker or stronger depending on whether the IGO communicates norms. Organizations like the UN or UNESCO may more directly communicate schemas relating to family size, whereas bodies like the WTO may not. We may thus expect stronger effects for IGOs that communicate schemas impinging on family size.

All five of these hypotheses represent manifestations of the same underlying process: the transfer of norms across national borders. But the mode of operation for each hypothesis is different. The effect of IGOs is top-down and thus less personal, whereas trade is more direct and thus more fully permeates all aspects of social life. We may therefore expect trade-related variables to have a greater impact on fertility convergence.

If found to be true, these hypotheses would suggest that the movement of schemas between countries is responsible for fertility convergence above and beyond the pure effect of economic development (since all the hypotheses are net of national income). This is consistent with theories that describe the spread of developmental idealism (Thornton et al. 2012) and the role of cross-national channels of communication in driving fertility change (Bongaarts and Watkins 1996). The underlying idea is that fertility change is culturally constituted, and that cultural change resulting from increased participation on the world stage drives fertility change.

Data

The empirical analysis uses panel data consisting of country-year records to generate dyad-level data. There are approximately 170 countries under analysis annually from 1965 to 2009. In a standard cross-country analysis, each row of the data would contain data on a particular country in a given year (country-years). In this analysis, each row contains data on a particular pair of countries in a given year. The unit of analysis is thus the dyad-year, representing two countries in a given year. If there were no missing data, the dataset would thus consist of $n(n-1) \times T$ observations, where n is the number of countries and T is the number of years in the data (see appendix A for details on the structure of the dataset). The outcome variable of interest is fertility, and it is measured using the period total fertility rate (TFR) for each country in each year. The period TFR can be interpreted as the number of children a woman could expect to have over her lifetime if current rates of childbearing prevailed and if she survived through the end of her reproductive years. These TFRs are taken from the World Bank's World Development Indicators database (WDI). TFR is a commonly used measure of fertility and is preferred to other measures because it has an intuitive interpretation and it is age standardized. Period fertility is the appropriate measure since the mechanism at play (schematic and material exchange) is theorized to operate in a period fashion. Furthermore, Ní Bhrolcháin (1992) showed that fertility declines within societies are simultaneously experienced by women of all childbearing ages. This period character of fertility decline implies that period TFR (as opposed to cohort TFR) is the more apt measure to use in studying fertility change. Data on countries' GDP per capita (in constant 2000 US dollars) and total trade as a percentage of GDP also come from the WDI. A country's trade partner is designated as rich if the trade partner has a GDP per capita of at least $12,500 in constant 2000 US dollars (roughly corresponding to the World Bank's definition of high-income countries). The "rich" indicator measures the potential for a country to act as a model for others.

The analysis also employs data on cross-country ties relating to bilateral trade and participation in global institutions. I obtained data from the Correlates of War (COW) project on participation in bilateral trade (Barbieri and Keshk 2012; Barbieri, Keshk, and Pollins 2009) and intergovernmental organizations (Pevehouse, Nordstrom, and Warnke 2004). These data contain entries that correspond to dyad-year pairs: each case in the dataset corresponds to a pair of countries in a given year (e.g., US–Indonesia 1982). Some of the entries included countries that no longer exist because of mergers with other countries or because of dissolution. The latter were listwise deleted. This should have minimal impact since only two countries posed this problem. Mergers, as in the case of East and West Germany, were handled by combining the constituent countries for pre-merger years. For example, total trade for the constructed Germany before merger would simply be the sum of total trade for East and West Germany. The final variable used in the regression analysis was constructed using the bilateral trade data and is equal to the percentage of total imports coming from each trade partner. This can be thought of as a "trade portfolio" variable.[1]

Six IGOs were selected for the analysis based on their size and capacity to effect global change: the World Bank; the World Trade Organization (WTO); the United Nations (UN); the UN Educational, Scientific, and Cultural Organization (UNESCO); the International Monetary Fund (IMF); and the World Health Organization (WHO). Eighteen major trade blocs recognized by the WTO and COW are included and are categorized into free trade agreements (FTAs), common markets, or monetary unions according to their stated policies (see appendix table B1). Indicators for single markets and political unions are excluded because these types of organizations are still relatively rare. Descriptive statistics for all variables used in this analysis are presented in table 1.

[1] I also estimated the models using bilateral trade as a percentage of GDP, which led to similar results and conclusions. I thus maintain the "trade portfolio" variable specification.

Missing data was not a severe problem with this dataset—the IGO and bilateral trade data were missing for relatively few cases. Fertility data was also near complete (less than 6 percent missingness). The TFRs are measured on a five-year basis and interpolated by the World Bank for years between measurements. Because fertility tends to move fairly smoothly and because this analysis is focused on trends, interpolation is unlikely to change the direction of regression coefficients and thus should not bias estimates. GDP per capita and trade as a percentage of GDP are missing for some countries in earlier years (closer to 1965) and for some less developed countries (less than 13 percent missingness). Given the relatively small number of missing cases, any observations with missing data were listwise deleted in this analysis.

Methods

I estimate the effect of the global network structure on fertility convergence by employing an autoregressive approach at the dyad-year level. Rather than using the country-year as the unit of analysis, this model focuses on dyad-years: a pair of countries in a given year. Diffusion is often conceptualized as a process through which goods, people, institutions, and ideas flow from one place to another, so measuring cross-country ties at the dyadic level is a natural choice. In this analysis, fertility convergence is modeled as a function of country-specific structural variables and dyadic ties. This regression model is therefore explicitly derived from the theoretical model described above.

Convergence is a dynamic phenomenon, and as such it is easy to incorrectly specify the ordering of events in the theoretical model and thus mistake the direction of causality in the statistical model. One way to overcome this potential misspecification problem is to estimate effects at different time lags and thus trace out the full dynamic response of fertility differences. This strategy, while theoretically appealing, is limiting when the time range of data is not exceptionally long. Instead, I adopt a lagged dependent variable (LDV) specification. The LDV allows us to interpret the estimated coefficients as the effect of changes in the independent variables—that is, the effect of new shocks to the structural and network variables. This is desirable since it precludes the ordering issues discussed above, allowing for interpretation of the parameters as effects of the independent variables on the dependent variable and not vice versa.

According to the theoretical model and hypotheses, the difference between any two countries' fertility rates in a given year is a function of the extent of bilateral trade and common membership in trade blocs and intergovernmental organizations. Rather than focusing only on year t variables, I assume that *all* past lags of all variables affect the outcome. In other words, I explicitly take into account the entire history of dyadic ties and control variables in the model. I assume that the relative importance of each variable changes in the same fashion over time. Formally, the model is specified as follows:

$$y_{i,j,t}=\delta_0+\gamma_1(\omega_0\tau_{ij1,t}n_{ij1,t} +\omega_1\tau_{ij1,t-1}n_{ij1,t-1} +\omega_2\tau_{ij1,t-2}n_{ij1,t-2} +\cdots)+\cdots+\gamma_K(\omega_0\tau_{ijK,t}n_{ijK,t} +\omega_1\tau_{ijK,t-1}n_{ijK,t-1} +\omega_2\tau_{ijK,t-2}n_{ijK,t-2} +\cdots)+\beta_1(\omega_0x_{1i,t} +\omega_1x_{1i,t-1}+\cdots)+\cdots+\beta_M(\omega_0x_{Mi,t} +\omega_1x_{Mi,t-1}+\cdots)+f_{ij}+u_{ijt} \quad (1)$$

where *i* refers to country *i*, *j* refers to country *j*, and *t* is the year. The outcome is the absolute difference between country *i*'s and *j*'s respective total fertility rates in year *t*. Since material and schematic diffusion reduce differences in countries' fertility rates, this is the appropriate outcome measure indicated by the theoretical model. The *k*th dyadic tie is represented by $n_{i,j,k,t}$, which equals 1 if countries *i* and *j* share the tie in year *t* and zero otherwise. For example, a given tie variable may represent whether countries *i* and *j* are connected through a free trade agreement or through common membership in the WHO. $\tau_{i,j,k,t}$ is a measure of the strength of tie *k* between countries *i* and *j* at time *t*. For membership in common organizations, the tie strength is standardized to equal 1. For dyadic relations where tie strength varies, $\tau_{i,j,k,t}$ is a measure of the volume or magnitude of the tie. For bilateral trade, for example, $\tau_{i,j,k,t}$ would be the proportion of country *i*'s total imports coming from country *j*. The $x_{mi,t}$ variables are controls specific to country *i* (e.g., GDP per capita). f_{ij} is a placeholder variable representing the sum of country *i*, country *j*, and dyad *i*, *j* fixed effects (note that this is the more general derivation, and fixed effects can be omitted without effect on the rest of the mathematics). These fixed effects sweep out factors that are time invariant after 1965. u_{ijt} is a mean-zero error term with constant variance. The ω_s terms ($s = 0,\ldots,\infty$) are weight parameters (between 0 and 1) indicating the relative importance of the *s*th lag of the variables.

Using some simplifying assumptions (see appendix A), equation (1) can be rewritten as

$$y_{i,j,t}=\boldsymbol{\alpha}+\boldsymbol{\omega}\cdot y_{i,j,t-1}+\boldsymbol{x}_{\boldsymbol{i},\boldsymbol{t}}^{\prime}\boldsymbol{\beta}+\sum_k\gamma_k\cdot\tau_{i,j,k,t}\cdot n_{i,j,k,t}+\boldsymbol{\mu}_i+\boldsymbol{\mu}_j+\boldsymbol{\mu}_{i,j}+\boldsymbol{\varepsilon}_{i,j,t}$$

where $\boldsymbol{x}_{i,t}$ is an *M*-dimensional vector of control variables specific to country *i*. ω is the autoregressive parameter (the first-order autoregressive functional form is derived following the simplifying assumptions in appendix A). The μ terms are fixed effects for country *i*, country *j*, and dyad *i*, *j*, respectively. They subsume time-invariant characteristics of countries and dyads, including variables like geographic adjacency, pre-1965 colonial history and linguistic similarity, and climate. The effects of these time-invariant variables aren't estimated, but are instead swept out of the regression via fixed effects to prevent confounding.

The main parameters of interest are the γ_k's, which measure the direction and magnitude of the effect of cross-country ties on fertility convergence. These parameters can be interpreted as the one-year effect of strengthening the tie by one unit. A negative sign indicates that the tie contributes to convergence in fertility levels. Convergence in this period is typically the result of a high-fertility country reducing its fertility relative to a low-fertility country, but nothing in the theoretical or empirical model requires fertility reduction. Indeed, there are several examples of countries attaining convergence by one country increasing its fertility. Slovenia and the Czech Republic experienced increases in fertility on the order of 0.25 children per woman after joining the European Union (EU), thus converging to other EU countries. Convergence and fertility decline are thus theoretically distinct phenomena, but overlap to a great degree in the study period.

This model is preferred to models based on country-year units of analysis because it takes cross-country relationships into account, and dyadic ties are the theoretical objects of interest.[2] One difficulty of this setup is that the estimator may be biased in small samples because of correlation between the lagged dependent variable and the error term. An instrumental variable strategy to overcome this potential bias is presented in appendix C.

Results

Figure 2 presents graphs of the IGO and regional trade bloc networks formed by countries in 1965 and 2005. The smaller circles (on the right of each graph) represent countries, the larger circles (on the left of each graph) represent IGOs and trade blocs, and the gray lines connecting the smaller and larger circles indicate that the country represented by the small circle has membership in the organization represented by the large circle. The six large circles located in the center of the left side of each graph are the IGOs, and the remaining large circles are the trade blocs. Two changes over time are apparent from these graphs. First, a greater number of countries have become connected to the IGOs. Second, countries have grown more interconnected through the formation of new trade blocs. In 1965, there were five major trade blocs, with a total of 30 countries connected to at least one of these blocs. By 2005, there were 15 trade blocs—a threefold increase—and 113 countries were members of at least one of these blocs. Beyond the organizational connectedness shown in the graphs, countries have also become more connected through trade. In 1965, the average country had 47 different trade partners. By 2005, this number had more than doubled to 99 trade partners. In short, countries have grown more interconnected through trade, IGOs, and trade blocs.

Tables 2 and 3 array the estimates of the autoregressive dyadic diffusion model described in the Methods section.[3] Each of the numbered columns represents a different regression specification. GDP per capita and trade openness are controlled for in all regressions. The first row of each table contains estimates for the lagged dependent variable (LDV) coefficient. The second row in table 2 shows the effect of bilateral trade ties on absolute TFR

[2]I present country-year-level estimates in appendix table B6 since they may be of interest to the reader. I omit them in the article since convergence is the theoretical object of interest, not absolute fertility rates.
[3]These estimates are based on a pooled OLS estimator. Fixed effects and GMM/IV fixed effects estimates are presented in appendix C as a robustness check and are not qualitatively different from the pooled OLS estimates.

differences. In table 3, the second and third rows decompose estimates for the effect of bilateral trade on the outcome into effects of trade with non-rich versus rich countries (from the importing country's perspective), respectively.[4] Rows 4 through 6 in table 3 show the coefficient estimates for variables representing different types of trade blocs. Finally, the last six rows in table 3 contain estimates that describe the effect of common IGO membership on the outcome. Negative coefficients are consistent with the hypotheses: they indicate that a network tie contributes to convergence (i.e., a decrease in the difference between the TFRs of two countries). Coefficient estimates for country-specific controls for GDP per capita and trade openness are not shown but are both negative and statistically significant in almost all regressions.

The first hypothesis predicted that bilateral trade is a form of social interaction—it acts as a vehicle for the diffusion of fertility-related schemas, so increased trade between two countries would produce convergence in fertility. Hypothesis 2 stated that this effect is highly asymmetric: rich countries exert convergent pressures on their non-rich trade partners' TFRs, whereas non-rich countries do not exert convergent pressures on non-rich countries. The effect of trade ties on rich countries is unspecified.

Regression 2 in table 2 shows a negative and statistically significant effect of trade (imports from country *j* as a percentage of country *i*'s total imports) on dyad-specific absolute differences in fertility. Trade between two countries is therefore associated with convergence in their TFRs. Thus, there appears to be support for the generic hypothesis 1, since increased trade relations appear to drive countries closer together in terms of their fertility rates (however, see appendix C, where this finding is shown to be sensitive to the model specification).

I find strong evidence in support of hypothesis 2. I specify a model with a three-way interaction between country *i*'s imports from country *j*, whether country *i* is rich, and whether country *j* is rich. The reported coefficients can be interpreted as the effect of a non-rich country increasing trade with a non-rich country or a rich country. The findings show that increased trade with a rich country results in fertility convergence (table 3, regressions 1 and 4). Increased trade with a non-rich country does not result in convergence. The estimates for regression 4 in table 3 indicate that a unit increase in the trade variable is associated with a year-over-year decline in the difference between the two countries' TFRs of 0.22 children per woman. This is a fairly sizable effect. Many less developed countries (LDCs) currently have TFRs in the range of four children per woman, so a 0.22 children per woman decrease in the TFR corresponds to a decrease of roughly 12 percent of the difference between a contemporary LDC's TFR and replacement-level fertility.[5] In summary, I find strong evidence in support of the hypothesis that bilateral trade with rich countries exerts convergent pressure on non-rich countries' fertility rates.

---

[4]These estimates are only from a non-rich country's perspective, since these are the countries relevant for hypothesis 2. The bilateral trade effects for rich countries are positive and statistically significant but are not shown here.

[5]This is an approximation since replacement-level fertility, defined as the TFR that would make the net reproductive rate (NRR) equal to 1, differs from country to country because of mortality differences. I use a TFR of 2.1 children per woman as an approximation.

Hypothesis 3 predicted that trade bloc participation, an institutionalized form of regional integration, is another channel of social interaction that facilitates fertility convergence. Furthermore, hypothesis 4 stated that free trade is the most important property of trade blocs in reducing differences in fertility across co-members of trade blocs. I analyzed three properties of trade blocs: whether or not the bloc supports free trade, whether it includes a common market agreement, and whether it is a monetary union. Of these, free trade is predicted to result in the greatest extent of convergence because it incorporates a deeper level of material exchange than the other two properties. Monetary unions are expected to exert the next greatest amount of convergence. Monetary coordination can be accompanied by increased uniformity in the types of goods and services consumed by member countries of the monetary union. However, the effect of this type of coordination on fertility should be sufficiently weaker than allowing for free trade. Common markets, which allow for the free flow of labor and capital, are theorized to have the weakest effect.

The regression estimates from table 3 provide support for hypotheses 3 and 4. Regressions 2 and 4 both show the same result: free trade agreements result in the greatest degree of convergence, while common markets result in fertility divergence. Monetary unions lie somewhere in between and yield divergence. While the relative ranking of the effects of these three types of blocs matches the hypotheses, the direction of the effects is somewhat surprising. All of the regressions indicate that common markets and, to a lesser extent, monetary unions result in a divergence of fertility levels between the two countries in the dyad. Taken together, these findings indicate that while regional integration can result in fertility convergence, distortive trade and labor policies may act against the free trade effect and hinder schematic and material diffusion. If one country in a dyad under common market policies is experiencing fertility declines, then restricting ideational diffusion in this manner may produce divergence in TFRs between the two countries. Joint monetary policies do not appear to produce convergence. These results highlight the importance of material exchange in driving fertility convergence, since free trade policies are the only properties of trade blocs examined in this analysis that produce convergence.

The final set of network ties I examine are common memberships in intergovernmental organizations. The third and fourth regressions in table 3 show that of the six IGO ties analyzed, two result in the reduction of fertility differences between countries. Bilateral ties through the UN and UNESCO both produce within-dyad convergence over time in TFRs. The UN, in particular, produces convergence at a quicker rate. In contrast to the other IGOs, the World Bank and the World Trade Organization fail to produce convergence. While joint participation in the WHO is associated with divergence, the magnitude of the effect is quite small. These results indicate the differential power of various IGOs to produce normative change relating to fertility at the global level.

Because of the dynamic nature of the estimated model, we can simulate fertility trajectories using stylized data and the estimates from table 3 (regression 4). Figure 3 presents four trajectories of absolute TFR differences simulated using various trade scenarios. Each trajectory is based on an imaginary country with a GDP per capita in 1960 of $300, which grows at an annual geometric rate of 6 percent. It joins the World Bank in 1967, the UN in 1962, the WHO in 1965, the IMF in 1980, the WTO/GATT in 1990, and UNESCO in 1963.

It joins a free trade agreement with a rich country in 1985. This made-up country starts with a TFR of 5.5 children per woman in 1960 and begins to engage in a trade relationship with a rich country in the same year. The rich country has a TFR in 1960 of 2.1 children per woman, which can roughly be considered “replacement-level” fertility. The absolute fertility difference between the two countries is allowed to change endogenously. There are four separate bilateral trade scenarios. The first (labeled T1 in figure 3) is that the country does not engage in any trade with the rich country (i.e., imports from the rich country are zero for the entire 1960–2009 period). In scenario T2, it linearly increases its imports from the rich country from 1 percent to 10 percent of total imports between 1960 and 2009. In T3, imports with the rich country increase from 1 percent to 20 percent. Finally, in trade trajectory T4, the made-up country increases its imports from 1 percent to 30 percent. T4 thus represents the greatest trade with a rich country scenario, whereas T1 represents the baseline case of no trade with a rich country.

Figure 3 plots the absolute TFR differences between the two countries according to each trade scenario. The T4 trajectory shows the greatest amount of convergence between the two countries. The absolute TFR difference starts at 3.4 children per woman in 1960 and declines to 0.20 children per woman by 2009. If we decrease the amount of trade with rich countries over time to only 10 percent (trajectory T2), the absolute fertility difference decreases from 3.4 to 1.3 children per woman. While this is smaller than the decline in the T4 trajectory, it still indicates a great degree of convergence: a decline in the absolute TFR difference of roughly 2.1 children per woman. If we restrict bilateral trade so that the first country doesn’t trade with a rich country at all, then we still see fertility convergence but not to as great a degree. The absolute TFR difference between the two countries decreases from 3.4 to 1.8 children per woman. This confirms the idea that trade is an important channel of social interaction that can lead to fertility changes. In the T2 and T4 scenarios (i.e., the lower and higher trade variants), bilateral trade accounts for roughly 26 percent and 50 percent of the convergence in fertility, respectively. The T1 results also underscore the fact that while trade and globalization are vital to understanding contemporary fertility transitions, they do not explain the entirety of fertility convergence. Table 4 shows the absolute and percent contributions to fertility convergence for each facet of globalization. Trade with rich countries, economic development, and participation in trade blocs all make contributions between 19 percent and 26 percent. Joint participation in the UN, UNESCO, and WHO contributes to 45 percent of convergence, but this is canceled out by the effect of participation in the WTO, IMF, and World Bank.

Discussion and Conclusion

This article employs a novel approach to highlight the importance of global institutions in mediating schematic and material exchange at the global level, thus driving change in nation-states’ fertility rates through normative influence. Trade and economic change do matter—just not in a purely economic manner. Classical theories of fertility decline emphasized countries’ transitions to modernity and the role of economic growth and development in driving fertility change (Notestein 1945). Recent work has moved in another direction, offering up the hypothesis that ideational diffusion is what really matters (Bongaarts and Watkins 1996; Cleland and Wilson 1987; Thornton 2001, 2005). This article confirms that elements of both are true: beyond its pure economic effects, global institution-building is a social process. It is a form of social interaction, and it embodies material and schematic diffusion. People, states, and societies take cues from materials circulated through trade and global institutions and reshape their schemas that impinge on fertility accordingly. Even after controlling for path dependence in fertility differences, national income, dyad fixed effects (including factors like colonial history, linguistic similarity, and geographic proximity), and trade openness, I find that joint participation in free trade agreements, the UN, and UNESCO, and trading with a rich country, lead to reduced fertility differences between the two countries. The trade effect is asymmetric, with non-rich nation-states converging with rich nation-states in the global network.

Entry into IGOs like the UN that promote global scripts impinging on fertility yields convergence in fertility rates, whereas entry into IGOs that do not directly deal with fertility-related schemas, like the WTO, does not. Free trade agreements lead to fertility convergence, whereas common markets and monetary unions yield divergence. The year-over-year magnitude of these effects, while still sizeable, is somewhat smaller than the trade effect. This may indicate the greater power of trade, which is a more direct form of social interaction, to effect fertility change compared to other institutions that are out of the hands of the average person. Trade is something that effects change on a much more personal level. Unlike with IGOs, people (whether knowingly or not) participate in trade daily and thus are directly exposed to this powerful channel of social interaction. One important qualification is that global network connections are not the only factors that explain fertility change; rather, globalization is one factor that has played an important role in affecting schemas that impinge on fertility.

These results confirm the macro-level mechanisms theorized by Bongaarts and Watkins (1996), Caldwell (2001), and Johnson-Hanks et al. (2011), among others, who write that globalization can lead to fertility transitions through development and a variety of international linkages or channels of communication. All of the hypotheses tested in this article are consistent with the idea that normative isomorphic pressures are at work in driving fertility convergence. The above results relating to trade with rich countries and participation in certain IGOs and trade blocs are thus in accord with recent findings that developmental idealism is widespread in both developing and developed countries (Thornton et al. 2012). However, these results also show that some organizations communicate norms, while others may not. The formation or strengthening of some types of institutional ties does not lead to convergence. Ties through monetary organizations do not appear to yield convergence. Trade has varied effects depending on the nature of the trade relationship, indicating a limit to the ability of global ties to produce convergence. This article provides support for the Theory of Conjunctural Action as a framework for studying fertility change. It tests and refines aspects of TCA: we learned that on the global level, diffusion through trade is directed, with non-rich countries adopting the fertility characteristics of rich countries, albeit through different means. Studying the relationship between globalization and fertility is important because we do not yet know whether the global fertility transition was initiated by the same forces for many countries, or if there were different mechanisms for different countries. Because the growth of the global network coincided with the worldwide fertility transition, globalization is a strong candidate as a vehicle for the spread of fertility declines internationally (Caldwell 2001).

In terms of policy, one might be tempted to interpret these results as prescribing increased trade between rich and poor countries to facilitate fertility convergence. This is a mistaken construal of the above results, since it does not take into account the fact that trade is, to a great extent, a voluntary exchange. People and nation-states do not blindly accept the constraints of structure. Rather, they are social actors with agency who actively take part in defining their interaction on the global stage. While carefully fostering a trade relationship might yield convergence, forcing a developing country into a trade relationship is unlikely to result in fertility convergence. In other words, these results may not be externally valid. There are also examples of countries that commenced fertility transitions seemingly independent of trade ties (for example, Iran in the 1980s). What these results do say is that fertility change seems to have been partially patterned by the process of integration into the global economy and polity.

The findings presented here suggest that further work should be undertaken on the linkages between cross-national ties and social processes. This type of analysis can be extended to the study of other types of change, like political views, and how they are shaped by the norms of neighbors and trade partners. This would be particularly interesting for cases where a global norm is less clearly established. Future studies can also examine the content of cultural products that move across borders. For example, one could analyze whether popular television programs or movies imported into countries have increasingly depicted smaller families over time. Bollywood films, which have gained a large following in South Asia, the Middle East, and Africa, used to depict larger, rural-dwelling families, but increasingly depict urban-dwelling, car-driving couples with zero to three children. On the other hand, cars have been getting larger over time and several American TV shows have depicted mega-families with 15 or more family members. By coding the content of cultural items, researchers can make progress in connecting change in content of globally circulated goods to change in family size. Finally, TCA emphasizes the fact that the distribution of schemas across social space is uneven. Empirical studies should therefore also consider how globalization may drive inequality in fertility outcomes within countries. Most importantly, future studies should consider the interaction of material and schematic structures rather than considering each in isolation.

Acknowledgments

This work was supported by the National Institute on Aging [T32 AG000177] and the National Institute of Child Health and Human Development [T32 HD007242]. Thanks to the anonymous reviewers, Irma Elo, Mauro Guillén, Michel Guillot, Emily Hannum, Kristen Harknett, Jessica Ho, Hans-Peter Kohler, Aart Liefbroer, Steven Martin, Jim Moody, Kelly Musick, Sam Preston, Herb Smith, and attendees of the 2013 Etienne Van de Walle Prize colloquium for encouragement, helpful comments, and suggestions on earlier versions of this paper.

APPENDIX A: Structure of Dataset, Derivation of Model, and Estimation

Structure of Dataset

The dataset for this analysis consists of dyad-years: that is, each row in the data is a particular pair of countries in a given year (e.g., Indonesia-U.S. 1982). Consider the example data extract below. There are seven countries in the year 2002 for which we have data on fertility, national income, and WTO membership. Our outcome variable is the absolute value of the difference between two countries' fertility rates. For India and Indonesia in 2002, the absolute difference in fertility is $|2.99 - 2.39| = 0.61$ (due to rounding). We are interested in the effect of country 1's GDP per capita on the countries' absolute TFR difference. India's 2002 GDP per capita is 479. Finally, we are interested in the effect of the countries' joint membership in the WTO on the outcome variable. Both India and Indonesia were in the WTO as of 2002. We can thus use the Country-Year Data table below to produce the Dyad-Year Data table.

Country-Year Data

Country	Year	Total Fertility Rate	GDP per capita	WTO membership
India	2002	2.99	479	1
Indonesia	2002	2.39	816	1
Iran	2002	2.00	1680	0
Iraq	2002	5.15	871	0
Ireland	2002	1.97	27518	1
Israel	2002	2.89	18853	1
Italy	2002	1.27	19764	1

Dyad-Year Data

Country 1	Country 2	Year	TFR Difference	1's GDP p.c.	Both in WTO
India	Indonesia	2002	0.61	479	1
India	Iran	2002	1.00	479	0
India	Iraq	2002	2.16	479	0
India	Ireland	2002	1.02	479	1
India	Israel	2002	0.10	479	1
India	Italy	2002	1.72	479	1
Indonesia	India	2002	0.61	816	1
Indonesia	Iran	2002	0.39	816	0
Indonesia	Iraq	2002	2.76	816	0
Indonesia	Ireland	2002	0.42	816	1
Indonesia	Israel	2002	0.50	816	1
Indonesia	Italy	2002	1.12	816	1

Derivation of Model

Equation (1) can be written more compactly as

$$y_{i,j,t}=\delta_0+\sum_{k=1}^{k}\gamma_k\sum_{s=0}^{\infty}\omega_s\tau_{ijk,t-s}n_{ijk,t-s}+\sum_{m=1}^{M}\beta_m\sum_{s=0}^{\infty}\omega_s\chi_{mi,t-s}+f_{ij}+u_{ijt}$$

where k is an index for cross-country ties that ranges from 1 to K, since there are K different ties under consideration (bilateral trade, common membership in a regional bloc, common membership in an IGO, etc).

This model has an infinite number of parameters and thus is not parametrically identified. I impose the following restriction to reduce the dimensionality of the parameter space: $\omega_s = \omega^s$, where $\omega \in (0,1)$. This is one way to formalize the assumption that older lags of variables are less important in explaining current outcomes (that is, more recent values are given greater weight). Using the lag operator L (the operator such that for any time series $\{X_t\}$ and any nonnegative integer s, $L^s X_t = X_{t-s}$), we can now write the model as:

$$y_{i,j,t}=\delta_0+\sum_{k=1}^{K}\gamma_k\frac{1}{1-\omega L}\tau_{ijk,t}\cdot n_{ijk,t}+\sum_{m=1}^{M}\beta_m\frac{1}{1-\omega L}x_{mi,t}+f_{ij}+u_{ijt}$$

where $\frac{1}{1-\omega L}$ represents the infinite-order lag polynomial $\sum_{s=0}^{\infty}\omega^s L^s$. Multiplying the equation by $1-\omega L$ and rearranging terms yields:

$$y_{i,j,t}=\delta_0(1-\omega)+\omega\cdot y_{i,j,t-1}+\sum_{k=1}^{K}\gamma_k\tau_{ijk,t}\cdot n_{ijk,t}+\sum_{m=1}^{M}\beta_m x_{mi,t}+(1-\omega)f_{ij}+(u_{ijt}-\omega\cdot u_{ij,t-1}).$$

This can be rewritten as:

$$y_{i,j,t}=\alpha+\omega\cdot y_{i,j,t-1}+\boldsymbol{x}_{\boldsymbol{i},\boldsymbol{t}}^{\prime}\boldsymbol{\beta}+\sum_{k}\gamma_k\cdot\tau_{i,j,k,t}\cdot n_{i,j,k,t}+\mu_i+\mu_j+\mu_{i,j}+\varepsilon_{i,j,t}$$

where $\mathbf{x}_{i,t}$ is a vector of the $x_{mi,t}$ variables, the μ variables are country i, country j, and dyad i, j fixed effects, and $\varepsilon_{i,j,t}$ is the error term.

Estimation

One can use the Newey-West estimator (Newey and West 1987) to account for potential autocorrelation and heteroskedasticity in the error terms. In Stata 12.1, this can be accomplished using the in-built **newey** command with the lag option. I specify a lag length of 3 for all estimates. The fixed effects version of this model can be estimated using the **xtivreg2** Stata command with the fe, robust, and bw options. In this paper, I specified a bandwidth of 3 and use the default Bartlett (Newey-West) kernel. To estimate the IV-fixed effects model, one can use the **xtivreg2** command and specify that the lagged exogenous variables are the excluded instruments. One can also use the gmm option to implement a two-step feasible efficient GMM estimator.

APPENDIX B. Supplementary Tables

Table B1

Trade Bloc Classifications

Type of Bloc	Names of Blocs
Free Trade Area	Andean Community, Association of Southeast Asian Nations (ASEAN), Caribbean Community (CARICOM), Caribbean Free Trade Association (CARIFTA), Central European Free Trade Agreement (CEFTA), Common Market for Eastern and Southern Africa (COMESA), Customs and Economic Union of Central Africa (UDEAC), East African Community (EACM), East Caribbean Common Market (ECCM), Economic and Monetary Union of Central Africa (CEMAC), Economic Community of Central African States (ECCAS), European Free Trade Association (EFTA), European Union (EU), Latin American Free Trade Association (LAFTA), Mercosur, Monetary Union of Central Africa (UMAC), North American Free Trade Agreement (NAFTA), South Asian Association for Regional Cooperation (SAARC), Southern African Customs Union (SACU), West African Economic and Monetary Union (UEMOA), West African Monetary Union (UMOA)
Common Market	Association of Southeast Asian Nations (ASEAN), Common Market for Eastern and Southern Africa (COMESA), East African Community (EACM), East Caribbean Common Market (ECCM), European Union (EU), Mercosur
Monetary Union	Caribbean Community (CARICOM), Economic and Monetary Union of Central Africa (CEMAC), Euro Area (Eurozone), Monetary Union of Central Africa (UMAC), West African Economic and Monetary Union (UEMOA), West African Monetary Union (UMOA)

Table B2

Fixed Effects Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)
LDV	0.984*** (0.000261)	0.984*** (0.000261)
Bilateral Trade		0.0642*** (0.0109)
N	801086	801086

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < .05$

** $p < .01$

*** $p < .001$

Table B3

Fixed Effects Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)	(3)	(4)
LDV	0.984*** (0.000261)	0.984*** (0.000261)	0.981*** (0.000315)	0.981*** (0.000315)
Bilateral Trade				
Not Rich/Not Rich	0.102*** (0.0122)			0.122*** (0.0148)

	(1)	(2)	(3)	(4)
Not Rich/Rich	−0.0349* (0.0162)			−0.0533** (0.0186)
Trade Blocs				
Common Market		0.0349*** (0.00300)		0.0417*** (0.00327)
Free Trade Area		−0.0238*** (0.00278)		−0.0229*** (0.00302)
Monetary Union		0.0283*** (0.00363)		0.0293*** (0.00487)
IGOs				
World Bank			0.00636* (0.00255)	0.00651* (0.00255)
UN			−0.0252*** (0.00252)	−0.0255*** (0.00252)
WHO			−0.0202*** (0.00395)	−0.0200*** (0.00395)
IMF			−0.00499* (0.00248)	−0.00500* (0.00248)
UNESCO			−0.00713*** (0.00105)	−0.00714*** (0.00105)
WTO			0.0243*** (0.000674)	0.0244*** (0.000674)
N	801086	801086	671957	671957

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < .05$

** $p < .01$

*** $p < .001$

Table B4

IV-Fixed Effects Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)
LDV	0.951*** (0.00664)	0.961*** (0.00587)
Bilateral Trade		0.111*** (0.0159)
N	793980	793980

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < .05$

** $p < .01$

*** $p < .001$

Table B5

IV-Fixed Effects Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)	(3)	(4)
LDV	0.976 *** (0.00563)	0.977 *** (0.00562)	1.050 *** (0.00488)	1.050 *** (0.00459)
Bilateral Trade				
Not Rich/Not Rich	0.116 *** (0.0157)			0.0290 (0.0168)
Not Rich/Rich	−0.0164 (0.0212)			−0.202 *** (0.0214)
Trade Blocs				
Common Market		0.0365 *** (0.00313)		0.0295 *** (0.00372)
Free Trade Area		−0.0239 *** (0.00280)		−0.0252 *** (0.00335)
Monetary Union		0.0282 *** (0.00370)		0.0400 *** (0.00514)
IGOs				
World Bank			0.0274 *** (0.00323)	0.0277 *** (0.00319)
UN			−0.0226 *** (0.00280)	−0.0227 *** (0.00280)
WHO			−0.0107 ** (0.00396)	−0.0106 ** (0.00396)
IMF			−0.00374 (0.00283)	−0.00381 (0.00284)
UNESCO			−0.0117 *** (0.00119)	−0.0116 *** (0.00119)
WTO			0.0158 *** (0.000836)	0.0159 *** (0.000826)
N	793980	793980	657296	657296

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < .05$

** $p < .01$

*** $p < .001$

Table B6

Country-Level IV-Fixed Effects Regression of Total Fertility Rate on Indicators of Globalization

	(1)
LDV	1.004 *** (0.002)
Bilateral Trade	

	(1)
Not Rich/Not Rich	−0.045** (0.016)
Not Rich/Rich	−0.086*** (0.015)
Participation in Any Regional Trade Bloc	−0.014* (0.006)
Participation in Any IGO	−0.086*** (0.023)
N	3538

Note: Heteroskedasticity and autocorrelation consistent standard errors in parentheses. All tests are two-tailed and HAC standard errors are in parentheses. LDV stands for Lagged Dependent Variable. The model controls for GDP per capita and trade openness of country *i*.

* $p < .05$

** $p < .01$

*** $p < .001$

APPENDIX C. Robustness of Results

These results can be interpreted as showing that global institutional change in its many forms is an important channel of social interaction that drives fertility diffusion. In particular, bilateral trade with rich countries promoted a great degree of convergence.

There are other possible interpretations. One might argue that these results tell us that free market orientation is what matters, not necessarily trade itself. Countries that are more free market-oriented, as the argument goes, are also more likely to converge with their exchange partners. While this is certainly a possibility, I have controlled for trade as a percentage of GDP, which is a measure of trade openness and free market orientation. Another possible explanation is that ideational diffusion isn't occurring at all—rather, as trade expands, populations are exposed to a greater number of luxury goods and consumption of these luxury goods is incompatible with high fertility. This is not incompatible with the theoretical predictions outlined in the main text. Nevertheless, it is unlikely this is the case. If the trade variables employed in this analysis were in absolute terms, this could be a possible explanation. However, the bilateral trade variables are defined as a percentage of total trade, so they only contain information on the relative strength of trade ties with a particular country. This same logic precludes the explanation that fertility change might be occurring alongside trade because expanded trade allows for changes in labor demand, which in turn would drive fertility change. A fourth possible explanation for these results is that they don't measure the effect of social interaction at all, and that they actually measure the effect of socioeconomic development. While development has shown to be a strong correlate of fertility in prior research, the model specification adjusts for GDP per capita, which is the most commonly-used measure of development. It is therefore unlikely that the trade and IGO results are being driven by trends in development or free market orientation. Finally, as stated above, economic and political globalization is not the only factor that drives global fertility change but should be recognized as part of the process.

While the diffusion model estimates shown in Table 3 indicate that certain types of global ties produce convergence in fertility, they must be interpreted with caution. These estimates are sensitive to the model specification, and thus are only correct insofar as the assumed model is correct. One potential problem is that the error terms in the model may be correlated over time. I account for this possibility by estimating heteroskedasticity and autocorrelation consistent (HAC) standard errors based on a lag length of 3 years (Newey and West 1987). All standard errors in Tables 2 and 3 and Appendix Tables B2 through B5 are thus adjusted for potential serial correlation.

Another difficulty is the possibility that there are unobserved factors influencing the dependent variable. If these unobserved variables are correlated with the other explanatory variables, then the pooled OLS estimates in Tables 2 and 3 may be biased. While it is possible that important variables have been omitted from this analysis,[1] I employ dyad and country-specific fixed effects to sweep out any of these variables that are time-invariant. These variables include such factors as colonial history, geographic proximity, linguistic similarity, and time-invariant cultural affinities. Fixed-effects estimates are shown in Appendix Tables B2 and B3. The fixed effects estimates do not differ substantially from the pooled OLS estimates, indicating that the pooled OLS results are robust.

The fixed effects estimates, however, may still be biased since the lagged dependent variable is correlated with the error term. I account for this possibility by estimating an instrumental variable (IV) fixed effects model, where lagged values of the explanatory variables act as instruments for the LDV. These estimates are shown in Appendix Tables B4 and B5 and are not very different from the pooled OLS results. Two differences between the IV-fixed effects and the pooled OLS estimates are that in the former, the effects of joint participation in the WHO and the IMF change signs. Joint participation in WHO now results in convergence, whereas joint participation in the IMF no longer has a statistically significant effect. Another major difference is shown in Table B4: the effect of generic bilateral trade ties now results in divergence as opposed to convergence. The effect of trade thus leads in general to divergence, and only produces convergence when a non-rich country imports from a rich country. We therefore find mixed evidence for hypothesis 1, but strong evidence in favor of hypothesis 2. The remaining parameter estimates (in particular, the effect of bilateral trade with a rich country) match closely with the pooled OLS estimates and thus increase our confidence in these results.

Because nation-states came into and went out of existence between 1965 and 2009, country mergers and dissolutions were dealt with through combination of data and listwise deletion, respectively. Since the number of mergers and dissolutions was small, the decision about how to treat these events is unlikely to affect the results. Nevertheless, as a robustness check for mergers, any countries that eventually merged with each other (e.g., East and West Germany) were listwise deleted, showing no qualitative difference from the combined data results (i.e., the results based on collapsing East and West Germany into one country prior to

[1]Note that I do not control for more proximate determinants of fertility like education, contraceptive prevalence, or family planning programs. This is by design, since the aim of this study is to understand what global factors have led to fertility convergence. The aforementioned proximate variables are mechanisms resulting from globalization, and thus lie along the causal pathway between global institutions and fertility.

German reunification). For dissolutions, keeping former nation-states in the analysis (subject to data availability) did not have any appreciable effect on the results.

One final potential issue with this analysis is the arbitrary cutoff for what value of GDP per capita defines a country as "rich." The cutoff used in this article is $12,500, but it is arguable whether this value is too high or too low. As a robustness check, I explore higher and lower cutoffs (ranging between $9,266 and $20,000) for whether or not a country is rich and find that the results are robust to this cutoff specification.

Biography

Arun s. Hendi is a postdoctoral fellow in the Population Research Institute and Department of Sociology at Duke University. His current research examines how improvements in social conditions have narrowed the US black-white life expectancy gap, causes of the recent US mortality stagnation, and the role of availability of potential spouses in driving racial divergences in marriage. His publications have appeared in *Demography*, the *American Journal of Public Health*, and the *International Journal of Epidemiology*.

References

Barbieri, K., Keshk, O. Correlates of War Project Trade Data Set Codebook, Version 3.0. 2012. Available at http://correlatesofwar.org

Barbieri K, Keshk OMG, Pollins B. TRADING DATA: Evaluating Our Assumptions and Coding Rules. Conflict Management and Peace Science. 2009; 26(5):471–91.

Barrett, DA. PhD dissertation. Department of Sociology, Stanford University; 1995. Reproducing Persons as a Global Concern: The Making of an Institution.

Barrett D, Kurzman D, Shanahan S. For Export Only: Diffusion Professionals and Population Policy. Social Forces. 2010; 88(3):1183–1208.

Barrett DA, Tsui AO. Policy as Symbolic Statement: International Response to National Population Policies. Social Forces. 1999; 78(1):213–33.

Berry H, Guillén MF, Hendi AS. Is There Convergence across Countries? A Spatial Approach. Journal of International Business Studies. 2014; 45:387–404. [PubMed: 25580035]

Boli, J., Thomas, GM. Constructing World Culture: International Non-Governmental Organizations Since 1875. Stanford, CA: Stanford University Press; 1999.

Bongaarts J, Watkins SC. Social Interactions and Contemporary Fertility Transitions. Population and Development Review. 1996; 22(4):639–82.

Caldwell JC. Toward a Restatement of Demographic Transition Theory. Population and Development Review. 1976; 2(3):321–66.

Caldwell JC. The Globalization of Fertility Behavior. Population and Development Review. 2001; 27:93–115.

Castles FG. The World Turned Upside Down: Below Replacement Fertility, Changing Preferences and Family-Friendly Public Policy in 21 OECD Countries. Journal of European Social Policy. 2003; 13(3):209–27.

Castles, S., Miller, MJ. The Age of Migration. New York: Guilford Press; 2009.

Cleland J, Wilson C. Demand Theories of the Fertility Transition: An Iconoclastic View. Population Studies. 1987; 41(1):5–30.

Galor O, Mountford A. Trade and the Great Divergence: The Family Connection. American Economic Review. 2006; 96(2):299–303.

Guler I, Guillén MF, Macpherson JM. Global Competition, Institutions, and the Diffusion of Organizational Practices: The International Spread of ISO 9000 Quality Certificates. Administrative Science Quarterly. 2002; 47(2):207–32.

Henisz WJ, Zelner BA, Guillén MF. The Worldwide Diffusion of Market-Oriented Infrastructure Reform, 1977–1999. American Sociological Review. 2005; 70(6):871–97.

Hirschman C. Why Fertility Changes. Annual Review of Sociology. 1994; 20:203–33.

Johnson-Hanks, JA., Morgan, SP., Bachrach, CA., Kohler, HP. Understanding Family Change and Variation: Toward a Theory of Conjunctural Action. New York: Springer; 2011.

Kaufman J, Patterson O. Cross-National Cultural Diffusion: The Global Spread of Cricket. American Sociological Review. 2005; 70(1):82–110.

Knodel J, van de Walle E. Lessons from the Past: Policy Implications of Historical Fertility Studies. Population and Development Review. 1979; 5(2):217–45.

Kohler HP, Behrman JR, Watkins SC. The Density of Social Networks and Fertility Decisions: Evidence from South Nyanza District, Kenya. Demography. 2001; 38(1):43–58. [PubMed: 11227844]

Krugman P. The Move Toward Free Trade Zones. Economic Review. 1991 Nov-Dec;:5–25.

London B. Dependence, Distorted Development, and Fertility Trends in Noncore Nations: A Structural Analysis of Cross-National Data. American Sociological Review. 1988; 53(4):606–18.

Luke N, Watkins SC. Reactions of Developing-Country Elites to International Population Policy. Population and Development Review. 2002; 28(4):707–33.

Mason KO. Explaining Fertility Transitions. Demography. 1997; 34(4):443–54. [PubMed: 9545624]

Mauldin WP, Berelson B. Conditions of Fertility Decline in Developing Countries, 1965–75. Studies in Family Planning. 1978; 9(5):89–147.

McCracken G. Culture and Consumption: A Theoretical Account of the Structure and Movement of the Cultural Meaning of Consumer Goods. Journal of Consumer Research. 1986; 13(1):71–84.

McNicoll G. Changing Fertility Patterns and Policies in the Third World. Annual Review of Sociology. 1992; 18:85–108.

Meyer JW. Globalization: Sources and Effects on National States and Societies. International Sociology. 2000; 15(2):233–48.

Meyer JW, Boli J, Thomas GM, Ramirez FO. World Society and the Nation-State. American Journal of Sociology. 1997; 103(1):44–181.

Ní Bhrolcháin M. Period Paramount? A Critique of the Cohort Approach to Fertility. Population and Development Review. 1992; 18(4):599–629.

Nortman DL. Status of National Family Planning Programmes of Developing Countries in Relation to Demographic Targets. Population Studies. 1972; 26(1):5–18. [PubMed: 22070172]

Notestein, FW. Population—The Long View. In: Schultz, Theodore W., editor. Food for the World. Chicago: University of Chicago Press; 1945. p. 36-57.

Pevehouse JC, Nordstrom T, Warnke K. The COW-2 International Organizations Dataset Version 2.0. Conflict Management and Peace Science. 2004; 21(2):101–19.

Piore, MJ. Birds of Passage. New York: Cambridge University Press; 1979.

Schofer E, Meyer JW. The Worldwide Expansion of Higher Education in the Twentieth Century. American Sociological Review. 2005; 70(6):898–920.

Thornton A. The Developmental Paradigm, Reading History Sideways, and Family Change. Demography. 2001; 38(4):449–65. [PubMed: 11723944]

Thornton, A. Reading History Sideways: The Fallacy and Enduring Impact of the Developmental Paradigm on Family Life. Chicago: University of Chicago Press; 2005.

Thornton A, Binstock G, Yount KM, et al. International Fertility Change: New Data and Insights from the Developmental Idealism Framework. Demography. 2012; 49(2):677–98. [PubMed: 22403035]

Torfason MT, Ingram P. The Global Rise of Democracy: A Network Account. American Sociological Review. 2010; 75(3):355–77.

United Nations Population Fund. State of World Population 2012. New York: UNFPA; 2012.

van de Walle E. Fertility Transition, Conscious Choice, and Numeracy. Demography. 1992; 29(4):487–502. [PubMed: 1483538]

Watkins, SC. Conclusions. In: Coale, Ansley J., Watkins, Susan C., editors. The Decline of Fertility in Europe. Princeton, NJ: Princeton University Press; 1986. p. 420-450.

Watkins SC. The Fertility Transition: Europe and the Third World Compared. Sociological Forum. 1987; 2(4):645–73.

Wejnert B. Diffusion, Development, and Democracy, 1800–1999. American Sociological Review. 2005; 70(1):53–81.

Westoff CF, Koffman DA. The Association of Television and Radio with Reproductive Behavior. Population and Development Review. 2011; 37(4):749–59. [PubMed: 22319772]

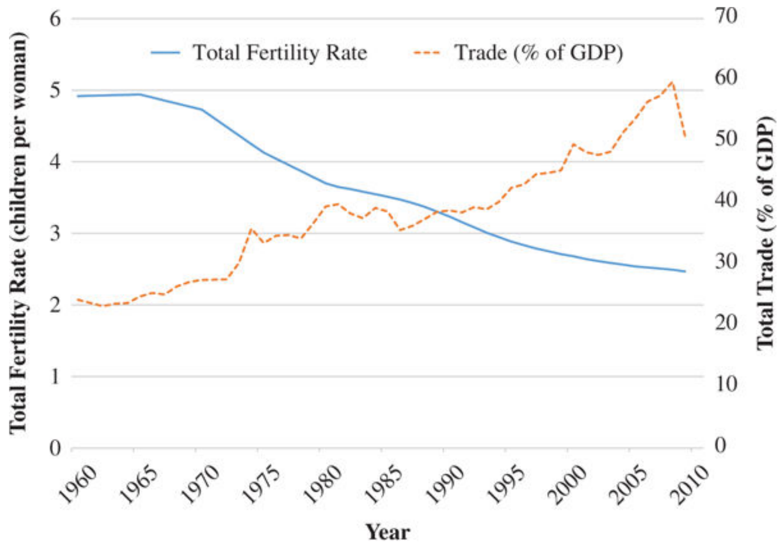

Figure 1. World total fertility rate and total trade, 1960–2009

Source: World Bank World Development Indicators.

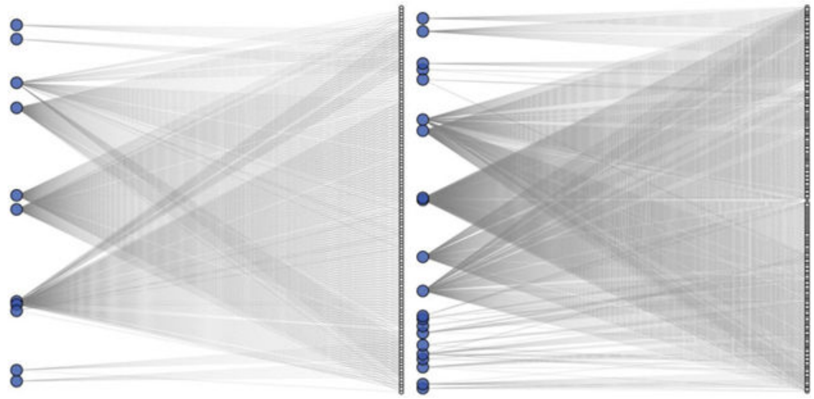

Figure 2. Network graph of countries' membership in intergovernmental organizations and regional trade blocs, 1965 and 2005

Note: The smaller (right of each graph) and larger (left of each graph) circles represent countries and organizations, respectively. The gray lines between the small and large circles indicate that a country is a member of a particular IGO or trade bloc in that year.

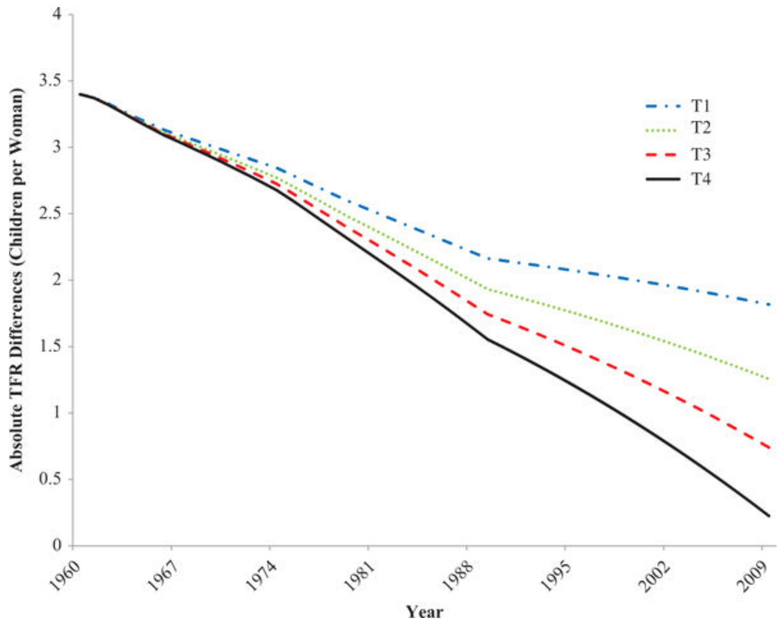

Figure 3. Simulated trajectories of absolute TFR differences, 1960–2009

Note: T1 through T4 represent four different stylized bilateral trade trajectories, where T4 is the scenario where the most trade occurs and T1 is the scenario where zero trade occurs. T2 and T3 are intermediate scenarios.

Source: Author's calculations based on regression 4 in table 3 and stylized data described in text.

Table 1

Descriptive Statistics for WDI and Correlates of War Data, 1965–2009

Variable	Mean	SD	Min	Max
Total fertility rate	4.0	2.0	1.1	9.2
Absolute TFR difference	2.1	1.6	0.0	7.9
Bilateral trade	0.0	0.0	0.0	1.0
Rich	0.2	0.4	0.0	1.0
Common market	0.0	0.1	0.0	1.0
Free trade agreement (FTA)	0.0	0.1	0.0	1.0
Monetary union	0.0	0.1	0.0	1.0
World Bank	0.8	0.4	0.0	1.0
UN	0.9	0.2	0.0	1.0
WHO	1.0	0.2	0.0	1.0
IMF	0.9	0.3	0.0	1.0
UNESCO	0.9	0.3	0.0	1.0
WTO	0.9	0.4	0.0	1.0
GDP per capita (constant 2000 US$)	6136.6	8800.2	57.8	108111.2
Trade openness (trade as % of GDP)	74.4	47.0	0.2	445.9

Note: All summary statistics not pertaining to the dyad refer to country *i* within dyad *i, j*, except for “Rich,” which refers to country *j*.

Table 2

Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)
LDV	0.994 *** (0.000)	0.994 *** (0.000)
Bilateral trade		−0.071 *** (0.006)
N	801389	801389

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 3

Regression of Fertility Convergence on Country and Dyad Variables

	(1)	(2)	(3)	(4)
LDV	0.995*** (0.000)	0.994*** (0.000)	0.994*** (0.000)	0.995*** (0.000)
Bilateral trade				
Not rich/Not rich	0.017* (0.009)			0.015 (0.011)
Not rich/Rich	−0.177*** (0.009)			−0.224*** (0.010)
Trade blocs				
Common market		0.020*** (0.002)		0.023*** (0.002)
Free trade area		−0.008*** (0.002)		−0.014*** (0.002)
Monetary union		0.014*** (0.002)		0.014*** (0.002)
IGOs				
World Bank			0.011*** (0.001)	0.011*** (0.001)
UN			−0.020*** (0.002)	−0.021*** (0.002)
WHO			0.003 (0.002)	0.005* (0.002)
IMF			0.005*** (0.001)	0.005*** (0.001)
UNESCO			−0.005*** (0.001)	−0.007*** (0.001)
WTO			0.029*** (0.001)	0.029*** (0.001)
N	801389	801389	672244	672244

Note: Heteroskedasticity and autocorrelation consistent (HAC) standard errors are in parentheses. LDV stands for Lagged Dependent Variable. All models control for GDP per capita and trade openness of country *i*, whose coefficients are negative and significant.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 4

Contributions of Forms of Globalization to Fertility Convergence

	Amount of convergence	
Form of globalization	**Children per woman**	**Percent contribution**
Trade with rich	0.56	26%
GDP growth and trade openness	0.40	19%
Participation in trade bloc	0.44	20%
Participation in IGOs	−0.16	−7%
WTO + IMF + World Bank	−1.11	−52%
UN + UNESCO + WHO	0.96	45%
Residual	0.51	24%
Total	2.14	100%

Note: These calculations are based on regression 4 in table 3 and stylized data described in text. Negative quantities indicate that the variable contributed to divergence.