



The Future of the Honduran Education System: A macro analysis of education quality and quantity's impact on development

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Acronyms List

CDCS	Country Development Cooperation Strategies
EDO	Education Development Office
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IFs	International Futures
IHME	Institute for Health and Metric Evaluation
ISCED	International Standard Classification of Education
MFP	Multifactor Productivity
MIDEH	Mejorando el Impacto al Desempeño Estudiantil de Honduras
OECD	Organization for Economic Co-operation and Development
PID	Proportional Integral Derivative
PROHECO	Programa Hondureño de Educación Comunitaria
SDG	Sustainable Development Goal
STEM	Science, Technology, Engineering, and Math
TERCE	Third Regional Comparative and Explanatory Study
TFR	Total Fertility Rate
TIMSS	Trends in International Mathematics and Science Study
TVET	Technical and Vocational Education
UIS	UNESCO Institute for Statistics
UN	United Nations
UNAH	Universidad Nacional Autónoma de Honduras
UNDESA	United Nations Department of Economics and Social Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
UNPD	United Nations Population Division
USAID	United States Agency for International Development

Abstract

This report models the impact of investments in education, with a goal of improving educational attainment (quantity) as well as test scores (quality), in Honduras on economic activity, social violence, and migration by conducting quantitative modeling using International Futures. We created a scenario (the *Current Path*) that estimated the future trajectory of education in Honduras based on a continuation of domestic investment and foreign aid allocation. Educational attainment in Honduras has improved and is on par with Central America, though primary and secondary test scores are very low. Honduras is not on track to achieve the Sustainable Development Goal (4.1). We estimated that the future trajectory of education in Honduras have broad and long-term positive impacts (through 2060) on increasing economic activity (increasing GDP by nearly \$330 billion), reducing social violence (by 5 percent), and reducing emigration (by 11 percent). Additionally, we created alternative scenarios that model a five-year push to increase education investment as well as the achievement of Sustainable Development Goals related to education. In both scenarios investments in education lead to improved economic opportunities, reduced social violence, and lowered pressure to emigrate. However, the impact of these investments is long-term, and we conclude that the efficacy of investments in education should be assessed over multiple decades.

Executive Summary

The Honduran education system appears to be improving, but the complete story of educational progress in the country is complex. Average educational attainment (average years of schooling for adults ages 15+) has been climbing since the mid-20th century, when data first became available, and was nearly equal to the Central American average (seven years of education) in 2017. Going forward, these advancements are expected to continue. However, Honduran primary and secondary test scores (core measures of education quality) are currently some of the lowest in Central America. Furthermore, Honduras is not on track to meet Sustainable Development Goal (SDG) 4.1 – provision of quality education for all boys and girls through secondary school.

These challenges persist for several reasons, driven largely by inefficient spending on education. Honduras spends more on education (as a percent of GDP) than any other county in Central America except Belize and Costa Rica, but corruption and poor government capacity interfere with the distribution of funds to students and their teachers. Even though it registers some of the highest spending per pupil (relative to GDP) in Central America, primary and secondary test scores are among the lowest in the region. In fact, primary test scores are second lowest in the region. This contributes to a bottleneck between primary and secondary school, whereby primary students fail to acquire the skills needed to succeed in and graduate from secondary school.

This report uses International Futures (IFs) – a quantitative tool for thinking about long-term futures – to understand these challenges and to highlight the value of additional educational investments. It also uses IFs to assess education’s impacts on various aspects of development, such as emigration, economic outcomes, poverty, and to a lesser extent, violence. The IFs platform uses data and a mix of different quantitative modeling approaches to provide an alternative way to think about tradeoffs in policymaking. Because education is modeled within IFS, as are the economy, violence and migration, we can shed light on the effects of education investments on these other outcomes. In the IFs model, education has direct (and indirect through other modules) effects on the economy (GDP and inequality) and labor. Education affects violence and migration indirectly through its impacts on the economy and labor. We believe that IFs provides a good way to help frame this work in the future, though we recognize that there is not a large literature documenting these relationships that affected the modeling choices made. In addition, the relationships, and findings, are affected by the quality of the data available for use in modeling. As more information is available on these variables and relationships, the modeling can be updated.

IFs Current Path scenario – which represents the “most likely” path of development - simulates a continuation of current policies and environmental factors in order to project improvements across the education system. It generates a wide range of non-linear forecasts and assumes that no impactful, unlikely events take place. Across the Current Path, Honduran average educational attainment is expected to improve from approximately seven years in 2017 to 8.7 years in 2040. Primary and secondary test scores (which range from zero to 100) are expected to increase from 31.3 and 38.3 in 2017 to 37.6 and 45.2, respectively, by 2040. Without these Current Path improvements, we forecast that GDP would be 7.5 percent lower,

poverty would be 13 percent higher, homicide would be three percent higher, and migration would be nearly four percent higher in the year 2040.

While current investments in education will pay dividends, increasing education funding and/or increasing the efficiency and effectiveness of education funding could unlock further developmental potential. To further assess this, we created two alternative scenarios and compared them to the Current Path of development. The first intervention, the *SDG Achievement* scenario, rapidly improves the Honduran education system to ‘fill’ the education pipeline and to ensure ‘complete free, equitable and quality primary and secondary education’ for all girls and boys (SDG 4.1). This ambitious scenario explores benefits and costs of a policy and spending push to give every child a free education.

In the *SDG Achievement* scenario, the number of skilled workers is projected to increase by three percent and the number of informal workers decreases by more than three percent compared to the Current Path in 2040. This, in turn contributes to higher levels of economic productivity; by 2040, total GDP is six percent higher and GDP per capita is 6.2 percent higher. Further, a slight reduction in inequality generated by improved education and small reductions in the relative size of the youth population, lower the homicide rate by about one percent in 2040. Furthermore, emigration from Honduras in 2040 is reduced by two percent.

The second scenario illustrates the effect of policy prioritization and targeted interventions at different levels of education over the next five years, keeping in line with USAID’s 5-year Country Development Cooperation Strategies (CDCS) planning periods. This *5-year education push* scenario simulates changes in efficiency and/or policy that can improve education systems with little to no additional spending. In this scenario, GDP and GDP per capita are each three percent higher than the Current Path in 2040. These increases in economic growth weaken the impetus to migrate, leading to about a one percent reduction in emigration in 2040.

Our analysis demonstrates that current investments in education have significant positive impacts on development, but that additional investments in improving enrollment and quality further boost human development in Honduras. Progress can be expected along the Current Path of development, but the country lags behind many of its regional peers in education quality (as measured using primary and secondary test scores) and lower and upper secondary graduation rates.

Efficiency gains in education spending and greater investment in primary schools could help ensure skills acquisition and generate improvements across various development outcomes. This could be achieved through the *SDG Achievement* scenario, but would require significant up-front investment. However, the *5-year education push* could help boost education quality and development outcomes and requires only a concerted policy effort and little to no cost.

Purpose and process

This case study was produced in conjunction with a larger regional development report on Central America and the Caribbean for the USAID Bureau for Latin America and the Caribbean Regional Sustainable Development office. The regional report explores trends in Central America and the Caribbean focusing on the education system to 2040. This Honduras case study is supported by USAID Honduras Education Development Office (EDO) as well as the USAID Latin America and Caribbean Regional Office in Washington D.C., with consulting support from Mathematica Policy Research. The Pardee Center produced a similar case study on Guatemala.

The Frederick S. Pardee Center for International Futures

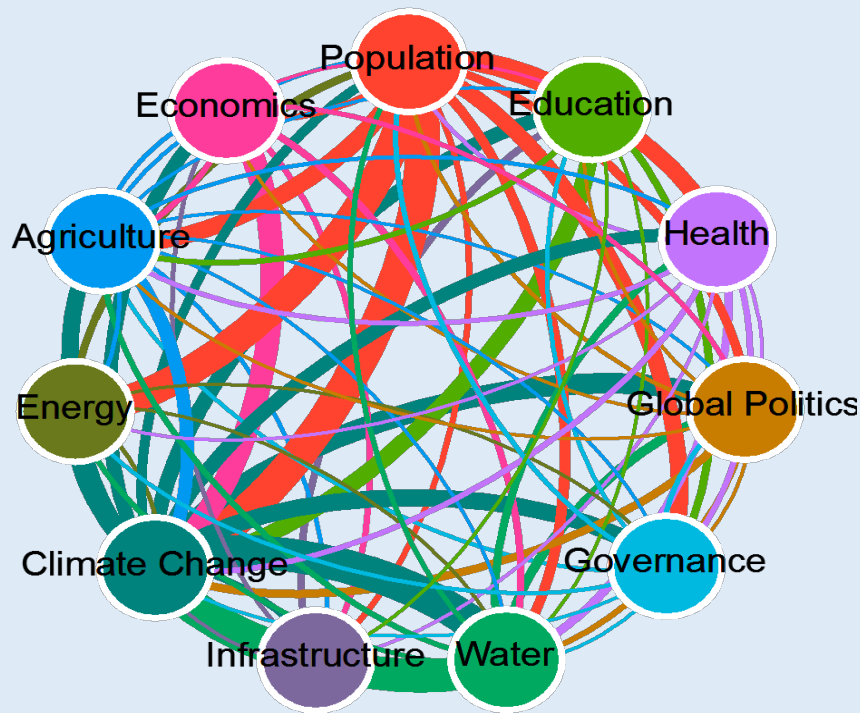
The Frederick S. Pardee Center for International Futures is based at the Josef Korbel School of International Studies at the University of Denver, USA. The Pardee Center specializes in helping governments, international organizations, and private sector organizations think strategically about the future. The Pardee Center focuses on exploring past development trends, understanding the inter-relationships that drive development outcomes, and shaping policies that achieve development outcomes.

International Futures (IFs) is a free and open-source quantitative tool for thinking about long-term futures. The platform helps users to understand dynamics within and across global systems, and to think systematically about potential trends, development goals and targets. While no software can reliably predict the future, IFs forecasts — which are calculated using data and a mix of quantitative modelling approaches — offer a broad and transparent way to think about the tradeoffs in policymaking.

There are three main avenues for analysis in IFs: historical data analysis (cross-sectional and longitudinal) of more than 4,000 series, Current Path analysis (how dynamic global systems seem to be developing), and alternative scenario development (exploring if-then statements about the future). To do this, IFs integrates relationships across 186 countries and 12 core systems, including: agriculture, demographics, economics, education, energy, environment, finance, governance, health, infrastructure, international politics, and technology. The sub-models for each system are dynamically connected, so IFs can simulate how changes in one system may lead to changes across all others. As a result, IFs endogenizes more variables and relationships from a wider range of key development systems than any other model in the world.

IFs is developed by The Frederick S. Pardee Center for International Futures. It was originally created by Professor Barry B. Hughes and is currently developed and maintained by a team of researchers. Learn more about IFs or download the tool for free at https://pardee.du.edu/wiki/Main_Page.

Figure 1: Stylistic representation of IFs submodules



IFs modules added for this project

As part of this report, the Pardee Center added four separate models (or modules) to IFs in order to better represent some of the key issues facing Honduras now and into the future. Below are brief descriptions of each model addition to the broader IFs platform – for more information or technical documentation please refer to the Pardee Center Wiki (https://pardee.du.edu/wiki/Main_Page). For more information on educational attainment and quality models, see Appendix 1. For a description of interventions for scenario analysis, see Appendix 2. For additional information on modeling documentation, see Appendix 3.

It is worth noting that the migration and violence models used in this report, which were developed by the Pardee Center in collaboration with USAID, are new and innovative. They allow us to be forward thinking and to understand the dynamics of these very complex issues using novel approaches. This is the first time USAID has worked on these types of models with the Pardee Center. The findings presented in this report will be used in conjunction with other USAID research to better understand the dynamics of migration and violence.

Education quality

The new modelling efforts from the Pardee Center use test scores as the main indicator of learning quality. Test scores offer a standardized, comparable indicator of student achievement across time and country, which is a crucial requirement for cross-country based modeling. IFs test scores projections are initialized from test scores from the World Bank Global Achievement database (Angrist et al, 2013). This database measures test scores (on a scale from 0 to 100) for 128 countries (from 1965 to 2010) at the primary and secondary level

across three subjects - science, reading, and math. IFs uses the average overall score across all three subjects as the main indicator of education quality (by level).

Test score estimates and projections in IFs are driven by adult educational attainment (average years of education) and education spending per pupil.¹ This represents an ‘intensive’ approach to modeling education quality at the secondary and primary levels, which reflects the view that as individuals participate in higher levels of schooling, they tend to allocate more resources to higher quality schooling (Castelló-Climent & Hidalgo-Cabrillana, 2012:392). Adult educational attainment also provides an indication of the family and home environment, and serves as a proxy for level of teacher education and level of development (GDP per capita).

In IFs, average test scores directly impact levels of multifactor productivity (MFP), and thus have fairly direct impacts on the economy. For more information and/or details of the education quality model please see the regional ‘reference’ report (The Pardee Center, 2018), Appendix 3 and/or the Pardee Center Wiki.

Social violence

The data for the violence model is taken from the IHME (Institute for Health and Metric Evaluation), as well as the Government Risk index in IFs, which cuts across multiple dimensions of security. The model uses homicides across two main categories (political and interpersonal) and five sub categories (conflict and terror, police executions, and interpersonal homicides of men, women, and children) as the core indicators of social violence. While homicides are an imperfect proxy for social violence (which does not include other forms such as domestic abuse), homicide rates generally represent levels of overall violence and are a robust dataset.

The drivers of homicides across categories include the youth bulge (interpersonal), inequality (interpersonal), probability of civil conflict (conflict and terror), and corruption (police executions). The drivers of types of homicides are also interconnected and some types of homicide drive others: the total number of homicides is a driver of police executions and homicides against women drives suicide.

The model contains parameters for increasing both the total number of deaths in any category and increasing the total death rate. Further, in IFs, homicides directly impact multifactor productivity (MFP) via the IFs Security Index, which is comprised of the IFs homicide index and government risk index. Because social violence impacts more than homicide rates, the government risk index provides a broader security context that measures drivers of state fragility from a multidimensional perspective. More details on governance in the region can be found in the governance section of this report on page 49; this governance section provides broad justification for our representation of security. The violence model is also used to calculate the ‘total number of deaths from intentional injuries’ that is used in the

¹ Spending per pupil impacts take effect only at values above/below the expected level. For example, countries that spend more than a typical country at that level of development will get a boost in the score projection. The spending-induced score boosts are reduced in proportion to the level of corruption and prevalence of insecurity in the society.

health model, and thus has forward linkages to the IFs demographic model. For more information and/or details of the education quality model please see the regional ‘reference’ report (The Pardee Center, 2018), Appendix 3 and/or the Pardee Center Wiki (https://pardee.du.edu/wiki/Main_Page).

Labor market dynamics

IFs models labor supply and demand by skill level across six economic sectors (agriculture, energy, mining, manufacture, services, and ICT). Labor supply is predominantly driven by demographics that determine the population and participation rate of working-aged individuals. Educational attainment determines the skill level of the workforce. Labor demand is largely driven by technological progress and potential economic output.

Supply and demand are equilibrated via wages, which can result in short- or medium-term fluctuations in unemployment. The model also forecasts the share of non-agricultural labor employed informally, driven primarily by level of development, educational attainment, and business regulation. For more information and/or details of the education quality model please see the regional ‘reference’ report (The Pardee Center, 2018), Appendix 3 and/or the Pardee Center Wiki (https://pardee.du.edu/wiki/Main_Page).

Bilateral migration

IFs forecasts total bilateral (country to country) migration through a “gravity model” using bilateral migration stock and flow data estimates from a number of sources. Migrant stock data is taken from the UN Department of Economic and Social Affairs migrant stock database (UNDESA, 2017) and migrant flow data is taken from Abel (2016), which estimates migrant flow data from the UNDESA stock data. Data on forced migration stocks is from the UN High Commission for Refugees (UNHCR, 2017); the Pardee Center has estimated annual flows of forced migrants using a methodology similar to that employed by Abel (2016).

Bilateral migration is forecast endogenously using a gravity model, which incorporates “push-pull” factors. Core push-pull factors are: distance (between two countries), size of the population (of the origin and destination countries), the size of migrant communities living in the destination country (as a percent of the destination country’s population), the ratio of household income per capita (between two countries), the GDP per capita of the origin country, security (which includes levels of homicide in origin country), and risk of government instability in origin country. For a more complete discussion of the migration analysis in this report, see Box 4 and Appendix 3.

IFs Current Path/Scenarios

The IFs Current Path is a collection of interacting forecasts that, while dynamic, represent a continuation of current policy choices and environmental conditions. It also assumes there will be no unforeseen man-made or natural disasters nor technological advancements that would fundamentally alter the development path. Therefore, the Current Path represents the “most likely” future of development in the region. Although the Current Path generally demonstrates continuity with historical patterns, it provides a structure that generates a wide range of non-linear forecasts rather than just a simple linear extrapolation of historical trends. The Current Path assumes no major paradigm shifts, seismic policy changes or impactful low-

probability events. Given that the Current Path is built from initial conditions of historical variables and is analyzed in comparison to other forecasts of particular issue areas, it can be a valuable starting point to carry out scenario analysis and construct alternative future scenarios. This report uses 2017 as the base year for reporting results; unless otherwise noted all 2017 values are model estimates.

In this report we compare the Current Path with two alternative scenarios. The first intervention, the *SDG Achievement* scenario ensures ‘complete free, equitable and quality primary and secondary education’ for all girls and boys (SDG 4.1). It does so by filling the education pipeline in the Honduran education system. It also boosts Honduran test scores across levels to Costa Rican levels. The *5-year education push* is the second alternative scenario. It simulates improvements in test scores and educational attainment through policy will and spending efficiency to align with the USAID 5-year CDCS planning periods.

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Introduction

Education generates a number of benefits for the individual and society as a whole. It improves skills and cognitive abilities while facilitating the acquisition of knowledge (Psacharopoulos & Patrinos, 2004). Dickson, Hughes, & Ifran (2009) explain that education improves communication skills and the ability to obtain information, promoting personal empowerment and the expansion of freedom. Furthermore, higher educational attainment (as measured by the level of education completed) is linked to better health outcomes, higher life expectancy, greater earnings, and improved subjective well-being (OECD, 2013; 2017).

At the societal level, education correlates with lower crime rates, increased civic participation, and economic growth (OECD, 2013, 2017). This is especially important in Honduras, where violence and suboptimal economic growth hamper societal progress. In Honduras, and Central America as a whole, many individuals emigrate to flee violence and to find economic opportunity (Bermeo, 2018; Passel, Cohn, & Gonzalez-Barrera, 2017a). Improved educational attainment at home could help boost per capita income and decrease inequality, thereby reducing the pressure for economic migration to countries with higher average wages (Morgan & David, 1963).

Using International Futures (IFs), this report examines historical progress, the expected trajectory (or Current Path)² and possible alternative futures of education in Honduras. It uses key national level education indicators to explore and forecast long terms trends in education outcomes and examine the effects of alternative futures on the education system and other key development sectors.

Honduras has made steady progress in the education sector over the past few decades, positioning the country to take advantage of education's benefits. Honduran average adult education years, a core indicator of the level of educational attainment in a society, has grown over the past 28 years from 4.9 in 1990 to approximately seven today. Currently, Honduran overall educational attainment is on par with the Central American average and other countries at its level of development (income peers).

However, Honduran education quality, as measured by average primary and secondary test scores, lags behind Central American averages. Currently, Honduras has the second lowest primary test scores and the lowest secondary test scores in the region. These quality issues in primary school cause a bottleneck between primary and secondary and constrain the pool of students able to move through the system. Honduras has some of the lowest secondary enrollment and graduation rates of any country in Central America. Currently only six out of 20 students who start primary school in Honduras today will graduate secondary school.

Spending inefficiencies encumber Honduras's education system, exacerbating education quality, and making it difficult to take advantage of education's positive effects. Honduras spends more money on education (as a percent of GDP and per pupil as a percent of GDP) than nearly all other Central American countries but corruption and poor government capacity lead to substandard education quality outcomes at both the primary and secondary level. Its primary

² See the Current Path/Scenario section above for an expanded definition of the Current Path.

survival rate outranks several Central American peers, but suboptimal graduation rates persist at the lower and upper secondary levels.

Furthermore, the allocation of education funds is skewed towards secondary education. This allocation strategy prevents skills and knowledge acquisition at the primary level and contributes to a constraint between primary and secondary school. This explains why Honduras has the second lowest overall primary scores of any country in Central America and the lowest overall secondary scores even though it spends a relatively large amount per pupil (relative to income).

Additional education investments and/or increases in education spending effectiveness could enhance educational attainment and quality and further boost development outcomes. To examine the impacts of high levels of investment in education and improved spending efficiency we constructed two alternative scenarios to the Current Path of development.

The first – the *SDG Achievement* scenario – is an ambitious scenario aimed at helping Honduras reach Sustainable Development Goal (SDG) 4.1 - the provision of quality education for all children through secondary school by the early 2030s. The second – the *5-year education push* scenario – is a less aggressive scenario that may offer a more feasible option for the country. This scenario simulates improvements in test scores and educational attainment through policy will and spending efficiency to align with the USAID 5-year CDCS planning periods.

Both the *SDG Achievement* scenario and the *5-year education push* help improve education and economic outcomes while slightly reducing emigration and violence rates. The *SDG Achievement* offers an aggressive, but expensive option, while the *5-year education push* has a smaller impact on development outcomes, but could boost education outcomes at little to no cost. Both interventions reinforce the importance of education investments and efficiency gains in shaping development in Honduras.

This report unfolds as follows. First, it examines historical trends in the Honduran education system and explores the Current Path of development in education out to 2040. Then, it discusses the impact of education investments on development outcomes. Next, it presents alternative scenarios to assess how changes in education investments and spending can affect development outcomes. The associated costs and the impacts on development are assessed for both scenarios.

Box 1: Distinguishing education quality and quantity in IFs

It is important to distinguish between the two major education measurements in IFs and used throughout this case study: quality (test scores) and quantity (or attainment). With respect to quantity, IFs forecasts rates of overall education attainment is measured as the average years of education held by the adult population (aged 15+), which is largely driven by enrollment, transition, and graduation rates at the primary, secondary, and tertiary level. Levels of average education attainment represent total stock of education in a society and help to measure how effectively the education system moves children and students through school.

Education quality is represented by internationally standardized test scores across primary and secondary for three subjects: reading, math, and science. It is intended to measure the quality of the education system and student outcomes and is driven largely by overall attainment and per pupil spending on education.

Educational quantity: attainment and completion

A starting point for examining the education system in Honduras is to assess average adult educational attainment, which is a core measure of the ‘stock’ of education in a given society. Average adult educational attainment is measured as the average years of education amongst individuals 15 and older. It serves as a main indicator of the success of the education system and the total amount of education in the productive portion of society from an education quantity standpoint.

Improving national educational attainment, or the ‘stock’ of education requires expanding access to formal education and incentivizing children and families to remain in school through the system. The IFs model represents the education system as a progression of students through the formal education system at primary, secondary, and tertiary levels. IFs models enrollment, survival, and graduation rates at each level using data from UNESCO Institute for Statistics (UIS) (see Table 1 below for definitions). Student completion at each level of education in interaction with population dynamics in IFs yields educational attainment estimates and forecasts. This approach can be used to identify education bottlenecks, situations in which progress and attainment stalls.

Table 1: Education indicator definitions

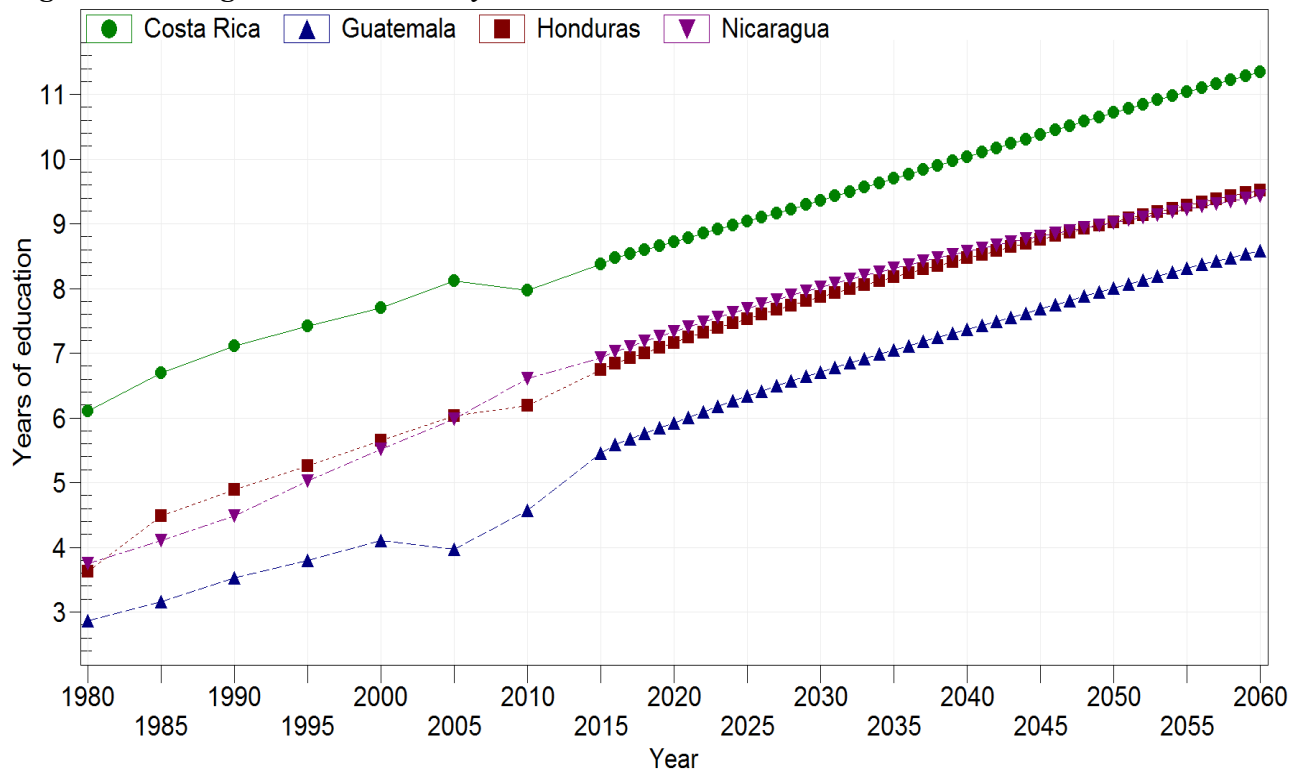
Variable	UNESCO Definition
Gross enrollment rate	Number of students enrolled in a given level of education, regardless of age, expressed as a percentage of the official school-age population corresponding to the same level of education. For the tertiary level, the population used is the 5-year age group starting from the official secondary school graduation age.
Net enrollment rate	Total number of students in the theoretical age group for a given level of education enrolled in that level, expressed as a percentage of the total population in that age group.
Graduation rate (gross)	Number of graduates regardless of age in a given level or programme, expressed as a percentage of the population at the theoretical graduation age for that level or programme.

Variable	UNESCO Definition
Completion rate	Percentage of a cohort of children or young people aged 3-5 years above the intended age for the last grade of each level of education who have completed that grade.
Transition rate	Number of students admitted to the first grade of a higher level of education in a given year, expressed as a percentage of the number of students enrolled in the final grade of the lower level of education in the previous year.
Survival rate by grade	Percentage of a cohort of students enrolled in the first grade of a given level or cycle of education in a given school year who are expected to reach a given grade, regardless of repetition.
Repetition rate by grade	Number of repeaters in a given grade in a given school year, expressed as a percentage of enrolment in that grade the previous school year.
Gender parity	Purely a numerical concept. Reaching gender parity in education implies that the same proportion of boys and girls - relative to their respective age groups - would enter the education system and participate in its different cycles.
Literacy rate	Total number of literate persons in a given age group, expressed as a percentage of the total population in that age group. The adult literacy rate measures literacy among persons aged 15 years and above, and the youth literacy rate measures literacy among persons aged 15 to 24 years.
Government expenditure per student (as % of GDP per capita)	Average total (current, capital and transfers) general government expenditure per student in the given level of education, expressed as a percentage of GDP per capita.
Government expenditure on education (as % of GDP)	Total general (local, regional and central) government expenditure on education (current, capital, and transfers), expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government.

Overall attainment and completion

In Honduras, average adult education years have grown steadily over the past 25 years. In 1990, the population averaged 4.9 years of education (4.9 male, 4.9 female); by 2017, that number had grown to 6.9 years (6.7 male, 7.0 female) (Barro and Lee, 2015). In 2017, average years of education in Honduras exceeded that of Guatemala (5.7) but fell slightly below the regional average (seven years) and all other regional peers. By 2040, Honduras's educational attainment (8.7) is projected to remain above Guatemala (7.5), on par with Nicaragua and the Central American average, but below the average for lower-middle income countries (nine years).

Figure 2: Average adult education years, select Central American countries, 1990 to 2040



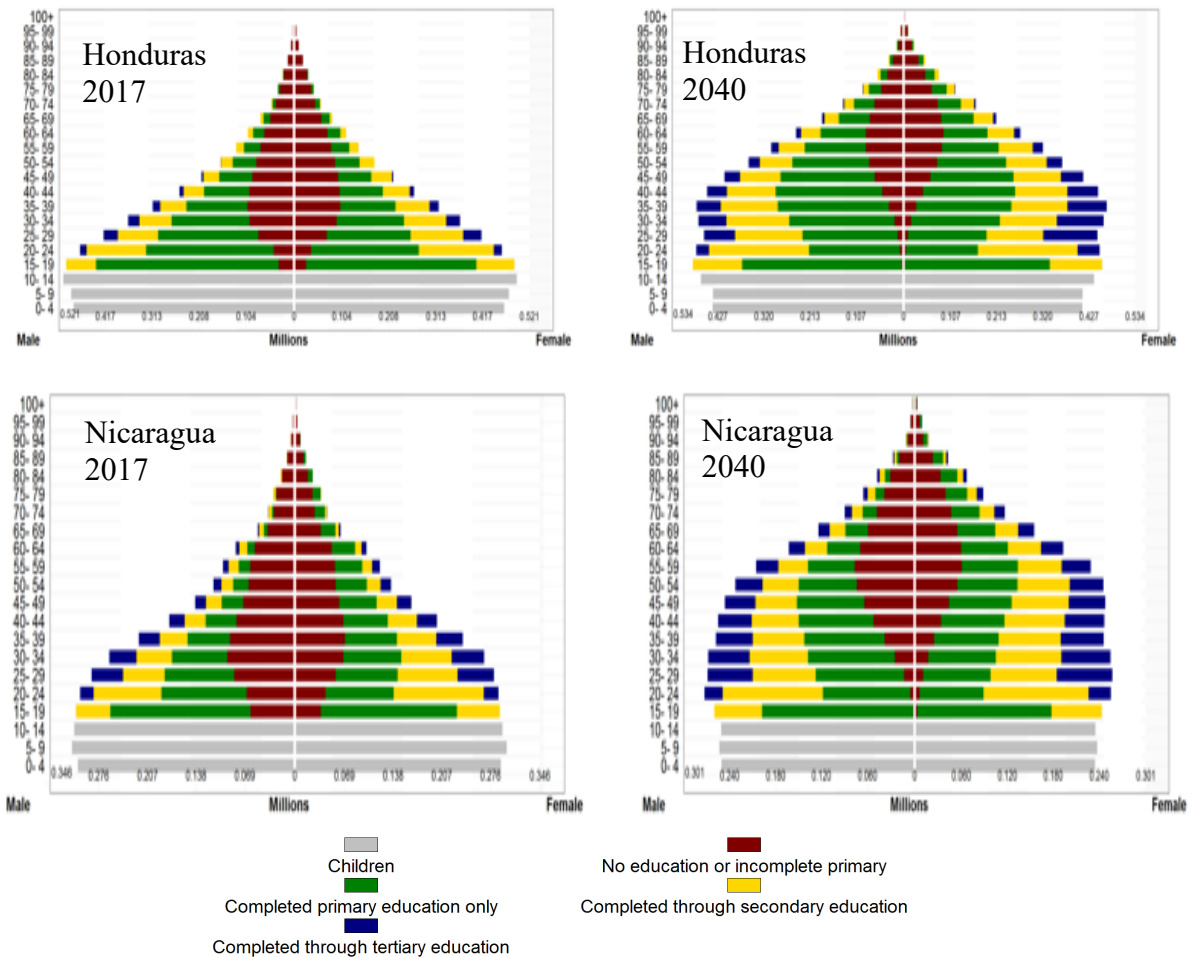
Source: Data from Barro & Lee (2015); forecast from IFs 7.38.

Another way to assess national education outcomes is to examine adult education completion rates (the percent of *adults* in Honduras who have completed a given level of education). Figure 3 depicts the human capital distribution of Honduras and Nicaragua by age and sex in 5-year increments in 2017 and 2040. Each pyramid reflects the country’s population overlaid with the highest level of education attained for each cohort in the population. The shape of the 2040 distribution reflects population aging in Honduras projected along the Current Path.³

Primary adult completion rates in 2017 were slightly higher in Honduras (69.3 percent) than its neighbor, Nicaragua (64.1 percent). However, at the secondary level this pattern is reversed. In 2017, an estimated 33.9 percent of Nicaragua’s adult population had completed secondary education, compared with 22.8 percent in Honduras. At the tertiary level, both countries have low completion rates. Almost 1.4 percent of Nicaragua’s adult population has completed tertiary education, compared to 2.4 percent in Honduras. This pattern of higher-than-average primary completion but lower-than-average secondary persists when Honduras is compared to the regional averages. The adult primary completion rate is slightly above regional averages while adult secondary and tertiary completion rates are below regional average (see Table 2).

³ IFs population pyramids show population distribution in 5-year age-and-sex cohorts. Younger populations have greater percentage of the population concentrated at the bottom of the pyramid. As the population ages, the middle and top of the pyramid begin to expand.

Figure 3: Human capital distribution, Honduras and Nicaragua, 2017 and 2040



Source: IFs 7.38.

Typically, when attainment or completion falls below expectations, a constraint, or bottleneck, exists at a particular level of the education system. This type of pattern would suggest that Honduras may have a bottleneck between primary and secondary levels that constrains completion through tertiary school. However, it is also likely that factors outside the education system are reducing adult completion rates.

Over the past 20 years, adult secondary and tertiary completion rates have stagnated despite improvements in the education system as a whole. This can be attributed to the emigration of highly educated individuals – a phenomenon often referred to as ‘brain drain’. In Honduras, brain drain has a negative effect on the skilled labor force and the proportion of skilled workers in the country (Beine, Docquier, & Rapoport, 2008).

Supply and demand side factors both contribute to this exodus of the highly educated; on the supply side, the growing interconnectedness of the global economy has facilitated the aggregation of human capital in areas where large communities of highly educated individuals are already present. On the demand side, host countries have adopted immigration policies that

target global talent (Beine et al., 2008). The benefits to host countries are clear, but the consequences for sending countries more complex. In their paper on the “winners and losers” of brain drain, Beine, Docquier, & Rapoport (2008) categorize Honduras as a country experiencing a detrimental brain drain, with negative impacts on the proportion of skilled labor, the skilled labor force, and the labor force as a whole.

Table 2: Adult completion rates, selected Central American region and countries, selected years

	Primary Completion			Secondary Completion			Tertiary Completion		
	2000	2017	2040	2000	2017	2040	2000	2017	2040
Honduras	56.8	69.3	84.1	16.7	22.8	36.8	2.4	2.4	9.6
Guatemala	35.3	58.6	76.0	13.7	14.7	30.2	1.7	0.9	5.4
Nicaragua	52.0	61.4	79.6	20.5	33.9	48.9	6.5	1.4	7.7
Central America	45.3	64.1	79.5	21.5	32.6	44.0	9.3	11.8	17.0

Source: Data from UNESCO, forecast from IFs 7.38.

Looking forward, IFs projects that Honduras will increase overall levels of completion, but will continue to lag across secondary and tertiary levels. By 2040, an estimated 84 percent of Hondurans aged 15+ are projected to have completed primary education (84.4 percent of males, 83.6 percent of females). However, only 36.8 percent are projected to have completed secondary education (35.7 percent of males, 37.7 percent females). Suboptimal secondary school completion translates into lower participation and completion at the tertiary level. By 2040, only 9.6 percent of the population will have completed tertiary education (7.4 percent males, 11 percent females).

While some of the Honduran underperformance in adult secondary and tertiary completion rates (especially in recent history) can be attributed to brain drain, it is also a function of key issues in the current education system (See Box 2). The discrepancy between primary and secondary completion gains suggest that there is a bottleneck between primary school and lower secondary school.

Box 2: Regional and ethnic disparities in educational attainment

National education estimates mask variability in attainment across socioeconomic groups. Disparities remain across income levels, rural and urban populations, and indigenous/non-indigenous groups. For instance, the highest-earning quintile in the population has nearly twice as many years of education compared to the lowest (11.1 and 5.7 years, respectively), a disparity that has persisted for much of the past decade (Orozco & Valdivia, 2017). While literacy rates have risen to almost 90 percent nationally, nearly a quarter of adults in the poorest income quintile are illiterate (FEREMA, 2017). Illiteracy rates are nearly two times higher in rural areas than urban (Orozco & Valdivia, 2017). Adelman and Székely (2016) find considerable differences in enrollment rates between rural and urban as well as indigenous and non-indigenous populations. Expanding progress and access to education will require special focus on these demographics.

As with national education attainment, country-wide enrollment and graduation rates obscure differences in education access across socioeconomic groups. Disparities are present across many dimensions in Honduras, including between urban and rural populations and across income groups. Living in a rural area in Honduras is linked to reduced likelihood of enrolling in secondary school (Adelman & Székely, 2016). Disparities in secondary school access are also more pronounced across income distributions. The gap in enrollment between children from the highest income quintile and those from the lowest quintile is nearly 20 percentage points in lower secondary and over 30 points in upper secondary (FEREMA, 2017). Being from an indigenous group is also negatively correlated with secondary enrollment, even when controlling for factors like income and rural household (Adelman & Székely, 2016).

In the past, the Honduran government has launched a number of initiatives to address shortcomings in access for those traditionally outside the formal system. In 1996, the government and USAID launched the *Educatodos* program, which provided out-of-school youth and adults the opportunity to complete grades one through six in a flexible format over three years, reducing cost and time constraints (Moore, 2007). In 1999, the Honduran Government and World Bank launched the *Programa Hondureño de Educación Comunitaria* (PROHECO). The program established new schools in rural villages at the primary and pre-primary level, reaching over 500 communities in its first year (Di Gropello, 2006).

Low teacher pay, limited benefits, and reliance upon unpaid parental and community labor for oversight have led to criticism of Central America's Community school programs (Ganimian, 2016; Poppema, 2009). Di Gropello and Marshall (2011) find that PROHECO teachers were less educated and paid less than public school teachers, but PROHECO schools were open more days per year than their non-PROHECO counterparts, were more efficient with class time, experienced fewer classroom disruptions and fights between students, and received higher scores on achievement tests (Di Gropello & Marshall, 2011). Analysis of the *Educatodos* program between 1996 and 2006 found that it achieved higher school completion rates and its students had higher test scores than students in the public school system (Moore, 2007).

The education pipeline

Education in Honduras is organized into pre-basic, basic, and middle education. Pre-basic education (ages three to five) lasts three years. Basic education occurs in three cycles, 1st to 3rd grade (ages six to eight), 4th to 6th grade (ages nine to 11), and 7th to 9th grade (ages 12-14). Middle education covers 10th to 12th grade (ages 15-17). The Fundamental Education law made education compulsory for 12 years, encompassing middle education (OECD, 2016). Superior education (ages 18-22) encompasses tertiary-level schooling. IFs follows the UNESCO International Standard Classification of Education (ISCED 2011),⁴ covering primary, lower secondary, upper secondary, and tertiary education. Table 3 maps these classification schemes.

Table 3: Mapping UNESCO ISCED education levels to the Honduras national system

UNESCO/IFs	Honduras	Grades	Ages
Primary	Basic I	1-3	6-8
	Basic II	4-6	9-11
Lower Secondary	Basic III	7-9	12-14
Upper Secondary	Middle Education	10-12	15-17
Tertiary	Superior Education	NA	18-22

Note: Honduran academic year is from February to November.

The Ministry of Education manages the education sector, with support from the Universidad Nacional Autonoma de Honduras (UNAH) in tertiary level coordination. These efforts are supplemented by the National Education Council, which coordinates national policy between all levels of the education system. Education provision in Honduras is further divided between governmental and non-governmental, or public and private. According to the OECD, in 2016 over 85 percent of basic education facilities were public, whereas over half of middle education schools were private (OECD, 2016).

Outcomes by level

Honduras has near universal primary enrollment. Net primary enrollment grew from nearly 88 percent in 2000 to 97.3 percent in 2012, before declining to 93 percent by 2015. This placed it above average enrollment rates in Central America in 2015 (89.8 percent), and above global net enrollment rates (90 percent). In 2017, approximately 90 percent of students who enrolled in primary school survived to the final year (grade six), and approximately 86 percent of those who reached the final grade of primary transitioned to lower secondary (88 percent females, 85 percent males).

After students move on to lower secondary school, the gaps in the Honduran education pipeline begin to show. Total net secondary enrollment in Honduras is only 50 percent, which means that only half of 'of age' students are currently in secondary school. At lower secondary level, cumulative dropout rate was around 15.2 percent in 2015, above the Dominican Republic (13.5 percent) but below El Salvador (23.3 percent). This may indicate that students who

⁴ See: <http://uis.unesco.org/en/isced-mappings> for more details on ISCED 2011 classification system.

transition from primary school are not prepared for secondary school or that there are other barriers to attending and graduating from secondary school.

According to one study, 53 percent of students cited economic reasons as primary motivation for dropping out, compared with 25 percent in El Salvador, Nicaragua, and Panama (Adelman & Székely, 2016). Migration, particularly among youth, has also contributed to school dropouts. In 2014, 17 percent of school dropouts in Honduras were due to international migration and 1.7 percent to domestic migration. Although international migration slowed somewhat in the following year, international and domestic migrants still accounted for seven and 4.8 percent of total dropouts in 2015, respectively (Orozco & Valdivia, 2017).

Gross enrollment (see Table 4), which includes ‘of age’ and all other current students, stands at 76.4 percent for lower secondary and 66.2 percent for upper secondary. When gross enrollment rates are significantly higher than net enrollment rates it signifies that significant number of adults or older students are returning or repeating. Cumulative repetition rates at the lower secondary level rose from 4.3 percent to 4.8 percent between 2001 and 2016.

Of the total students enrolled in lower secondary school, only 59.5 percent graduate and, of those enrolled in upper secondary, only 39 percent graduate.⁵ Honduras had the third lowest lower secondary graduation rates and lowest upper secondary graduation rates of Central America countries in 2017. Costa Rica (92.9 percent), El Salvador (75.6 percent) and Panama (72.6 percent) have the highest rates lower secondary graduation, while Nicaragua (45.9 percent) and Guatemala (40.3 percent) outpaced Honduras at upper secondary level. Along the Current Path, lower and upper secondary rates are projected to improve out to 2040, reaching 76.1 percent and 62.3 percent, respectively, in Honduras. Yet these will remain among the lowest graduation rates in the region in 2040.

⁵ Table 4: Primary survival rate is the percentage of entrants in grade one who persist to the last grade of primary school. All enrollment figures are gross enrollment, or the number of students enrolled regardless of age divided by the typical school age population. Graduation figures represent the total number of graduates (the graduates may be of any age) divided by the population at the typical graduation age of the specified level.

Table 4: Education pipeline indicators forecast, Honduras, 2017 and 2040

		Primary Enrollment	Primary Survival	Lower Secondary Enrollment	Lower Secondary Graduation	Upper Secondary Enrollment	Upper Secondary Graduation	Tertiary Enrollment	Tertiary Graduation
2017	Male	111.7	88.8	72.8	52.6	57.2	33.0	19.1	8.2
	Female	109.4	91.6	80.1	66.7	75.6	45.1	25.7	13.7
	Total	110.6	90.1	76.4	59.5	66.2	39.0	22.3	10.9
2040	Male	102.2	99.1	85.6	71.9	71.6	58.9	32.1	17.2
	Female	100.1	100.0	89.0	80.6	79.1	66.0	42.2	25.9
	Total	101.2	99.5	87.3	76.1	75.2	62.3	37.0	21.4

Source: Data initialized from UNESCO Institute of Statistics, 2017; forecast from IFs 7.38.

Enrollment and graduation bottlenecks at the secondary level constrain opportunity to pursue tertiary education. Approximately 22 percent of age-appropriate students enrolled in tertiary education in Honduras in 2017, compared with 54.2 percent in Costa Rica, 38.7 percent in Panama, and 29 percent in El Salvador. Of the students enrolling in tertiary education, less than half graduate. Furthermore, only 11 percent of these graduates obtain degrees in science, technology, engineering, and math (STEM), the fields that are shown to boost technological and economic advancement. Along the Current Path, tertiary enrollment is projected to reach 38 percent in 2040, approximately the level of Panama today.

Education outcomes across each level also differ by sex. Honduras experiences a “reverse gender disparity” in education, with female enrollment and graduation outpacing males at almost every level of education (see Table 4). In 2017, females aged 15+ had an estimated 1.05 additional years of education. These trends are projected to persist in Honduras and across Latin America and the Caribbean (Fiszbein et al., 2009). In Honduras, this reverse gender disparity can be partly explained by fewer educational opportunities and the perception of education as being “feminine” (Jha, Bakshi, & Faria, 2012).

To put some of the indicators in Table 4 in perspective and show how the pipeline moves over time, we can follow a cohort of individuals (100 students) enrolling in primary school today and moving through the system along the Current Path. In 2017, if 100 students enroll in primary school in Honduras, then approximately 91 will make it to the final grade of Basic II (grade 6) in 2022. Of those 91, approximately 82 students move into Basic III (grade 7) in 2023, and only 55 are expected to graduate in 2025. Of those who graduate, all 55 are expected move on to middle education (grade 10) in 2026, but only approximately 30 students will graduate from middle education in 2028, thus successfully completing 12 years of compulsory education as mandated by the Fundamental Law on Education.

Box 3: Technical and vocational education

Technical and vocational education (TVET) can provide an alternative to traditional education. Data from UNESCO suggest enrollment in vocational training (as a percent of total enrollment in secondary education) has fluctuated in Honduras. Vocational enrollment (as a percent of lower secondary enrollment) has declined from around 30 percent in 2004 to 17.6 percent in 2015 (UNESCO, 2016). IFs estimates enrollment in 2017 at around 17.9 percent (18.9 percent of males, 16.4 percent of females). Vocational enrollment at the upper secondary level is much higher; it grew from 45 percent in 2013 to 59 percent in 2014. IFs estimated that 70 percent of students enrolled in upper secondary school are in a vocational program (equally split across genders).

Honduras has a national TVET provider, the *Instituto Nacional de Formación Profesional* (INFOP), responsible for overseeing accreditation processes of TVET programs, though a UNESCO survey of TVET programs across Latin America (UNESCO, 2016) found quality assurance to be “nonexistent” in Honduras (pg. 22). This is consistent with recent assessments of TVET in Latin America, which have found them to be outdated and inefficient (Salazar-Xirinachs, 2015). UNESCO’s survey also finds that Honduran companies typically fail to provide sufficient training for their workers. As a result, many firms are constrained by an inadequately trained workforce.

In sum, the Honduran education pipeline sees a major bottleneck between primary and secondary school, leading to low secondary enrollment and graduation rates. Despite relatively high primary survival and transition to secondary school, only about half of the children that are of secondary school age are currently enrolled and Honduras has some of the lowest graduation rates in the region.

Factors both within and outside the education system contribute significantly to these sub-par outcomes. Localized violence may deter students in some areas from attending and staying in school and gang culture in general may encourage children to forego education (Reisman, 2006). Further, high levels of societal violence paired with lack of economic opportunity may reduce the incentive to stay in school or in country, causing children to migrate.

Within the education system, low access and high cost of secondary represent barriers for many Honduran families to send and keep children in school (Orozco & Valdivia, 2017). Lack of quality education at the primary levels may mean that students are not prepared to enter and succeed at the secondary level and, for those who are prepared for secondary school, poor secondary education quality constrains completion. In other words, many students may not be prepared to enter the secondary level and those that are may not be receiving the skills necessary to proceed through the secondary system.

Education quality and learning achievement

The World Bank Honduras Country Strategy 2016-2020 explicitly identifies education quality as one of its policy priorities, particularly at the secondary level. Average regional test scores in Central America are low compared with other regions of the world and Honduras regularly scores at the low end of the region across grades and disciplines (Flotts et al., 2015). According to the National Academic Performance Report released by the Secretary of Education, more than 60 percent of the students evaluated classified as ‘Unsatisfactory’ or ‘Must Improve,’ with results worse in math (71 percent) than in Spanish (49 percent). Results are especially concerning at the lower secondary level, where less than 10 percent of students achieved ‘Satisfactory’ or ‘Advanced’ scores (FEREMA, 2017).

Education quality is increasingly highlighted as an important aspect of economic growth and development, both across and within countries (Hanushek, Ruhose, & Woessmann, 2015). Recent studies have even suggested that improving education quality can provide more returns than simply expanding attainment with the same quality (OECD, Hanushek, & Woessmann, 2015). However, measuring and modeling education quality is an inherently challenging exercise. Global standardized data on education quality is hard to come by and education quality is influenced by a number of factors both inside and outside the education system.

Student achievement (test scores) across national, regional, and international exams are commonly measured at multiple grade levels, years, and subjects, making comparability across countries and time particularly challenging. For example, the TERCE regional exam measured achievement level for 8th graders in 2010, while the international TIMSS exam measured achievement for 6th grades in 2012. Many countries administer their own national, curriculum-specific exams to measure student achievement. However, given that these exams are prepared for the national education context, they are often not comparable across countries.

Further, modeling education quality is challenging because drivers of quality originate both within and outside the school. UNICEF (2000:3) states that education quality includes health and nutrition of students, safe, protective, and inclusive learning environments, relevant content and materials, appropriate student-centered teaching approaches, and appropriate methods to evaluate knowledge, outcomes, and skills. Systemic factors (drivers inside the school) include teacher quality and pedagogy, school infrastructure, access to books, materials and resources for learning, and spending on education. Structural factors (drivers outside the school) include household income, student health and nutrition, parental expectations, and child labor rates.

Measuring and modeling education quality

The education model in IFs uses average test scores at the primary and secondary level as the main indicators of education quality. IFs test score estimates are initialized from the World Bank Global Achievement database (Angrist et al, 2013). This database measures cognitive achievement for 128 countries around the world from 1965 to 2010 at the primary and secondary level and across three subjects – science, reading, and math – on scale from zero to 100.⁶ IFs projects and forecasts the overall score averaged across the three subjects for primary and secondary.

Test score forecasts by level are driven by adult educational attainment (average years of education) and education spending per pupil (relative to income).⁷ Adult educational attainment provides an indication of the family and home environment, and serves as a proxy for teacher education and overall level of development (GDP per capita). Education spending per pupil (relative to GDP per capita) provides a proxy for overall education system resources such as school infrastructure and teacher pay.

Honduran test scores: a global perspective

Before analyzing Honduran test scores, it is important to place IFs estimated test scores in perspective. First, the scale ranges from zero to 100 for all subjects and the overall average; all countries achieve average scores between 20 and 60 across all levels and subjects. Globally, Montenegro has the highest estimated average scores (across all three subjects) at the primary level (55) and Singapore has the highest at the secondary level (59), while Burkina Faso has the lowest scores in primary (22) and Niger has the lowest in secondary (32).

In 2017, average primary test scores (across reading, science, math) for Honduras were estimated at 31.3, which is second lowest in the region. Belize and Panama had the highest

⁶ The data are constructed from regional and global achievement tests, such as the Programme for International Student Assessment (PIRLS), Trends in International Mathematics and Science Study (TIMSS), and the regional tests, like SACMEQ, the Programme d'Analyse des Systemes Educatifs de la Confemen (PASEC), and the Laboratorio Latinoamericano de Evaluacion de la Calidad de la Educacion (LLECE), among others. Where data are unavailable, IFs estimates test scores by level and subject based on levels of average adult educational attainment and spending per pupil (relative to income).

⁷ Spending per pupil (relative to income) is calculated as the percent of average per capita income spent on each student in each level. The impacts of this driver take effect only at values above/below expected level.

scores in Central America (43 and 37.4 respectively) while Guatemala’s scores (30.1) were the lowest in Central America. Honduran average secondary scores were estimated to be 38.3 in 2017, which is the lowest in the region and is about a point less than the next closest regional peer (Guatemala, 39.2).

Honduras’s overall primary and secondary test scores rank slightly below what would be expected at its level of development. Average primary test scores rank 140th out of 186 countries in IFs, placing Honduras just above Mali and Bangladesh and just below Namibia and Palestine. Average secondary test scores rank 146th globally, immediately ahead of Djibouti and behind Myanmar.

Table 5: Primary and secondary test scores by subject and gender, 2017 and 2040

		Primary			Secondary		
		Male	Female	Total	Male	Female	Total
Reading	2017	33.9	34.4	34.2	36.9	37.2	37.1
	2040	40.0	41.0	40.5	43.6	44.3	44.0
Math	2017	26.4	26.4	26.4	39.6	37.0	38.3
	2040	32.7	32.7	32.7	46.0	44.4	45.2
Science	2017	33.3	33.3	33.3	39.4	39.4	39.4
	2040	39.5	39.8	39.6	46.2	46.4	46.3
All	2017	31.2	31.4	31.3	38.6	37.9	38.3
	2040	37.4	37.8	37.6	45.3	45.0	45.2

Source: Initialized from World Bank Global Achievement database⁸; forecast from IFs 7.38.

Along the Current Path, average test scores for both primary and secondary are projected to improve significantly over the next 22 years – Honduras is expected to surpass the Central American average across both levels by 2040. Average primary scores are projected to reach 37.6 by 2040, pushing Honduras well ahead of Guatemala and above Nicaragua. Further, Honduras’ global ranking is expected to improve to 129th by 2040, placing it just below Egypt and just above Lebanon.

Average secondary scores are projected to reach 45.2 by 2040, pushing Honduras above both Nicaragua and Panama. Honduras’ global ranking is expected to improve to 125th by 2040, placing it just above Lebanon and just below Kosovo.

This relatively rapid increase in both levels of test scores is driven by continued gains in overall development and educational attainment and Honduras’ relatively high levels of per pupil spending. However, these gains are not guaranteed. Honduras spends a significant portion of GDP on education (both overall and per pupil), but much of that funding is either misallocated or used ineffectively.

⁸ IFs used the World Bank Global Achievement database and information from a new World Bank data set on test scores to estimate and forecasts score by gender. Further, Honduran test scores were reestimated/adjusted based on feedback and research – see Annex A for details.

Honduran test scores: national and regional estimates and factors

Due to differences in testing methods and questions, national test scores and results from regional tests often cannot be easily compared across countries.⁹ But, the takeaways from national and regional tests and analysis can shed light on country or regionally specific trends and issues in educational quality.

At the national level, the MIDEH project (Mejorando el Impacto al Desempeño Estudiantil de Honduras) supports a multitude of government efforts to more reliably measure student achievement (AIR, 2012). Average MIDEH scores are available annually (from 2007 to 2016) based on a nationally representative sample of student scores for reading and mathematics, grades one through nine. These data show that students typically score higher on average in reading than in mathematics, and students at Basic III level (grades seven through nine) score lower than their counterparts at Basic I and II. Lower scores at Basic III could reflect the failure to acquire essential knowledge and skills at the Basic I and II levels.

At the regional level, the Third Regional Comparative and Explanatory Study (TERCE) offers a benchmark of education quality in Honduras relative to other countries in Central and Latin America. TERCE measures learning achievement of over 67,000 third and sixth grade students in reading, writing, mathematics, and science for fifteen countries across Latin America and the Caribbean (Trevino et al., 2015; UNESCO, 2015). The results of the TERCE report find that Honduras scores below the regional average for every subject in both third and sixth grade, along with Guatemala, Nicaragua, Panama, and the Dominican Republic.

Within the Honduran education system, issues with education quality begin at the primary level, but extend to the secondary level. Pupil-teacher ratios, the quality of the teachers, and education infrastructure across levels are all factors that impact test scores to varying degrees. In 2015, Honduras had some of the highest primary pupil-teacher ratios in the region, around 29 \ students per teacher, a figure that has remained relatively consistent over the past decade (UNESCO, 2017).¹⁰ However, at the secondary level there is one teacher for every 16 students, which is second highest in the region behind El Salvador (31 students per teacher) in 2015.

Even though the teacher-pupil ratio is adequate at the secondary level, class-time is often utilized poorly. A World Bank (2015) study estimates that only 64 percent of class time in Honduras is used for instruction or classroom management, roughly 20 percentage points below accepted benchmarks. There are differences at the subnational level; schools in the province of Copan averaged 83 percent of time spent instructing (as percent of total class time), whereas schools in Colon were closer to 33 percent. Teachers still tend to rely on traditional learning methods like a blackboard, rather than modern technology. In a 2011 sample of schools in

⁹ The World Bank Global Achievement dataset does use some regional test scores to estimate and produce standardized test scores. The standardization process includes rigorous qualitative and quantitative comparison of scores produced by regional and global tests.

¹⁰ Pupil-teacher ratios are not equivalent to average class size. UNESCO acknowledges pupil-teacher ratios are a basic indicator of education quality that may depend on a wide variety of factors, including the age and academic needs of pupils, or experience and skill of the teachers. Academic qualifications vary heavily across countries. They do provide a basic indication of student-teacher access.

Honduras that had implemented One Laptop per Child initiatives, less than one percent of classroom time was devoted to these tools.

Additionally, access to schools and basic resources, such as textbooks and notebooks, remain limited. Close to 80 percent of public schools in Honduras that offer secondary education are concentrated in urban environments, putting rural students at a disadvantage (Orozco &Valdivia, 2017).

External factors, such as economic considerations, are among the most commonly cited reasons for poor performance and high dropout rates at the secondary level. For example, Orozco &Valdivia (2017) explain that literacy rates in Honduras differ greatly by income quintile of the student, with those in the top quintile achieving rates that are five times those of the bottom quintile. Further, perceptions of economic benefit and lack of income factor heavily into dropout rates in Honduras. According to one study, 53 percent of students surveyed cited economic reasons as primary motivation for dropping out, compared with 25 percent in El Salvador, Nicaragua, and Panama (Adelman & Székely, 2016). Trevino et al (2015) find Honduras has one of the highest rates of child labor in the region, with an estimated 11.5 percent of children in third grade also holding jobs and six percent in sixth grade.

Parental expectations and localized violence can also influence student performance and dropout rates. Around 53 percent of parents in the region believe their child will complete tertiary education, compared to only 48 percent of parents in Honduras (Trevino, 2015). Further, in some violence-ridden areas, schools are perceived as unsafe due to threats against teachers, extortion, and the altercations that occur on school property (ACAPS, 2014).

Education spending and effectiveness

Spending on education is a key lever for governments and NGOs to improve attainment and quality, but equally important is the effectiveness with which those funds are spent. Honduras spends more on education than many of its regional peers, but rampant corruption and poor government capacity constrain the effectiveness of education spending.

There are three key measures that can help assess levels of spending on education: total spending education (as a percent of GDP), total per pupil spending on education by level (as a portion of GDP), and total per pupil spending by level (in absolute terms). Each of these measures explains something different about how much is being spent on education in a given region or country.

Total public spending on education as a percent of GDP is meant to be a cross-country indicator of the portion of output that a country spends on education. According to data from UNESCO, public spending on education in Honduras grew from 3.5 percent in 1995 to 5.9 percent of GDP in 2013. Within the region, Honduras spent more on education than most countries in 2017, surpassed only by Belize (6.6 percent) and Costa Rica (7.6 percent). This is on the high end of widely accepted targets for education spending defined by the UNESCO Global Education for All Muscat Agreement (2014), which sets education spending targets between 4 and 6 percent of GDP for all countries by 2030.

While these figures show that Honduran education spending is meeting and exceeding international standards, they fail to capture the full spending story. Honduras is still a very young country – median age is only 24 and 31 percent of its population is below the age of 15. This means that the country needs to provide for more students (relative to the total population) than many OECD countries. Honduras currently has 2.2 million students enrolled in some form of education (1.3 million enrolled in primary alone), which is nearly a quarter of the country's total population.

Spending per pupil, in both absolute and relative terms, serve as important measures because they take demographics and student numbers into account. Per pupil spending (relative to GDP)¹¹ in Honduras is well above the Central American average. In fact, Honduras ranks first or second in per pupil spending (relative to GDP) across all education levels. At the upper secondary levels this is especially pronounced, Honduras spends as much per pupil (relative to income) as Cuba (one of the regional leaders in education) does at the upper secondary level.

Per pupil spending (absolute) by level paints a bit of a different picture of spending on education in Honduras. Honduras is on par with the regional average for per pupil spending (absolute) on secondary school, but lags behind in both primary and tertiary spending per pupil. This means that each student in primary school receives significantly less funding than regional peers, even though Honduras spends far above the regional average for per pupil spending (relative to income).

As outlined in the previous sections on attainment and test scores, students must graduate primary school with the appropriate skills to be able move on and succeed in secondary school. Even though Honduras spends a relatively large portion of national income on primary and secondary, test scores across both levels are some of the lowest in the region. This dichotomy suggests that Honduran education spending is either inefficient or ineffective.

Government effectiveness and corruption remain a serious problem in Honduras, casting doubt on the efficiency of education spending. Currently, Honduras ranks second worst in the region in government effectiveness, as measured by the World Bank, and in transparency, as measured by Transparency International. Globally, Honduras ranks 136th in transparency, and 144th in government effectiveness, which places it directly below Mozambique in both measures.

Corruption in Honduras is widespread and recently, details have emerged of a scheme to divert government funds into the pockets of politicians, including powerful government ministers (Ernst and Malkin, 2018). This type of corruption has had direct impacts on the education system. Recently there was a scheme to approve unqualified teachers for service without requisite qualification because they were ruling party members or affiliates.

Further, disagreements between teacher unions and government actors have directly disrupted learning in Honduras. In 2006, 61,000 elementary school teachers went on strike for

¹¹ This measure refers to per pupil spending per GDP per capita, which is a measure of spending per student based on GDP per capita. It serves as a key benchmark for per pupil education spending relative to income levels, i.e. the portion of income that is devoted to education spending per student.

11 days resulting in class cancelations for millions of students (Yitzack Pavon, 2008). In 2011, the Law to Strengthen Public Education and Community Participation provoked additional strikes because teachers viewed the law as form of political interference aimed at limiting their independence (Cuevas, 2011).

Honduras has some of the highest spending on education in the region, but without significant efforts to curb corruption and improve government effectiveness that spending will continue to fall flat. Moreover, absolute spending per pupil shows that funds may need to be reallocated to primary school to help improve test scores outcomes for students who complete primary school.

What is the impact of Current Path investments in education on Honduras?

The Current Path projects improvement in the overall stock of education quality and quantity in Honduras, due to continued investment and progress. But what is the impact of this continued progress? What are the possible impacts of stagnation in education outcomes? To try and demonstrate the value of education in the region moving into the future, we simulated a world in which improvements in educational attainment and quality completely stall¹² to show the benefits of education investments along the Current Path of development.

The Current Path education system improvements in Honduras will have significant impacts on the future development of the country. As the stock and quality of education in the region improves, those who enter the labor force have core skills and are able to increase overall productivity in the economy. We estimate that projected improvements in educational attainment and quality will contribute \$25 billion in overall GDP between 2018 and 2040. Without investments in education, GDP would be approximately 7.5 percent lower in 2040.

Current Path improvements in education also contribute to reductions in inequality, as education access and quality expands so too do the gains across the population. Current Path educational progress reduces the number of people living in poverty by nearly 275,000 people by 2040. In other words, poverty is nearly 13 percent higher in a world without education investment. Further, the additional reductions in inequality and acceleration of population ageing from improved education outcomes contribute to a three percent decline in homicides by the year 2040.

Lastly, the economic gains and reductions in societal violence from continued investment in education reduce migration out of Honduras. Increased economic output increases economic opportunity and reduced violence lowers the impetus for individuals to flee the country. As such, Current Path improvements in education reduce emigration by a total of 5,800 individuals

¹² In the stalled education world, average educational attainment remains the same out to the 2030's in both Central America and the Caribbean, before declining slightly out to 2060. Average attainment begins to fall in each region as older educated individuals begin to die, but younger individuals lack the education necessary to increase the overall stock of education in society.

between 2018 and 2040.¹³ This suggests that, without education investments, emigration is forecast to be nearly four percent higher in 2040.

Because education systems are slow moving, children must move through levels of education sequentially to get to the next step and eventually the workforce, the gains from Current Path improvements in education are even more pronounced in the extreme long-run. Educational improvement along the Current Path scenario will contribute a total of \$323 billion (14 times current GDP) between 2018 and 2060. In the year 2060, GDP would be 25 percent lower without education investments. Further, Current Path improvements are expected to reduce the number of those in poverty by nearly 455,000 and reduce the number of homicides by 5.1 percent (156 homicides). Without investments in education, poverty would be 45 percent higher in the year 2060. Finally, total emigration from Honduras is expected to be reduced by 27,000 individuals between 2018 and 2060 due to educational improvements along the Current Path. Without investments, migration would be nearly 11 percent higher in the year 2060.

Comparing the Current Path to a world in which education improvement cease helps to show the importance of continued gains in education for overall development. These projected education gains have significant impacts on overall economic output, poverty reduction, societal violence, and migration. Moreover, if Honduras improves upon this Current Path, the country could see additional benefits across the education system and overall development.

Exploring alternative futures

The previous sections outline historical trends, the current path of key education indicators, and challenges and bottlenecks in educational attainment and quality in Honduras. The next step is to construct scenarios that simulate changes in key indicators and leverage points identified by this analysis.

Scenario construction and analysis is one of the key uses of the IFs tool and can help policymakers better understand the effects of interventions in and across key sectors. The following section will present a number of different scenarios that simulate improvements in the drivers of educational attainment and test scores. Each scenario presented here includes a compilation of key interventions across a number of education indicators over time.

Each scenario is built upon and compared to the Current Path of development across indicators – the Current Path provides a baseline of assessment that is grounded in the current trajectory of trends and dynamics in Honduras. Further, because education systems change slowly and effects of interventions in the education system are not immediate, we show results in both 2040 and 2060.

Below we present two scenarios that aim to tackle different questions and present different futures for the education system in Honduras. The first scenario rapidly improves the Honduran education system to ‘fill’ the education pipeline with carefully sequenced interventions. This is

¹³ Emigration refers to those individuals who have left Honduras and currently reside in another country. It does not include those who leave and return in the same year or attempt to migrate and are unsuccessful. Current emigration is approximately 16,500 and is forecast to be approximately 15,600 in 2040 under the Current Path.

meant to simulate a push to ‘ensure that all girls and boys complete free, equitable and quality primary and secondary education’ (SDG 4.1). This scenario is an extremely ambitious scenario that aims to explore benefits and costs of a huge policy and spending push to give every child an education.

The second scenario aims to show the effect of policy prioritization and targeted interventions at different levels of the education pipeline over the next five years (to coincide with the USAID CDCS five year planning periods). This scenario simulates changes in efficiency and/or policy that can improve education systems with little to no additional spending. Lastly, we demonstrate the importance of primary quality improvements by isolating a 5-year intervention to improve primary test scores from the larger 5-year scenario as exploring the impacts.

SDG achievement scenario

This scenario simulates a sequenced push to achieve SDG goal 4.1, which aims to ensure ‘complete free, equitable and quality primary and secondary education’ for all boys and girls. It represents a very ambitious scenario to get Honduras to ‘full’ enrollment and graduation across primary, lower secondary, and upper secondary levels by 2030. Concurrently, it boosts Honduran test scores across levels to Costa Rican levels. This scenario is meant to showcase the immense benefits (and costs) of educating every child in Honduras.

Table 6: SDG achievement scenario details

Variable(s)	Intervention	Time period
Full primary school	Increases the primary survival rate and transition rate between primary and secondary to 100 percent	By 2022
Full lower secondary school	Increases lower secondary graduation and primary to lower secondary transition rates to 100 percent	By 2026
Full upper secondary school	Increases upper secondary graduation and lower to upper secondary transition rates to 100 percent	By 2030
Improved test scores	Improves primary and secondary test scores to Costa Rican levels	By 2030

The *SDG Achievement* scenario improves average adult education attainment by 3.6 percent and adult average test scores by 4.5 percent by 2040 and, by 2060, it improves average adult attainment by 6.6 percent and average test scores by 8.4 percent. In this scenario, over 360,000 additional adults will have completed primary school and 920,000 additional adults will have completed secondary school by 2040.

By 2060, a comparable number of additional adults will have completed primary school, but the number of adults who have completed secondary school will jump to nearly two million. Furthermore, primary tests scores reach levels seen in Ireland today and secondary test scores reach levels seen in Finland today, both of which currently rank in the top five globally in education quality.

This increase in educational attainment and quality produces impacts across other development systems. Table 7 below shows the impact of the *SDG achievement* scenario across key indicators.

Table 7: Various outcome indicators, Honduras, 2040 and 2060

	GDP (billion \$)	GDP per capita (thousand \$)	Informal labor (millions)	Skilled labor (millions)	Emigration (thousands)	Poverty (millions)	Homicides (per 100,000)
In 2040							
Current Path	54.4	4.57	2.22	1.16	15.6	2.14	27.8
SDG push	57.7	4.85	2.14	1.20	15.3	1.99	27.5
Difference	3.3	0.29	-0.07	0.03	-0.3	-0.15	-0.3
In 2060							
Current Path	118.4	9.00	2.03	1.66	13.7	1.04	22.1
SDG push	140.0	10.65	1.84	1.73	12.9	0.84	21.9
Difference	21.6	1.65	-0.19	0.07	-0.8	-0.20	-0.2

Source: IFs 7.38.

The increases in the total stock and quality of education under *SDG Achievement* scenario significantly increases economic potential and output (total and per person) over the forecast horizon. Under this scenario the number of skilled workers is 34,000 (2.9 percent) higher and the number of those working informally is 67,000 (three percent) fewer than under the Current Path in 2040. This, in turn improves productivity of economy as whole; by 2040, total GDP is \$3.3 billion (six percent) higher and GDP per capita is \$280 (6.2 percent) higher. Total additional economic output (GDP) amounts \$19.7 billion (cumulative) between 2019 and 2040. These enormous gains in economic output, paired with a slight reduction in inequality, pull a total of 143,000 people out of poverty (those living on less than \$3.10 per day) by 2040.

While the *SDG Achievement* scenario does slightly reduce inequality by providing education to all populations, it does not get at the core issues that sustain long term economic inequality. Increasing education access does not necessarily change the government's ability to provide other services to vulnerable populations and much of the population remains in the informal sector, which has little to no institutional social safety net. Nonetheless, the slight reduction in inequality, along with slight reductions in the relative size of the youth population, does reduce the homicide rate by about one percent (33 homicides) by 2040.

Finally, the increase in economic growth and wider provision of quality education reduces the impetus for Hondurans to emigrate. By 2040, emigration from Honduras is reduced by two percent and a cumulative 3,000 fewer Hondurans emigrate between 2018 and 2040. See Box 4 for an in-depth review of the migration analysis carried out for this report.

While the effects of the *SDG Achievement* scenario are significant in 2040, they do not capture the full impact of this type of scenario. Even by 2040 the students who entered primary school in 2030 will not be in the workforce for at least another two years. However, by 2060, those who benefitted from the scenario will all be in the workforce.

By 2060, the compounding positive effects of the *SDG Achievement* scenario further improve Honduran development across the indicators above. In 2060, total GDP is \$23.7 billion (20 percent) higher. The *SDG Achievement* scenario generates a cumulative increase in GDP of \$254 billion (11 times current GDP). Further, GDP per capita is \$1,790 (20 percent) higher in the year 2060, and the number of those living on less than \$3.10 per day is 211,000 (20 percent) fewer. The scenario does not significantly reduce the number of homicides compared to 2040, but does result in a nearly six percent (nearly 800 people) reduction in emigration in the year 2060. Further, there are 11,700 fewer migrants between the years 2018 and 2060 compared to the Current Path.

Box 4: Overview of migration metrics

In this report, IFs forecasts the annual flow of **migrants** from Honduras who are projected to relocate to the United States. While it is impossible to know the exact number of Honduran migrants in the US at a given time, these data do adjust for undocumented workers. However, they do not capture those who move seasonally or who traverse the border multiple times in a given year, or who are caught and returned by border patrol. USAID, on the other hand, uses a different metric to understand migration from Honduras to the US. Using Honduran Mission analysis data, it measures the number of “attempted migrants” to the US, which accounts for migrants caught crossing the US border and those who are encountered at US ports of entry but are determined to be “inadmissible.” Whereas “migrants” (in this report) captures the foreign-born living in the US, “attempted migrants” to the US (as tracked by USAID) include those who did not make it across the border.

All demographic models in the report rely on understandings of stocks and flows, and models of migration are no different. Stocks are measures that persist across time, while flows add or remove from stocks. Abel (2016) uses the stock of foreign-born population living in each country on a bilateral basis (provided by the United Nations Population Division) to estimate the flows of people moving from one country to another (not those moving temporarily). While the stock measure captures the number migrants residing in the US, flows are changing and capture movements of migrants over a specified period.

Bilateral migration flows are forecast using a “gravity model”,¹⁴ which incorporates push-pull factors, such as distance (between two countries), size of the population (of the origin and destination countries), the size of migrant communities living in the destination country (as a percent of the destination country’s population), the ratio of the household income per capita (between two countries), the GDP per capita of the origin country, security (which includes the levels of homicide in origin country among other components), and risk of government instability in origin country. The resulting bilateral migration flow pattern is then adjusted through an iterative process until the sum of all inward flows to a country is equal to the country-level forecast value of inward migration. Migrant populations (stocks) increase with migrant inflows and decrease with outflows and deaths.

IFs allows us to forecast the flow of migrants we can expect during a given period under each of the scenarios. This flow of migrants differs from the total stock of Honduran immigrants residing in the US. Pew (2014) estimates that there are approximately 573,000

¹⁴ In physics, gravity is defined by distance and mass. In gravity models of trade or migration, physical distance is one variable and mass is measured by the size of populations or GDP.

Honduran immigrants residing in the US, 60 percent of whom are undocumented. IFs also estimates that approximately 560,000 Honduran migrants resided in the US in 2018, a figure which also attempts to account for undocumented migrants.

Under the Current Path forecast, we expect approximately 290,000 Honduran migrants between 2018 and 2040 and 514,000 between 2018 and 2060. Under the SDG Achievement scenario, we can project 287,000 Honduran migrants between 2018 and 2040 and 507,000 migrants between 2018 and 2040. We find that cumulatively, the SDG Achievement scenario reduces the number of emigrants from Honduras to the US by about 3,000 between 2018 and 2040 and 11,700 between 2018 and 2060. When we examine bilateral migration from Honduras to the United States under the 5-year push, we forecast that there are a total of 289,000 migrants between 2018 and 2040 and 509,000 between 2018 and 2060. We project the 5-year push to reduce the total number of emigrants by approximately 1,400 between 2018 and 2040 and by 5,200 between 2018 and 2060.

Data from the Honduran Mission indicate that there were approximately 90,000 attempted migrants to the US in fiscal year 2018. The figure includes person-attempts to cross the border into the US, but does not account for the number of irregular migrants that crossed the border into the US successfully. Notably, the magnitude of the difference between these two metrics (**migrants v. attempted migrants**) in 2018 is quite large.

Assuming that the share of people captured at the border relative to those successfully crossing the border does not change across time, we estimate the total number of Honduran **migrants and attempted migrants** to 2060. We also calculate the combined number of migrants expected each year under the SDG Achievement and 5-year education push scenarios. First, we find the ratio between the total migrants (those referred to as **migrants and attempted migrants**) and **migrants** in 2018; the ratio is approximately eight total migrants to one migrant who enters the US, either formally or informally. Then, we multiply this ratio by the **migrants** in each year under the Current Path. This gives us the expected number of total migrants, while maintaining the ratio of total migrants to permanent. We also estimate the total number of migrants under the SDG Achievement scenario by multiplying the annual number of permanent migrants under the SDG Achievement scenario by the same ratio described above.

Inflating our estimate of the number of Hondurans moving to the United States with the number of migrants captured at the border, we project a cumulative number of 2.32 million migrants by 2040 and a cumulative of 4.1 million by 2060. Under the SDG Achievement Scenario, we project the cumulative number of migrants to be approximately 2.29 million by 2040 and four million by 2060. Between 2018 and 2060, we estimate that the SDG Achievement scenario leads to a 94,000 reduction in total attempted and actual migration, documented and undocumented. The two percent reduction observed in IFs when we examine the impact of the SDG Achievement scenario on **migrants** remains constant when we examine the total impact on **migrants and apprehensions**. Under the 5-year push, we estimate a cumulative of 2.31 million migrants by 2040 and nearly four million migrants by 2060. We also forecast that the 5-year push would reduce the number of migrants by a total of 41,200 between 2018 and 2060. The one percent reduction observed in IFs remains constant when we assess the impact of this scenario on total **migrants and apprehensions**.

Costs of the SDG Achievement scenario

The provision of quality education for all students through secondary school has immense benefits, but requires significant political will and mobilization of resources. As such, we calculate an estimated minimum cost of achieving SDG 4.1 by 2030 for the Honduras.

To approximate the cost of this intervention we estimated the additional per pupil cost needed to improve test scores to Costa Rican levels by 2030 and applied that cost to all students entering the system in the *SDG Achievement* scenario out to 2060. We then subtracted the cost of the Current Path scenario (calculated using the same method) to determine a minimum additional cost for the *SDG Achievement* scenario.

Because Honduras already spends well above the regional average in overall spending (percent of GDP) and per pupil spending (relative to income) across secondary and tertiary, additional costs in primary per pupil spending constitute much of the additional costs required to achieve SDG 4.1 by 2030. If Honduras continues per pupil spending patterns across secondary and tertiary levels and boosts primary per pupil spending to support full enrollment, graduation, and increases in primary test scores, the additional cost of reaching SDG 4.1 amounts to approximately \$33 billion (146 percent of current GDP) by 2060.

However, these additional costs can be cut significantly if Honduras improves the efficacy of education spending and redistributes spending from secondary and tertiary to focus more on primary students. If Honduras shifts spending from tertiary and secondary (bringing it in line with Costa Rican relative spending per pupil spending) to increase primary spending per pupil it could reduce the additional cost of the *SDG Achievement* scenario by \$5.7 billion (25 percent of current GDP). In other words, improved spending efficiency and reallocating funds could eliminate 82 percent of the additional costs of the *SDG Achievement* scenario.

Without changes in government efficiency or effectiveness or reallocation of funds, the returns on investment in an *SDG Achievement* push are more than seven-fold by 2060. If the Honduran government is able to increase efficiency and government effectiveness by shifting funds and improving service delivery, the return on an SDG education investment could be even higher.

A push to achieve SDG 4.1 by 2030 without spending efficiency gains would cost a significant amount on the front end (today through 2030). Honduras would need to spend an additional \$3.5 billion (16 percent of current GDP) over the next 11 years. These additional funds would need to be shifted from other sectors or the Honduran government would need increase revenue to cover the additional costs (whether that be through international donors or taxes).

The *SDG Achievement* scenario illustrates the immense societal benefits of providing quality education for all individuals. However, it is a highly ambitious endeavor for both financial and political reasons; implementation would require substantial spending and, more importantly for Honduras, political will over a long period of time. The cost assessment here is a minimum cost based on spending in other countries with successful education systems (Costa Rica) and much more efficient and less corrupt governments.

5-year education push

The *5-year education* push scenario simulates a world in which authorities and donors improve key areas in the Honduran education system through policy will and increased spending efficiency. This scenario represents a shorter policy timeline that aligns with USAID 5-year CDCS planning periods.

This scenario simulates an increase in primary and secondary enrollment, transition, and graduation rates to move students through the education system and increase overall educational attainment and quality from 2019 to 2023. It assumes a five to 15 percent increase (over the Current Path) in primary and secondary test scores and survival, transition, and graduation rates from 2018 to 2023 (and maintains that effort/difference out to 2060).¹⁵ This increase pushes Honduran primary survival, and secondary enrollment, transition, and graduation rates to or slightly above the Central American averages by 2023.

Table 8: 5-year education push scenario details

Variable	Intervention	Explanation/Benchmarking
Primary survival rate	Increases primary survival rate from 90.6 percent today to 98.9 percent by 2023. This represents a 5.7 percent increase compared to the Current Path (93.2 percent) in 2023.	Honduras has seen sizable increases in primary survival rates in the past - from 2011 to 2017 primary survival increased by 20 percent. This intervention brings Honduras above the Central American average in primary survival.
Primary test scores	Increases average primary test scores from 31.6 today to 36.2 in 2023. This represents a 3-unit increase compared to the Current Path (33.2) in 2023.	Given the dearth of data in globally comparable estimates of test scores, it is difficult to benchmark this historically. This intervention brings Honduras above the Central American average (34.1) in primary test scores in 2023.
Primary to lower secondary transition rate	Increases primary to lower secondary transition rate from 86.7 percent today to 100 percent by 2023. This represents a 10.1 percent increase compared to the Current Path (88.9 percent) in 2023.	Honduras's transition rate increased from 72 percent to 85 percent between 2011 and 2015. By 2023, its transition rate will exceed the Central American average (92 percent).
Lower secondary graduation rate	Increase lower secondary graduation rates from 60.2 percent today to 70 percent in 2023. This represents a 5.5 percent increase compared to the Current Path (64.5 percent) in 2023.	This intervention brings Honduras in line with the Central American average (67.5 percent) in 2023.

¹⁵ See Appendix B for intervention details

Variable	Intervention	Explanation/Benchmarking
Lower to upper secondary transition rate	Increases secondary transition rates from 98.7 percent today to 98.9 percent in 2023. This is in line with the Current Path in 2023.	This brings Honduras's transition rate above Central America's (94.5 percent) in 2023.
Upper secondary graduation rate	Increases upper secondary graduation rates from 40 percent today to 49.7 percent in 2023. This represents a 3.6 percent increase compared to the Current Path (46.1 percent) in 2023.	This intervention brings Honduras to just below the Central American average (50.7 percent) in 2023.
Secondary test scores	Increases average secondary test scores from 38.6 today to 43.1 in 2023. This represents a 2.9-unit increase compared to the Current Path (40.2) in 2023	Given the dearth of data in globally comparable estimates of test scores, it is difficult to benchmark this historically. This intervention brings Honduras in line with the Central American average (41.6) in test scores in 2023.

The *5-year education push* improves average adult educational attainment by one percent and average adult test scores by four percent by 2040 and, by 2060, it improves overall attainment by 1.5 percent and average test scores by six percent. In this scenario, 36,000 more people will have completed primary school and 220,000 more have completed secondary school by 2040.

By 2060, there will be a comparable number of additional adults who have completed primary school, but there will be 450,000 additional adults who have completed secondary. Further, by 2060, primary test scores reach Austrian scores today (ranked 19th in the world), and secondary test scores match Estonia today (ranked 14th in the world).

This increase in educational attainment and quality impacts other development systems. Table 9 below shows the impact of the *5-year education push* across key indicators.

Table 9: Various outcome indicators, Honduras, 2040 and 2060

	GDP (billion \$)	GDP per capita (thousand \$)	Informal labor (millions)	Skilled labor (millions)	Emigration (thousands)	Poverty (millions)	Homicides (per 100,000)
In 2040							
Current Path	54.4	4.57	2.22	1.16	15.64	2.14	27.8
5-year push	56.0	4.71	2.21	1.17	15.50	2.09	27.9
Difference	1.6	0.14	0.00	0.01	-0.14	-0.05	0.1
In 2060							
Current Path	118.4	9.00	2.03	1.66	13.72	1.04	22.1
5-year push	128.5	9.76	1.99	1.69	13.39	0.96	22.1
Difference	10.1	0.76	-0.04	0.03	-0.34	-0.08	0.0

Source: IFs 7.38.

As in the *SDG Achievement* scenario, the increases in the total stock and quality of education under *5-year education push* scenario significantly increases economic potential and output (total and per person) over the forecast horizon. Under this scenario the number of skilled workers is roughly 10,000 (0.8 percent) higher and the number of those working informally is 3,000 (0.14 percent) fewer than under the Current Path in 2040. This, in turn, improves productivity of economy as whole; in 2040, total GDP is \$1.6 billion (three percent) higher and GDP per capita is \$140 (three percent) higher. Cumulative additional economic output (GDP) amounts \$10.2 billion (cumulative) between 2019 and 2040. These gains in economic output, paired with a slight reduction in inequality, pull 51,000 (2.4 percent) people out of poverty (those living on less than \$3.10 per day) in the year 2040.

While the *5-year education push* scenario does slightly reduce inequality by providing education to all populations, it does not get at the core issues that sustain long term economic inequality. Increasing education access does not necessarily change the government's ability to provide other services to vulnerable populations and much of the population remains in the informal sector, which has little to no institutional social safety net. Nonetheless, the slight reduction in inequality, along with slight reductions in the relative size of the youth population, does reduce the homicide rate by about 0.4 percent by 2040.

Finally, the increase in economic growth and wider provision of quality education reduces the impetus for Hondurans to emigrate. The *5-year education push* scenario reduces the total number of emigrants by approximately 1,400 between 2018 and 2040. Between 2018 and 2040, emigration from Honduras is reduced by about one percent.

While the effects of the *5-year education push* scenario are significant in 2040, they do not capture the full impact of this type of scenario. Even by 2040 the students who entered primary school in 2030 won't be in the workforce for at least another two years. However, by 2060, those who benefitted from the scenario will all be in the workforce.

By 2060, the compounding positive effects of the *5-year education push* scenario further improve Honduran development across the indicators above. In 2060, total GDP is \$10.1 billion (8.5 percent) higher, GDP per capita is \$758 (8.4 percent) higher, and the number of those living on less than \$3.10 per day is 84,000 (8.1 percent) fewer. The scenario does not significantly reduce the number of homicides compared to 2040, but does reduce the total number of emigrants by about 340 in 2060 and approximately 5,200 overall between 2018 and 2060.

Primary education quality

This overall push to improve key issue areas in the Honduran education system produces significant synergistic gains across education outcomes. But, if we break down the effect of each of the interventions listed in Table 8, primary education quality emerges as one of the key drivers to overall gains.

A 5-year push to improve only education quality at the primary level to the Central American average produces nearly \$55 billion (cumulatively) from 2019 to 2060, increases the number of skilled workers by 12,000 (0.7 percent), and reduces the number of those in poverty by 39,000 (3.8 percent) by 2060. In other words, this intervention alone accounts for nearly half of the total effect on some key indicators of the overall *5-year education push* (see Table 10 for scenario outputs).

Table 10: Various outcome indicators, Honduras, 2040 and 2060

	GDP (billion \$)	GDP per capita (\$)	Informal labor (millions)	Skilled labor (millions)	Emigration (thousands)	Poverty (millions)	Homicide (per 100,000)
In 2040							
Current Path	54.4	4.57	2.22	1.16	15.64	2.14	27.8
Primary test scores	55.1	4.63	2.22	1.16	15.58	2.12	27.9
Difference	0.7	0.06	0.00	0.00	-0.06	-0.02	0.1
In 2060							
Current Path	118.4	9.00	2.03	1.66	13.72	1.04	22.1
Primary test scores	123.2	9.36	2.02	1.67	13.56	1.00	22.1
Difference	4.8	0.36	-0.01	0.01	-0.16	-0.04	0.0

Source: IFs 7.38.

These results corroborate the issues identified in the Current Path sections of this report. The major bottleneck in the Honduran system is between primary and lower secondary school – while most students make it to the end of primary, test scores are very low and constrain the ability to move on and succeed in secondary school. Further, because many of those who graduate primary do not complete with the skills necessary to move on to secondary, they also lack the skills needed to pursue gainful employment.

Conclusion and policy recommendations

The Honduran education system has made important strides since the end of the 20th century. Overall educational attainment has improved and primary survival rates exceed the regional average in Central America. However, obstacles remain. Many primary students fail to acquire the skills and knowledge needed to succeed in secondary school. Test scores across both primary and secondary levels are lower than would be expected and secondary enrollment and graduation rates are some of the lowest in the region.

Poor government capacity, corruption, and the misallocation of education funding are key drivers of these issues in the education system. Honduran education spending exceeds the regional average, but funds do not always reach students and their educators. Moreover, current education spending is skewed towards secondary levels, which means that primary schools likely do not receive the funding necessary to provide quality education and move through the system.

Our analysis shows that, even with these inefficiencies and bottlenecks, improvements in education along the expected trajectory of development have immense impacts on Honduran development. Without expected improvements and investments in education along the Current Path of development, poverty would be 13 percent higher, GDP would be 7.5 percent lower, homicide would be three percent higher, and migration would be roughly four percent higher in the year 2040.

That said, gains along the Current Path of development are far from guaranteed and Honduras may be missing out on an opportunity to take advantage of the links between education improvements and development outcomes. Improvements in spending efficiency and the effectiveness of the education system could significantly improve Honduras' long-term development outlook. To demonstrate the importance of improvements in education above and beyond the current trajectory, we created two alternative futures that significantly improve Honduran education outcomes.

The *SDG Achievement* scenario pushes for 'full' enrollment and graduation in primary and secondary school and test scores that match those of Costa Rica. Implementation of this intervention is costly and requires political will, but the reallocation of funds from secondary and tertiary students to primary students help lower the total cost of implementation. The *5-year education push* is a less ambitious scenario that improves key bottlenecks in the education system, such as poor primary education quality and low secondary enrollment rates, over the next five years. This scenario demonstrates how concerted political will and improved spending efficiency could significantly boost education outcomes at little to no cost.

The *SDG Achievement* scenario and the *5-year education push* simulate investments and efficiency gains that allow for greater quality and attainment levels in Honduras. While the country's education system is on track to improve across the forecast horizon, the boost from these investments could lead to higher rankings (compared to Central American peers) and outcomes that more closely align with SDG 4.1. Further, the economic gains from improvements in education across each of these scenarios are significant – under the *SDG Achievement* and *5-year education push* scenarios, Honduran GDP sees a six percent and three percent boost, respectively, in 2040.

Considering the importance of education in future human development in Honduras, implementation of one of these alternative scenarios could be advantageous. The *SDG Achievement* scenario is expensive and difficult to implement, but hits education targets established by the international community. Alternatively, the *5-year education push* shows how improvements in spending efficiency could promote education quality and quantity at little to no cost. Adopting such a scenario could enable the country to improve its education quality and pave the way for enhanced development outcomes.

The findings in this report are based on analysis conducted using the IFs platform, a quantitative modeling tool, to develop scenarios that can be used to assess the impacts of education investments. IFs uses data and a mix of different quantitative modeling approaches to provide an alternative way to think about tradeoffs in policymaking. Because education is modeled within IFS, as are the economy, violence and migration, we can shed light on the effects of education investments on these other outcomes. In the IFs model, education has direct (and indirect through other modules) effects on the economy (GDP and inequality) and labor. Education affects violence and migration indirectly through its impacts on the economy and labor. We believe that IFs provides a good way to help frame this work in the future, though we recognize that there is not a large literature documenting these relationships that affected the modeling choices made, and the relationship and findings are affected by the quality of the data. As more information is available on these relationships, modeling can be updated.

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Appendix 1: Education attainment and quality model in IFs

The education model of IFs simulates patterns of educational participation and attainment in 186 countries over a long time horizon under alternative assumptions about uncertainties and interventions (Irfan 2008). Its purpose is to serve as a generalized thinking and analysis tool for educational futures within a broader human development context.

The model forecasts gender- and country-specific access, participation and progression rates at levels of formal education starting from elementary through lower and upper secondary to tertiary. The model also forecasts costs and public spending by level of education. Dropout, completion and transition to the next level of schooling are all mapped onto corresponding age cohorts thus allowing the model to forecast educational attainment for the entire population at any point in time within the forecast horizon.

From simple accounting of the grade progressions to complex budget balancing and budget impact algorithm, the model draws upon the extant understanding and standards (e.g., UNESCO's ISCED classification explained later) about national systems of education around the world. One difference between other attempts at forecasting educational participation and attainment (e.g, McMahon 1999; Bruns, Mingat and Rakotomalala 2003; Wils and O'Connor 2003; Delamonica, Mehrotra and Vandemoortele. 2001; Cuaresma and Lutz 2007) and our forecasting, is the embedding of education within an integrated model in which demographic and economic variables interact with education, in both directions, as the model runs.

We emphasize the inter-connectedness of the components and their relationship to the broader human development system. For example, during each year of simulation, the IFs cohort-specific demographic model provides the school age population to the education model. In turn, the education model feeds its calculations of education attainment to the population model's determination of women's fertility. Similarly, the broader economic and socio-political systems provide funding for education, and levels of educational attainment affect economic productivity and growth, and therefore also education spending.

Education quality is a recent addition to the International Futures (IFs) education model. This part of the model compares and forecasts quality of learning at the educational levels of primary and secondary for 186 model countries. To initialize the quality variables IFs model pre-processor uses the World Bank Global Achievement database of country scores in international achievement tests or regional equivalent of such tests in the test areas of reading, science and math. There is a total of eight new variables, four for primary and four for secondary. At each level, there are three subject area scores – science, math and reading – and an overall score. The scores will be further disaggregated by sex of the student depending on the availability of necessary data.

Test score forecasts in our model are driven by average educational attainment of the adults as an aggregate indicator of family environment and expenditure per student as an indicator of the quality of the school system. Each of the subject area scores are regressed against these variables using data for the base year or the most recent year with data. The regression relationships compute the scores in the forecast-years using values for the independent variables obtained from other IFs models. Any difference in scores obtained from historical database with

those obtained from regression is considered as a country-specific situation. The base-year country shifts in the scores, added to the regression output in the subsequent years, decrease gradually as the country merge towards the general relationship.

Some researchers have discovered that the quality of education is an important determinant of economic growth and productivity. The education quality model contains a forward linkage from learning quality to economic productivity. This linkage is implemented through the introduction of an elasticity of productivity to learning quality.

Data for education quality are initialized in the model using the global education dataset from the world bank. This dataset does not provide education quality disaggregated by gender. 8 variables are initialized namely education quality at the primary level (Math, Science, Reading, Total) and at the secondary level (Math, Science, Reading, Total)

Education Quality Conversion (Honduras)

This section explains the methodology followed to make the MIDEH scores that are the national level test scores for Honduras comparable to the education quality test scores from the World Bank Global achievement database which are currently being used in the education model pre-processor. The document lists all the data sources that are currently available, coverage of these datasets, scales followed by these data sets and then explains the methodology used. The final section of this document presents the converted test scores over time for Honduras.

Test score data available for Honduras:

Currently there are three main types of test score data that are available for Honduras at the primary and secondary level for math and reading,

- *World Bank Global Achievement Database (WB data)* - Test score data available for primary reading and math for Honduras for one year (1995). Scale of the scores is from 30 to 60. No disaggregation available by sex.
- *Education Quality Test Scores from Nadir Altinok (Altinok data)* - Test score data compiled by Altinok, Patrinos, Angirst and Harry. Test score data available for primary math and reading from 1995 to 2015. Scale of the test scores is from 100 to 700. Disaggregation available by gender.
- *MIDEH test score data* - Test score data collected for Honduras by USAID for math and reading. Scale of test scores is from 100 to 500. Data is available from 2007 to 2016 for both genders.

Objective and methodology used:

Ideally, we would have converted the MIDEH scores directly to the World Bank scale for Honduras. However, there is no overlap between the two test score data. Hence, we have to use the Altinok test scores to arrive at a value that is similar to the World Bank value for Honduras.

Step 1: Creating a relationship between the Altinok test score and the WB test score

We initially created a relationship between the total Altinok test score data and the total WB test score data at each level of education (Primary and Secondary) and for each subject (Math and Reading).

However, when creating the cross-sectional relationship, we used the reference year as 2005. The WB Data for Central American countries is based on two main tests. First is the LLECE conducted in 1992 and the second is the SECE conducted in 2005. This yields two data points for most Central American countries (one in 1995 and one in 2005). However, the quality of the tests is quite different. Therefore the 1995 data point is much higher than the 2005 data point. In the case of Honduras, the only data point available is from 1995 which is why the model initializes the country much higher than Costa Rica whose data comes from the 2005 data point. Given the difference in the test scores, we used a regression based on the 2005 data rather than the latest data point.

Step 2: Generating Altinok test scores for each year

Another challenge is that the Altinok test score data is only available in 5 year intervals. In order to have a complete dataset, we used the growth rates from the MIDEH dataset and applied the same to the Altinok test scores to get a more complete dataset.

Note that we used the average of Grade 5 and Grade 6 scores from the MIDEH dataset for Primary and the Grade 9 test scores from the same dataset for Secondary.

Step 3: Using the co-efficient from the above relationships to arrive at WB scores

Finally, we used the above co-efficients and the more complete Altinok data set to compute test score data for Honduras for math and reading at the primary and secondary levels. As mentioned above, we did not use the co-efficients from the relationship between the World Bank data set and the Altinok data set in the computation of the secondary reading data point for Honduras. We used the co-efficients for primary reading instead.

Appendix 2: Description of interventions for scenario analysis

Scenario name	Parameter name	Parameter description	Base value	Changed value	Justification for intervention
200_HEdFlat	edyrsagm	Years of Education Multiplier	1	0.6	Simulates a decrease of years of education attained by 40%
210_HEd5year	edseclowrgram	Education, Lower Secondary, Graduation rate, Multiplier	1	1.1	Simulates a 10% increase in graduation rate in lower secondary education in Guatemala over a 5 year period
210_HEd5year	edseclowrtranm	Education, Lower Secondary, transition rate, Multiplier	1	1.2	Simulates a 20% increase in education quality in secondary education in Honduras over a 5 year period
210_HEd5year	edqualsecallm	Education, quality, multiplier on secondary	1	1.075	Simulates a 7.5% increase in education quality in secondary education in Honduras over a 5 year period
210_HEd5year	edsecupprgram	Education, Upper Secondary, Graduation rate, Multiplier	1	1.1	Simulates a 10% increase in graduation rate in upper secondary education in Honduras over a 5 year period
210_HEd5year	edprisurm	Education, primary, survival rate, Multiplier	1	1.075	Simulates a 7.5% increase in survival rate in primary education in Honduras over a 5 year period
210_HEd5year	edqualpriallm	Education, quality, multiplier on primary	1	1.0925	Simulates a 9.25% increase in education quality in primary education in Honduras over a 5 year period
211_HEdPriTest	edqualpriallm	Education, quality, multiplier on primary	1	1.0925	Simulates a 9.25% increase in education quality in primary education in Honduras over a 5 year period
220_HSDG2030	edpriintnrtyr	Education, Primary, Net Intake Rate, Target Year	0	6	Simulates an increase of net intake rate at the primary rate to 100% by 2030, thus achieving SDG
220_HSDG2030	edprisurtrtyr	Education, Primary, Survival Rate, Target Year	0	6	Simulates an increase of survival rate at the primary rate to 100% by 2030, thus achieving SDG

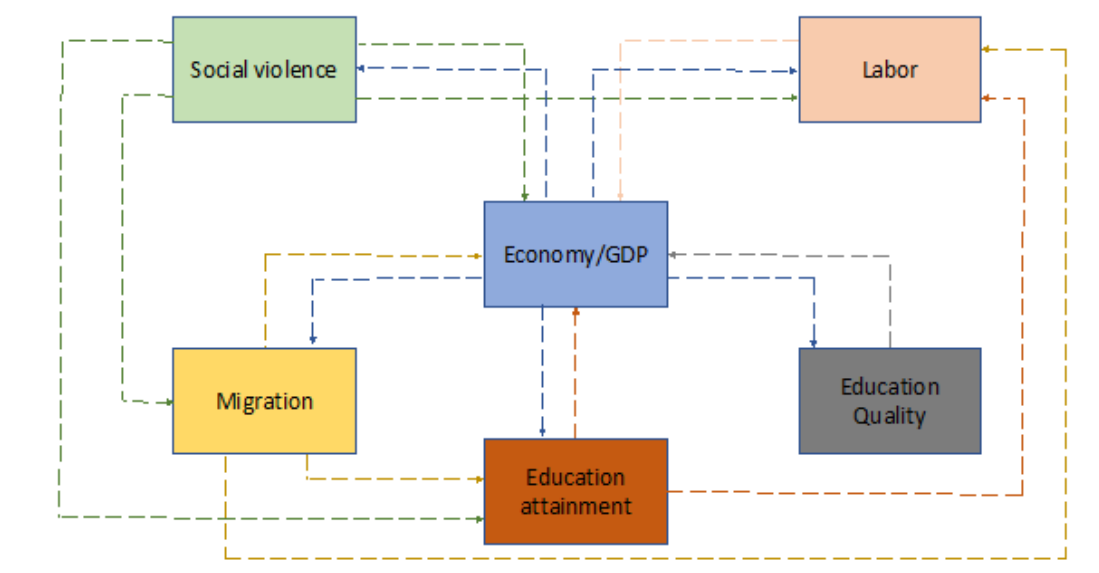
Scenario name	Parameter name	Parameter description	Base value	Changed value	Justification for intervention
220_HSDG2030	edseclowrtrantrgtyr	Education, Sec Lower, Transition Rate, Target Year	0	9	Simulates an increase of transition at the lower secondary rate to 100% by 2030, thus achieving SDG
220_HSDG2030	edseclowrgratrtyr	Education, Sec Lower, Graduation Rate, Target Year	0	9	Simulates an increase of graduation at the lower secondary rate to 100% by 2030, thus achieving SDG
220_HSDG2030	edsecupprtrantrgtyr	Education, Sec Upper, Transition Rate, Target Year	0	12	Simulates an increase of transition at the upper secondary rate to 100% by 2030, thus achieving SDG
220_HSDG2030	edsecupprgratrtyr	Education, Sec Upper, Graduation Rate, Target Year	0	12	Simulates an increase of graduation at the upper secondary rate to 100% by 2030, thus achieving SDG
220_HSDG2030	edtergradgr	Education, tertiary, graduation rate, annual growth	0	0.8	Simulates an decrease in tertiary graduation rate by 20%
220_HSDG2030	edqualpriallm	Education, quality, multiplier on primary	1	1.185	Simulates a 18.5% increase in education quality in primary education in Honduras over a 12 year period
220_HSDG2030	edqualsecallm	Education, quality, multiplier on secondary	1	1.135	Simulates a 13.5% increase in education quality in secondary education in Honduras over a 12 year period

Appendix 3: Modelling documentation

IFs integrates variables across 186 countries and 12 core systems, including: agriculture, demographics, economics, education, energy, environment, finance, governance, health, infrastructure, international politics, and technology (see Figure 1 in the Methodology section of the report). The sub-models for each system are dynamically connected, so IFs can simulate how changes in one system may lead to changes across all others. As a result, IFs endogenizes more variables and relationships from a wider range of key development systems than any other model in the world.

Education attainment and the new model additions - education quality, labor market dynamics (with updated data), societal violence, and bilateral migration – are fully integrated within the broader IFs platform (see Figure 1). These additions are endogenized within the broader modeling framework and have been developed using a combination of literature and statistical analysis. While there are “hard links”, or connections in which one variable impacts another through (potentially) multiple separate links within the model, between each of these model additions (discussed in more detail below), Figure 1 captures the effects observed if changes are made to the module included in a scenario.¹⁶

Figure 1: Model connections



Education quality and attainment, variables on which this report focuses, have hard links in the model to the other variables of interest in this report, namely the economy/GDP, labor, societal violence, and migration. Education has direct (and indirect through other modules) effects on the economy (GDP and inequality) and labor. Education affects violence and migration indirectly through its impacts on the economy and labor.

¹⁶ Note: The economy/GDP and labor are all connected to migration, violence, and education in the IFs model, but the effects may not be observed in the particular scenario. This figure is not exhaustive of all connections between variables in IFs.

Specifically, education quality impacts human capital, which affects multifactor productivity (MFP), which drives GDP. Economic factors influence other variables in the model, including emigration and violence. This is because voluntary emigration is driven in part by the ratio of household income between the home and destination countries. Also, the youth bulge and inequality (GINI co-efficient), which are affected by demographics and the economy (both of which are affected by education), drive homicides.

Also, educational attainment influences the total fertility rate (TFR), which affects the population size, influencing GDP per capita (providing another channel through which education can impact the economy). Attainment also impacts the skill profile of workers, which influences labor dynamics. By pushing cohorts through the education system, the SDG achievement scenario generates a more highly educated workforce. A change in the labor force can influence the GINI, impacting societal violence.

Labor impacts the economy through its effect on economic output. Further, there is a hard link between labor and violence whereby labor impacts the GINI coefficient, which influences societal violence. Labor's effects on the economy also impact migration and education.

Societal violence also has hard links to the additions in this report. Homicides and government risk and instability impact forced migration. Further, violence impacts education via the security index. Violence can affect labor through homicides, which contribute to total deaths, affecting the population size, and thus the size of the labor force. Finally, violence affects MFP via the security index.

Migration impacts education attainment, labor and the economy, all of which impact other variables in the model. Migration impacts educational attainment and labor because it changes the population in the country, thereby changing those in school, the labor supply and the size of the informal labor market. Migration impacts the economy through its effects on remittances from the foreign population and the link between household consumption and migration. Migration can impact household consumption by influencing the population growth rate.

Each of these modules is discussed in more depth in the sections that follow.

Economy

The population model provides forecasts of cohorts within the population and the economic model provides forecasts of spending in accordance with the GDP of regions. These two models become the basis for the education model. Thus the education model is able to produce forecasts of the pipeline of education at different levels (primary, secondary and tertiary) and by genders (male, female, total). This model generates a number of final outcome variables, the most important of which are average years of education for the population aged 15+ (and 25+), and quality of education (overall and at each level of education).

Education can impact other variables in the IFs system through impacts on multifactor productivity (MFP). This is because average years of education amongst adults ages 15+ impacts human capital, which (along with social capital, physical capital, and knowledge) affects MFP. Then, MFP has forward linkages to economic growth, which is tied to health, violence, migration, and other aspects of development.

There is a multitude of other ways in which the economy is tied to variables explored in this report. For example, education attainment impacts the skill level of workers, which affects labor dynamics. Labor is tied to the GINI coefficient, which influences societal violence. Furthermore, attainment impacts the fertility rate, which impacts the population size, a driver of GDP per capita.

Demographics

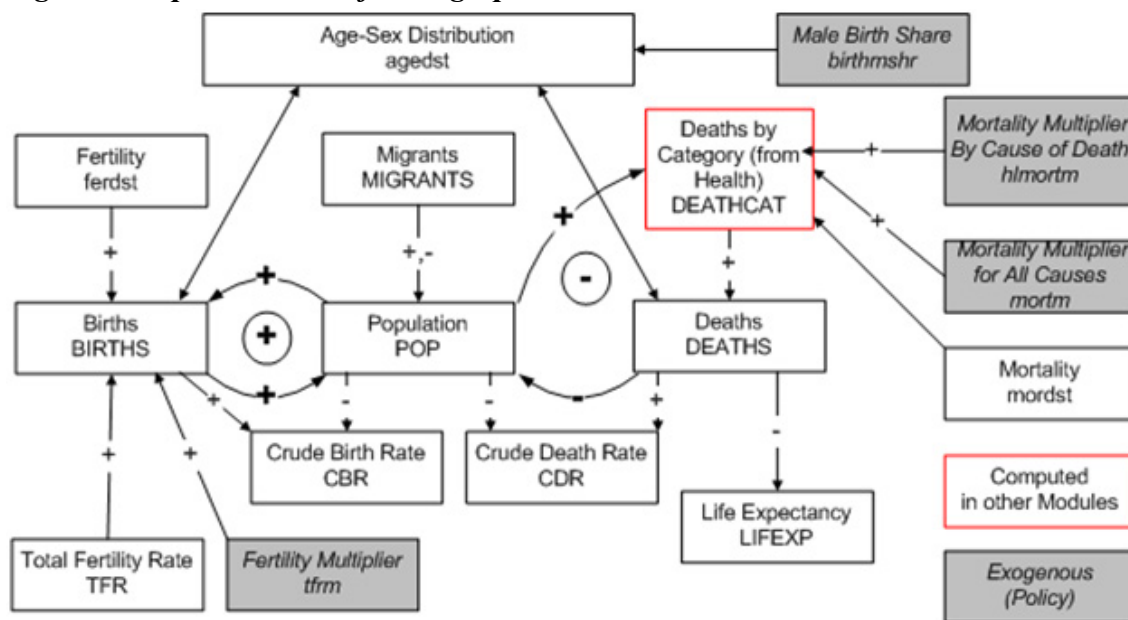
As mentioned above, the population model provides forecasts of cohorts within the population and serves as a basis for the education model. The dominant population equation is a simple addition of births at the bottom of the cohort distribution, subtraction of deaths from each population cohort, and advance of people to the next cohort over time.

The following key dynamics are directly linked to the Dominant Relations:

- Births are primarily a function of the total fertility rate, which in the longer term responds especially to education level of the adult population. The model user has direct control over TFR with a multiplier, but also much control for low fertility countries with a parameter specifying long-term stabilization level and lower boundary for fertility. There is also a secular trend reduction in fertility.
- Deaths are primarily a function of life expectancy, itself computed within the IFs health model where, like fertility, it responds in the long run to adult education and also to GDP per capita and technology change. The model user has direct control over all deaths with a mortality multiplier and over those specific to a cause of health with an alternative multiplier. There is also a secular trend reduction in mortality.

The larger demographic model (Figure 2) in combination with the health model provides representation of and control over migration; the fertility impact of infant mortality and contraception use rates; and the mortality impact of many factors including undernutrition, smoking rates, and indoor air pollution from open burning of solid fuels.

Figure 2: Representation of demographic model



Migration

This project has supported expansion of the IFs tool to include a representation of international bilateral migration forecasts (see Figure 3). Forecasts are disaggregated by motivation, being voluntary (i.e. seeking better economic opportunity, education, or reuniting with family) or forced (i.e. seeking asylum from the threat of violence or persecution).

The bilateral migration model has four major procedures (1) initialization of migration stock and flow forecasts with data, (2) distribute country-level outflows among all partner-countries using a gravity equation, (3) balancing of bilateral migration flows with gross, country-level forecasts of outward and inward flows, and (4) options for scenario analysis.

The initialization process draws migration stock and flow data from multiple sources to provide first-year values for forecasts of bilateral and country-level migration stocks and flows (inward and outward) for total migration and forced migration.¹⁷ Voluntary migration is calculated as the annual residual between these two values.¹⁸ In the current Base Case, outflows and inflows are adjusted so that they are equal to forecasts of country-level net migration from the UNPD (2017). Forced migration is currently forecast as a function of IFs' existing forecast of domestic instability (SFINTLWARMAG) divided by population (POP). The goal is for this

¹⁷ Total migration stock data comes from UNDP 2017. Abel (2016) estimated migration flow data from an earlier version of UNDP 2017. Forced migration stock data comes from UNHCR (2017). Forced migration flow data has been estimated by the Pardee Center using a methodology similar to that of Abel (2016).

¹⁸ This method can sometimes lead to negative voluntary flows given discrepancies in the primary data sources. In such cases, we assume voluntary migration flows to be equal to 5 percent of forced migration flows and adjust total migration accordingly.

driver to be replaced by one measuring broad societal violence, which is currently under development as part of this project.

The bilateral distribution of inward and outward migration flows is determined by the initial data and evolved according to a gravity model which includes a set of push and pull drivers such as physical distance between origin and destination countries, origin country population size, the ratio of household income per capita between origin and destination countries, and the size of origin-country population living in the destination country. The resulting bilateral migration flow pattern is then adjusted through an iterative process until the sum of all inward (outward) flows to a country is equal to the country-level forecast value of inward (outward) migration.

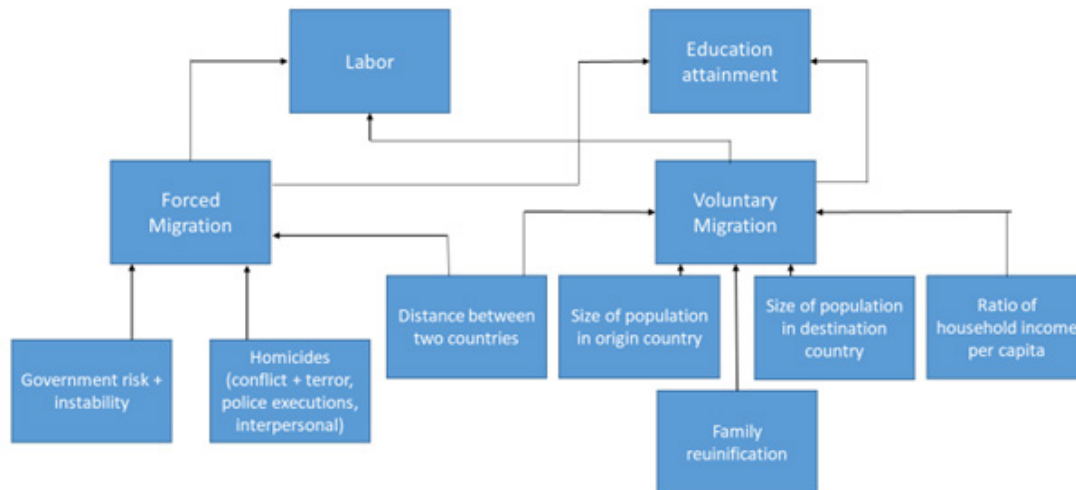
Bilateral migration flows directly augment bilateral stocks. Stocks decrease with deaths and return migration.¹⁹ In the case of forced migration stocks, it is assumed that annually a portion of forced migrants make the decision to voluntarily remain in the country.²⁰ If forced migration flows are lower than voluntary flows, forced migrants are assumed to return to their country of birth over a period of 5 years.

Through scenario analysis, users have the flexibility to change many of the assumptions around country-level flows, bilateral patterns, death rates, return rates, as well as relax the exogenous specification of net migration using UNPD forecasts. Doing so results in forecasts which are determined to a greater extent by the gravity equations.

¹⁹ The death rate of migrant stocks is assumed to be equal to the weighted average of death rates in the countries of origin and destination, with parameterized weights of 0.2 and 0.8 respectively. The share of return migrant flows in any bilateral flow is assumed to be equal to the ratio of bilateral migrant stocks between the origin and destination countries. This assumption is also a parameter and can be modified through scenario analysis.

²⁰ This conversion of forced migrant stocks to voluntary migrant stocks occurs at a similar rate as the expected voluntary flows from country of origin to country of destination.

Figure 3: Representation of Bilateral Migration



Education attainment

The education model of IFs (Figure 4) simulates patterns of educational participation and attainment in 186 countries over a long time horizon under alternative assumptions about uncertainties and interventions (Irfan 2008). Its purpose is to serve as a generalized thinking and analysis tool for educational futures within a broader human development context.

Educational attainment of the adult is obtained through an accounting system that splits population into five-year cohorts starting from the age of fifteen. Each of the cohorts are initialized with an average level of educational quality (EDQUALAG15) and quantity (EDYRSAG15). The cohort averages change as people join or leave the cohorts bringing in or taking away their education with them. The computation of the educational attributes of the youngest couple of cohorts uses the high school and college graduation rates from the enrollment model.

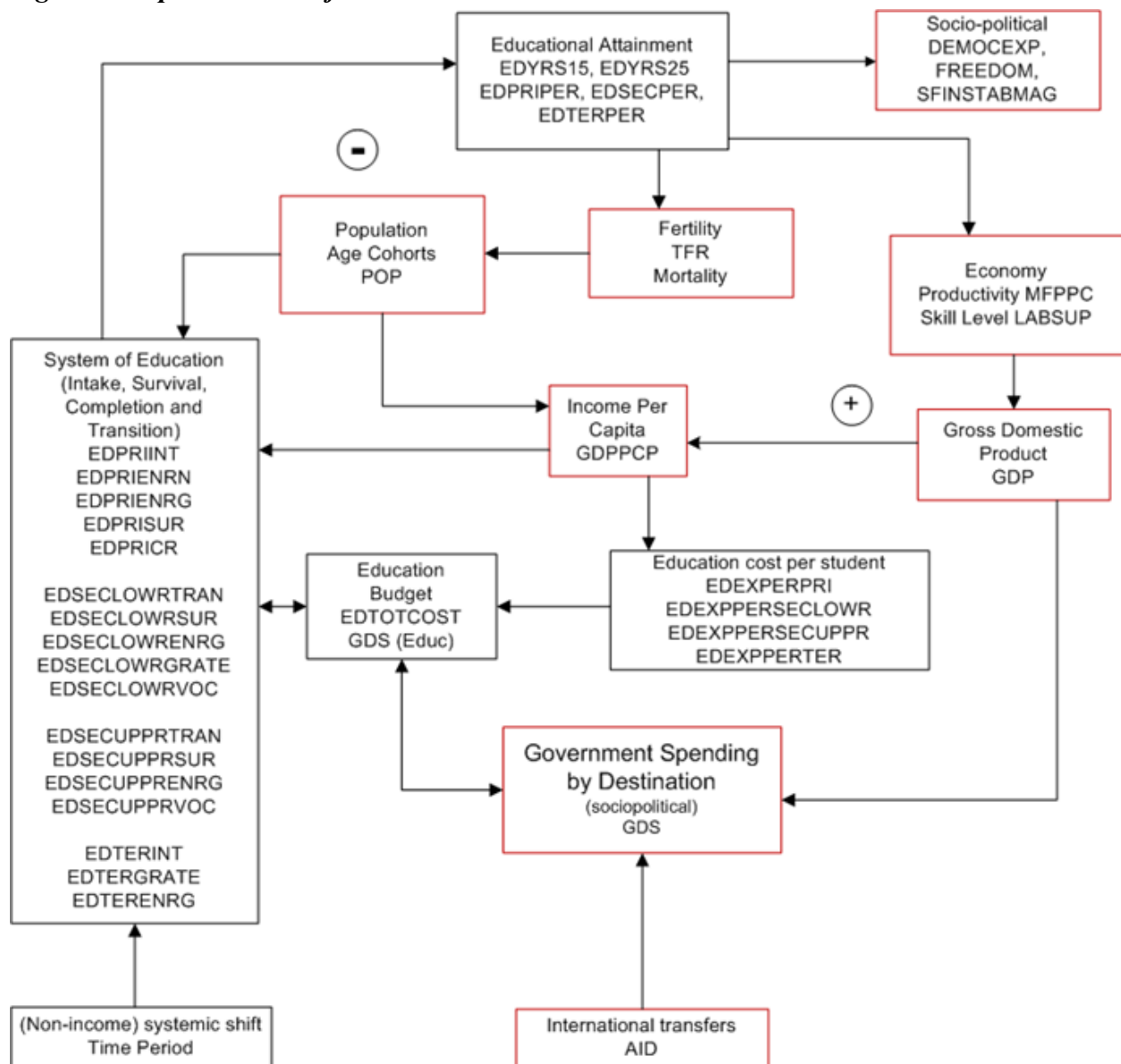
The model forecasts gender- and country-specific access, participation and progression rates at levels of formal education starting from elementary through lower and upper secondary to tertiary. The model also forecasts costs and public spending by level of education. Dropout, completion and transition to the next level of schooling are all mapped onto corresponding age cohorts thus allowing the model to forecast educational attainment for the entire population at any point in time within the forecast horizon.

From simple accounting of the grade progressions to complex budget balancing and budget impact algorithm, the model draws upon the extant understanding and standards (e.g., UNESCO's ISCED classification explained later) about national systems of education around the world. One difference between other attempts at forecasting educational participation and attainment (e.g, McMahon 1999; Bruns, Mingat and Rakotomalala 2003; Wils and O'Connor 2003; Delamonica, Mehrotra and Vandemoortele. 2001; Cuaresma and Lutz 2007)

and our forecasting, is the embedding of education within an integrated model in which demographic and economic variables interact with education, in both directions, as the model runs.

We emphasize the inter-connectedness of the components and their relationship to the broader human development system. For example, during each year of simulation, the IFs cohort-specific demographic model provides the school age population to the education model. In turn, the education model feeds its calculations of education attainment to the population model's determination of women's fertility. Similarly, the broader economic and socio-political systems provide funding for education, and levels of educational attainment affect economic productivity and growth, and therefore also education spending.

Figure 4: Representation of the education model



Education quality

Education quality is a recent addition to the IFs education model. This part of the model compares and forecasts quality of learning at the educational levels of primary and secondary for 186 model countries. To initialize the quality variables IFs model pre-processor uses the World Bank Global Achievement database of country scores in international achievement tests or regional equivalent of such tests in the test areas of reading, science and math.

Test score forecasts in our model are driven by three factors representing three different areas – society, family and school system. Variables that represent these three areas are – income per capita as a proxy for the level of development of the society, average educational attainment of the adults as an aggregate indicator of family environment and expenditure per student as an indicator of the quality of the school system. Each of the subject area scores are regressed against these three variables using data for the base year or the most recent year with data. The regression relationships compute the scores in the forecast-years using values for the independent variables obtained from other IFs models. Any difference in scores obtained from historical database with those obtained from regression is considered as a country-specific situation. The base-year country shifts in the scores, added to the regression output in the subsequent years, decrease gradually as the country merge towards the general relationship.

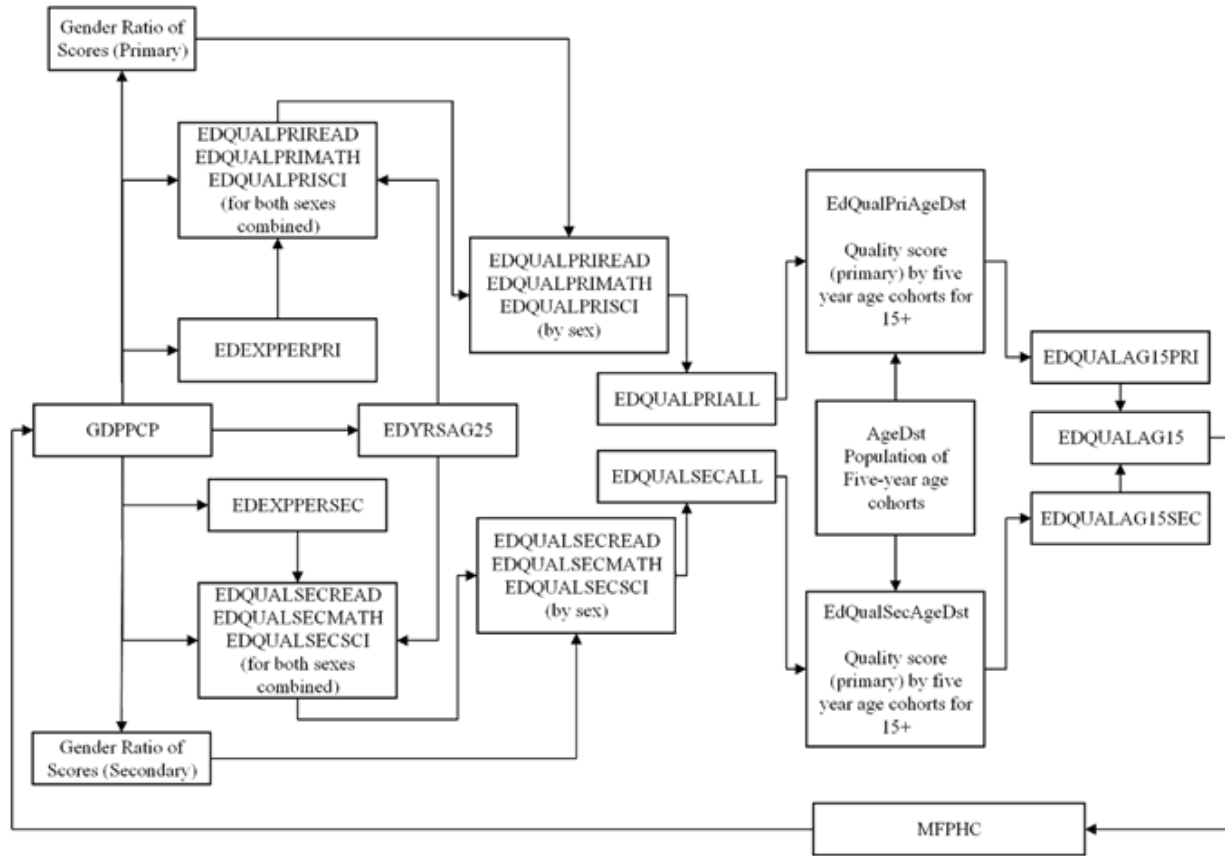
Learning quality indicators for primary and secondary education (EDQUALPRI, EDQUALSEC) are driven by level of development, parental education and spending in the corresponding level of education.

We have used test score data from twenty-five years back as an average measure for the learning quality of the adults in the model base year. Historical quality scores for primary and secondary, for all subjects combined, are used in this way to initialize adult quality scores. This is not a very accurate way of measuring adult education quality. It incorporates several crude assumptions, for example, the quality score of adults of a certain age are same as the quality score when these adults were in school. This is the best we could do given the availability of data.

The model starts with spreading these quality scores into scores for each of the five-year age-sex cohorts. As the model runs, students age and join the youngest of the adult cohorts carrying their quality score with them. Also, as the model runs, each year each of the five-year cohorts is joined by some from the younger cohorts and left by others who move to the older cohort. The scores of the cohort are re-aggregated each year to reflect the score changes from these entry and exit. Population weighted average of all five-year age-sex cohorts gives two quality scores (EDQUALAG15PRI and EDQUALAG15SEC) for the adults, 15 years and older. An overall adult score (EDQUALAG15) is obtained by averaging these two. This score drives multi-factor productivity in the economic model of IFs.

Figure 5 is a diagrammatic representation of the education quality model in IFs.

Figure 5: Representation of the education quality model

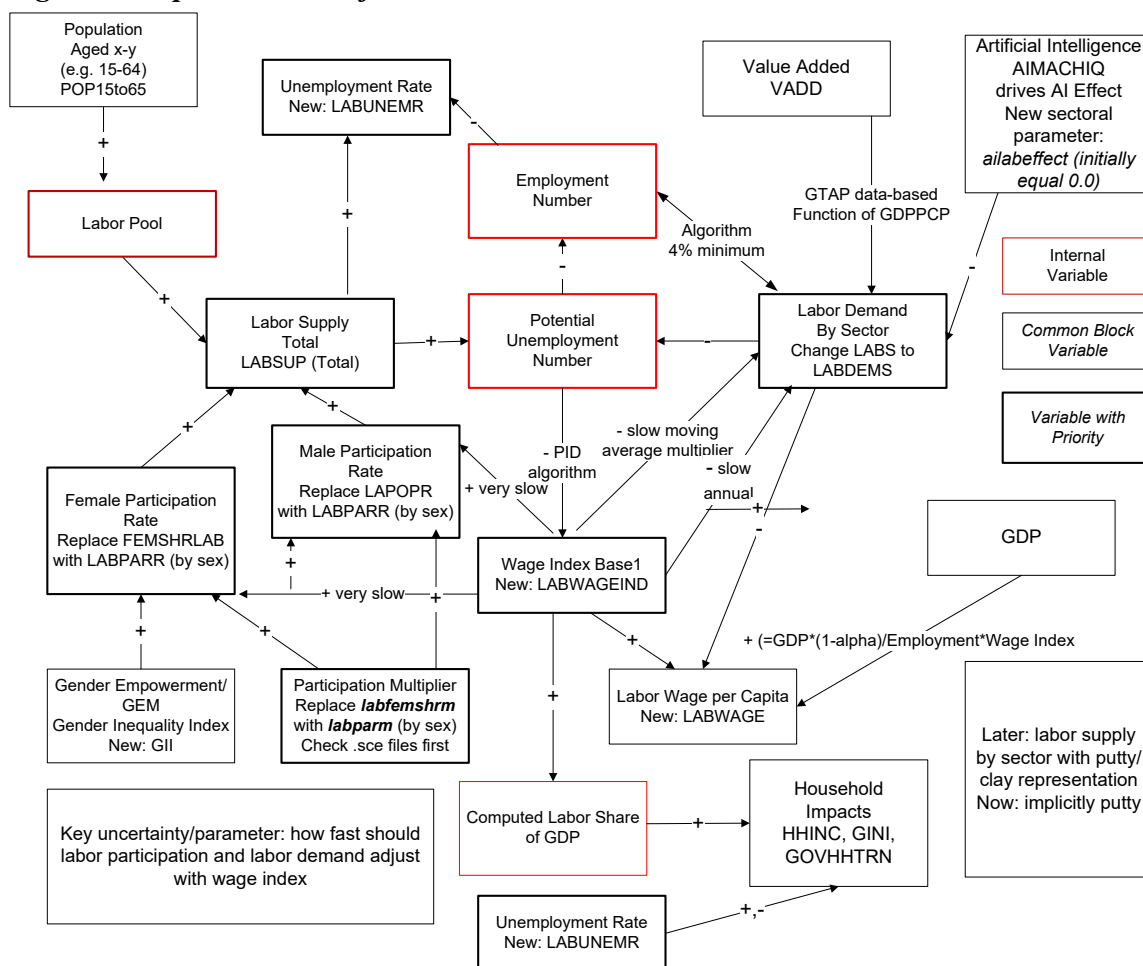


Labor

The labor model in IFs (Figure 6) was modified by incorporating unemployment through this contract. Labor supply is determined by the working age population and the share of that population who are willing to work. The labor supply is relatively stable. It is the demand instability that gives rise to most of the imbalances in the labor market. Economists generally use a demand curve of labor which shows the quantity of labor the employers are willing to hire at a given wage. These demand curves are helpful in studying the short-term demand fluctuations, for example, those that result from the business cycle. In the longer-term labor demand is driven by technological progress. The advent of new technology in a particular sector usually reduces the demand for labor in that sector, more so for the labor with less or no skills.

Neoclassical assumptions are used to balance the market. The higher the wage the more willing are the workers to work. Firms, in contrast, prefer to hire when the wage is low. The imbalance shows up first in the rate of unemployment. Shifts in the rates of unemployment beyond what is usual impacts wage, the price of labor. For example, wages drop in the event of rising unemployment as there are more people to hire from. Wage adjustments feed back to the demand for labor thus bringing the system back to the equilibrium.

Figure 6: Representation of labor model



Description of initial labor market modelling in IFs:

IFs model follows the notion of an equilibrium market. However, instead of computing an analytical solution at each point in time, as is usually done in comparative statics models, we balance the market through an equilibrium seeking algorithm. We use an algorithm borrowed from the control systems engineering.

This PID controller algorithm, described also in the IFs economic model documentation, works basically by computing corrective signals for equilibrating variables using a buffer variable, for example wage, as the buffer moves towards or away from a target value. The signal is computed from two quantities, the distance of the buffer from the target and the current rate of change of the buffer, and scaled to a suitable base. The computed signal is then applied on the variable/s which need to be balanced, demand and supply of labor in our case, thus getting closer to a balance at each step of simulation. The target value for the buffer variable and the parameters of the control algorithm are obtained through expert judgment and model calibration.

IFs labor model uses two PID controllers to balance the demand and supply of labor. One of the controllers use unemployment (LABUNEMPR) as a buffer variable and the other uses wage

(LABWAGEIND) as a buffer. The model assumes labor to be perfectly substitutable across all sectors of the economy with an overall wage and unemployment rate for the entire labor market. This assumption is rather simplistic but this is the best we can do with the data we have at our hand.

Violence

The IFs system includes a representation of mortality from different types of societal violence. The types of violence represented are homicides, police violence, violence from conflict, self-harm and violence against vulnerable populations (women & children). Total violence is calculated using a weighted average of mortality rates for each of the above and using population of the respective age-cohorts as a weight. The different types of violence are then fed into the security index in IFs (GOVINDSECUR) which has forward linkages to multifactor productivity, forced migration and educational enrollment.

In the first year of the model, data for the different types of violence are initialized using mortality data from the Institute for Health and Metric Evaluation (IHME). Note that we currently do not forecast prevalence of any kind of violence due to a lack of data related to the same. There is a switch that a user can activate to normalize violence related mortality to violence related to intentional injuries (based on data from UNPD) in the first year of the model.

Levels of homicide deaths and levels of deaths of vulnerable populations are determined in the forecast years using the youth bulge and inequality (GINI co-efficient) as drivers. Conflict deaths are driven using the probability of internal war, police violence is driven by levels of homicides and corruption and self-harm is driven using deaths from mental health and levels of homicides.

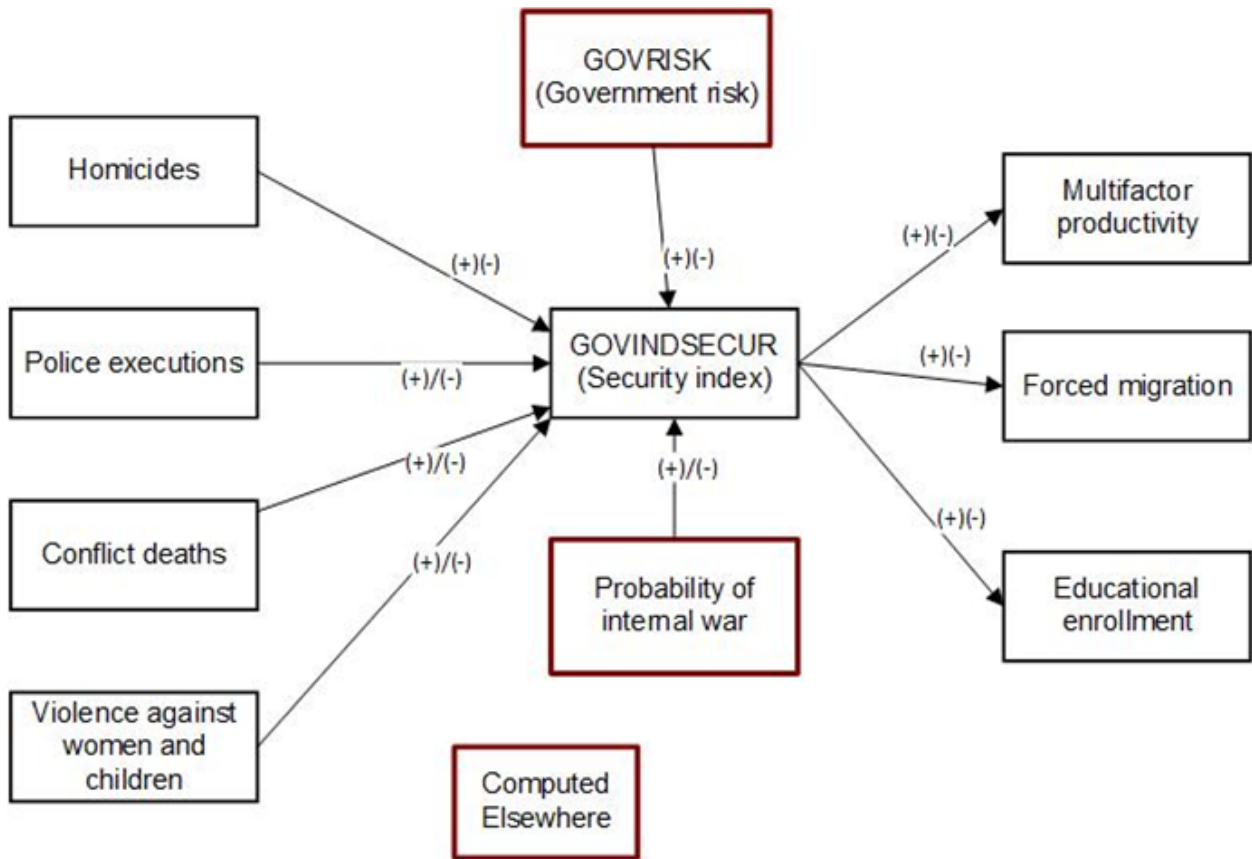
In addition to the variables themselves, there are multiplicative and additive parameters available to the user to simulate an increase or decrease in levels of violence.

Finally, the different types of violence are used in the calculation of a violence term which is one of three terms used in the computation of the government security index (GOVINDSECUR). The other two terms used are a term for government risk and a term for probability of war.

The security index has a forward linkage to multifactor productivity, a forward linkage to forced migration and a forward linkage to educational enrollment. All forward linkages are represented through elasticities in the model. In addition to these, the violence model itself has a linkage to the demographic model since it contributes to the death rate.

The flowchart in Figure 7 provides a diagrammatic representation of the violence model along with relevant forward linkages.

Figure 7: Representation of the violence model



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