Conditional Convergence and Future TFP Growth in Israel

Eyal Argov* Shay Tsur†

May 2017

Abstract

This study is a part of a broad project of constructing a long-run growth model to forecast Israel's GDP, and to evaluate how different exogenous developments, or policy steps, are expected to affect the long run growth rate. The current study describes the Total Factor Productivty (TFP) block of the project. We first estimate output per worker determinants in a cross section level regression with common fundamental variables as geography and culture, together with policy affected variables such as physical and human infrastructures, and institutions indicators. Using the estimates from this regression we calculate the gap of each country's output per worker from its own predicted value, and forecast Israel's TFP growth by using this calculted gap as the potential to grow faster then the average global growth rate. We find that the israeli actual productivity level is similar to the predicted one, suggesting a lack of potential to grow faster then the average global growth. The baseline TFP growth forecast for the years 2015-2060 is 0.54, very similar to the historic growth rate of the Israeli TFP over the last 15 years. The Israeli productivity is not expected to get much closer to the OECD countrys' average productivity, consistently with findings that the productivity in Israel has not converged to the frontier over the last 30 years.

*Bank of Israel, Research Department (eyal.argov@boi.org.il).
†Bank of Israel and Tel-Aviv University (shay.tsur@boi.org.il).

1 Introduction

There are large differences in the standard of living and in output per worker across countries. Explaining this global inequality using models of production-factor accumulation predicts that sooner or latter poor nations will converge to the standard of living of rich nations Solow (1956). However, this phenomena is barely observed in cross contry data. The lack of convergence between nations' wealth has lead the literature to focus on "conditional convergence" rather then on "global convergence". Barro (1991) found in a cross section regressions that the growth rate of real GDP per capita is negatively related to the initial level of real GDP per capita, only after controlling each countries' human capital. Barro and Sala-i Martin (1992) emphasized that it is more informative to look on the distribution of wealth conditional on various characteristics of each economy, such as govrenment expenditure and political stability. They found that the importence of the inclusion of these characteristics becomes larger when the sample of economic units is more hetrogenous: The inclusion of background characteristics was not importanent at all in a sample of U.S states, it increased the degree of the convergence in a sample of OECD countries, and it was essential for finding convergence in a sample of 96 countries over the world.

This paper uses deep roots of economic growth and policy variables in order to explain differences in GDP per worker (productivity) across countries and TFP growth. We first estimate productivity determinants in a regression with geography, genetics diversity, culture and other common fundamental variables, together with policy affected variables such as physical and human infrastructure, and institutions indecators. Using the estimates from this regression we predict the "conditional productivity" of each country and the gap from this predicted level. Then, we estimate TFP growth using the gap from the predicted level as an explanatory variable.

There are two objectives to this analysis: first, estimating the effect of policy variables

on the level of productivity after controlling deep roots gets us closer to the casual effect of policy measures on long run standards of living. In the trade-off between achieving a "clean" casual effect and achieving estimates with external validity, our estimates will have higher external validity; This compared to researches that exploit a specific exogenous event in order to find a causal relationship between policy and growth. Second, considering deep roots of economic growth and policy variables in a framework of conditional convergence let us predict future development of countries, given a country's fundamental and current set of policies. This framework will also let us ask questions on changes in the potential growth of one country or another following a policy change.

The weakness in cross section convergence regressions is that the estimate of the convergence rate might be biased in the case of Ommited Variables (OVB) that are correlated with the initial level of GDP per Capita. Islam (1995) employed a panel regression framework with country fixed effects in order to control the basic unobserved characteristics of each country. That way he found a much more intensive degree of convergence, concluding that indeed, omited variables were positively correlated with the initial level of GDP per Capita. In a later study, Islam (2003) claimed that the OVB problem led the convergence literture to depart from the cross section framework. However, while the panel regression framework can identify more properly the speed of convergence, the country fixed effect pre-determines the steady state level of the economy, unlike the cross section framework that defines the steady state of each country by the typical GDP per Capita of countries with similar characteristics.

In recent years, growth literture has abandoned convergence literture and it has focoused on the deep roots of growth such as geography, culture, institutions, and policies. Our work exploits this growing literture to improve the cross section convergence regressions, in order to properly predict the typical potential path of each county, with a reduced risk of OVB. Using deep roots of growth has an advatage in that senese, since some of the variables that are used in the classic convergence regressions might be the result of the growth prosses

rather than the cause of it.

This study is a part of a broad project of constructing a long-run growth model to forecast Israel's GDP growth over an horizon of approximately 50 years given various assumptions, and to evaluate how different exogenous developments, or policy steps, are expected to affect the long run growth rate Argov and Tsur (2017). The long run growth model is built from several conected models. **The unifying model** assumes constant returns to scale in a Cobb-Douglas production function that determines how much output (GDP) may be produced from a combination of physical capital, aggregate effective human capital and Total Factor Productivity (TFP). Physical capital evolves according the the economies investment depands on three demographic variables (**demografic investment rate block**): the fertility rate, life expectancy at birth and the Old (aged 65+) age dependency. The **effective human capital model block** aggregates the human capital of 84 population groups divided by gender, 5-year-age-group and religion. The effective human capital of each group is defined by its labor input, human capital from effective education years and from work experience. Labor input depends of the population size of the group, its labor force participation rate, its unemployment rate and its average hours per worker. The current study describes the **TFP model block** in detail.

The remainder of this paper is organized as follows: Section 2 disscuses deep determinants of Income Differences. Section 3 describes the data used in this paper. Section 4 demonstrates the difference between global and conditional convergence based on the data and variables we use in the paper. Section 5 sets the empirical model for output per worker and TFP growth and show the results. Section 6 illustrate future convergence patterns based on our results and focusses on the forecast to Israel. Section 7 summarize.

2 Deep Determinants of Income Differences

In the introduction (Section 1) we described the evolution of the literature from predicting global convergence following Solow (1956) to predicting "club" or a conditional convergence

(Barro and Sala-i Martin (1992)). This evolution was accompanied by a literature that criticized growth theory for focussing solely on proximate causes rather than fundamental causes of economic growth. As North and Thomas (1973) put it: "The factors we have listed (innovation, economies of scale, education, capital accumulation etc.) are not causes of growth; they are growth" (p.2).

Acemoglu (2008) defines four groups of fundamental causes: geography; institutions; luck and multiple equilibria; and culture. We will briefly survey a small sample of key papers regarding these fields.

The professional and popular book of of Diamond (1997), *"Guns, Germs, and steel"*, argues that differences in soil quality and fertility between Eurasia and other areas around the globe affected the ability of nations to build a complex organization and an hirarchy that positively influenced economic prosperity. Acemoglu *et al.* (2005) claimed that institutions, as broadly designed by the European colonialism, have shaped economic differences between countries. Furthermore, they show that there has been a reversal of fortune in income levels among former colonies. Jones and Olken (2005) found that leaders effect the economic growth of countries, and conclude that luck played a major role in cross country income differences. However, Acemoglu (2008) claims that the selection of-, and the policy of-leaders are part of the institutional explanations. Ashraf and Galor (2013) found that there is an optimum of genetic diversity within a country. They use the genetic diversity that predicts by the prehistoric exodus of Homo sapiens out of Africa, and claim that there is a "trade-off between the beneficial and the detrimental effects of diversity on productivity". Becker and Woessmann (2009) claims that Protestant economies prospered because tradition of reading the Bible increased human capital. They found that Protestantism indeed led to higher economic prosperity and better education. A resemble study relevant for the Israeli context (Botticini and Eckstein (2007)) suggests that Judaism enforced a religious norm of studying that has influenced Jewish economic and demographic history. Our study uses variables from the groups of causes we briefly reviewed above, as deep

explanatories of the level of GDP per Capita.

3 The Data

The initial level of country specific productivity gap, as well as the parameters determing the marginal effect of differant varibles on productivity, are derived from a cross country regression of the (log) level of actual GDP per worker in 2010 on a set of fundamental and policy variables. Country level macro data, such as GDP per worker and TFP, are taken from Penn World Tables. The fundemetal (deep root) variables are taken from a variety of studies that explored the deep roots of growth, as organized in Ashraf and Galor (2013): (1) **Neolithic transition** is the number of years (in thousands) that elapsed since agriculture became the primary mode of substistence; (2) **Arable land** is the fraction of total land area that is arable, as reported by the World Bank's World Development Indicators; (3) **Population in tropical** is the percentage of a country's 1995 population that lives in tropical areas; (4) **Distance to waterway** is the average across the grid cells of a country, in thousands of km, from an ice-free coastline or sea-navigable river; (5) **OPEC dummy** equals 1 for countries membered in The Organization of The Petroleum Exporting Countries; (6) **Genetic diversity** is the expected heterozygosity (genetic diversity) as predicted by migratory distance from East Africa (Ashraf and Galor (2013));(7) **Etnic fractionalization** is the probability that two randomly selected individuals, will belong to different ethnic groups; (8) **Religion controls** include variables that represent the shares of Muslims, the share of Catholics and the share of Protestants in the country. As for the policy variables: (1) **Doing business** is the countries "Distance to Frontier" in the World Bank's indicator which measures the easiness of doing business in several areas; (2) **Social Infrastructure** is an index, calculated by Hall and Jones (1999) as a mean between two separate indexes: (i) Data from the "International Country Risk Guide", that represents the average between law and order, bureaucratic quality, corruption, risk of expropriation, and government repudiation of contracts. (ii) An index of openness to

trade, based on Sachs *et al.* (1995) (3) Data on **transportation infrastructures (roads and rails)** - a principal component of indicators for the quality and the quantity of roads and rails, based on indexes taken from the "International Road Federation" (4) data on **communication infrastructures** - main telephone lines and mobile phones per 1000 workers, as published by the World Bank, based on the International Telecommunications Union; (5) Data on Education Quality**: Tests scores** for the years 1995-2010, standardized over time, across subjects (Math, Reading and Science), across schooling levels, and across various international and regional assessments. These data will be obtained from the World Bank, based on a study by Angrist *et al.* (2013). (6) The share of **educated persons** (at least tertiary education) in the middle class (third quintal) of income and the ratio between this share among the lowest class to the share among the middle class - (7) **an indicator for the equalty of educational opportunities**. These variables are based on data from the "World Development Indicators". The regression will include around 70 developing and advanced economies, among them Israel[1].

Figures 4-6 in the appendix present the order of the countries over the policy oriented variables that were described above. The Israeli transportation infrastructures are at the middle of the distribution of OECD countries, whereas it's communication infrastructures are at the top of the distribution. Regarding the quality of institutions, Israel is at the middle of the distribution of countries with GDP per Capita above 5000$, but it is at the bottom of the OECD countries distribution. Israel's relative condition is the worst when it comes to education: Israel is at the bottom of the distribution of the grades in national tests, and within OECD countries, it's grades are only better than Mexico and Turkey. Israel is in a better place when looking at the share of educated persons at the third quintal , but it seems that educational opportunities are low.

[1] The accurate actual number is depend on data availability for each specification.

4 Past convergence Patterns

We begin the empirical analysis with basic cross section convergence regressions using the deep root variables we employed for our study (described in Section 3). These variables are organized in Ashraf and Galor (2013) as part of a larger set of controls, and we reduced it by omitting variables with negative R squared adjusted in a partial regressions analysis. The variables that survived this analysis will be used also in the rest of the regressions.

Table 1 presents the results of regressions that formally represented by:

$$\Delta prod_{i(1980-2010)} = \alpha + \beta prod_{i1980} + \gamma Fundementals_i \tag{1}$$

Where:

$prod_{i1980}$ is GDP Per Worker in country i in 1980, and $\Delta prod_{i(1980-2010)}$ is the average annual growth in the period 1980-2010.

$Fundementals_i$ is the country level set of unchangeable fundemetal variables.

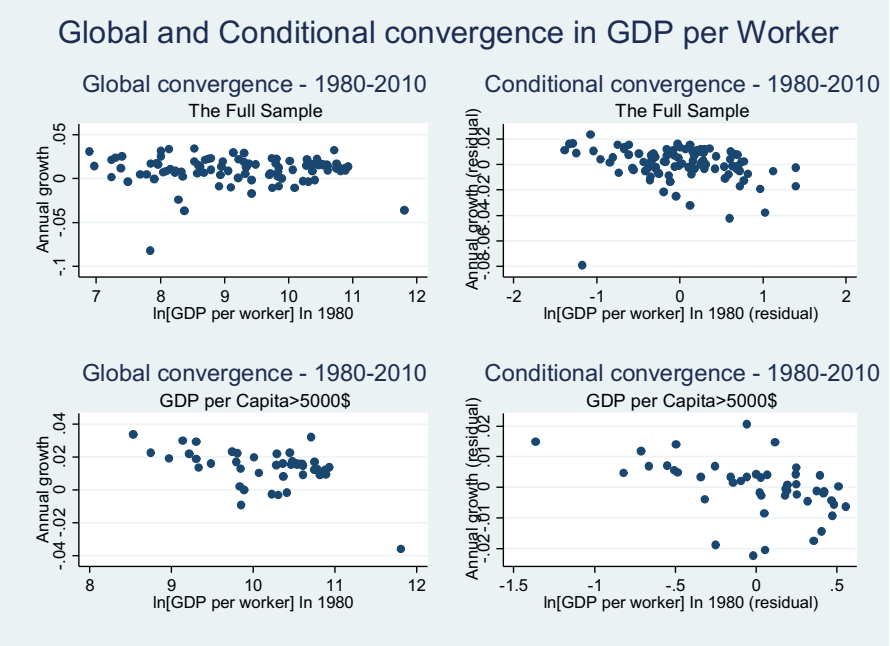
β is the convergence parameter.

The results show that "global convergence" - the value of $\widehat{\beta}$ without conditioning on $Fundementals_i$ is not significant among the full sample of countries. Controlling for the set of $Fundementals_i$ yields a significant estimate for "β convergence", and in the "expected" direction, meaning that the growth rate of a country is lower, if it's initial GDP Per Capita in 1980 is higher. These findings can also be seen graphically at figure 1: without controlling fundamentals no link between the growth rate and the initial level of income can be found, whereas after controlling for fundamentals, we observe a clear negative slop.

As for the sample of countries with annual GDP per capita above 5000$, "$\beta$ convergence" is found also without controls, but $\widehat{\beta}$ is slightly stronger after adding controls. Our findings are consistent with those of Barro *et al.* (1991), but as already explained, using deep roots of growth in our regression is more useful , since some of the variables that are used in the

classic convergence regressions might be the result of the growth prosses rather the cause of it.

Figure 1



5 Empirical Model for TFP Growth

5.1 Empirical Model Description

The empirical model set here is built to retrieve a few basic parameters: the marginal effect of fundamental and policy variables on the frontier path of GDP per worker and the distance of each country from its own frontier will be estimated from the first level regression. The global TFP growth rate and the speed of convergence will be estimated from the second, growth rate regression.

The empirical model outlined here first estimates GDP per Worker for each $t = 1965, 1970, ..., 2010$, using a large set of fundamental and policy variables:

$$prod_{i,t} = \alpha + \beta_{t,1}\overline{Fundementals}_i + \beta_{t,2}\overline{Policy}_i + \epsilon_{i,t} \tag{2}$$

Where:

$\text{prod}_{i,t}$ is GDP Per Worker in country i in period t.

$\overline{Fundementals}_i$ is a country level set of unchangeable variables as geography, culture, luck and other determines (described in section 2).

$\overline{Policy}_{i,t}$ is a set of changeable variables as institutions and growth enhancing policies in country i on period t.

and $\epsilon_{i,t}$ is the error term.

Using the estimates of Equation 2 we are able to predict GDP per Worker for each country i in period t conditioned on it's fundamentals and policy variables:

$$\widehat{prod}_{it} = \alpha + \beta_{t,1} \times \overline{Fundementals}_i + \beta_{t,2} \times \overline{Policy}_{i,t} \tag{3}$$

The difference between the predicted GDP per Worker and the actual GDP per Worker represents the gap of each country from it's own frontier path in period t given it's fundamentals and policy variables:

$$Gap_{it} = -\epsilon_{it} = \widehat{prod}_{it} - prod_{it} \tag{4}$$

In order to estimate the speed of convergence to the frontier path a the basic global growth rate of TFP, we will specify the TFP growth in period t as a function of the Gap in period $t-1$ for each country i:

$$\Delta TFP_{i,t} = \delta_{g,t} + \rho Gap_{i,t-1} + \lambda_{i,t} \tag{5}$$

Where:

$\delta_{g,t}$ is the basic world growth that can get a differential value depending on the specific period t, using dummies for periods.

Gap in Equation 5 is calculated from a formula that is similar to Equation 4, except that the variables that determines $\widehat{prod}_{it}$ in each period are only the fundamental variables.[2] The estimate ρ represents a factor that determines the speed of convergence. In this we assume that the convergence in labor productivity is achieved through the TFP.

and $\lambda_{i,t}$ is the error term that represents a stochastic shock to TFP growth of each country i on period t.

After estimating 2, calculating $\widehat{prod}_{it}$ and Gap_{it} as described in 3 and 4, and then estimating 5 we can predict ΔTFP for country i in period $t+1$:

$$\Delta TFP_{i,t+1} = \delta_{g,\tilde{t}} + \rho \times Gap_{i,t} + \lambda_{i,t+1} \tag{6}$$

where:

$\tilde{t}$ is an average of a selected period dummies.

and $\lambda_{i,t+1} = \begin{cases} > 0 & \text{predicting an exogenous positive shock} \\ < 0 & \text{predicting an exogenous negative shock} \\ = 0 & otherwise \end{cases}$

5.2 Regressions Results

Table 2 presents the results of regressions that include only the fundamental variables we control. The first 4 columns report specifications in which three groups of variables are gradually included in the regressions: Geography variables, Genetic Diversity variables and Culture. The time that has passed since the neolithic transition is positively correlated with GDP per Worker (prod), and after controlling it, two other variables that are associated with strong agriculture are negatively correlated with prod: the share of arable land and

[2] A full panel of the policy variables is not avalaible.

proximity to water way. The genetic diversity variables, as explored by Ashraf and Galor (2013), affect prod positively at low enough variables and negatively at high values. Most of the variables remain significant and with the same sign in the specification that includes the full set of fundamentals, except for Ethnic fractionalization that loses significance.

We described 6 policy variables in Section 3. Along with 8 fundamental categories (11 variables, including three religion dummies and two genetic diversity variables), we have a total of 14 controls. Including all of them in a single regression naturally yields some non-significant variables. Table 3a and 3b presents the results of few combinations that includes all the fundamental variables and some policy variables. Since there is a huge number of combinations, and choosing between them might be Arbitrary and simplistic, we decided to focus on specifications the include the full set of fundamentals, one institutions variable, one infrastructure variable, and one education category[3]. This strategy is somewhat similar to the one adopted by Sala-i Martin (1997), who ran around 2 million regressions in order to test which variables are the most correlated with prosperity. Sala-i Martin (1997) decided to include three fixed variables and three variables that changed from one specification to the other.

Equation 6 in table 3a, Equation 6 in table 3b, and the 6 Equations in table 4 are the 8 combinations that our rule created. Tables 5-7 repeat the above analysis, that is presented in tables 2-4, for a sample of countries with GDP per capita above 5000$. The significance of the fundamental variables is changing between the specification, but most of them stays with the same sign and with a reasonable explanatory power. regarding the policy variables, The doing business variable as well as the communication infrastructures variables appears to be the most stable variables, transport variables seem to be correlated with prod only in the full sample, the national test variable usually has a weak correlation with the dependant variable. The social infrastructure variable, and the the educational

[3]education category is either the national tests variables or two variables - tertiary education share at the middle class (third quintal) and the ratio between this share among the lowest class to the share among the middle class - that together represent educational opportunities.

opportunities proxy are more correlated with prod in the sample of the more prospered countries.

Table 8 presents the estimate for the speed of convergence. The estimate of the lagged gap represents ρ from Equation 5, and the constant represent δ. The excluded period is the sixties, so δ is the average growth in these years, and the period dummies should be added according to the assumptions on the patterns of the past and the future growth over the world.

The estimate $\widehat{\rho}$ is identical, both using the full sample of countries or using only countries with GDP per Capita>5000\$. Since the regressions uses five years intervals, the annual estimate is 0.017, meaning that 1.7% of the lagged gap of the country is added to the average world growth of prod.

6 Predictions

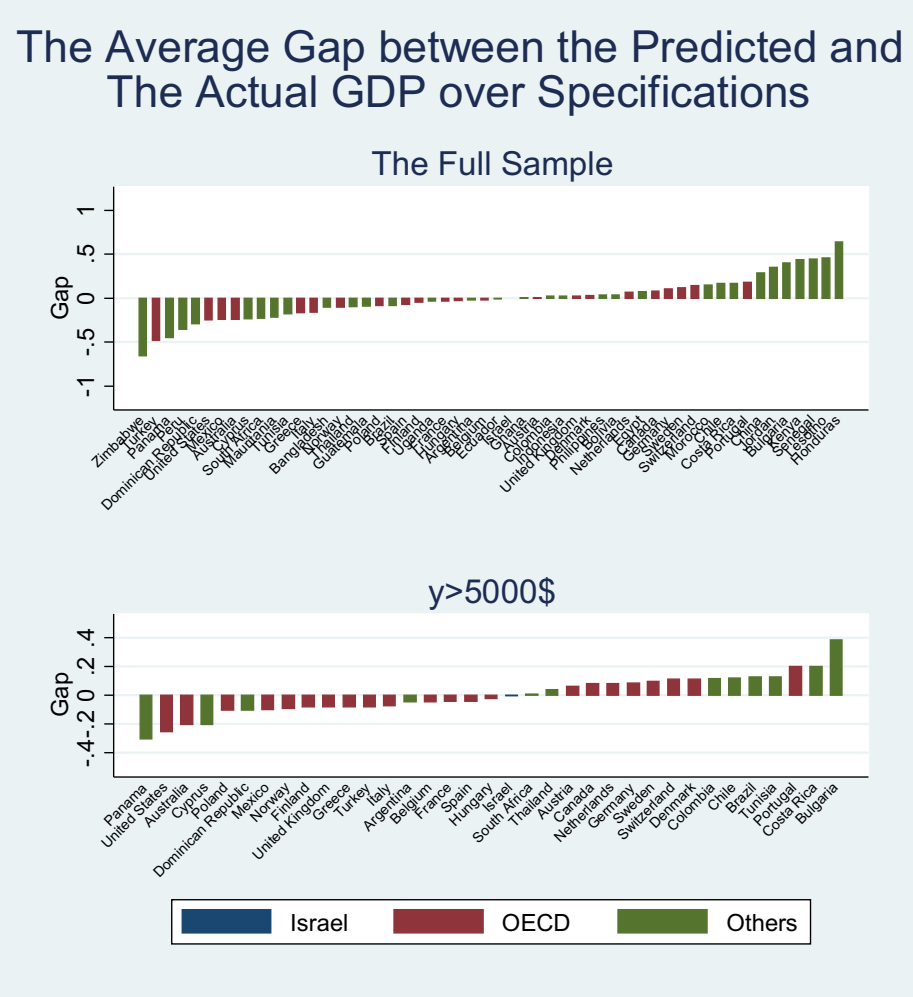
6.1 The Predicted Gap

As explained in the last Section, we would like to use the information from the eight specification that includes all the fundamental variables, and three policy variables, one for each area - institutions, physical infrastructure, and education quality. There are several options to weight the predicted gap, resulted from the eight regression. We decided (at least at this point) to simply average between the predicted gaps from the eight specifications. Figure 2 shows the average gap for each country in the sample. The analysis using the full sample finds that the gap for Israel between the predicted prod and the actual one is close to zero. Developing countries such as Honduras, Senegal, Bulgaria and China are the countries with the largest positive gap, suggesting that these countries have a higher growth potential compared to the average, meaning that they are picking up to the level of productivity of richer countries. Countries at the left side of the Graph might have, according to our analysis, an higher actual prod compared to the one predicted for them

based on the fundamental and policy variables that we use.

The analysis using the sample of countries with y>5000$ finds the same zero gap for Israel, although some of the estimates are different between the two samples. The gap for most of the other countries seems to be robust as well to the sample choosing.

Figure 2



6.2 TFP Forecast for Israel

Using the calculation presented in Equation 6 we create a long term forecast for TFP growth. The baseline TFP growth for the years 2015-2060 (0.54) is very similar to the

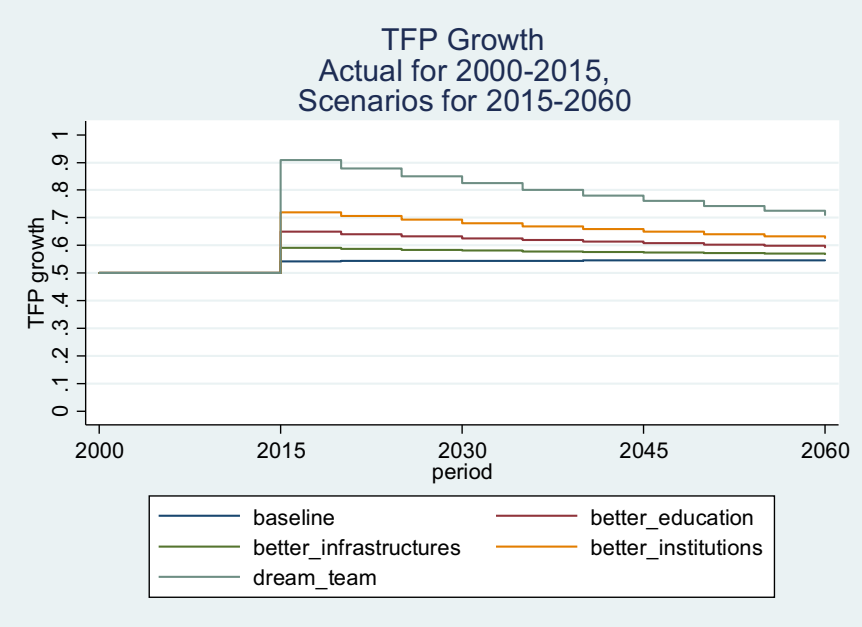
historic growth of the Israeli TFP (0.5, Figure 3). The calculation reflects the average growth for the years 1990-2010 over the sample of countries with GDP per Capita>5000$, and the convergence component of the Israeli economy relative to the average over the sample which equals to zero. Since the average gap for the OECD countries is around -2%, the Israeli productivity is not expected to get much closer to the OECD countries average productivity. This result is consistent with findings that suggests that past Israeli productivity has not converged to the frontier over the last 30 years.

Figure 3 also presents four scenarios for TFP growth. The first three scenarios are based on gaps that were calculated with alternative policy values, that were set to reflect nearly the best practice for each of them.[4] The forth Scenario combines the three other scenarios. The graph shows that better physical infrastructures would contribute 0.05 percentage point to the annual TFP growth at the beginning of the forecast horizon, better quality of education would contribute 0.1 percentage point, and better institutions would contributes 0.18 percentage point to the annual TFP growth. Combining the three scenarios would contribute 0.45 percentage point to the annual TFP growth. The contribution is gradually eroded, since the gap that has to be closed is decreasing from period to period along the process.

The dominance of institutions in the regressions described in Section 5.2, as well as the relatively large effect in the scenario of a change in the quality of institutions, is consistent with findings by Rodrik *et al.* (2004). He found that once institutions are controlled for, other important variables such as geography and trade are barely significant. These variables still have an indirect effect by influencing the quality of institutions.

Figure 3

[4]Nearly the best practice, meaning national tests grades as in Finland, Opportunities of education as in Sweeden, communication (Phone lines) as in Norway, transportation infrastructures as in Netherlands, Doing Buisnees index as in Germany, and Social infrastructure as in Denmark.



7 Summary

The first goal of this study is to forecast TFP growth for the Israeli economy using a conditional convergence framework, as part of a broad project of constructing a long-run growth model over an horizon of approximately 50 years. Based on various specifications that include fundemental and policy variable, we forecast that the Israel's TFP annual growth will be 0.54% over this horizon. This TFP growth reflect the average world growth, and a zero convergence component, since the convergence gap of the Israeli GDP per Worker was found to be zero. The baseline forecast was obtained under the assumption that the current policy parameters will be unchanged; The second goal of this study is to evaluate how different policy steps are expected to affect the long run growth rate. We found that better physical infrastructures - nearly the best practice - would contribute 0.05 percentage point to the annual TFP growth at the beginning of the forecast horizon, better quality of education would contribute 0.1 percentage point, and better institutions would contributes to the annual TFP growth the most - 0.18 percentage point. Our broad project, and

specifically The TFP growth forecast, are not intended to be a guess. Their purpose is to establish a well-organized tool to help the policy makers having a founded planning process, and a better considerd decisions.

8 Appendix

Figure 4

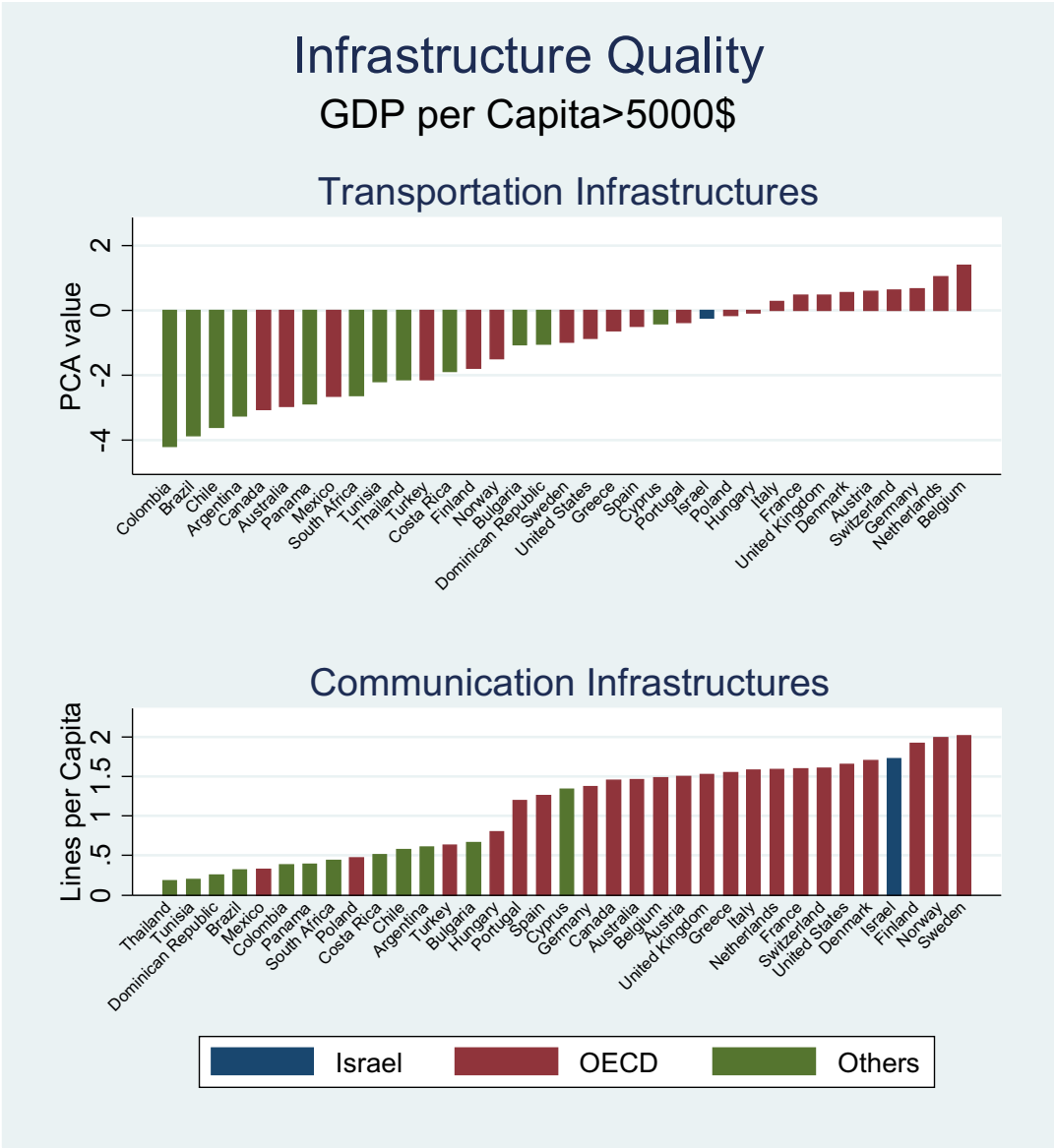


Figure 5

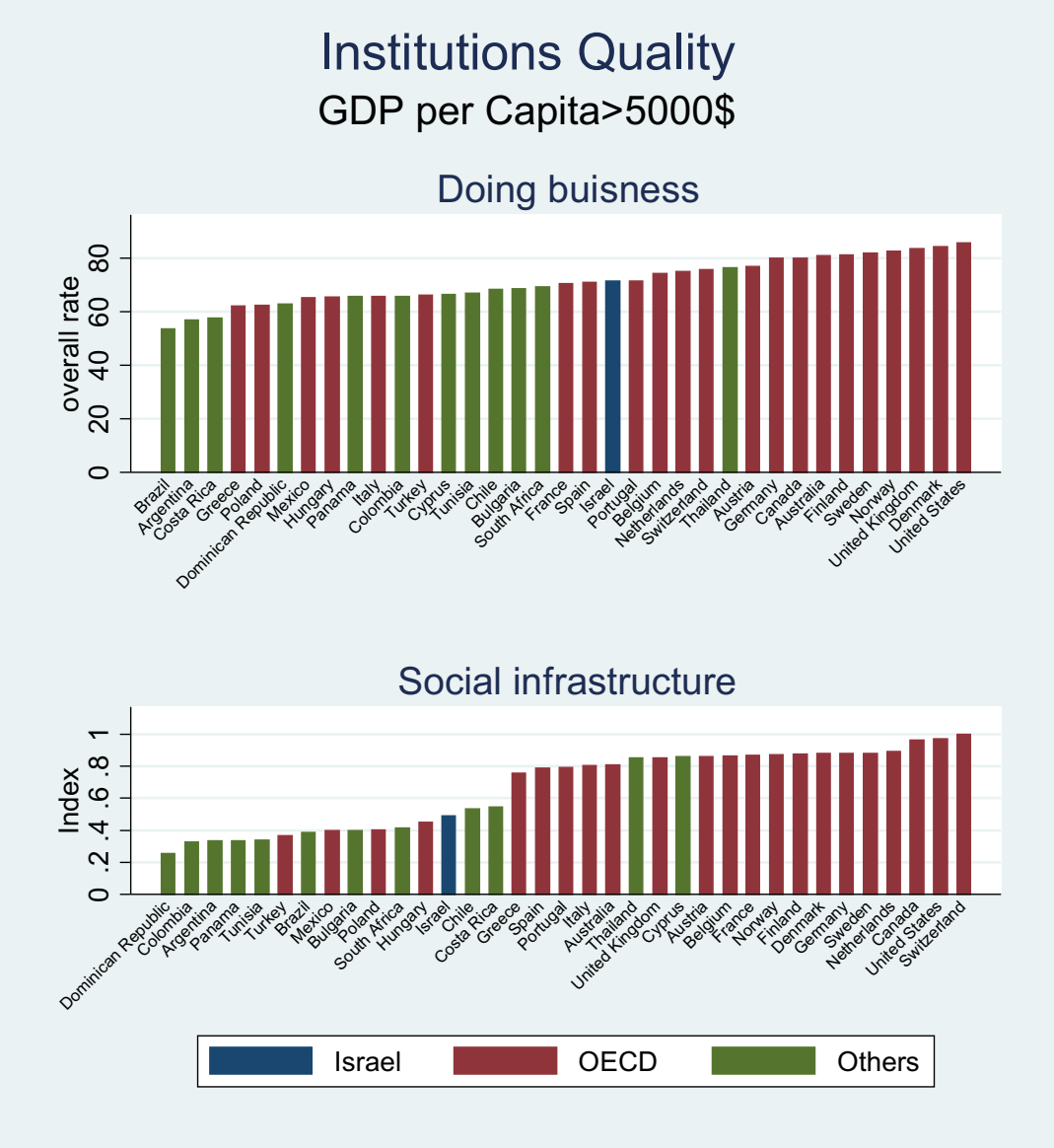

Institutions Quality
GDP per Capita>5000$
Doing buisness
overall rate
0
20
40
60
80
Brazil
Argentina
Costa Rica
Greece
Poland
Dominican Republic
Mexico
Hungary
Panama
Italy
Colombia
Turkey
Cyprus
Tunisia
Chile
Bulgaria
South Africa
France
Spain
Israel
Portugal
Belgium
Netherlands
Switzerland
Thailand
Austria
Germany
Canada
Australia
Finland
Sweden
Norway
United Kingdom
Denmark
United States
Social infrastructure
Index
0
.2
.4
.6
.8
1
Dominican Republic
Colombia
Argentina
Panama
Tunisia
Turkey
Brazil
Mexico
Bulgaria
Poland
South Africa
Hungary
Israel
Chile
Costa Rica
Greece
Spain
Portugal
Italy
Australia
Thailand
United Kingdom
Cyprus
Austria
Belgium
France
Norway
Finland
Denmark
Germany
Sweden
Netherlands
Canada
United States
Switzerland
Israel
OECD
Others

Figure 6

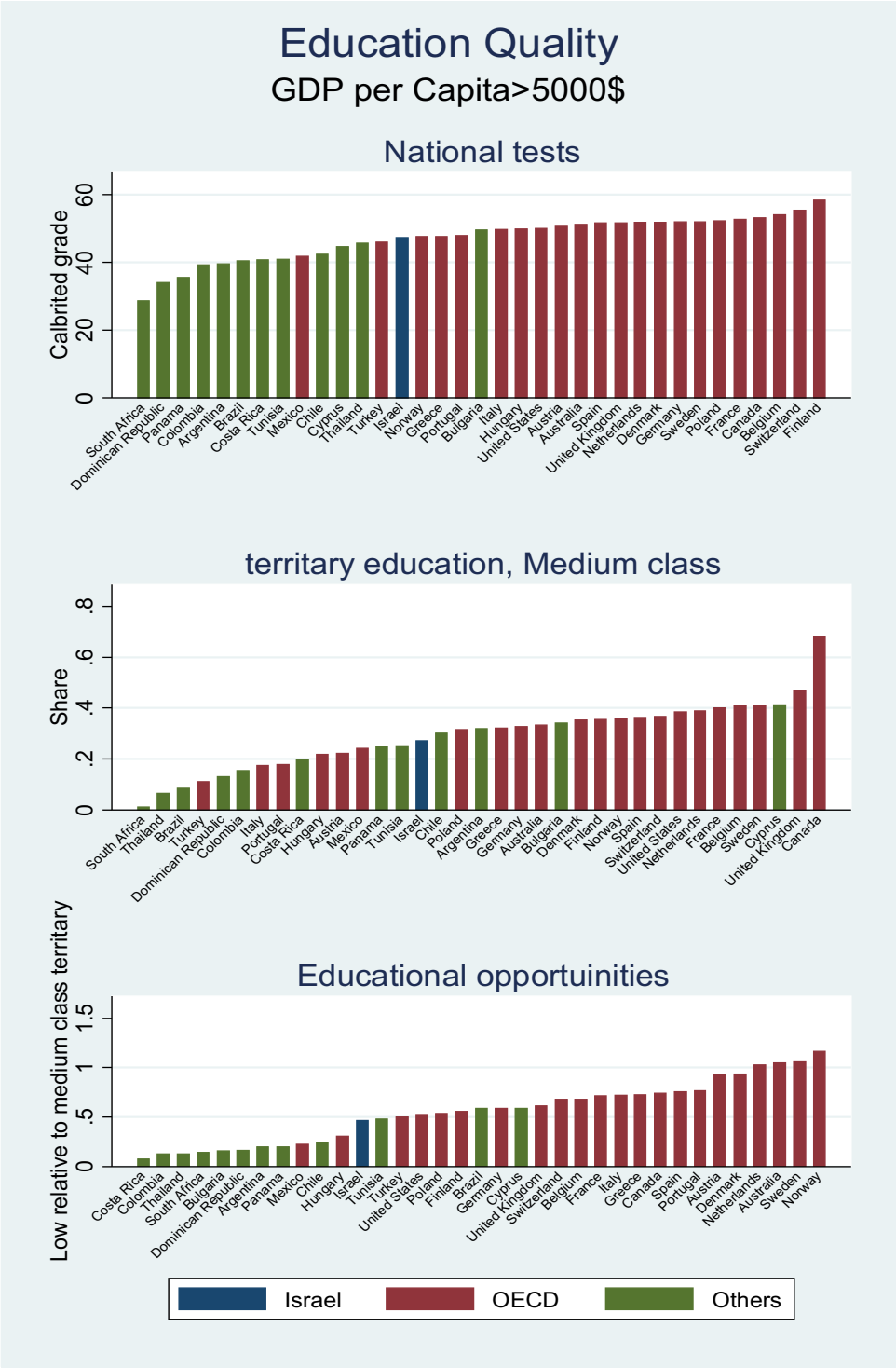

Education Quality
GDP per Capita>5000$
National tests
Calbrited grade
0
20
40
60
South Africa
Dominican Republic
Panama
Colombia
Argentina
Brazil
Costa Rica
Tunisia
Mexico
Chile
Cyprus
Thailand
Turkey
Israel
Norway
Greece
Portugal
Bulgaria
Italy
Hungary
United States
Austria
Australia
Spain
United Kingdom
Netherlands
Denmark
Germany
Sweden
Poland
France
Canada
Belgium
Switzerland
Finland
territary education, Medium class
Share
0
.2
.4
.6
.8
South Africa
Thailand
Brazil
Turkey
Dominican Republic
Colombia
Italy
Portugal
Costa Rica
Hungary
Austria
Mexico
Panama
Tunisia
Israel
Chile
Poland
Argentina
Greece
Germany
Australia
Bulgaria
Denmark
Finland
Norway
Spain
Switzerland
United States
Netherlands
France
Belgium
Sweden
Cyprus
United Kingdom
Canada
Educational opportuinities
Low relative to medium class territary
0
.5
1
1.5
Costa Rica
Colombia
Thailand
South Africa
Bulgaria
Dominican Republic
Argentina
Panama
Mexico
Chile
Hungary
Israel
Tunisia
Turkey
United States
Poland
Finland
Brazil
Germany
Cyprus
United Kingdom
Switzerland
Belgium
France
Italy
Greece
Canada
Spain
Portugal
Austria
Denmark
Netherlands
Australia
Sweden
Norway
Israel
OECD
Others

Table 1: Global and Conditional convergence in GDP per Worker

VARIABLES	(1) The Full Sample growth	(2) The Full Sample growth	(3) GDP>5000 growth	(4) GDP>5000 growth
Log[y in 1980]	-0.000112	-0.00499*	-0.00849***	-0.00999***
	(0.00145)	(0.00253)	(0.00231)	(0.00341)
Log[Neolithic]		0.00849*		0.00733
		(0.00479)		(0.00545)
Log[arable land]		-0.00305*		-0.00149
		(0.00163)		(0.00153)
tropical zones		-0.0143***		-0.00321
		(0.00509)		(0.00700)
nearest waterway		-0.00940		-0.00297
		(0.00627)		(0.00733)
OPEC dummy		-0.00608		-0.0172
		(0.00666)		(0.0105)
Genetic diversity		1.244		5.521
		(2.387)		(5.641)
Genetic diversity sq'		-0.815		-3.801
		(1.688)		(3.983)
Ethnic fractionalization		0.00201		-0.00608
		(0.00810)		(0.00867)
Share of Muslims		-0.000185***		-3.59e-05
		(6.84e-05)		(7.11e-05)
Share of Catholics		-8.75e-05		-7.07e-06
		(6.48e-05)		(5.00e-05)
Share of Protestants		-7.97e-05		9.20e-06
		(9.99e-05)		(7.83e-05)
Constant	0.0107	-0.466	0.0999***	-1.944
	(0.0135)	(0.840)	(0.0236)	(1.978)
Observations	96	96	46	46
Adjusted R-squared	-0.011	0.149	0.218	0.345

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: The Effect of Fundamental Variables on GDP per Worker

VARIABLES	(1) Log[y]	(2) Log[y]	(3) Log[y]	(4) Log[y]	(5) Log[y]
Log[Neolithic]	0.937***		0.892***		1.142***
	(0.176)		(0.180)		(0.167)
Log[arable land]	-0.228***		-0.248***		-0.297***
	(0.0724)		(0.0716)		(0.0638)
tropical zones	-1.318***		-1.251***		-1.143***
	(0.199)		(0.199)		(0.193)
nearest waterway	-1.400***		-1.201***		-1.063***
	(0.246)		(0.263)		(0.237)
OPEC dummy	0.465		0.512*		0.719***
	(0.301)		(0.292)		(0.253)
Genetic diversity		616.1***	294.7***		306.7***
		(146.2)	(105.7)		(93.68)
Genetic diversity sq'		-439.7***	-208.0***		-214.1***
		(103.3)	(74.92)		(66.27)
Ethnic fractionalization				-2.308***	-0.0624
				(0.388)	(0.338)
Share of Muslims				-0.000224	-0.00830***
				(0.00442)	(0.00284)
Share of Catholics				0.00193	0.00219
				(0.00395)	(0.00260)
Share of Protestants				0.00846	0.00782**
				(0.00595)	(0.00385)
Constant	3.223**	-205.4***	-100.5***	10.59***	-108.2***
	(1.508)	(51.65)	(37.04)	(0.350)	(33.00)
Observations	96	96	96	96	96
Adjusted R-squared	0.616	0.163	0.640	0.296	0.739

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3a: The Effect of Fundamental and Policy Variables on GDP per Worker

VARIABLES	(1) Log[y]	(2) Log[y]	(3) Log[y]	(4) Log[y]	(5) Log[y]	(6) Log[y]
Log[Neolithic]	1.241***		0.707***	0.805***	0.662***	0.502**
	(0.213)		(0.203)	(0.195)	(0.236)	(0.205)
Log[arable land]	-0.271***		-0.250***	-0.490***	-0.323***	-0.404***
	(0.0786)		(0.0649)	(0.0774)	(0.0706)	(0.0750)
tropical zones	-1.293***		-0.999***	-0.883***	-1.084***	-0.815***
	(0.262)		(0.223)	(0.230)	(0.237)	(0.211)
nearest waterway	-1.002***		-0.712***	-0.00460	-0.774***	-0.171
	(0.313)		(0.264)	(0.321)	(0.282)	(0.298)
OPEC dummy	0.438		0.334	0.303	0.419	0.291
	(0.389)		(0.321)	(0.322)	(0.344)	(0.295)
Genetic diversity	312.6***		169.5*	169.2*	232.8**	119.7
	(111.0)		(95.40)	(95.79)	(100.1)	(88.81)
Genetic diversity sq'	-218.9***		-116.3*	-120.4*	-162.3**	-83.39
	(78.92)		(67.86)	(67.91)	(71.12)	(63.04)
Ethnic fractionalization	0.297		0.125	0.273	0.331	0.190
	(0.428)		(0.354)	(0.354)	(0.379)	(0.326)
Share of Muslims	-0.00874***		-0.00370	-0.00319	-0.00448	-0.00124
	(0.00322)		(0.00282)	(0.00286)	(0.00303)	(0.00268)
Share of Catholics	0.00131		0.00287	0.00167	0.00261	0.00281
	(0.00292)		(0.00243)	(0.00242)	(0.00260)	(0.00224)
Share of Protestants	0.00880**		-0.000329	0.00548	0.00456	0.000211
	(0.00431)		(0.00395)	(0.00362)	(0.00394)	(0.00363)
Doing Buisness		0.0459***	0.0448***			0.0266***
		(0.0111)	(0.00847)			(0.00955)
Roads and rails		0.0894		0.391***		0.234***
		(0.0701)		(0.0748)		(0.0825)
School grades		0.0282			0.0517***	0.0143
		(0.0172)			(0.0126)	(0.0133)
Constant	-110.9***	6.144***	-59.54*	-54.07	-80.10**	-37.90
	(38.90)	(0.803)	(33.49)	(33.94)	(35.20)	(31.40)
Observations	69	69	69	69	69	69
Adjusted R-squared	0.694	0.637	0.792	0.791	0.761	0.825

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3b: The Effect of Fundamental and Policy Variables on GDP per Worker

VARIABLES	(1) Log[y]	(2) Log[y]	(3) Log[y]	(4) Log[y]	(5) Log[y]	(6) Log[y]
Log[Neolithic]	1.152***		0.914***	0.118	0.670***	0.0620
	(0.185)		(0.186)	(0.166)	(0.201)	(0.167)
Log[arable land]	-0.0467		-0.0594	0.0189	-0.0304	0.0171
	(0.0795)		(0.0729)	(0.0492)	(0.0694)	(0.0488)
tropical zones	-1.205***		-0.928***	-0.285	-0.878***	-0.260
	(0.214)		(0.216)	(0.170)	(0.203)	(0.167)
nearest waterway	-0.572*		-0.518*	0.151	-0.702**	0.0169
	(0.305)		(0.279)	(0.205)	(0.266)	(0.213)
OPEC dummy	0.158		-0.0682	0.160	0.0458	0.126
	(0.369)		(0.346)	(0.225)	(0.332)	(0.232)
Genetic diversity	253.5***		207.2**	82.71	173.7**	69.60
	(88.87)		(82.76)	(57.94)	(79.63)	(57.14)
Genetic diversity sq'	-178.5***		-145.5**	-57.02	-122.8**	-47.83
	(63.35)		(59.00)	(41.29)	(56.71)	(40.73)
Ethnic fractionalization	0.337		0.167	-0.0905	0.304	-0.0800
	(0.369)		(0.342)	(0.231)	(0.321)	(0.231)
Share of Muslims	-0.00608**		-0.00380	0.000961	-0.00465*	0.00103
	(0.00276)		(0.00264)	(0.00188)	(0.00247)	(0.00193)
Share of Catholics	0.00461*		0.00425*	0.00176	0.00273	0.00161
	(0.00248)		(0.00227)	(0.00155)	(0.00224)	(0.00158)
Share of Protestants	0.0120***		0.00737**	0.00262	0.00632*	0.00172
	(0.00345)		(0.00351)	(0.00238)	(0.00350)	(0.00252)
social infrastructure		0.00802	1.072***			0.139
		(0.250)	(0.355)			(0.287)
phones per capita		0.456***		0.484***		0.418***
		(0.0422)		(0.0573)		(0.0659)
educational opportunities		0.261			0.267	-0.0144
		(0.168)			(0.271)	(0.207)
teriery education		1.023**			2.082***	0.867*
		(0.406)			(0.582)	(0.447)
Constant	-89.35***	7.192***	-71.68**	-23.69	-57.21**	-18.36
	(31.06)	(0.166)	(29.02)	(20.51)	(28.10)	(20.25)
Observations	54	54	54	54	54	54
Adjusted R-squared	0.766	0.917	0.804	0.912	0.824	0.916

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: The Effect of Fundamental and Policy Variables on GDP per Worker
Covariates combinations

VARIABLES	(1) Log[y]	(2) Log[y]	(3) Log[y]	(4) Log[y]	(5) Log[y]	(6) Log[y]
Log[Neolithic]	0.568**	0.0991	0.584***	0.399**	0.0867	0.0427
	(0.233)	(0.183)	(0.201)	(0.188)	(0.175)	(0.162)
Log[arable land]	-0.236**	0.00390	-0.132	-0.174**	-0.0139	-0.00530
	(0.0996)	(0.0585)	(0.0987)	(0.0838)	(0.0570)	(0.0499)
tropical zones	-0.831***	-0.277	-0.750***	-0.704***	-0.319*	-0.296*
	(0.209)	(0.174)	(0.206)	(0.183)	(0.168)	(0.163)
nearest waterway	-0.153	0.109	-0.322	-0.203	0.101	0.000902
	(0.353)	(0.216)	(0.354)	(0.308)	(0.209)	(0.207)
OPEC dummy	-0.115	0.103	-0.0569	0.128	0.210	0.192
	(0.329)	(0.236)	(0.326)	(0.296)	(0.227)	(0.226)
Genetic diversity	176.8**	82.15	150.0*	105.2	69.20	60.52
	(79.68)	(58.80)	(78.10)	(71.31)	(57.51)	(55.92)
Genetic diversity sq'	-125.8**	-56.59	-106.8*	-74.07	-47.00	-41.09
	(56.62)	(41.90)	(55.55)	(50.79)	(41.02)	(39.89)
Ethnic fractionalization	0.271	-0.0884	0.192	-0.00732	-0.161	-0.130
	(0.332)	(0.243)	(0.319)	(0.291)	(0.239)	(0.227)
Share of Muslims	-0.00286	0.00105	-0.00279	-0.00178	0.00101	0.000953
	(0.00255)	(0.00192)	(0.00256)	(0.00229)	(0.00185)	(0.00184)
Share of Catholics	0.00294	0.00180	0.00262	0.00319	0.00226	0.00197
	(0.00222)	(0.00158)	(0.00223)	(0.00198)	(0.00155)	(0.00155)
Share of Protestants	0.00503	0.00190	0.00502	0.000866	0.000623	0.000409
	(0.00349)	(0.00254)	(0.00346)	(0.00337)	(0.00259)	(0.00261)
social infrastructure	0.318	0.219	0.358			
	(0.447)	(0.287)	(0.445)			
Roads and rails	0.183*		0.134	0.132		
	(0.102)		(0.102)	(0.0804)		
School grades	0.0205	0.00296			0.000621	
	(0.0140)	(0.0104)			(0.00978)	
phones per capita		0.452***			0.412***	0.378***
		(0.0681)			(0.0705)	(0.0692)
educational opportunities			0.0747	0.0764		0.00590
			(0.290)	(0.241)		(0.186)
teriery education			1.502**	1.051*		0.784*
			(0.629)	(0.581)		(0.434)
Doing Buisness				0.0265***	0.0134*	0.0110
				(0.00825)	(0.00750)	(0.00709)
Constant	-56.74*	-23.35	-47.26*	-31.69	-19.23	-15.47
	(28.29)	(20.79)	(27.75)	(25.28)	(20.30)	(19.80)
Observations	54	54	54	54	54	54
Adjusted R-squared	0.823	0.910	0.834	0.867	0.916	0.920

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: The Effect of Fundamental Variables on GDP per Worker

Only countries with GDP per Capita>5000					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Log[y]	Log[y]	Log[y]	Log[y]	Log[y]
Log[Neolithic]	0.679***		0.564***		0.711***
	(0.181)		(0.176)		(0.211)
Log[arable land]	-0.108*		-0.116*		-0.122*
	(0.0635)		(0.0604)		(0.0675)
tropical zones	-0.874***		-1.008***		-0.925***
	(0.192)		(0.211)		(0.259)
nearest waterway	-0.121		-0.263		-0.288
	(0.295)		(0.280)		(0.321)
OPEC dummy	0.342		0.688*		0.655*
	(0.344)		(0.373)		(0.385)
Genetic diversity		458.0*	623.6***		486.9*
		(270.1)	(221.9)		(246.3)
Genetic diversity sq'		-317.3	-439.1***		-342.9*
		(189.9)	(156.5)		(173.8)
Ethnic fractionalization				-0.806**	0.0253
				(0.372)	(0.377)
Share of Muslims				0.00511	9.92e-05
				(0.00366)	(0.00317)
Share of Catholics				0.00169	0.00108
				(0.00282)	(0.00220)
Share of Protestants				0.00541	0.00488
				(0.00378)	(0.00316)
Constant	5.304***	-154.4	-214.8***	10.77***	-167.7*
	(1.538)	(96.00)	(78.24)	(0.240)	(86.55)
Observations	46	46	46	46	46
Adjusted R-squared	0.429	0.070	0.503	0.092	0.486

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6a: The Effect of Fundamental and Policy Variables on GDP per Worker

Only countries with GDP per Capita>5000						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Log[y]	Log[y]	Log[y]	Log[y]	Log[y]	Log[y]
Log[Neolithic]	0.582**		0.627***	0.495***	0.383*	0.535***
	(0.228)		(0.188)	(0.159)	(0.221)	(0.167)
Log[arable land]	-0.139**		-0.216***	-0.304***	-0.205***	-0.308***
	(0.0644)		(0.0564)	(0.0529)	(0.0638)	(0.0513)
tropical zones	-1.082***		-0.606**	-0.692***	-0.785***	-0.541**
	(0.246)		(0.235)	(0.184)	(0.251)	(0.197)
nearest waterway	-0.318		-0.309	0.326	-0.383	0.200
	(0.302)		(0.248)	(0.237)	(0.277)	(0.250)
OPEC dummy	-0.0108		-0.353	0.0783	0.139	-0.107
	(0.451)		(0.381)	(0.314)	(0.416)	(0.322)
Genetic diversity	482.5*		12.68	213.9	219.5	41.62
	(240.6)		(230.3)	(173.3)	(241.2)	(192.8)
Genetic diversity sq'	-339.9*		-3.761	-151.7	-152.1	-27.62
	(170.1)		(163.3)	(122.4)	(170.8)	(136.9)
Ethnic fractionalization	0.0741		-0.0637	0.115	0.209	0.0391
	(0.367)		(0.304)	(0.255)	(0.339)	(0.254)
Share of Muslims	0.00174		0.00113	0.00408*	0.00194	0.00331
	(0.00309)		(0.00254)	(0.00218)	(0.00283)	(0.00215)
Share of Catholics	0.00125		0.00412**	0.00174	0.00218	0.00303*
	(0.00202)		(0.00181)	(0.00140)	(0.00188)	(0.00151)
Share of Protestants	0.00542*		0.00152	0.00480**	0.00422	0.00304
	(0.00296)		(0.00262)	(0.00206)	(0.00274)	(0.00218)
Doing Buisness		0.0223**	0.0373***			0.0181*
		(0.0102)	(0.00936)			(0.00915)
Roads and rails		0.0600		0.270***		0.216***
		(0.0581)		(0.0462)		(0.0575)
School grades		0.0168			0.0336**	-0.000198
		(0.0164)			(0.0126)	(0.0113)
Constant	-164.9*	8.501***	-4.027	-67.89	-72.79	-9.919
	(84.59)	(0.808)	(80.42)	(61.04)	(84.75)	(67.29)
Observations	43	43	43	43	43	43
Adjusted R-squared	0.528	0.326	0.681	0.772	0.605	0.787

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6b: The Effect of Fundamental and Policy Variables on GDP per Worker

Only countries with GDP per Capita>5000						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Log[y]	Log[y]	Log[y]	Log[y]	Log[y]	Log[y]
Log[Neolithic]	0.701**		0.411*	-0.101	0.414*	-0.0382
	(0.277)		(0.227)	(0.213)	(0.229)	(0.202)
Log[arable land]	-0.0521		-0.0680	0.106*	-0.0202	0.0623
	(0.0863)		(0.0671)	(0.0588)	(0.0683)	(0.0597)
tropical zones	-1.014***		-0.583**	-0.224	-0.613***	-0.194
	(0.244)		(0.217)	(0.196)	(0.217)	(0.185)
nearest waterway	-0.199		-0.165	0.143	-0.456*	-0.0673
	(0.312)		(0.242)	(0.200)	(0.257)	(0.211)
OPEC dummy = o,	-		-	-	-	-
Genetic diversity	404.8		-110.7	37.74	110.3	-105.0
	(260.5)		(238.1)	(170.8)	(217.0)	(177.8)
Genetic diversity sq'	-284.5		82.03	-28.26	-76.72	74.18
	(184.9)		(169.1)	(121.0)	(153.9)	(126.3)
Ethnic fractionalization	0.119		0.0808	-0.0275	0.482	0.150
	(0.362)		(0.282)	(0.225)	(0.300)	(0.232)
Share of Muslims	-0.00147		0.000557	0.00399*	-0.000860	0.00309
	(0.00297)		(0.00236)	(0.00202)	(0.00237)	(0.00196)
Share of Catholics	0.00205		0.00409**	0.00188	0.00178	0.00244*
	(0.00198)		(0.00162)	(0.00122)	(0.00159)	(0.00131)
Share of Protestants	0.00710**		0.00541**	0.00113	0.00437*	0.00156
	(0.00297)		(0.00234)	(0.00206)	(0.00247)	(0.00200)
social infrastructure		0.0792	1.114***			0.313
		(0.220)	(0.272)			(0.274)
phones per capita		0.480***		0.654***		0.442***
		(0.0834)		(0.103)		(0.131)
educational opportunities		0.337*			0.671***	0.248
		(0.165)			(0.218)	(0.191)
teriery education		0.477			1.085**	0.486
		(0.328)			(0.452)	(0.358)
Constant	-139.1	7.131***	43.54	-5.684	-33.23	44.38
	(91.77)	(0.442)	(84.03)	(60.41)	(76.64)	(62.72)
Observations	35	35	35	35	35	35
Adjusted R-squared	0.664	0.869	0.797	0.872	0.792	0.888

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: The Effect of Fundamental and Policy Variables on GDP per Worker
Covariates combinations, Only countries with GDP per Capita>5000

VARIABLES	(1) Log[y]	(2) Log[y]	(3) Log[y]	(4) Log[y]	(5) Log[y]	(6) Log[y]
Log[Neolithic]	0.423*	-0.0355	0.321	0.455**	0.0426	0.0291
	(0.241)	(0.211)	(0.216)	(0.212)	(0.225)	(0.211)
Log[arable land]	-0.121	0.0838	-0.0493	-0.108	0.0645	0.0482
	(0.0885)	(0.0647)	(0.0880)	(0.0787)	(0.0690)	(0.0627)
tropical zones	-0.626**	-0.222	-0.461*	-0.498**	-0.210	-0.189
	(0.230)	(0.191)	(0.225)	(0.211)	(0.193)	(0.184)
nearest waterway	0.00814	0.110	-0.339	-0.256	0.0844	-0.0889
	(0.304)	(0.199)	(0.331)	(0.308)	(0.203)	(0.210)
OPEC dummy = o,	-	-	-	-	-	-
Genetic diversity	1.497	-90.01	-115.1	-3.342	-36.36	-80.56
	(268.4)	(184.0)	(256.5)	(215.5)	(176.4)	(167.1)
Genetic diversity sq'	0.905	63.30	84.16	4.836	25.93	57.36
	(191.2)	(130.7)	(183.0)	(153.5)	(125.3)	(118.7)
Ethnic fractionalization	0.0673	-0.0376	0.314	0.287	-0.0576	0.143
	(0.290)	(0.221)	(0.286)	(0.285)	(0.223)	(0.231)
Share of Muslims	0.00110	0.00388*	0.000480	-0.000211	0.00325	0.00258
	(0.00247)	(0.00199)	(0.00228)	(0.00228)	(0.00205)	(0.00198)
Share of Catholics	0.00304	0.00280**	0.00323	0.00307	0.00311**	0.00272*
	(0.00197)	(0.00130)	(0.00200)	(0.00187)	(0.00140)	(0.00137)
Share of Protestants	0.00494*	0.00180	0.00433*	0.00295	0.000870	0.000925
	(0.00249)	(0.00204)	(0.00234)	(0.00232)	(0.00203)	(0.00195)
social infrastructure	0.797*	0.512*	0.709			
	(0.449)	(0.281)	(0.443)			
Roads and rails	0.0837		0.00906	0.0577		
	(0.0841)		(0.0897)	(0.0690)		
School grades	-0.00105	-0.00690			-0.00471	
	(0.0116)	(0.00887)			(0.00864)	
phones per capita		0.544***			0.565***	0.444***
		(0.130)			(0.127)	(0.126)
educational opportunities			0.377	0.431*		0.275
			(0.235)	(0.221)		(0.181)
teriery education			0.834	0.662		0.468
			(0.502)	(0.481)		(0.356)
Doing Buisness				0.0172*	0.0138	0.01000
				(0.00994)	(0.00810)	(0.00769)
Constant	5.306	38.94	46.14	5.239	18.20	34.45
	(94.16)	(64.92)	(89.81)	(75.32)	(61.99)	(58.74)
Observations	35	35	35	35	35	35
Adjusted R-squared	0.788	0.879	0.824	0.827	0.877	0.890

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: The convergence speed (rau):
The Effect of The Gap Between Predicted and
Actual GDP per Worker on TFP Growth, 1960-2010

	(1)	(2)
	The Full Sample	y>5000
VARIABLES	TFP 5 years growth	TFP 5 years growth
The lagged gap (rho)	0.0842***	0.0852***
	(0.0159)	(0.0166)
d1960 = o,	-	
d1965 = o,	-	
d1970	0.0646	0.0693
	(0.0471)	(0.0425)
d1975	0.0479	-0.0249
	(0.0465)	(0.0416)
d1980	0.197***	0.0545
	(0.0460)	(0.0412)
d1985	-0.202***	-0.140***
	(0.0457)	(0.0412)
d1990	-0.0497	-0.0652
	(0.0457)	(0.0412)
d1995	-0.134***	-0.0722*
	(0.0457)	(0.0412)
d2000	-0.132***	-0.0677
	(0.0457)	(0.0412)
d2005	-0.0719	-0.0818**
	(0.0457)	(0.0412)
d2010	-0.0620	-0.0837**
	(0.0457)	(0.0412)
Constant	0.120***	0.107***
	(0.0346)	(0.0307)
Observations	865	443
Adjusted R-squared	0.145	0.134

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

References

Daron Acemoglu, Simon Johnson, and James A Robinson. Institutions as a fundamental cause of long-run growth. *Handbook of economic growth*, 1:385–472, 2005.

Daron Acemoglu. *Introduction to modern economic growth*. Princeton University Press, 2008.

Noam Angrist, Harry A Patrinos, and Martin Schlotter. An expansion of a global data set on educational quality: a focus on achievement in developing countries. *World Bank Policy Research Working Paper*, (6536), 2013.

Eyal Argov and Shay Tsur. A long run growth model for israel. *Bank of Israel - The Research Department. Discussion Paper, Forthcoming*, 2017.

Quamrul Ashraf and Oded Galor. Genetic diversity and the origins of cultural fragmentation. *The American economic review*, 103(3):528–533, 2013.

Robert J Barro and Xavier Sala-i Martin. Convergence. *Journal of political Economy*, pages 223–251, 1992.

Robert J Barro, Xavier Sala-i Martin, Olivier Jean Blanchard, and Robert E Hall. Convergence across states and regions. *Brookings papers on economic activity*, pages 107–182, 1991.

Robert J Barro. Economic growth in a cross section of countries. *The quarterly journal of economics*, 106(2):407–443, 1991.

Sascha O Becker and Ludger Woessmann. Was weber wrong? a human capital theory of protestant economic history. *The Quarterly Journal of Economics*, 124(2):531–596, 2009.

Maristella Botticini and Zvi Eckstein. From farmers to merchants, conversions and diaspora: Human capital and jewish history. *Journal of the European Economic Association*, 5(5):885–926, 2007.

Jared Diamond. Guns, steel and germs: The fate of human societies. *New York*, 1997.

Robert E Hall and Charles I Jones. Why do some countries produce so much more output per worker than others? *The quarterly journal of economics*, 114(1):83–116, 1999.

Nazrul Islam. Growth empirics: a panel data approach. *The Quarterly Journal of Economics*, 110(4):1127–1170, 1995.

Nazrul Islam. What have we learnt from the convergence debate? *Journal of economic surveys*, 17(3):309–362, 2003.

Benjamin F Jones and Benjamin A Olken. Do leaders matter? national leadership and growth since world war ii. *The Quarterly Journal of Economics*, 120(3):835–864, 2005.

Douglass C North and Robert Paul Thomas. *The rise of the western world: A new economic history*. Cambridge University Press, 1973.

Dani Rodrik, Arvind Subramanian, and Francesco Trebbi. Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of economic growth*, 9(2):131–165, 2004.

Jeffrey D Sachs, Andrew Warner, Anders Åslund, and Stanley Fischer. Economic reform and the process of global integration. *Brookings papers on economic activity*, 1995(1):1–118, 1995.

Xavier X Sala-i Martin. I just ran two million regressions. *The American Economic Review*, pages 178–183, 1997.

Robert M Solow. A contribution to the theory of economic growth. *The quarterly journal of economics*, pages 65–94, 1956.