1 Social Infrastructure

Our models have shown that savings rates, investment in skills, and population growth rates are key determinants for output per worker in the long run. However, so far, our model takes these parameters as exogenous. Moreover, we still have an incomplete understanding about the factors driving productivity differences across countries and productivity growth over time. Here, we will ask what lies behind some of the differences we observe across countries and within a country over time.

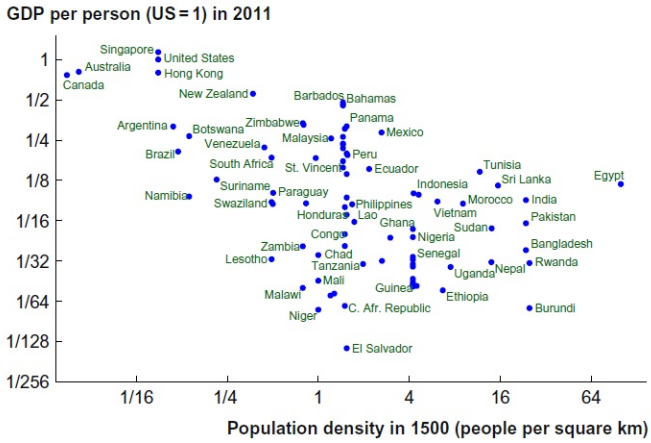
1.1 Is it all pre determined

One possibility for income differences across countries is that they are all determined by factors that are close to impossible to change. Factors that come to mind are geography and culture. One may be inclined to think that a country like Mali has simply a geography that makes economic development very difficult. It has low agricultural yields, and it has few natural resources. However, a country like Israel is not that different geographically, yet it is much more developed. Another explanation may be culture. For example, historians have argued that the work ethic of Calvin Christians has helped the development in Switzerland. However, we do observe huge income differences between countries with similar religions, such as Ethiopia and Italy which are both majority Roman Catholic. Acemoglu et al. (2001) study the importance of epigraphy and culture in more detail and find that these factors explain little of the variation in cross-country income levels.

In fact, Acemoglu et al. (2002) highlight a provocative historic fact. Comparing economic development in 1500 (proxied by the population density) with economic development today, we observe that countries most developed in 1500 tend to be poorer today than those countries less developed in 155, see Figure 1. They term this phenomenon the "Reversal of Fortune". Put differently, factors that are extremely persistent over time, like geography, do not appear to be very useful to understand income levels today.

Despite this very long run evidence, we have seen that income differences across countries have been relatively stable at least since the 1960s. Maybe to understand modern economic growth, geography and culture matter. However, we also have

Figure 1: Reversal of fortune



Source: Acemoglu et al. (2002)

more current examples of countries drastically changing over time, the already discussed growth miracles. If everything was pre determined, it would be impossible to understand why some countries move from among the poorest economies in the world to upper-income countries within few decades. In fact, some of these growth miracles provide excellent anecdotal "natural experiments" that countries with very similar cultures and geographies can take very different paths of economic development. North and South Korea share most of a joint history and are geographically similarly situated, yet, the former is much poorer than the latter since separating in the 1950s. Similarly, East and West Germany had similar starting conditions after World War II, yet, at reunification in 1991, the former was much poorer. Both examples suggest that economic institutions, in this case socialism vs. capitalism matter for economic development.

1.2 Explaining cross-country differences

Here, we are aiming to understand cross-country differences in income per worker. Our aim is to understand differences in investment rates into physical and human capital as well as differences in technology levels.

1.2.1 Low investment rates in capital and skills

Most of our treatment will be data, instead of theory, driven. However, to fix ideas, it is useful to have a very simple framework in mind. In particular, assume we have a neo-classical investment problem where households will be willing to save until the net marginal product of capital, its benefit, is equal to its costs, F_K:

$$MPK - \delta = F_K. \tag{1}$$

Similarly, households will be willing to invest into skills until the marginal product of human capital is equal to its costs:

$$MPH = F_H, \tag{2}$$

where I abstract from human capital depreciation. This simple neo-classical framework highlights that low investment rates in poor countries may be either related to low returns on investment or high costs of investment.

Starting with the costs of physical capital, several directly come to mind. First, there are the permits needed to start a business. Second, in many developing countries, entrepreneurs must pay bribes to receive permits. Third, financial markets may determine the costs of starting a business by determining the costs of lending. Particularly in rural areas of developing countries, large financial institutions are often absent leading to high borrowing costs. The World Bank's doing business indicator tries to capture some of the costs associated with physical capital investment. In particular, it measures for different countries the costs of setting up a medium size firm, and the time it takes to receive all permits. For example, in 2018, the costs of starting a business in percent of income per capita were one percent in the U.S., four percent in Spain, and 16 percent in Mexico.

Next, consider factors that affect the returns on physical capital investment. In our model, this concept is quite abstract, $MPK - \delta$, and depends only on the capital intensity and the production function through the parameter α. There are several real-world policies affecting those returns. The most obvious are business income taxes. When those taxes are high, investing in physical capital is relatively unattractive. An alternative institution that extracts profits from firms are extor-

tion from criminal organizations. For example, "protection" payments to criminal organizations in Mexico make investing in private businesses less attractive in some parts of the country. Labor may also be able to "extort" profits. For example, well-organized harbor workers can close down all exporting of firms until the fees paid to the harbor workers drive firms profits towards zero. Finally, in the presence of increasing returns, returns on capital may also depend on the size of a market. It is often believed that the U.S. has an advantage over many other countries by having one large, common consumer market. To reach a similar number of consumers, a company would have to enter a number of distinct markets in Europe, each producing costs. For example, to sell an Alzheimer drug, a company needs to negotiate prices with each individual country that it wishes to sell the drug to. In general, the European Union was designed to create a single market, however, the implementation is still imperfect.

Next, consider the investment into human capital. From the cost side, the costs of education are one way to asses the costs of investing in human capital. For example, consider the differences between the U.S. and most European countries. In the U.S. a Bachelor degree costs often more than 30,000 Dollar. These costs become yet much larger when attending professional schools. Attending business, law, or medical school costs often more than 100,000 Dollar. In contrast, in most European countries, university education is almost free.

Not only the costs are different but also the benefits. The average physician in the U.S. earns $316,000. In Spain, where wages are basically set by the public sector this number is only $57,000. Put differently, the high costs of medical school can take only two years to recuperate in the U.S. In Mexico, the average salary is only $12,000. These are gross income figures, and we have to take into account again the taxes individuals pay. Indeed, taxes on high-income people vary substantially across countries. However, also here, taxes are generally much higher on high-income people in Europe compared to the U.S. Returns on schooling can be particularly low for some people in developing countries. For example, Oyelere (2010) finds returns of only 3 percent per year of schooling, compared to common estimates of 10 percent in the developed world. The result may surprise given that education levels in developing economies are relatively low and, hence, we would expect a high marginal return. However, in some rural areas, schooling has a very

low quality and even after finishing compulsory schooling, students cannot read or write.

Beyond the immediate costs and benefits of investment, another factor driving investment rates is economic uncertainty. The reason is that investment is a long-term decision that is often irreversible. For example, once a factory is build, it is costly to move it to a different place. Similarly, once a person invests in his/her human capital, the decision is irreversible. Economists have long understood that uncertainty creates a wait-and-see incentive for such long-term investment decisions. Extreme examples for such uncertainty are revolutions where property owners may be expropriated. However, also smaller changes in policy of democratically elected governments can have such effects. A good example are the frequent tariff policy changes by the U.S. government in 2025 that make the returns on investment in some types of physical capital highly uncertain.

1.2.2 Productivity differences

Table 1: Apple vs. Foxconn

	Apple (U.S.)	Foxconn (Taiwan)
Value added (billions)	163	20
Capital (billions)	46	14
Employment (millions)	0.16	1.30

We know from development accounting that we have to understand ultimately productivity differences between countries. We have seen models where human capital could potentially explain these productivity differences. However, quantifying the effect is difficult as these models rely on externalities that are difficult to measure. Here, we are going to relate productivity differences to other things, institutions, than skill differences. To serve as a motivational example, Table 1 displays some accounting data from two companies, Apple which is U.S. based, and its main supplier Foxconn which is Taiwanese but has also many factories in China. I measure the capital stock by the accounting term "Land, machinery, and equipment" which is not a perfect equivalent but suffices for this example. The

table shows that Apple is indeed operating at a much higher capital-to-labor ratio, however, not at a higher capital-to-output ratio. Most importantly, given factor inputs, output (measured by value added) is simply much higher for Apple than for Foxconn. Our theories, thus far, would suggest that this higher productivity of Apple results from it using many more capital varieties. However, the production processes of Foxconn are quite complicated and require high-precision machinery making this explanation not fully satisfying. Instead, the key to understanding the relatively high productivity of Apple is to understand that the two firms produce very different goods, despite both firms contributing to the production of the same good, e.g., the Iphone. While Foxconn's value added results from assembling the good, Apple's value added lies in the design of the good. In fact much of Apple's accounting book value is in terms of intangible goods like patents it holds on these designs.

One reason why Apple may decide to produce in the U.S. is that its intangible goods are well protected because of a well-functioning system of property rights. The importance of property rights for economic development was studied by North (1990) for which he won the Nobel price. He points out that when property rights are clearly defined, people will invest in productive activities instead of predatory activities. For example, firms will invest into tangible capital instead of investing resources in stealing intangible capital from other firms. Note, both types of economic activities may require physical capital investment, however, the output effect of the different types of investment will be very different. Put differently, an aggregate capital stock measure may not tell us all about its productivity. Instead, to measure the effect of the capital stock on output, we would either need to measure in some way the amount of productive vs. predatory capital, or we would need to control for the strength of property rights.

North also points out that the same institutions are key to create trust and reduce transaction costs. To understand the effect of trust on the productivity of factor inputs, note that it is close to impossible to write complete contracts for many economic transactions. For example, when two firms enter into a joint venture to produce some good, the contract will specify the amount of initial investment by each firm, the number of employees from each firm, and how profits will be divided. However, it is impossible to specify how much effort each employee

of each firm will put into the joint project. Moreover, unexpected circumstances will most likely arise during the time the joint venture is ongoing, and these will have to be dealt with on an ad hoc basis. Hence, such joint ventures can only happen in societies where enough trust exists between people. Tabellini (2010) shows that trust, and other cultural variables, can indeed explain some European differences in income per worker.

Property rights not only ensure productive, long-term capital investment but, as we have seen, are also key for innovation in new products, i.e., new technologies. In particular, we have seen in the Romer model that in order to have a research sector, researchers need to profit from their ideas by making them patentable. Without these patents, the capital goods makers would not generate any profits from their sales which would not allow them to sue these profits to buy ideas and, thus, incentivize research.[1] Hence, counties with weak property rights may suffer from low research activity and, hence, low productivity.

In our models, we have not thought too much about the exact source of property rights such as patents. In a democratic country, those rights are first most the result of legislators passing laws, such as patent laws. Though laws are the basis for any property rights, they are often broad and further details are filled in by the executive branch through regulations that interpret these laws. Moreover, in the case of patents, it is the executive branch that interprets these regulations when granting patents to individuals. For example, in the U.S. the Patent and Trademark office denied a patent on a process of managing risk (risk hedging) in commodities trading. They did so despite the law specifying that a patent shall be granted to "Whoever invents or discovers any new and useful process [...], or any new and useful improvement thereof". The case highlights the basic trade-off in patenting decisions. On the one hand, as we have seen, inventing new business processes such as the assembly line is an important part of technological progress and there are good reasons to incentivize firms in experimenting and coming up with better processes. On the other hand, granting a monopoly on all risk hedging in commodity markets, where risk hedging is a common financial tool, to a single company for decades would eliminate competition in that sector leading to lower

[1] In fact, the Romer model assumes a very high degree of property right protection where patents last forever allowing the patent holder to exclusively sell the capital good forever.

output. The company that wanted the patent challenged this decision arguing that risk hedging is undoubtedly a "useful process" and their particular method was at least an "useful improvement" on existing processes. The dispute rose to the U.S. Supreme Court that ultimately agreed with the executive branch decision. It reasoned that though business processes are generally patentable, the present case was only an abstract idea of risk hedging that was already well-known and, thus, not patentable. Another recent example of the importance of courts was a dispute between Samsung and Apple. Samsung had infringed on some of the design patents held by Apple, in particular, patents held on the screen. The law specifies that in such a case, the infringer shall pay the profits resulting from the infringement of the "article of manufacturing". Samsung argued that this latter term only refereed to the screen, as it is a separate article of the manufacturing process, and, hence, the law requires to compute the profit share that is attributable to only the screen. Apple argued that the term refers to the cell phone as a whole, even though the patent infringement was only on one of its components. This case also went to the U.S. Supreme court that provided a narrow victory to Apple saying that the term can refer to either and asked a lower court to apply the analysis in that particular case.

So far, the discussion deals mostly with property rights being well defined. However, what matters equally is that they are enforceable. One issue may be that the executive branch is selectively not enforcing the law, for example, for political reasons. Moreover, enforceability may also be impracticable because courts take too long in deciding cases. For example, in Spain, the median duration of a civil case is in excess of 3 years. In Italy, the median duration is even 8 years. With such long disputes, a firm may decide not to enter into a contract as it becomes almost impossible to enforce it.

Recent literature started to study, apart from the level and the type of capital investment, the role of the allocation of capital for output. The idea is that misacllocation of the capital stock can have productivity effects. To see why think about your Microeconomic class: Firms should employ capital and labor until marginal products are equalized across firms. If firms have different levels of productivity, this will imply that more productive firms will be bigger but the marginal worker (unit of capital) is just a productive as in a less productive firm. Is this

condition would not hold, aggregate output can be increased by reallocating the factors of production. To measure how far the economy is from this optimal, i.e., to measure how much misallocation of factors of production is present in the economy, consider the following firm problem:

$$\max \left\{ \pi_i = P_i z_i K_i^{\alpha} L_i^{1-\alpha} - r(1+\tau_i^K) K_i - w(1+\tau_i^L) L_i \right\}, \tag{3}$$

where r is the aggregate interest rate, and w is the aggregate wage rate. τ_i is what we call firm-specific price distortions. The optimal capital choice is:

$$\alpha P_i z_i K_i^{\alpha-1} L_i^{1-\alpha} = r(1+\tau_i^K) \tag{4}$$

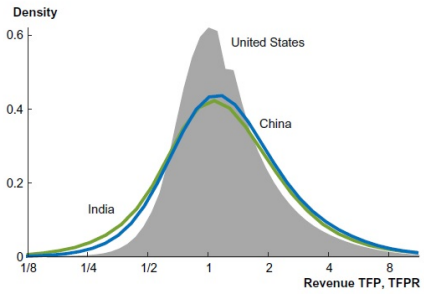
$$\alpha P_i Y_i = r(1+\tau_i^K) K_i \tag{5}$$

$$\frac{r K_i}{P_i Y_i} = \frac{\alpha}{(1+\tau_i^K)}. \tag{6}$$

One can derive an analogous condition for labor. The equation is familiar. All it says is that in the absence of firm-specific price distortions, $\tau_i = 0$, each firm equalizes its capital expenditure share of revenue to α. If a firm obtains capital at more favorable conditions than the average firm, $\tau_i < 0$, it will choose a higher capital stock. The attractive aspect of the equation is that the left-hand-side can be measured in balance-sheet data which provide estimates of the capital stock and firm revenue. The model obviously assumes that all firms have a common production function, i.e., a common α. The assumption makes only sense within narrowly defined industries, hence, the literature usually estimates these model within industry. However, given that assumption, using balance sheet data allows us to back out the firm-specific price τ_i^K.

Figure 2 is from Hsieh and Klenow (2009) who compute these distortions for the U.S., China, and India. Starting with the U.S., they measure significant factor misallocation. There may be two reasons for this. First, it may be due to measurement error, for example, mismeasurement of the capital stock or a too broad industry definition. Alternatively, it may arise from true distortions. For example, young firms may not have yet good banking relationships and, thus, face higher borrowing costs than old firms. The figure also shows that misallocation is yet much larger in China and India. Given that, they fo the following thought

Figure 2: Misacclocation of capital



experiment: What would happen to output if China and India would reduce their misallocation to the level of the U.S., i.e., to a level that should be attainable. They find that such a reduction would increase output in China and India by 40 and 50%, respectively, i.e., the allocation of factor inputs across firms explains a substantial fraction of output differences across countries.

Figure 3: Misallocation in Europe

(a) Average

	STD in revenue labor productivity	STD in revenue total factor productivity	OP covariance term
United States	0.58	0.39	0.51
United Kingdom	0.59	0.42	0.15
Germany	0.71	NA	0.28
France	0.53	0.23	0.24
Netherlands	0.55	0.15	0.30
Hungary	1.04	0.92	0.16
Romania	1.05	0.55	−0.03
Slovenia	0.80	0.22	0.04

(b) Change over time

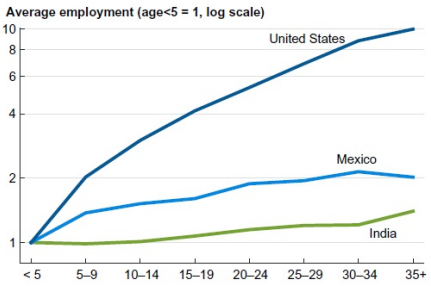
	STD in revenue labor productivity	STD in revenue total factor productivity	OP covariance term
United States	0.02	0.00	0.09
United Kingdom	0.04	0.03	0.06
Germany	0.06	NA	0.14
France	NA	NA	NA
Netherlands	0.01	0.00	0.11
Hungary	−0.02	−0.03	0.18
Romania	0.03	−0.03	0.25
Slovenia	−0.06	−0.02	0.16

Bartelsman et al. (2013) take a similar approach to Hsieh and Klenow (2009) and compare several European countries to the U.S. during the 1990s. Their preferred measure is the correlation between firm productivity and firm size. The left panel of Figure3 shows that this correlation is indeed high in the U.S. Maybe surprisingly, it is substantially weaker in Western Europe (U.K., Germany, France, Netherlands) suggesting that the most productive firms are not sufficiently large (or the last productive firms are too large). Finally, in Eastern Europe, the correlation is basically zero, i.e., a highly productive firm is on average not bigger than an unproductive firm. The right panel computes the change in this correlation between the beginning and the end of their sample period. In general, the correlations have increased suggesting the economies becoming more efficient. The increase is particularly large for Eastern European countries.

The potential importance of misallocation obviously raises the question how it

may be linked to governmental policies. In China and Eastern Europe, we have good anecdotal evidence for the institutions that could drive misallocation. That is, firms owned by the state face cheaper input factors than privately owned firms. Even among privately owned firms, fortunes depend heavily on how well one is connected to the local and federal government. Similarly, Eastern European countries came out of socialist governments in the 1990s that probably suffered from similarly poor institutions. Consistent with this, once these countries adopted a capitalist system, we observe improvements in factor allocations. However, the data highlights that this reallocation of factor inputs is a very slow process that takes more than a decade. Slow reallocation of factors is not only an issue in Eastern Europe. For example in Germany, hard coal production became uncompetitive with brown coal and imports in the 1960s. Nevertheless, production did not stop until 2018, in large parts because of large government subsidies.

Figure 4: Firm growth over the life cycle



In follow-up work, Hsieh and Klenow (2014) highlight yet other institutions that are possibly resulting in factor misallocation. In particular, as Figure 4 shows, manufacturing firms in India and Mexico are growing much less over their life cycles than firms in the U.S. A possible explanation is that in countries like Mexico and India, regulatory costs increase in plant size leading to productive plants choosing to stay smaller. For example, in Mexico, if you open a corner shop selling groceries, you are most likely running it as an informal firm meaning you pay no taxes, social security contributions, and you are not subject to any business regulations. In general, these shops are relatively unproductive with low turnover of goods and an employee spending hours without sales. However, a more productive firm like Walmart that has hundreds of large stores with thousands of employees cannot

run as an informal business and, thus, has higher labor costs and higher regulatory costs.

So far, we considered aggregate measures of labor and capital across firms. However, misallocation can also mean that the wrong people are working in the wrong jobs. In fact, Hsieh et al. (2019) find that such misallocation was persuasive in the U.S. during the 1960s because the was pervasive discrimination against women and minorities in the labor market. For example, in 1960, 94 percent of doctors and lawyers were white men. However, there is no good reason to believe that the innate talents of minorities or women for those professions are any worse than those of white men. Hence, output would be increased if those people with the highest skills across all types of demographics would work as layers and doctors and some of the white men would work, instead, in other professions. The authors find that reducing the misallocation of talent contributed to 20 to 40% of the total output growth in the U.S. For example, going back to the example off doctors and lawyers, by 2010, the fraction of white men was just 62 percent.

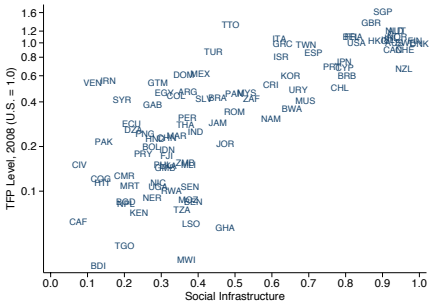
Optimally, we would like to have good measures of all these institutions across countries: government efficiency, stability of economic conditions, the strength of property rights and their enforceability through the government, institutions that favor some firms over others, institutions that stifle firm growth, and discriminatory practices. It is obvious that we can only, at best, measure proxies for these institutions. The World Bank's Governance indicator project is such an attempt and provides measures on the rule of law, regulatory quality, accountability of politicians, political stability, government effectiveness and corruption. In general, we could relate each of these variables to economic outcomes. However, to simplify the analysis, Figure 5 relates years of schooling and TFP to the simple average of all these indicators. TFP is a direct measure for productivity, and we have seen theories that suggest that productivity should be proportional to skills of which education is a proxy. Both graphs display a positive correlation, i.e., countries with better institutions have a more educated workforce and a higher productivity.

Importantly, we cannot claim causality from these correlations. As so often, endogeneity is a major concern: For example, countries that are rich may have high education and high productivity and, at the same time, decide to invest more resources into good institutions. To establish causality, we require some exogenous

Figure 5: Institutions and

(a) education

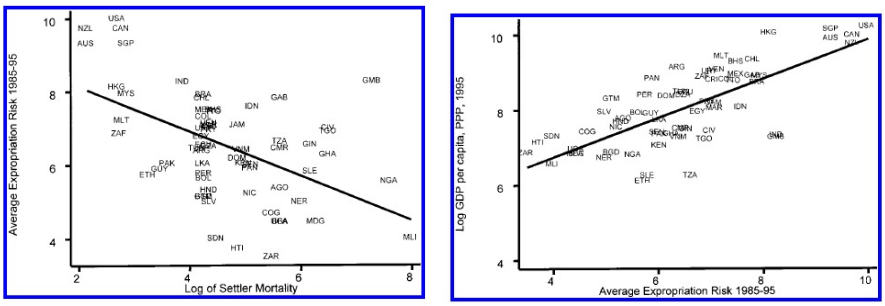
(b) productivity



variation in institutions across countries. A highly influential paper that tried to find such variation is Acemoglu et al. (2001) who won the Nobel price for their work. Their basic idea is to use the time of colonization to think about the type of institutions that European settlers brought with them. In particular, settlers have an incentive to bring good institutions with them in places where they want to permanently settle. This idea would suggest to simply use the number of settlers going to a place as an instrument for institutions. This, however, ignores that there is still an endogeneity issue: settlers were more likely to move to places with higher economic prospects. For example, Greenland was not a popular choice among settlers leaving Europe.

The idea from Acemoglu et al. (2001) is to exploit cross-country variation in the probability of sickness for European settlers. In countries where sickness was high, e.g., the Central African Republic, colonizers did not plan to settle permanently but rather, their objective was to extract as many resources from those countries as possible. Hence, the institutions they set up were highly extractive, e.g., establish large farming companies that used slaves and did not need to obey by the rule of law. In contrast, in regions where sickness was less an issue, Europeans planned to settle permanently and brought institutions from Europe with them that were more inclusive. One can see that the argument is quite attractive, however, it may still have an issue when it comes to understand income differences across countries today: These institutions were established in the 17^{th} and 18^{th} century but we want to understand institutions today. However, it turns out that these institutional differences persist until today, a point we will come back to below.

Figure 6: Causality between institutions and GDP per person



Source: Acemoglu et al. (2001)

The left panel of Figure 6 shows exactly this phenomenon. Even today (1985-1995), institutions, here measured by the protection against being expropriated, are better in countries where settlers were less likely to dye. The right panel shows, in turn, that better institutions today are associated with GDP per capita today. To obtain the causal effect of institutions on GDP per capita, the authors use an IV-approach. In the first stage, they regress institutions today on settler mortality, i.e., they use the exogenous variation in institutions across countries that results from differences in settler mortality rates. In the second step, they regress GDP per capita today on predicted differences in institutions from the first step. Their results suggest that differences in institutions can, indeed, explain sizable GDP per capita differences between countries. For example, the regression predicts that moving from the institutions at the 25th percentile (Nigeria) to the 75th percentile (Chile) would increase GDP per capita by a factor of 7. The actual GDP per capita difference is 11, i.e., the model explains a sizable fraction.

One compelling aspect of Acemoglu et al. (2001)'s explanation is that it provides at the same time a plausible explanation for the reversal of fortune we have seen in Figure 1. That is, in areas of the world where European settlers found a low population and, hence, little gains from extracting resources, they had the most incentives to establish inclusive institutions. At the same time, in those areas where they found large existing populations, they had a much stronger incentive to establish extractive institutions to extract resources from these populations.

Key to Acemoglu et al. (2001)'s argument is that extractive institutions can persist over long periods of times, i.e., more than a century. This may be surpris-

ing given that a society leaves rents on the table, i.e., it could increase output just by implementing better institutions. In fact, a famous theory in microeconomics suggest that under some conditions, the initial allocation of rights to resources is irreverent for the final allocation, the so called Coase theorem:
"*In the case of zero transaction costs, no matter how the rights are initially allocated, negotiations between the parties will lead to the Pareto optimal allocation of resources*"
The basic idea behind the theorem is one of trading opportunities, i.e., by increasing the total pie of the economy, one can always find a trading scheme that makes all parties at least as well off as under the initial allocation of rights. In the case of extractive institutions, two possible negotiations would be feasible. First, the ruling elite could implement less extractive associations, thereby, taking a smaller slice of a greater pie and still be better off. Second, the ruled could implement better institutions and use the additional resources to pay off the elite for stepping down from power. So why do such beneficial exchanges not take place, i.e., what are the transaction costs in the Coase theorem? Robinson and Acemoglu (2012) identify limited commitment as the core problem. That is, the ruling elite cannot commit to take a smaller slice of the pie once people have done the investments, i.e., they have a permanent incentive to reimpose the extractive institutions as long as they are in power. Similarly, the ruled cannot commit to pay the elite once they have stepped down from power. This is obviously not to say that extractive institutions will necessarily persist forever. After all, European countries have overcome the monarchies and aristocracies of medieval Europe and replaced them by liberal democracies. However, a theory of limited commitment helps us understanding why such changes may take sometimes centuries.

A related question is whether good, i.e., inclusive institutions will necessarily persist forever. Unfortunately, the answer is again no. Particularly over the last decades, incidences of countries becoming more authoritarian, sometimes called democratic back-sliding, have increased. Unfortunately, our understanding of these incidences is at best imperfect. Often, judicial review is seen as the most important backstop against the other branches of government becoming too authoritarian. For example, post World War II Germany explicitly established a constitutional court that could review the constitutionality of laws passed by the legislator. This

design was informed by the experience of the Weimar Republic that had no such court that could have constrained the Nazis when taking over power. Hence, can we enshrine good institutions by having robust rights guaranteed by a constitution and guarded by a constitutional court? Experience tells us that such a framework is neither necessary, no sufficient. Regarding necessity, in England, parliament is supreme and judicial review is absent, yet, England is one of the oldest well-functioning democracies. Regarding sufficiency, many authoritarian countries have very strong right-protecting language in their constitutions, those rights are, however, not enforceable. For example, the constitution of North Korea guarantees the freedoms of speech and travel. In the end, what matters is to have institutions that assure that not all the power of the government can be concentrated in a single person or group.

The discussion above may suggest that institutions are the principal force behind GDP per capita. Though economists certainly agree that they are important, it is difficult to determine how much of the cross-sectional variation in GDP per capita these long-term institutions can explain. Moreover, economists are also convinced that policy choices given an institutional structure do matter for GDP per capita. For example, in Europe, it was a political choice to introduce the cap-and-trade scheme that made high-energy sectors less profitable. In the U.S., the same institutions gave rise to a more free-trade policy under President Clinton and a more restrictive trade policy under President Trump. The same institutions in Argentina can produce a President Kirchner who believes in governmental regulation and a President Milei who believes more in free markets. Such political choices do determine the economic outlook for countries, i.e., long-run institutions cannot be everything.

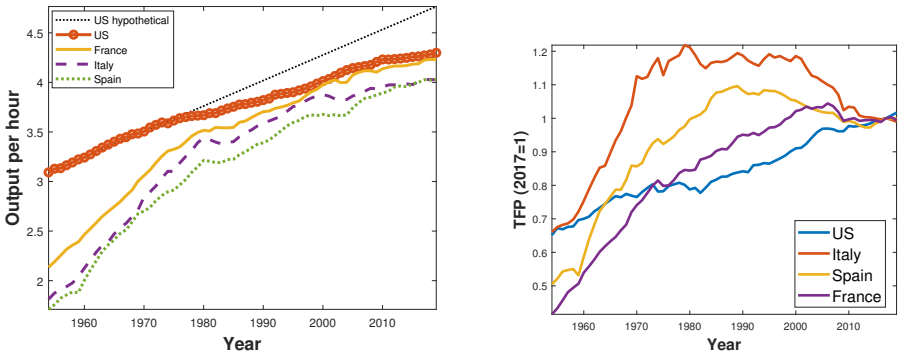
What have we learned about the effectiveness of such policies over the last decades? In the 1990s, the Washington Consensus emerged leading the World Bank to push for protecting property rights, limited government, and free market reforms. This has become a very controversial approach because it often implied reductions in welfare spending and success was mixed. Recently, Nobel winning economist Micheal Spence surveyed the 13 biggest successes over the last decades and finds some common denominators across those countries. First, consistent with theories on technological adoption, he finds that openness to trade is important.

Particularly, policies of import substitution practiced by many South American countries and India have not proven to lead to sustained economic growth. Second, consistent with theories that stress physical capital accumulation, he observes that many of these countries experiences high savings rates. Third, as the example of China makes obvious, having a small government may not be necessary, however, the government should concentrate its spending on infrastructure and education instead of welfare spending. A type of policy that was not raised by Spence but gained some interest during the last decades is the importance of financial development. That is, good financial institutions are needed so that productive firms can actually grow and, thus, reduce misalloction of resources in an economy.

Beyond those success stories, economists have also extensively studied which kind of policies often fail to bring economic development. One focus has been on education. Though many developing countries have expanded their mandatory years of education and build school houses, the quality of education is often questionable. Another focus has been on foreign aid. Unfortunately, foreign aid has not shown to be particularly effective in producing economic growth. One issue is that foreign aid always relies on local governments which have their own, often extractive, interests. One attempt to overcome the problem has been conditional aid, i.e., only providing aid for structural political and market reforms. However, such attempts are often not working very well.

1.3 The growth slow-down

Figure 7: Slow-down in growth



The left panel of Figure 7 shows that in several economies across the developed world, the growth rate in output per hour started to slow down in the 1970s. To get a sense of the magnitude of this effect, the dotted line shows the hypothetical output per hour in the United States, if the growth rate would not have had slowed down. In this alternative world, the United States would be today 40% richer which is again a reminder that small changes in the growth rate can have long term consequences. The figure also shows that the slowdown was even stronger in several European countries. One stark example is Italy which in 2019 was not significantly richer than 20 years earlier!

A natural question to ask is whether the slow-down is associated with slower capital accumulation or with slower TFP growth. We know already the answer to this for several countries as we have seen that capital-to-output ratios have, if any, increased over time. Indeed, the right panel of the figure shows that all countries experienced a significant slowdown in TFP growth. The picture is particularly depressing in Southern European countries where TFP has peaked around 1985 and has been *falling* since then by as much as 20 percent.

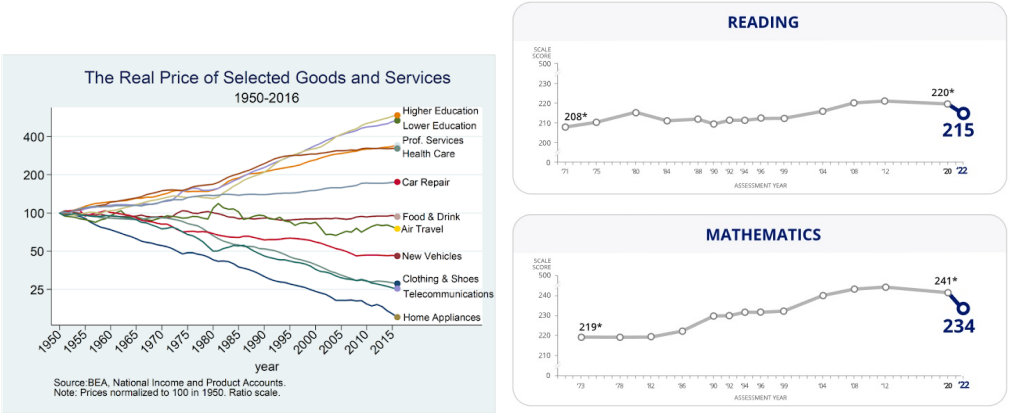
Such large falls in TFP seem hard to comprehend. After all, it is unlikely that Italy just forgot how to produce things in an efficient way. As a result, some economists suggest that the problem is actually one of mismeasurement. As discussed at the beginning of the course, GDP is a measure designed to measure physical output. Measuring service output is much more difficult and the economy has shifted to these services. In fact, we have anecdotal evidence that GDP measurement may have become less accurate. For example, much of the internet 2.0 is missing from GDP measures as products like *Instagram* have no prices and, at the same time, people appear to value these goods highly. In the end, it is hard to falsify the claim that mismeasurement is the issue. However, some anecdotal evidence may help to convince us that there is more. Think about the average U.S. household during the 1960s and 1970s. Said household acquired a dish washer, a laundry machine, and a car; three goods that radically transform daily life. Now think about that household during the 2000s and 2010s. The major new goods that the household acquired was probably the cell phone and a laptop. Again, households seem to value the time they spend with such goods highly but it appears a little underwhelming. Maybe most notably, for the last 30 years, daily

transportation has changed very little for most people. Cars, trains, metros, and airplanes have not become faster. This observation has made a famous investor, Peter Thiele, coin the phrase "We were promised flying cars and all we got is 140 characters".

The Romer model may provide a first idea of why technological progress may have slowed down. There, we have seen that a constant growth rate in technology is only feasible when the number of researchers is also growing at a constant rate. However, though the data is certainly imperfect, the work by Bloom et al. (2020) does not suggest that there is a meaningful fall in the growth rate of researchers since the 1970s. However, the nature of researchers has changed significantly over time. Jones (2016) shows that since the 1970s, much of the increase comes from software development and entertaining. Research spending that has grown much less since the 1970s is governmental spending which peaked as a share of GDP in the late 1960s at the hight of the space race and the Cold War. Why might it matter what kind of research we are spending resources on? Recall from the Romer model that the "standing of the shoulder of giants" effect is important for the technological growth rate. One would expect that more basic research, the type found usually in governmental research is more important than research in entertainment. For example, Facebook employing a researcher who runs experiences on what shade of blue makes it users engage longer with the website probably produces little spillover effects on future researchers compared to the work on signal transmission that came out of the space program such as satellite communication.

Another theory behind the falling productivity growth is one based on structural transformation. Jorgenson and Stiroh (2000) shows that manufacturing industries have on average higher productivity growth. However, households consume more and more services as a share of their income in developed economies over time which have lower productivity growth. Particularly many major governmental, such as health and education, suffer from poor productivity growth yet, they rapidly increasing in importance. The left panel of Figure 8 shows that the result are steeply increasing prices in those industries. The right panel shows the poor productivity growth in the U.S. education sector. It shows average test scores in standardized tests going back to the 1970s. Today's students have only a slightly better average reading and math scores than students in the 1990s. During

Figure 8: Explaining falling productivity growth



Source: Marginal Revolution and National Center for Education Statistics.

the same time, per student real dollar spending has increased by almost 50%.

A yet different theory for the slowdown in productivity growth is that institutions may have become "worse". The anecdotal evidence here is that major governmental projects, particularly infrastructure projects, become incredibly hard to get done. For example, just to approve a major windfarm in the U.S. took 18 years. Almost comically, the delay was partly due to extremely long environmental impact evaluations. The U.S. is not alone. In Germany, the new Berlin Airport started construction in 2006 and was planned to open in 2011. Instead, it finally opened in 2020. The ITER fusion reactor in France was scheduled to be operative in 2020. Currently, it is scheduled to start operating in 2039. Now compare this to major governmental projects from earlier times. The Apollo Program took 6 years to send humans to the moon. The Manhattan Project build the atomic bomb in 2 years. The Hoover Dam was build in 5 years. Such impressive time lines did not come without costs. Maybe, a more thorough environmental impact evaluation for the Hoover Dam would have been good. Moreover, 96 workers died during its construction, a death tole that would certainly stop any infrastructure project today. However, such environmental and human costs do not show up in GDP and, hence, do not show up in our TFP measure.

There have been recent propositions by economists of why the regulation of the economy is constantly growing over time. One idea is that this is driven by vested interests that have the ear of policy makers. Alternatively, there is the idea that

Figure 9: Spacial misallocation

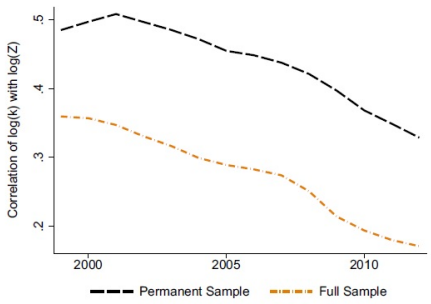
TABLE 1—EMPLOYMENT, AVERAGE WAGES, TFP, HOUSING PRICES, AND AMENITIES

	1964	2009
log employment		
New York, San Francisco, San Jose	2.89	2.55
Rust Belt cities	1.63	0.96
Southern cities	0.82	1.14
Other large cities	2.68	2.23
log TFP		
New York, San Francisco, San Jose	3.81	7.14
Rust Belt cities	2.77	1.14
Southern cities	1.14	1.95
Other large cities	3.36	3.68
log housing price		
New York, San Francisco, San Jose	0.409	0.610
Rust Belt cities	0.125	−0.104
Southern cities	−0.128	0.106
Other large cities	0.225	0.333

it is society as a whole that values more security and becomes more complacent as it becomes richer. Finally, as we become richer, people may value consensus more than individual success.

Low productivity growth has also renewed the interest of studying misallocation in developed economies. Recently, Hsieh and Moretti (2019) study the issue of housing restrictions to understand the misallocation of people across space. They study the case of the U.S. but the problem is also well-known in Europe: in large cities where job opportunities are good, housing rents are increasing rapidly. Figure shows that in some of the U.S.'s most successful cities, New York, San Francisco, and San Jose, employment has not increased between 1964 and 2009 despite productivity, i.e., wages, more than doubling while, at the same time, TFP falling in cities of the rust-bell. How is it possible that employment does not reallocate from places with falling productivity and towards places where productivity is growing? The table shows that housing prices have increased in those high-TFP growth cities, i.e., it becomes harder for people to move there. The picture is somewhat better in south U.S. cities which also saw TFP growth, however, even there, house prices have increased. Usually, in economics, we would think that higher housing prices will lead to more construction which would allow people to move to those cities. However, cities severely restrict housing supply by restricting the areas where new houses can be constructed, limiting the height of buildings, restricting the number of people per apartment, and designating areas for low density single-family housing. Hsieh and Moretti (2019) find that these type of

Figure 10: Productivity growth in Southern Europe



housing restrictions have become more sever in the most successful U.S. cities and that reducing restrictions to their levels in 1964 would increase U.S. GDP by 3.7% by reallocating workers to more productive cities.

Finally, the extraordinary poor productivity growth in Europe has also received attention from economists who have linked it to the stronger factor misallocation in Europe that we have already seen above. in particular, Gopinath et al. (2017) find that Spanish (and southern European) capital allocations has worsened after the introduction of the Euro. Figure 10 shows this phenomenon in terms of a falling correlation between firms' productivities and the amount of capital they have in Spain. Gopinath et al. (2017)'s model rationalizes the fact by poorly working capital markets. The introduction of the Euro decreased real interest rates and lead to capital inflows to Southern Europe. That, by itself, does not imply more capital misallocation. However, they find that the financial system channeled too much of the additional capital to relatively inefficient firms.

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