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On the Growth Slowdown in Developed Economies

Gelişmiş Ülkelerde Büyüme Yavaşlaması Üzerine

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Abstract

After the Global Financial Crisis of 2008, the long-run growth patterns in developed economies have been under closer academic scrutiny because of dismal prospects of growth slowdown and secular stagnation. There exist various conflicting views on whether this slowdown of growth rates started prior to the Global Financial Crisis or not. Moreover, the debate is extended concerning the source of this slowdown, arguing the pace of innovation. This paper presents an investigation of the structure of long-run growth patterns for a large set of countries using empirical methods to directly test whether and to what extent long-run growth slowed down in developed economies. Our findings show that, in high-income economies, the long-run growth rates of GDP per capita, GDP per worker and TFP exhibit clear declining trends over the period 1970-2019. Furthermore; the statistical significance of growth slowdown is not sensitive to (i) country classification criteria (D1: high-income countries according to World Bank, D2: high-income countries according to United Nations, and D3: OECD member countries), and (ii) the estimation method (fixed effects versus random effects).

Jel Codes: *A10, C23, O00*

Key Words: *Growth slowdown, Developed Countries, Panel Data*

Öz

2008 Küresel Mali Krizinden sonra, gelişmiş ekonomilerdeki uzun vadeli büyüme örüntüleri, büyümedeki yavaşlama ve seküler durgunluğa ilişkin iç karartıcı beklentiler nedeniyle daha yakın akademik incelemeye tabi tutulmuştur. Büyüme oranlarındaki bu yavaşlamanın Küresel Mali Kriz öncesinde başlayıp başlamadığı konusunda çeşitli çelişkili görüşler bulunmaktadır. Ayrıca bu yavaşlamanın kaynağına ilişkin tartışmalar inovasyonun gidişatını değerlendirerek artmaktadır. Bu makale, gelişmiş ekonomilerde uzun vadeli büyümenin yavaşlayıp yavaşlamadığını ve ne ölçüde yavaşladığını doğrudan test etmek için ampirik yöntemler kullanarak, çok sayıda ülke için uzun vadeli büyüme örüntülerinin yapısı hakkında bir araştırma sunmaktadır. Bulgularımız, yüksek gelirli ekonomilerde, kişi başına GSYİH, çalışan başına GSYİH ve TFV'nin uzun vadeli büyüme oranlarının 1970-2019 döneminde net düşüş eğilimleri gösterdiğini göstermektedir. Üstelik; büyümedeki yavaşlamanın istatistiksel değeri ülke sınıflandırma kriterlerine (D1: Dünya Bankası'na göre yüksek gelirli ülkeler, D2: Birleşmiş Milletlere göre yüksek gelirli ülkeler ve D3: OECD üye ülkeleri) ve (ii) tahmin yöntemine (sabit etkiler modeli vs rastgele etkiler modeli) duyarlı değildir.

Jel Kodları: *A10, C23, O00*

Anahtar Kelimeler: *Büyüme Yavaşlaması, Gelişmiş Ülkeler, Panel Veri*

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1. Introduction

The long-run growth rates of real Gross Domestic Product (GDP) per capita widely differ across countries. In the postwar era, various groups of countries have exhibited dramatic changes in long-run growth rates. Some countries such as Taiwan and South Korea, i.e., growth miracles, have achieved fastest growth in the postwar era with average growth rates exceeding 6% or 7% per annum. There also have been growth disaster economies such as Congo or Chad with long-run growth rates near or below zero.

As for the present, many industrialized and developed economies, especially the early industrialized countries, have modest and positive long-run growth rates. In countries such as the United States (US) and the United Kingdom (UK), for instance, real GDP per capita grows at a rate closer to 2% per annum in the very long run.

After the Global Financial Crisis of 2008, the long-run growth patterns in developed economies have been under closer academic scrutiny because of dismal prospects of growth slowdown and secular stagnation. Various scholars have argued that sizable decreases in growth rates observed during the Global Financial Crisis are actually related with longer term changes in the sources of growth.

Gordon (2015) emphasizes the importance of slow potential GDP growth by way of its direct and indirect effects on the standard of living and slower productivity growth resulting from reduced net investment. Summers (2014) suggests that the course of advanced economies over the last two decades is quite worrisome considering sustainability of substantial growth with financial stability. Plosser (2014) points out that this period of low growth accompanied with decreased productivity may last for a long time.

Motivated by the current debates about secular stagnation and growth slowdown, this paper aims to investigate the structure of long-run growth patterns for a large set of countries using empirical methods. Specifically, our purpose is to directly test whether and to what extent long-run growth slowed down in developed economies. The purpose of the empirical analysis is twofold: First, the paper tests whether the growth slowdown in developed economies is a statistically significant feature of reality relative to the growth dynamics observed in developing and least developed economies. To that end, we estimate various regression models with panel data and isolate the effect of being a developed economy on the long-run growth rate. Second, the paper investigates the patterns of growth slowdown in total factor productivity (TFP) to check whether TFP slowdowns contribute to any slowdown pattern observed in the growth rate of GDP per capita.

The main sample of our analysis covers the 1970-2019 period, and we define 5-year growth rates to disregard the role of annual fluctuations in GDP and in TFP. There are 80 countries in our sample; we choose to include the countries that have highest data availability in terms of TFP. Since we work with 5-year growth rates in different specifications, our panel of long-run growth rates has a large number N of cross-section units and a small number T of time units. We obtain the full set of data from the Penn World Tables of Feenstra et al. (2015).

Our main result is the following: In high-income economies, the long-run growth rates of GDP per capita, GDP per worker and TFP exhibit clear declining trends over the period 1970-

2019. This main result is obtained with the 5-year data sample and under the World Bank classification (D1) of high-income economies. We use the estimates from the random effects estimation to establish our benchmark results.

We also present additional econometric results to demonstrate the robustness of the main result. It turns out that the statistical significance of growth slowdown is not sensitive to (i) country classification criteria (D1: high-income countries according to World Bank, D2: high-income countries according to United Nations, and D3: OECD member countries), and (ii) the estimation method (fixed effects versus random effects). Specifically, under all of these specifications, our estimates show that developed or high-income economies exhibit sizable growth slowdowns.

The remainder of the paper is organized as follows: Section 2 gives an overview of the related literature. Section 3 introduces the methodology and Section 4 the data used. Section 5 summarizes the main results of the paper. Section 6 demonstrates the robustness of the main results. Section 7 then concludes with some final remarks.

2. A Review of the Related Literature

2.1. Growth Slowdowns: Before or After the Global Financial Crisis

The Global Financial Crisis adversely affected the productive capacity of economies and countries have lost 8.4% of their potential output on average (Ball, 2014). According to Plosser (2014), such a regime of low-growth and diminished productivity may continue in the future. Although the mechanisms through which the potential output shrinks following a recession remain largely unexplored, the slowdown in the growth of TFP is shown to be a pertinent channel in various studies (Reifschneider et al., 2015; Hall, 2015).

A conflicting view argues that the growth slowdown started before the Global Financial Crisis. Various studies trace the origin of the growth slowdown back to early and mid-2000s (e.g., Baily & Lawrence, 2001). Byrne et al. (2016) present econometric evidence indicating that there exists a worldwide economic growth slowdown starting in 2004. Similarly, Lusine & Cardarelli (2015) show that the growth episodes that featured an average TFP growth rate of about 1¾ percent per year during 1996–2004 were followed by a slowdown episode. Furthermore, their findings suggest that the slowdown in TFP growth is not related to the IT revolution of 1990s since it is prevailing in many sectors and not only in the IT-intensive or IT-producing ones.

2.2. Growth Slowdown or Secular Stagnation

Some studies on the long-run patterns of growth slowdown focus on the experiences of developed or high-income economies in the context of secular stagnation. In the aftermath of the Great Depression, Hansen (1939) argued that the US economy entered an episode of secular stagnation mainly because of diminished technological and demographic opportunities. After the Global Financial Crisis, Summers (2014) revived and extended the Hansen's (1939) classic thesis by underlining low levels of private investment spending observed along with excess savings. Hence, in addition to continuing obstacles in terms of

technological and demographic dynamism, the US and other developed economies also face the risk of demand-side secular stagnation. If such a regime persists without public debt or government investment that would close the gap in aggregate demand, then the economy stays in a regime of persistently low marginal productivity of physical capital and actual growth rate below its long-run potential (Blanchard, 2019).

For the studies that implicitly accept the relevance of secular stagnation for high income economies, the main controversy is over the question of whether the 21st century stagnation patterns are associated with demand deficiency or not. According to Storm (2017), the reasonable way to explain the slowdown in TFP growth is to understand the fall of labor productivity growth since there exists no such thing as a Solow residual. In his paper, he tests theoretically and empirically the reasons behind the fall in labor productivity which is taken to reflect inadequate demand as the trigger of secular stagnation. His demand-side diagnosis remains close to Summers (2015) as he identifies sluggish demand to be the reason behind secular stagnation. Hence, interpreting TFP growth (or slowdown) from a supply-side perspective is not coherent.

2.3 Technological Progress versus Technological Stagnation

Many argue that the fall in potential output levels would impede economic activity that feeds back the technological progress (Haltmaier, 2013; Reifschneider et al., 2015).

Regarding the endogenous dynamics of TFP growth in advanced and innovative high-income economies, Gordon (2012) gathers his observations concerning the pace of growth over the last 250 years that witnessed three industrial revolutions under six headwinds. He argues in favor of the so-called low-hanging fruit (or fishing out) effect. According to this thesis, innovative potential narrows down or closes in time as the most useful innovative ideas are getting harder to find. Put differently, we have collected the low-hanging fruits since the Industrial Revolution, and the world will soon find itself in a situation where there is no possibility of a great invention (Gordon, 2012; Fernald & Jones, 2014; Aeppel, 2014). The obvious implication of this dismal scenario is that the pace of technological progress (and its contribution to economic growth) would be minuscule in the future.

Although Jones (2017) accepts the fact that his findings align with those of Gordon's (2016), so that the ideas are getting harder and harder to find, he also states that this has always been the case and nothing negates this in his analysis. Consequently, this idea could not be the reason behind the slowdown of productivity growth in the developed world.

In their further and more comprehensive analysis, Gordon & Sayed (2019) emphasize the catching-up effect between the US and the EU, substantiating not only the growth slowdowns but also the decreases in productivity growth rates. They show that just starting at a productivity level of 50 percent of the U.S. in 1950, the EU caught up with the US by 81 percent in 1972. Then more interestingly, they demonstrate that the EU productivity growth in 1972-95 mirrored the one of U.S. in 1950-72 not only in terms of the growth rates which were the same but also of the highly correlated productivity growth rates across industries between the EU and the U.S. during the stated periods.

Contrary to Gordon (2012), the economic historian Mokyr (2018) suggests that the rate of innovation is getting faster and faster, and there is no strong evidence proving that a slowdown in innovation existed over the past decades. Moreover, he emphasizes that TFP can grow regardless of technological progress and technological progress can take place without TFP growth. Likewise, based on their suggestions on the necessity of adaptive innovation in business models and institutional setups to profit from ICT revolution, Brynjolfsson and McAfee (2014) argue that the slowdown in TFP is temporary and ICT revolution will blossom forth in the coming decades.

After examining the contribution of various theoretical and structural studies about the argument of slower recovery, in this paper we attempt to simply demonstrate whether this slowdown in long-run growth rates can be empirically established.

3. Methodology

Our purpose is to develop a direct test of long-run growth slowdown in developed (or high income) economies. This research objective requires a particular research design: (i) the inclusion of a large number of countries at all stages of economic development so that we can identify the differing experience of developed (or high income) economies vis-a-vis developing ones, (ii) the use of five-year growth rates of relevant outcome variables so that the effects of annual fluctuations on income levels are sterilized, (iii) a static panel regression to identify the (fixed or random) country and time effects (since various country-dependent and time-invariant factors such as geography partially determine the long-run growth rate of an economy).

It is important to emphasize that quarterly data is not appropriate for the analysis of long-run growth rates of real GDP per capita. It is simply because of high volatility at this frequency. As in Blomström (1996), Reed (2008), Barro (2015), and El Khanji & Hudson (2016), we achieve long-run identification through 5-year growth rates and therefore construct a wide and short panel. With a large number N of countries, random effects and fixed effects models can be used without any major inference problem even if T is fixed.

Let $i \in \{1,2,\ldots,I\}$ and $t \in \{1,2,\ldots,T\}$ index countries and periods, respectively. The set of countries includes both high-income (or more developed) and low-income (or less developed) countries. As noted above, the periods are 5-year intervals since we focus on long-run growth rates and disregard the effects of annual fluctuations. In line with Jones (2002), a linear regression model would be adequate to enable us to reach reasonable and comparable estimates that have some theoretical relevance.

Consider, then, the linear regression model

$$G_{i,t} = \alpha_i + \beta t + \gamma D_i + \theta t D_i + \varepsilon_{i,t}$$

where $G_{i,t}$ is the long-run growth rate of a variable of interest (e.g., GDP per capita). In this model, $D_i \in \{0,1\}$ is a dummy variable that takes the value of one if country i is among high-

income economies. The term α_i is the country effect, and $\varepsilon_{i,t}$ is an idiosyncratic error term. The model parameters (β, γ, θ) are assumed to be fixed real numbers.

In this regression model, the interaction term $\theta t D_i$ allows us to obtain a direct estimate of growth slowdown for high-income economies. Specifically, we have

$$\frac{\partial G_{i,t}}{\partial t} = \beta + \theta D_i$$

Hence, for any given value of β, the term $\beta + \theta$ yields an estimate of whether high-income economies experience growth slowdown: The statistical inference supporting the case of $\beta + \theta < 0$ implies that the null hypothesis of growth slowdown in developed economies cannot be rejected.

In addition to the point estimation of $\beta + \theta$, we run a one-sided interval estimation of linear combination of estimators with the null hypothesis of $\beta + \theta < 0$, and the alternative hypothesis of $\beta + \theta \geq 0$. The results are explained in the next section.

The advantage of using a regression model such as this one is that it allows us to isolate various effects on long-run growth: The term βt isolates the global growth momentum that affects all countries for any t. The term $\alpha_i + \gamma D_i$ isolates time-invariant country effects such as geography and culture that causally determine long-run growth rate in country i. Then, the remaining term $\theta t D_i$ isolates the temporal growth slowdown effect observed in the high-income economy i.

Let us recall that the stationarity tests are of no relevance since the time dimension T is very small. Even if we run stationarity tests, they are not meaningful. Besides, our outcome variables are growth rates and they are therefore stationary by construction.

4. Data

This paper uses a dataset covering 80 countries over the 1970-2019 period. We compute average growth rates for the 5-year intervals starting from 1974 and ending in 2017.

Table 1: Summary Statistics

Variables	N	Mean	Std. Dev.	Min	Max
Country	720	42.925	23.745	1	83
Time	720	5	2.584	1	9
Gpc	720	0.138	0.21	-0.859	1.921
Gpw	720	0.112	0.199	-0.861	1.844
Tfp	720	0.151	0.115	-0.394	1.273

Source: (Stata)

The econometric analysis of the model uses the long-run growth rates of GDP per capita, GDP per worker, and TFP. The source of TFP data for all countries is the Penn World Table version 10. These growth rates exhibit variation across countries and time periods. We group the countries as high income and non-high-income countries in the analysis and they are represented by the term D_i (where $D_i = 1$ means a high income economy and 0 otherwise).

5. Main Results

We estimate the regression model defined above under different specifications: There are various outcome variables for which we estimate the growth slowdown effects, e.g., GDP per capita, TFP. Country classifications also change across estimations. Finally, we report both fixed effects and random effects estimates of the model.

In this section, we present main results for 5-year growth rates of GPC, GPW and TFP. To classify countries into high-income versus low-income groups, we build on the World Bank's classification criteria (D1). The results we obtain for other specifications are presented in the next section.

Table 2: Main Results

GPC for 5 Years		GPW for 5 Years		TFP for 5 Years	
Parameters	RE	Variables	RE	Variables	RE
γ	0.145***	γ	0.131***	γ	0.080***
	(0.035)		(0.033)		(0.019)
β	0.014***	β	0.013***	β	0.012***
	(0.004)		(0.004)		(0.002)
θ	-0.025***	θ	-0.023***	θ	-0.014***
	(0.006)		(0.006)		(0.003)
Constant	0.059**	Constant	0.039*	Constant	-0.051***
	(0.023)		(0.022)		(0.013)
# of Observations	320	# of Observations	320	# of Observations	320
# of Countries	80	# of Countries	80	# of Countries	80

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

Table 2 reports the RE estimation results for our simple linear regression. As mentioned earlier, the country specification reflects the set of high-income countries according to the World Bank's classification (D1) and it is composed of 36 industrialized economies (see Appendix A).

The parameter γ isolates the long-run growth effect of being a high-income economy. This effect is independent of time. The parameter estimates take positive values and are statistically significant for all variables. Moreover, we can state that the effect of being among high income countries is still important; in other words, when D1 equals to 1,

annualized growth effect of being a developed country enhances by 1% GPC, by again 1% GPW and by 0.8% TFP.

The next parameter we can see from Table 2 is our time-trend parameter β, and, according to the values shown in the table, there exists a positive and statistically significant growth effect for all the countries with respect to time. Hence, on average, there is no growth slowdown globally. This makes sense since a majority of countries in our sample are developing or low-income countries.

Finally, the last parameter that appears in Table 2 is θ, and it is the parameter that enables us to evaluate the growth slowdown effect for high-income economies decoupled from time-trend and country effects. Hence, under our null hypothesis of a growth slowdown in developed economies, we expect to have $\beta + \theta$ being negative.

The main result that can be inferred from Table 2 is that, for each variable and for any given value of β, the term $\beta + \theta$ takes negative values; -0.011 points for GDP per capita, -0.01 points for GDP per worker and -0.002 points for total factor productivity, and the results are statistically significant. Therefore, based on these findings, we may infer that there exists a slowdown of the long-run growth rates of relevant variables in high-income countries.

Notice that there exists a small difference between the slowdown results obtained for GDP per worker and GDP per capita. This clearly originates from the dependent population (e.g., the children and the retired). Since the effect is not zero, one can argue that the pace of demographic transition is important for all high-income economies, eventually leading to more pronounced slowdown effects in GDP per capita.

Regarding the growth slowdown in TFP, we observe that the effect of being among high-income economies is smaller relative to GDP per capita and GDP per worker. Specifically, the total effect with respect to time, $\beta + \theta$, implies a reduction of 0.002 percentage points in 5-year TFP growth rate. Hence, our findings suggest that, on average, there is a minor growth slowdown in TFP measures in the Penn World Tables.

The hypothesis test results for the interval estimation of $\beta + \theta$ indicate that, for GPC and GPW, our interval estimates statistically significantly imply $\beta + \theta < 0$ under all of the country classification criteria and estimation methods. For TFP, we cannot make an inference using interval estimates since the lower bound and upper bound of the confidence interval have differing signs. Our point estimates, however, remain statistically significant for D1, D2 and D3 classifications and for RE and FE estimations.

6. Robustness

The results we obtain in the previous section are also valid with slight differences for various specifications of the model. First, the FE estimation does not alter the main result (the sign

and significance of $\beta + \theta$) since it only eliminates the sole rich-country effect from the model. More generally, we obtain results that support the existence of growth slowdowns in high-income countries and for all three variables of interest. The qualitative nature of our results does not change when we change the country classification criteria.

Table 3: Fixed Effect Regression vs Random Effect Regression for GPC 5 Years

Parameters	FE1	FE2	FE3	RE1	RE2	RE3
β	0.014***	0.009**	0.008**	0.014***	0.009**	0.008**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
θ1	-0.025***			-0.025***		
	(0.006)			(0.006)		
θ2		-0.020***			-0.020***	
		(0.006)			(0.006)	
θ3			-0.015**			-0.015**
			(0.006)			(0.006)
γ1				0.145***		
				(0.035)		
γ2					0.095**	
					(0.037)	
γ3						0.058
						(0.036)
Constant	0.125***	0.125***	0.125***	0.059**	0.094***	0.103***
	(0.017)	(0.017)	(0.017)	(0.023)	(0.021)	(0.022)
R-squared	0.028	0.017	0.010			
# of Observations	720	720	720	720	720	720
# of Countries	80	80	80	80	80	80

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

Clearly, the estimates for the linear combination $\beta + \theta$ of parameters are not altered between FE and RE estimations. Hence, even if we do not separately identify the sole rich-country effect γ in the FE estimations, we still obtain identical estimates of the growth slowdown effect.

However, since both β and θ change under different country classifications, it is necessary to compare and contrast the magnitude changes in estimated $\beta + \theta$ values when we change the country classification criteria. For GDP per capita (GPC), we have an estimated total effect of -0.011 for D1, -0.011 for D2, and -0.007 for D3 classifications. Similar figures that

have a narrow range are also estimated for GDP per worker (GPW) and TFP as seen from Tables 4 and 5.

Table 4: Fixed Effect Regression vs Random Effect Regression for GPW 5 Years

Parameters	FE1	FE2	FE3	RE1	RE2	RE3
β	0.013***	0.009***	0.008**	0.013***	0.009***	0.008**
	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
θ1	-0.0229***			-0.023***		
	(0.006)			(0.006)		
θ2		-0.019***			-0.019***	
		(0.006)			(0.006)	
θ3			-0.014**			-0.014**
			(0.006)			(0.006)
γ1				0.131***		
				(0.033)		
γ2					0.099***	
					(0.035)	
γ3						0.060*
						(0.034)
Constant	0.098***	0.098***	0.098***	0.039*	0.066***	0.076***
	(0.016)	(0.016)	(0.016)	(0.022)	(0.020)	(0.021)
R-squared	0.027	0.017	0.011			
# of Observations	720	720	720	720	720	720
# of Countries	80	80	80	80	80	80

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

Recall that the benchmark estimates with 5-year data and the World Bank classification (D1) imply minor slowdown effects on TFP on average, i.e., a reduction of about 0.002 percentage points in 5-year growth rate. With the United Nations and OECD classifications (D2 and D3, respectively), the effects are similar; 0.002 and 0.001 percentage point reductions, respectively.

Yet we fail to reject that there exists a growth slowdown in high-income economies. Here, the magnitudes of individual parameters naturally change and the sample size is also larger in the time dimension. However, estimated $\beta + \theta$ values are still negative for all specifications. In all cases, we estimate the critical values for the null hypothesis of $\beta + \theta < 0$ and confirm that this null hypothesis cannot be rejected at 5% level of significance.

Table 5: Fixed Effect Regression vs Random Effect Regression for TFP 5 Years

Parameters	FE1	FE2	FE3	RE1	RE2	RE3
β	0.012***	0.010***	0.009***	0.012***	0.010***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
θ1	-0.014***			-0.014***		
	(0.003)			(0.003)		
θ2		-0.012***			-0.012***	
		(0.003)			(0.003)	
θ3			-0.010***			-0.010***
			(0.003)			(0.003)
γ1				0.080***		
				(0.019)		
γ2					0.071***	
					(0.020)	
γ3						0.048**
						(0.019)
Constant	-0.015	-0.015	-0.015	-0.051***	-0.038***	-0.032***
	(0.009)	(0.009)	(0.009)	(0.013)	(0.011)	(0.0120)
R-squared	0.048	0.039	0.033			
# of Observations	720	720	720	720	720	720
# of Countries	80	80	80	80	80	80

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

The main message originating from the tables above is the following: Regardless of the country classification criteria (World Bank, United Nations, or OECD) and the estimation method (fixed effects or random effects), the parameter estimates suggest that the null hypothesis of a growth slowdown in high-income economies cannot be rejected at 5% significance level.

7. Concluding Remarks

In this paper, we directly test the hypothesis that there exists a growth slowdown in developed economies. We use a panel data set for 80 countries covering the period of 1970-2019 and estimate fixed and random effects regressions. Our results lead us to conclude that high income countries do experience a growth slowdown in the long term. Besides, this conclusion is not sensitive to various modelling choices such as different definitions of the country classification criteria (D1, D2 or D3) and the estimation method (fixed effects vs random effects).

The main limitation of the paper is that the estimated empirical models do not build upon microeconomic foundations that identify how and why long-run growth slowed down in

high-income economies in recent decades. Therefore, the methodology used is not entirely appropriate for formulating policy proposals since it does not identify the microeconomic mechanisms that result in growth slowdowns. Formulating such policy proposals requires the construction of an endogenous growth model calibrated with actual long-run data.

The growth literature provides us with seminal theoretical and empirical works about secular stagnation, productivity slowdown and/or technological progress. To understand these structural mechanisms in a truly satisfactory manner, we need to develop endogenous growth models and take these models to the data.

Yet, endogenous growth models may not easily identify the deep causal factors of long-run growth such as geography, culture, and institutions. The models should be rich enough to clarify how geography, culture, and institutions affect human capital accumulation, innovation, investment, and trade. Such rich models would be essential to assess the cause-and-effect relations around the dynamics of the growth slowdown while at the same time to examine the endogeneity of rich-country effects.

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Appendix

Appendix 1:

List of High Income Countries

World Bank Group (D1)		United Nations Group (D2)		OECD Group (D3)	
Australia	Italy	Australia	Ireland	Australia	Ireland
Austria	Japan	Austria	Iceland	Austria	Iceland
Belgium	Republic of Korea	Belgium	Italy	Belgium	Israel
Canada	Luxembourg	Canada	Japan	Canada	Italy
Switzerland	Malta	Switzerland	Luxembourg	Switzerland	Japan
Chile	Mauritius	Cyprus	Malta	Chile	Republic of Korea
Cyprus	Netherlands	Germany	Netherlands	Colombia	Luxembourg
Germany	Norway	Denmark	Norway	Germany	Netherlands
Denmark	New Zealand	Spain	New Zealand	Denmark	Norway
Spain	Panama	Finland	Portugal	Spain	New Zealand
Finland	Portugal	France	Romania	Finland	Portugal
France	Romania	United Kingdom	Sweden	France	Sweden
United Kingdom	Singapore	Greece	United States	United Kingdom	Turkey
Greece	Sweden			Greece	United States
China, Hong Kong SAR	Trinidad and Tobago				
Ireland	Taiwan				
Iceland	Uruguay				
Israel	United States				