Does the Version of the Penn World Tables Matter? An Analysis of the Relationship between Growth and Volatility

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Abstract

The Penn World Tables (PWT) are an important data source for cross-country comparisons in various fields of economics. The PWT have undergone several substantial revisions over time and it is possible that due to these revisions, some well-received conclusions based on one version of the PWT may not hold when another version of the data is used. The current paper explores such a possibility. Using all publicly available versions of the PWT, we first examine how countries' output growth rates vary across the versions. We demonstrate that the magnitude of the differences is not negligible for some countries. Moreover, for 13% of all countries, the sign of the growth rates changes across the versions. We then analyze the effects of the revisions on the evidence provided by Ramey and Ramey (1995) that growth volatility has a significant negative effect on growth. Our findings indicate that their conclusion is version-dependent: it is supported in some versions of the PWT but not in others. This study identifies the possibility that depending on the version of the PWT used, past studies may have reached different conclusions.

JEL Codes: O11, O47, and O50.

Key Words: Growth, uncertainty, growth regression, Penn World Tables.

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1 Introduction

The Penn World Tables (hereafter PWT) are one of the most popular data sources containing an expanded set of international comparisons. Data in the PWT are measured at purchasing power parity and cover a large number of countries from all regions for more than 50 years. This allows researchers to make real quantity comparisons both across countries and over time. the PWT have been extensively used in various fields of economics including growth, development, and international trade.

While numerous findings on economic relationships have been provided based on the PWT, the relevance of these findings depends crucially on how accurately the variables in the PWT are measured. As noted in the technical documentation to the PWT, the data quality varies across countries; data on some countries are measured relatively accurately, while data on others are not. Only a few studies have addressed the data quality of the PWT. For example, Dawson et al. (2001) examined the effect of data quality on several economic relationships. It was demonstrated that some findings reported in the literature do not hold when controlling for countries' data quality using a quality index provided by the PWT. Dowrick (2005) reported that PWT5.6 appears to contain errors in the demographic data for some countries.

The current paper discusses data revisions in the PWT, an issue unexplored in the literature. Since the first release in the early 1990s the PWT has been substantially revised and updated[1]. The revisions have an important implication for empirical findings obtained from the PWT. The data quality is not only different across countries in a given version of the PWT but is also likely to vary across versions. This suggests that some conclusions based on one version of the PWT may not be relevant when another version is used instead. This paper explores such a possibility. We first document how countries' growth rates change across the four versions of the PWT (PWT5.0,

[1]The PWT (mark 5) was made publicly available in 1991, along with the description provided by Summers and Heston (1991). A revised and updated version of PWT5, PWT5.5, became available in 1993. Subsequently, version 5.6 was released in January 1995. The current version of Penn World Tables, PWT6.1, became available in 2002.

PWT5.5, PWT5.6, and PWT6.1). We then analyze the effects of the revisions on the empirical findings in Ramey and Ramey (1995). Using PWT5.0, they examined the link between growth and uncertainty and found that growth volatility is significantly and negatively related to growth. Using the four versions of the PWT, we examine whether this evidence is version-dependent or not.

The rest of the paper is organized as follows. In the subsequent section, we describe the construction of the PWT. Section 3 documents how countries' growth rates change across the four versions. In Section 4, we examine the robustness of the relationship between growth and uncertainty found by Ramey and Ramey (1995). Section 5 concludes.

2 Penn World Table

The PWT are constructed using data from the International Comparison Program (ICP). The ICP has conducted so-called benchmark studies in 1970, 1975, 1980, 1985, 1990 (only partial), 1993/1996, and 2005. In a benchmark study, each participating country provides national annual average prices of goods and services. The characteristics of items are closely specified to ensure that countries are pricing the same items adjusted for quality. Item prices are expressed as ratios of the corresponding item prices of the numeraire country (i.e., the United States). For example, if the price for fresh milk is \$2 per litter in the US while that in Australia is AU\$3, then the price ratio is 1.5AU\$/\$. Price ratios are grouped by expenditure categories called "basic headings", the lowest aggregate level for which national expenditure data are available. Within each basic heading, price ratios are averaged to obtain the basic heading price parity.

The basic heading parities (p_{ij}) are then aggregated by using data on local currency expenditures $(pq)_{ij}$, where i and j denote basic heading and country, respectively[2]. Data on $(pq)_{ij}$ are provided by participating countries. The local currency expenditures and the price parities are divided by the exchange rate and hence all input values are expressed in the nominal U.S. dollars. Given these

[2]Hereafter, we rely heavily on PWT6 Technical Documentation.

inputs, the aggregate price levels, pl_j, are obtained as follows. First, expenditures are multiplied by so called "super-country weights", scw_j, and notional quantities (q_{ij}) are obtained by dividing the super-country weighted expenditures by the price parities, i.e., $q_{ij} = (pq)_{ij} \cdot scw_j / p_{ij}$[3]. Then, the Geary multilateral method (Geary, 1958) is used along with $(pq)_{ij}$ and q_{ij} as inputs. The procedure is based on the two equations:

$$\pi_i =_j \frac{(pq)_{ij}}{pl_j} \times \frac{1}{\sum_j q_{ij}} \tag{1}$$

$$pl_j = \frac{\sum_i (pq)_{ij}}{\sum_i \pi_j q_{ij}}, \tag{2}$$

where π_i is the international price for basic heading i. $\pi_i q_{ij}$ and $(pq)_{ij}/\pi_i q_{ij}$ represent the real expenditure for and the price parity of basic heading i in country j, respectively. The equations are iteratively solved for π_i and pl_j with initial values of 1's for all pl_j. Given $(pq)_{ij}$, q_{ij}, π_i, and pl_j, it is possible to compute the price levels of consumption, investment, government expenditure, and their sum (i.e., domestic absorption), as well as their real aggregate values. An important implication for equations (1) and (2) is that poor quality data for some countries can potentially affect the results for those countries and all other countries.

Not all of the countries participated in the benchmark studies and the number of participating countries varies across the rounds: 10 countries in 1970, 34 in 1975, 60 in 1980, 64 in 1985, 117 in 1993/1996, and 147 in 2005. For countries not participating in the benchmark study, the price levels of consumption, investment, and government expenditure are estimated using "post-adjustment indexes" created from three price surveys in capital cities around the world. Fist, regressions of the following type are run using data on participating countries:

$$\ln(RDA) = \theta_0 + \sum_{k=1}^{3} \theta_k \ln\left(\frac{NDA}{PAI_k}\right) + \theta_4 AFRICA + \theta_5 ASIA + \epsilon,$$

where RDA (NDA) is the real (nominal) per capita domestic absorption, $AFRICA$ ($ASIA$) is

[3]The objective of using super-country weights is to minimize the difference in results that may occur from adding or removing countries from an aggregation. For more details on super-country weights, see PWT Technical documentation.

a dummy variable for the sub-Sahara African (Central Asian) countries, and PAI_k are the post-adjustment indexes on the basis of the three surveys conducted by (1) the United Nation International Civil Service Commission ($k = 1$), (2) the Employment Conditions Abroad, a British organization with members including multinational firms, governments, and non-profit international agencies ($k = 2$), and (3) the U.S. State Department ($k = 3$). Using the coefficients and national accounts series, short-cut regression estimates of the real per capita domestic absorption are obtained for non-participating countries.

Subsequently, the following set of equations are estimated using data on participating countries:

$$\begin{aligned} RSHAREC &= \alpha_1 NSHAREC + \beta_1 NSHAREI + \gamma_1 NSHAREG + \delta_1 RDA + u_1 \\ RSHAREI &= \alpha_2 NSHAREC + \beta_2 NSHAREI + \gamma_2 NSHAREG + \delta_2 RDA + u_2 \\ RSHAREG &= \alpha_3 NSHAREC + \beta_3 NSHAREI + \gamma_3 NSHAREG + \delta_3 RDA + u_3 \end{aligned}$$

where $RSHAREC$ ($NSHAREC$), $RSHAREI$ ($NSHAREI$), and $RSHAREG$ ($NSHAREG$) are the real (nominal) shares of consumption, investment, and government expenditure, respectively. Using the coefficients and national accounts series, a set of estimated real shares are obtained for non-participating countries. Finally, the price level for consumption in country j is computed as

$$\frac{NSHAREC_j}{RSHAREC_j} \times \frac{NDA_j}{RDA_j},$$

and similarly for investment and government expenditure.

When a country has participated in one or more previous benchmark studies, the PWT incorporates price levels from earlier studies in the following manner. Suppose that the PWT was using the 1996 benchmark. Then, the PWT extrapolates price levels from the previous study, i.e., 1985 to 1996, using the national account deflators. Consequently, the PWT has extrapolated price levels from the 1985 benchmark, in addition to actual price levels from the 1996 benchmark and predicted price levels from the short-cut regression estimates. Generally, the two or three sets of price levels are averaged with pre-specified weights to obtain the final price levels for 1996.

Finally, given that all of the components are available for the benchmark year, applying the relevant national accounts growth rates provides the corresponding component values for any other year. For chain series see PWT6 Technical Documentation.

One might expect that the PWT data derived from more recent benchmark studies have better quality, as they consist of more participating countries for which the price levels need not to be estimated. However, this is not necessarily the case. As is noted in the PWT web-site (http://pwt.econ.upenn.edu/icp.html), the quality of PWT6 derived from the 1993/1996 benchmark study is not necessarily better than that of PWT5 from the 1985 study. Price levels reported in PWT6 may not well represent actual ones, because the number of basic headings used for PWT6 is substantially smaller than that for PWT5: 32 headings for PWT6 and about 150 for PWT5. In the 1993 round, reduced information surveys on the 32 headings were conducted in a number of countries with limited resources and/or statistical capability, while information on many more basic headings was gathered for other participating countries. Though this increased the number of participating countries dramatically (i.e., from 64 in 1985 to 117 in 1993/1996), price levels in PWT6 needed to be computed based only on the 32 headings despite the availability of information on more headings for other countries. Moreover, those countries for which the reduced surveys were conducted did not have much experience in the survey and hence the results might have been relatively unreliable.

3 Data Description

In this section we examine properties of the growth rate of GDP per capita (log difference) in four versions of the PWT.

Table 1 presents the mean and standard deviation of the growth rates over the period from 1962 to 1985 for 110 countries in 4 versions of the Penn World Tables: PWT5.0, PWT5.5, PWT5.6, and PWT6.1. Note that some countries do not have data for the whole period from 1962 to 1985. For

these countries the period over which the mean and standard deviation were calculated is shown in parentheses. The countries for which the means have different signs for different versions of the Penn World Tables are indicated in bold. As shown in the table, a significant fraction (13%) of countries, most of which are African, have experienced sign changes in the mean growth rates across the versions.

Table 2 shows the quantitative differences in the mean growth rates across the different versions of the Penn World Tables. The second column in Table 2 shows the maximum absolute differences between the pairs of the mean growth rates in different versions.[4] The third column shows the maximum percentage differences.[5] All entries in Table 2 are sorted by the maximum absolute difference. On the top of the table is a country with the smallest maximum difference and on the bottom with the largest. As can be seen from this table, almost all of the OECD countries in old definition (23 countries shown in bold) are in the first half of the table indicating that GDP data in these countries were not very severely affected by the PWT revisions. Japan is at the top of the table with the smallest difference (only 0.05 percentage points) in the mean growth rates and Mauritania is at the bottom with the largest difference (3.278 percentage points). Overall, the results in Table 2 indicate that revisions of the PWT have had a substantial effect on the mean growth rate.

Table 3 shows the correlations among the growth rates. As can be seen from this table, correlations between the growth rates in different versions of the PWT are ranging from 53% to 78% except for the pair PWT5.5 and PWT5.6 where the correlation is as high as 93%. These numbers are surprisingly low given that we are dealing with the same variable.

Table 4 refers to the results of the t-test with the null hypothesis that the mean of the growth rate in one version of the PWT is the same as in the other version. For each pair of versions the

[4]For instance, for Australia the absolute difference between the the mean growth rate in PWT5.0 and PWT5.5 is 0.048 percentage points.

[5]The percentage difference between the Australian mean growth rate in PWT5.0 and PWT5.5 is calculated as $|2.401 - 2.449|/|2.449| = 0.02$ or 2%. The maximum relative difference for Australia is equal to 4.9%.

table presents the countries for which the null is rejected at 1%, 5% and 10% level of significance. It is demonstrated that for 30 countries (27% of all countries considered) the null is rejected at 10% level of significance for at least one pair of the PWT versions.

4 Replication of Ramey and Ramey (1995)

4.1 Model

In the previous section, we show that the growth rate of a country differs across the versions of the PWT. This suggests that growth rates reported in three or potentially all versions are measured with error. Given measurement errors in growth rates, output is also expected to be measured with error. As measurement error leads to econometric problems such as inefficiency and/or inconsistency, it is possible that evidence from one version of the PWT does not survive when another version is used instead. In other words, evidence is potentially version-dependent. To examine this possibility, we choose a particular study, namely, Ramey and Ramey (1995) (hereafter referred to as RR occasionally) in which the link between growth and growth uncertainty is examined in the multi-country panel framework.[6] Specifically, Ramey and Ramey (1995) estimated the following equation:

$$\Delta \ln Y_{it}^{*} = \lambda \sigma_i + \theta \ln X_{it}^{*} + \epsilon_{it} \tag{3}$$

$$\epsilon_{it} \sim N\left(0, \sigma_i^2\right) \tag{4}$$

where Y_{it}^{*} is output per capita for country i in year t and X_{it}^{*} is a set of control variables. In this model, growth uncertainty measured by the standard deviation of ϵ_{it}, σ_i, is allowed to be directly related to the growth rate. As σ_i is assumed to differ across countries but not across time, the model can be classified as a special case of a panel ARCH in Mean model. Using data from PWT5.0, RR found that growth uncertainty is significantly and negatively associated with growth for both a sample of 24 OECD countries and a broader sample of 92 countries.

[6] For the recent discussion of the empirical relationship between growth and uncertainty see Lloyd-Ellis (2002), Grier et. al. (2004) and Fountas et. al. (2006).

In the presence of measurement error in Y_{it}^* and X_{it}^*, parameter estimates are generally inconsistent. To examine the effect of measurement error on equation (3), assume that

$$Y_{it} = Y_{it}^* U_{it}$$

$$X_{it} = X_{it}^* V_{it}$$

where Y_{it} and X_{it} are the measured levels of Y_{it}^* and X_{it}^*, respectively and U_{it} and V_{it} are the corresponding measurement errors. We also assume that U_{it} and V_{it} are log-normally distributed. Specifically,

$$\ln U_{it} \sim N\left(0, \sigma_{Ui}^2\right)$$

$$\ln V_{it} \sim N\left(0, \sigma_{Vi}^2\right)$$

and $\ln U_{it}$ and $\ln V_{it}$ are assumed to be serially uncorrelated.

Expressing equation (3) using observables Y_{it} and X_{it}, one obtains

$$\Delta\left(y_{it} - u_{it}\right) = \lambda\sigma_i + \theta\left(x_{it} - v_{it}\right) + \epsilon_{it},$$

where lower case letters indicate log values. It immediately follows that

$$\Delta y_{it} = \lambda\sigma_i + \theta x_{it} + w_{it}, \tag{5}$$

where $w_{it} = (\epsilon_{it} + u_{it} - u_{it-1} - \theta v_{it})$ is a composite error term. As argued in Dawson et al. (2001), when one estimates equation (5), σ_i is replaced by the estimated standard error of w_{it}, $\widehat{\sigma}_i = (\sigma_i + s_i)$. This causes an error-in-variables problem with σ_i and hence an estimate of λ is expected to be inconsistent. Dawson et al. (2001) indeed show that the asymptotic bias in the estimate of λ is

$$plim\left(\widehat{\lambda} - \lambda\right) = -\frac{\lambda VAR\left(s_i\right)}{VAR\left(\sigma_i\right) + VAR\left(s_i\right)} + \Psi, \tag{6}$$

where Ψ is a set of additional terms. Equation (6) along with findings in the previous section essentially suggests that RR's results are likely to be subject to bias. However, the direction of the bias is hard to determine due to the second term in equation (6). See Dawson et al. (2001) for details on Ψ.

4.2 Estimation Results - a Broad Sample

Table 5 shows the results of replication of RR for a broad sample of countries.[7] The second column shows the coefficients from RR (some of them are re-scaled) and the third column presents the results of replication with a sample of 91 countries (the human capital variable was not available for Tanzania). All estimations are made using a maximum likelihood method. As can be seen from the table, the results of RR and replication using PWT5.0 are very similar. The last four columns contain the results of RR replication for a sample of 78 countries[8] available in all four versions of the PWT. This allows us to compare results across the versions.

When we use the sample of 78 countries from PWT5.0, the estimate of λ is found to be significant and negative. This is consistent with the evidence provided by RR, though the size of the effect in RR is more pronounced. A similar finding is obtained for PWT6.1. However, PWT5.5 and PWT5.6 provide substantially different results. For each version, the estimate of λ is insignificant at any conventional level of significance. Moreover, the magnitude of the coefficient becomes much smaller in absolute terms. For PWT5.6 in particular, the magnitude is only 40% of that for PWT5.0 and PWT6.1.

As in Ramey and Ramey (1995), we also control for forecasting variables including lags of GDP per capita, time trend, etc. Table 6 presents the results. The second column shows the estimates from RR, while the third column presents the replication results for the 91-country sample. The estimated coefficient is reasonably close to that of RR and found to be significant at the 10% level. The fourth to seventh columns present the results for the samples of 78 countries from different versions of the PWT. Our findings do not change even when we include more control variables in the regression; the version matters to the results. The estimate of λ is found to be significant for PWT6.1, but not for other versions. Two aspects of the results are worth mentioning.

[7]The covariates include Levine-Renelt variables: the average investment fraction of GDP, initial log GDP per capita, initial human capital and the average growth rate of population

[8]The 78-country sample excludes the following countries from RR: Liberia, Sierra Leone, Sudan, Swaziland, Tanzania,Tunisia, Zaire, Haiti, Afghanistan, Burma, Iraq, West Germany, Malta and Yugoslavia.

First, the coefficient on σ_i becomes insignificant when we use the 78-country sample from PWT5.0, suggesting that the evidence provided by RR may be sensitive to the choice of countries included in the sample. Second, with regard to the absolute magnitude of the growth-uncertainty effect, we observe a similarity between the models with and without additional controls: PWT6.1 provides the largest effect, PWT5.0 the second, PWT5.5 the third, and PWT5.6 the smallest. This result is somewhat puzzling as the correlation between growth rates in PWT6.1 and PWT5.0 is the smallest among any other pair, as shown in the previous section.

Overall, our findings do not support the robustness of the results in Ramey and Ramey (1995). Their conclusions do not necessarily survive when the number of countries in the sample is slightly reduced. More importantly, the results are not robust across the versions of the PWT. In other words, researchers would reach different conclusions depending on the version of the PWT they use.

4.3 Estimation Results-OECD Countries

This section discusses the results of replication of Ramey and Ramey (1995) using a sample of 24 western industrialized countries.[9] Because of the Germany reunification, the data for Western Germany are unavailable in some versions of the PWT. We excluded this country from the analysis, as our purpose is comparing across versions. The second lag of growth rate of GDP per capita for PWT6.1 is unavailable for Sweden and Greece in 1952. Thus, for these countries the data start from 1953. The population growth rate for these countries is also unavailable between 1950 and 1951 in PWT6.1 and hence it was replaced with the one from PWT5.6. This does not seem to generate a large difference, since the population growth rate from 1950 to 1951 cannot be revised substantially from one version of the PWT to the other.

[9]The countries in the sample are Australia, Austria, Belgium, Canada, Switzerland, Denmark, Spain, Finland, France, the United Kingdom, West Germany, Greece, Ireland, Iceland, Italy, Japan, Luxembourg, Netherlands, Norway, New Zealand, Portugal, Sweden, Turkey, and thd United States.

Table 7 shows the replication results for a sample of 24 OECD countries (23 when Germany is excluded). Table 8 presents the results for a model with additional control variables. The second column in both tables shows the coefficients from RR, the third column the replication results with the 24-country sample, and the rest of the columns the replication results using the 23-country sample from different versions of the PWT.

As can be seen from Table 7, the estimate of λ is negative and significant for PWT5.0. However, for the later versions of the PWT, the coefficient is found to be insignificant. It becomes smaller in absolute value over version; surprisingly, it is almost zero for PWT6.1. The results again suggest that the version significantly affects the results.

The effects of the versions are milder when we include additional control variables in the regression. As Table 8 indicates, for all versions of the PWT, the coefficient on σ_i is found to be significant at least at the five percent level. This suggests that the researcher would reach the same conclusion qualitatively; growth uncertainty is negatively associated with growth. Nonetheless, the results are substantially different quantitatively. Like in the model without the additional controls, the estimate of λ is the highest for PWT5.0, monotonically decreasing in absolute value for the later versions. Note that the magnitude of the coefficient for PWT6.1 is approximately half of that for PWT5.0.

To summarize the results, the significant negative effect of growth uncertainty on growth is robust across the versions only when we control for the forecasting variables. With a simpler specification, the significant relationship between the growth uncertainty and growth is observed only for PWT5.0. In either specification, the magnitude of the effect considerably varies across the versions.

5 Conclusion

This study analyzed the properties of different versions of the Penn World Tables. We provided evidence that countries' growth rates were substantially revised across the versions. We also analyzed the effects of the revisions on the empirical evidence presented in Ramey and Ramey (1995) that growth volatility has a significant negative effect on growth. We found that their evidence is supported in some versions but not in others. This study raises the possibility that depending on the version of the PWT used, past studies may have reached different conclusions.

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http://pwt.econ.upenn.edu/Documentation/Doc-tech.pdf

Table 1: Mean and standard deviation of the growth rate (%) of GDP per capita over the period 1962-1985 for different versions of the PWT for 110 countries. (Countries for which the average growth rate changes sign over versions are shown in bold.)

country	$mgr50$	$mgr55$	$mgr56$	$mgr61$	$stdgr50$	$stdgr55$	$stdgr56$	$stdgr61$
Algeria	3.342	2.564	2.605	3.362	1.164	0.767	0.799	0.917
Angola	-1.883	-1.394	-1.320	-1.392	1.013	0.972	0.948	1.020
Argentina	0.407	0.422	0.452	0.547	0.424	0.474	0.511	0.522
Australia	2.449	2.401	2.433	2.329	0.257	0.271	0.256	0.247
Austria	3.271	3.014	3.023	3.243	0.190	0.196	0.186	0.227
Bangladesh	0.393	1.325	0.933	0.550	0.817	0.747	0.998	0.531
Barbados	2.472	3.261	3.270	4.146	0.483	0.437	0.437	0.606
Belgium	2.716	2.758	2.808	3.020	0.250	0.262	0.240	0.241
Benin	0.061	-0.272	-0.030	0.358	0.465	0.456	0.491	0.410
Bolivia	1.305	1.724	1.759	0.263	0.408	0.364	0.360	0.464
Botswana	6.847	5.681	5.960	5.934	0.739	0.744	0.721	0.762
Brazil	2.889	3.173	3.179	3.570	0.479	0.468	0.463	0.404
Burkina Faso (66-85)	1.498	1.426	1.415	1.373	0.415	0.394	0.443	0.381
Burundi	0.697	-0.463	-0.643	2.060	0.857	1.020	0.979	0.848
Cameroon	3.569	2.865	3.384	2.149	0.418	0.407	0.436	0.649
Canada	2.763	3.191	3.184	2.875	0.298	0.256	0.248	0.266
Cape Verde	1.806	3.542	3.141	3.557	1.038	0.839	0.974	0.985
Central African Rep.	-0.721	-0.543	-0.568	-1.511	0.412	0.448	0.451	0.494
Chad	-1.793	-2.249	-2.549	-0.703	0.817	0.974	1.210	1.487
Chile	0.631	0.315	0.586	1.005	0.616	0.804	0.688	0.635
China (69-85)	6.266	6.277	4.918	4.113	0.574	0.530	0.515	0.366
Colombia	2.229	2.215	2.239	2.135	0.304	0.275	0.269	0.203
Congo, Dem. Rep.	0.035	-0.107	-0.193	-1.142	0.751	0.728	0.731	0.634
Congo, Rep. of	3.621	3.649	3.647	6.245	0.557	0.689	0.692	0.968
Costa Rica	2.135	1.951	1.705	1.409	0.376	0.408	0.417	0.382
Cote d'Ivoire	1.332	1.699	1.212	1.493	0.539	0.478	0.667	0.619
Cyprus	4.624	4.469	4.513	4.540	1.002	0.942	0.906	0.914
Denmark	2.723	2.463	2.486	2.305	0.283	0.305	0.289	0.306
Dominican Rep.	2.436	2.601	2.556	2.695	0.677	0.678	0.696	0.486
Ecuador	2.673	2.901	2.864	2.846	0.494	0.498	0.499	0.459
Egypt	5.197	3.656	3.641	2.469	0.592	0.326	0.329	0.538
El Salvador	1.338	1.017	1.098	0.355	0.490	0.472	0.464	0.476
Ethiopia	0.819	0.500	0.566	-0.227	0.207	0.249	0.249	0.485
Fiji	1.540	1.658	1.728	1.916	0.542	0.554	0.548	0.512
Finland	3.314	3.106	3.139	3.230	0.312	0.320	0.304	0.286
France	2.969	2.758	2.899	3.106	0.204	0.225	0.205	0.207
Gabon	4.126	3.015	3.006	3.323	1.507	0.979	0.948	1.047
Gambia, The	2.499	1.262	1.299	2.305	0.922	0.994	1.059	0.727
Ghana	-0.973	-0.733	-0.709	0.865	0.508	0.690	0.757	1.021
Greece	4.165	4.099	4.115	3.796	0.384	0.387	0.374	0.473
Guatemala	1.109	0.869	0.895	1.640	0.286	0.338	0.332	0.270
Guinea	0.311	-0.391	0.699	-0.841	0.339	0.427	0.701	0.455
Guinea-Bissau	1.286	1.145	1.186	0.711	0.951	1.078	1.044	1.519
Guyana	-1.120	-1.006	-1.061	0.391	0.967	1.057	1.141	0.755
Haiti	0.623	0.472	0.471	0.090	0.432	0.408	0.410	0.395
Honduras	1.359	1.099	1.236	1.236	0.360	0.338	0.314	0.399
Hong Kong	5.967	6.362	6.271	6.589	0.405	0.436	0.421	0.491
Hungary (71-85)	3.655	3.006	3.015	3.555	0.356	0.336	0.318	0.321
Iceland	3.370	3.614	3.826	3.591	0.409	0.478	0.427	0.459
India	0.745	1.435	1.396	1.913	0.362	0.476	0.545	0.364
Indonesia	3.650	4.068	4.033	3.811	0.480	0.430	0.418	0.344
Iran	2.638	2.067	1.477	2.100	1.121	0.991	1.001	0.960
Ireland	2.387	3.199	3.074	2.921	0.287	0.307	0.236	0.212
Israel	3.215	3.269	3.281	2.871	0.448	0.408	0.414	0.520

Table 1: continued

country	$mgr50$	$mgr55$	$mgr56$	$mgr61$	$stdgr50$	$stdgr55$	$stdgr56$	$stdgr61$
Italy	3.354	3.251	3.280	3.286	0.276	0.298	0.284	0.258
Jamaica	1.092	0.728	0.932	0.637	0.499	0.529	0.537	0.493
Japan	5.241	5.212	5.235	5.191	0.362	0.361	0.355	0.375
Jordan	2.469	3.134	4.170	2.385	0.735	0.789	1.014	0.804
Kenya	1.759	1.405	1.433	1.758	0.558	0.761	0.773	0.639
Korea, Rep. of	5.844	6.393	6.353	6.038	0.449	0.444	0.430	0.378
Lesotho	5.353	4.774	4.734	2.621	0.846	0.749	0.754	0.743
Luxembourg	2.260	1.833	1.899	2.143	0.345	0.468	0.452	0.372
Madagascar	-1.646	-1.813	-1.781	-1.032	0.379	0.433	0.466	0.321
Malawi	0.876	0.901	0.954	1.652	0.531	0.533	0.523	0.627
Malaysia	3.916	4.295	4.298	3.779	0.433	0.477	0.463	0.263
Mali	-0.266	0.276	0.127	-0.368	0.543	0.534	0.557	0.662
Mauritania	-0.111	-0.365	-0.110	2.914	0.849	0.738	0.737	1.265
Mauritius	2.191	0.993	1.003	2.237	0.587	0.805	0.803	0.564
Mexico	2.548	2.597	2.810	2.737	0.388	0.427	0.428	0.297
Morocco	2.744	2.816	2.820	3.035	0.462	0.469	0.468	0.420
Mozambique	-2.056	-2.017	-1.805	-2.970	0.791	0.745	0.732	0.935
Nepal	0.889	1.689	1.777	1.140	0.414	0.722	0.772	0.378
Netherlands	2.700	2.553	2.571	2.511	0.241	0.233	0.233	0.223
New Zealand	1.459	1.435	1.457	1.250	0.329	0.346	0.316	0.395
Nicaragua	0.103	0.196	0.254	0.012	1.335	0.974	0.948	0.717
Niger	0.088	0.119	0.045	-2.532	0.846	0.851	1.070	0.767
Nigeria	-0.004	1.878	2.734	0.137	0.909	1.079	1.208	1.000
Norway	3.611	3.658	3.676	3.328	0.184	0.165	0.163	0.165
Pakistan	2.212	2.711	2.707	3.435	0.382	0.473	0.468	0.296
Panama	3.281	3.030	3.032	3.502	0.345	0.346	0.336	0.385
Papua New Guinea	1.340	0.910	0.810	0.847	0.572	0.413	0.404	0.501
Paraguay	2.682	2.471	2.248	2.228	0.515	0.561	0.655	0.370
Peru	0.837	0.840	0.767	1.063	0.495	0.493	0.500	0.463
Philippines	1.532	1.209	1.211	1.203	0.378	0.408	0.388	0.342
Portugal	4.011	3.831	3.874	3.852	0.466	0.452	0.437	0.427
Rwanda	1.525	1.667	1.782	0.875	0.982	0.943	0.948	0.684
Senegal	-0.057	0.276	0.339	-0.753	0.459	0.473	0.472	0.609
Seychelles (77-85)	2.688	4.706	4.970	1.806	0.667	0.777	0.762	1.055
Sierra Leone	0.472	0.801	0.126	0.511	0.599	0.631	0.946	0.697
Singapore	5.903	6.299	6.668	7.502	0.446	0.457	0.521	1.021
South Africa	1.643	1.886	1.691	1.769	0.487	0.389	0.398	0.210
Spain	3.082	3.116	3.205	3.372	0.351	0.329	0.320	0.332
Sri Lanka	1.715	2.536	2.472	2.187	0.509	0.478	0.437	0.221
Sweden	2.492	2.197	2.188	2.328	0.181	0.195	0.187	0.217
Switzerland	1.531	1.613	1.620	1.522	0.244	0.285	0.268	0.295
Syria	4.127	4.038	4.045	3.029	1.025	1.198	1.198	1.434
Taiwan	6.285	5.850	5.978	6.748	0.303	0.283	0.281	0.302
Tanzania	2.555	1.680	1.856	2.309	0.538	0.582	0.588	0.624
Thailand	3.820	3.917	3.926	4.480	0.297	0.326	0.319	0.224
Togo	1.955	2.156	2.309	1.098	0.661	0.698	0.668	0.900
Trinidad and Tobago	1.573	1.933	1.922	2.879	0.880	0.805	0.794	0.584
Tunisia	3.177	3.669	3.696	3.662	0.343	0.366	0.339	0.402
Turkey	2.658	2.667	2.645	2.447	0.360	0.351	0.346	0.330
Uganda	0.834	-1.440	-0.247	0.766	1.259	1.006	1.767	0.935
United Kingdom	2.064	2.124	1.989	1.994	0.220	0.291	0.221	0.226
United States	2.142	2.171	2.127	2.713	0.259	0.291	0.267	0.288
Uruguay	0.132	-0.081	0.057	0.224	0.504	0.522	0.493	0.492
Venezuela	1.508	-0.146	-0.107	-0.719	0.651	0.390	0.366	0.437
Zambia	-1.733	-0.823	-0.731	-0.563	0.711	0.720	0.707	0.635
Zimbabwe	1.676	0.658	0.794	3.077	0.619	0.542	0.578	0.811

Table 2: The difference in the mean growth rate across the versions of the PWT

country	abs MAX dif perc. points	% of rel dif	country	abs MAX dif perc. points	% of relative dif
Japan	0.050	0.954	Thailand	0.660	17.292
Switzerland	0.098	6.033	Sierra Leone	0.675	304.741
Italy	0.103	3.072	Brazil	0.681	23.573
Colombia	0.104	4.642	Chile	0.690	218.850
Australia	0.120	4.897	Costa Rica	0.727	34.023
Burkina Faso	0.125	8.315	Guatemala	0.771	88.705
United Kingdom	0.134	6.319	Malawi	0.776	88.597
Argentina	0.139	34.158	Madagascar	0.781	43.070
Cyprus	0.155	3.357	Algeria	0.798	31.142
Portugal	0.179	4.474	**Ireland**	0.812	34.031
Netherlands	0.189	7.004	Sri Lanka	0.821	47.847
Finland	0.208	6.279	Tanzania	0.874	37.398
New Zealand	0.209	14.331	Nepal	0.889	100.011
Turkey	0.220	8.251	Taiwan	0.897	15.338
Ecuador	0.228	8.533	Rwanda	0.907	50.894
Nicaragua	0.242	147.745	Bangladesh	0.932	237.190
South Africa	0.243	14.793	Central African Rep.	0.968	178.222
Austria	0.257	7.856	El Salvador	0.982	73.431
Dominican Rep.	0.259	10.651	Ethiopia	1.046	145.402
Honduras	0.260	19.130	Senegal	1.092	1214.280
Mexico	0.262	10.280	Syria	1.098	26.607
Spain	0.289	9.390	Gabon	1.119	27.133
Morocco	0.292	10.629	Iran	1.161	43.996
Peru	0.296	38.670	Mozambique	1.165	64.561
Belgium	0.305	11.213	Botswana	1.166	17.027
Sweden	0.305	12.228	India	1.168	156.683
Uruguay	0.305	377.618	Zambia	1.170	67.533
Philippines	0.328	21.428	Congo, Dem. Rep.	1.177	3357.828
Norway	0.347	9.447	Togo	1.211	52.446
France	0.349	12.641	Pakistan	1.224	55.324
Kenya	0.354	25.120	Gambia, The	1.237	82.642
Greece	0.369	8.867	Mauritius	1.244	125.246
Fiji	0.375	24.358	Trinidad and Tobago	1.307	83.089
Israel	0.410	12.495	Cameroon	1.420	39.786
Indonesia	0.418	11.440	Bolivia	1.496	85.045
Denmark	0.418	15.341	Guyana	1.510	138.823
Luxembourg	0.427	18.878	Guinea	1.540	370.734
Canada	0.427	15.468	Singapore	1.599	27.081
Paraguay	0.454	16.917	Barbados	1.674	67.725
Jamaica	0.455	41.703	Cape Verde	1.752	97.007
Iceland	0.456	13.529	Jordan	1.785	68.891
Panama	0.472	15.573	Ghana	1.837	221.911
Cote d'Ivoire	0.487	28.661	Chad	1.846	72.414
Tunisia	0.519	16.326	China	2.164	34.472
Malaysia	0.519	12.074	Venezuela	2.227	571.745
Papua New Guinea	0.530	39.560	Uganda	2.274	410.071
Haiti	0.533	85.495	Zimbabwe	2.419	367.893
Korea, Republic of	0.549	9.397	Congo, Rep. of	2.624	72.460
Angola	0.563	29.911	Niger	2.651	5731.454
Guinea-Bissau	0.575	44.743	Burundi	2.703	544.434
United States	0.586	27.561	Egypt	2.728	52.486
Hong Kong	0.623	10.436	Lesotho	2.733	51.044
Benin	0.630	1293.783	Nigeria	2.738	70080.291
Mali	0.644	389.537	Seychelles	3.164	84.888
Hungary	0.649	18.239	Mauritania	3.278	2753.804

Note: OECD countries (in old definition) are in bold.

Table 3: Correlation between the gross rates for 110 countries.

	gr50	gr55	gr56	gr61
gr50	1.00			
gr55	0.78	1.00		
gr56	0.74	0.93	1.00	
gr61	0.53	0.62	0.60	1.00

Note: Period is 1962-1985 (for some countries the period is shorter, see Table 1).

Table 4: Mean equality test for growth rates across versions

m and n are the versions of the PWT					
m=50 n=55	m=50 n=56	m=50 n=61	m=55 n=56	m=55 n=61	m=56 n=61
The null hypothesis for the equality of the means is rejected at 1%level:					
Tunisia	Costa Rica	Costa Rica	Costa Rica	Canada	Canada
	Ireland	India	South Africa	Costa Rica	El Salvador
		USA		Taiwan	Taiwan
				USA	USA
The null hypothesis for the equality of the means is rejected at 5%level:					
Austria	Austria	Belgium	China	El Salvador	
Ireland	China	Brazil	Netherlands	Niger	
Mali	Nigeria	Denmark	Spain	Spain	
Taiwan	Tunisia	El Salvador		Uganda	
Zambia	Zambia	Niger			
The null hypothesis for the equality of the means is rejected at 10%level:					
Cameroon	Panama	Guinea	Cameroon	Austria	Belgium
Panama	Philippines	Mauritania	El Salvador	Mauritania	Costa Rica
Philippines	Sweden	Spain	Papua New Guinea	Uruguay	Niger
		Taiwan	Senegal		
			Taiwan		

The table shows the list of countries for which the hypothesis for the equality of the mean of growth rates per capita in versions m and n of the PWT is rejected at least at 10% level of significance.

Table 5: Replication of Ramey and Ramey (1995) (specification with Levine-Renelt variables)

		Version of the PWT (number of countries in the sample)				
Independent variable	R&R	5.0(91)	5.0(78)	5.5(78)	5.6(78)	6.0(78)
sigma	-0.211**	-0.2051**	-0.1544*	-0.1011	-0.0619	-0.1547**
	(-2.61)	(-2.29)	(-1.74)	(-1.22)	(-0.62)	(-2.37)
constant	0.0727***	0.0775***	0.0673***	0.1015***	0.1147***	0.0954***
	(3.72)	(3.86)	(2.90)	(5.55)	(4.776)	(5.86)
average investment fraction	0.127***	0.1302***	0.1314***	0.1441***	0.1461***	0.1198***
	(7.63)	(8.56)	(7.90)	(7.96)	(8.03)	(7.65)
initial log GDP per capita	-0.088***	-0.098***	-0.0867***	-0.1366***	-0.1488***	-0.1077***
	(-3.61)	(-3.53)	(-2.77)	(-5.93)	(-5.19)	(-5.65)
initial HC	0.0078	0.0107	0.0093	0.0127*	0.0132*	0.0094
	(1.18)	(1.27)	(1.07)	(1.76)	(1.79)	(1.46)
average population growth rate	-0.058	-0.0375	-0.0228	-0.217	-0.3561**	-0.1776
	(-0.38)	(-0.51)	(-0.48)	(-1.45)	(-2.44)	(-1.19)
Summary of variance estimates (all variance numbers are multiplied by 1000):						
Mean variance	3.58	3.59	3.33	3.19	3.59	3.11
Lowest variance country	0.317 (Sweden)	0.313 (Sweden)	0.31 (Sweden)	0.27 (Norway)	0.26 (Norway)	0.34 (Norway)
Highest variance country	28.7 (Iraq)	29.07 (Iraq)	17.25 (Nicaragua)	14.44 (Syria)	30.02 (Uganda)	19.76 (Syria)
Log of likelihood function	3589.4	3556.12	3097.26	3077.16	3082.87	3183.90

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Numbers in parentheses are t statistics.

Table 6: Replication of Ramey and Ramey (1995)(specification with forecasting variables)

		Version of the PWT (number of countries in the sample)				
Independent variable	R&R	5.0(91)	5.0(78)	5.5(78)	5.6(78)	6.0(78)
sigma	-0.178**	-0.144*	-0.1261	-0.1089	-0.0902	-0.175***
	(-2.43)	(-1.95)	(-1.28)	(-1.21)	(-1.22)	(-2.58)
constant	0.0607**	0.0675***	0.0613**	0.0828***	0.0888***	0.0999***
	(3.58)	(3.69)	(2.12)	(4.175)	(4.46)	(4.11)
initial investment fraction	0.019	0.0237*	0.0324**	0.0371**	0.0426***	0.0412***
	(1.37)	(1.78)	(2.16)	(2.39)	(2.81)	(3.22)
initial population growth rate	0	0.0017	0.0316	-0.0494	-0.0792	-0.0692
	(0.13)	(0.05)	(0.47)	(-0.68)	(-0.75)	(-0.44)
initial human capital	0.012**	0.0167**	0.0138	0.0168**	0.0167***	0.0178***
	(2.01)	(2.53)	(1.54)	(2.46)	(2.59)	(2.80)
initial log GDP per capita	-0.23***	-0.2354***	-0.2260**	-0.3052***	-0.3071***	-0.2961***
	(-4.46)	(-4.88)	(-3.49)	(-5.78)	(-5.80)	(-5.46)
first lag of log GDP per capita	2.18***	2.2253***	2.2451***	1.8109***	1.7372***	1.6176***
	(10.8)	(9.75)	(9.26)	(7.56)	(7.19)	(6.69)
second lag of log GDP per capita	-2***	-2.0506***	-2.0729***	-1.5835***	-1.5156***	-1.4173***
	(-9.34)	(-8.49)	(-8.1)	(-6.26)	(-5.97)	(-5.56)
trend	-0.0027	-0.0017	-0.0001	-0.0133	-0.0125	-0.0057
	(-0.22))	(-0.10)	(0.00)	(-1.16)	(-1.12)	(-0.41)
trend squared	-0.001	-0.0018	-0.0028	0.0064	0.0058	0.0029
	(-0.17)	(-0.14)	(-0.22)	(0.79)	(0.74)	(0.28)
post-1973 trend	-0.0009	-0.0009	-0.0005	-0.0026	-0.0023	-0.0016
	(-0.45)	(-0.31)	(-0.18)	(-1.26)	(-1.17)	(-0.61)
Post-1973 dummy	-0.0108***	-0.0108***	-0.0128***	-0.0152***	-0.0155***	-0.0153***
	(-3.19)	(-3.06)	(-3.26)	(-4.18)	(-4.47)	(-4.52)
Summary of variance estimates (all variance numbers are multiplied by 1000):						
Mean variance	NA	3.41	3.17	3.04	3.50	3.06
Lowest variance country	NA	0.161 (France)	0.158 (France)	0.285 (France)	0.211 (France)	0.286 (France)
Highest variance country	NA	27.43 (Iraq)	18.76 (Nicaragua)	16.74 (Syria)	31.30 (Uganda)	22.46 (Syria)
Log of likelihood function	NA	3680.96	3212.8	2819.7	3184.2	3260.5

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Numbers in parentheses are t statistics.

Table 7: Replication of Ramey and Ramey (1995) for the OECD-country sample (specification with Levine-Renelt variables)

		Version of the PWT (number of countries in the sample)				
Independent variable	R&R	5.0 (24)	5.0(23)	5.5(23)	5.6(23)	6.1(23)
sigma	-0.385	-0.3923*	-0.3994**	-0.212	-0.2069	-0.0083
		(-1.85)	(-2.14)	(-1.43)	(-1.43)	(-0.21)
constant	0.158***	0.1649***	0.1668***	0.1449***	0.146***	0.1599***
	(5.73)	(5.56)	(6.00)	(6.03)	(6.27)	(6.80)
average investment share	0.069***	0.0661**	0.0648***	0.0672***	0.0716***	0.0555***
	(2.76)	(2.88)	(2.79)	(2.74)	(2.97)	(2.74)
initial log GDP per capita	-0.172***	-0.1776***	-0.1793***	-0.1575***	-0.1585***	-0.1664***
	(-5.70)	(-5.50)	(-6.05)	(-5.97)	(-6.09)	(-5.93)
initial human capital	0.0014**	0.131*	0.1302*	0.0856	0.0864	0.0888
	(2.00)	(1.93)	(1.93)	(1.12)	(1.23)	(1.35)
average population growth rate	0.212	0.2388	0.2466	0.0013	-0.0037	-0.1197
	(0.70)	(0.77)	(0.88)	(0.03)	(-0.14)	(-0.46)
Summary of variance estimates (all variance numbers are multiplied by 1000):						
Mean variance	0.99	0.99	0.996	1.07	1.01	1.11
Lowest variance country	0.299 (Norway)	0.313 (Norway)	0.30 (Norway)	0.32 (Norway)	0.30 (Sweden)	0.31 (Norway)
Highest variance country	2.90 (Turkey)	2.87 (Turkey)	2.88 (Turkey)	2.64 (Turkey)	2.62 (Turkey)	2.62 (Turkey)
Log of likelihood function	1883.8	1883.13	1798.80	1756.48	1788.06	1750.67

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Numbers in parentheses are t statistics.

Table 8: Replication of Ramey and Ramey (1995) for the OECD-country sample (specification with forecasting variables)

		Version of the PWT (number of countries in the sample)				
Independent variable	R&R	5.0 (24)	5.0(23)	5.5(23)	5.6(23)	6.1(23)
sigma	-0.949***	-0.9336***	-0.9110***	-0.7789***	-0.7618***	-0.4599**
	(-4.09)	(-3.29)	(-3.47)	(-3.577)	(-2.61)	(-2.46)
constant	0.294***	0.2984***	0.2930***	0.2881***	0.2865***	0.2990***
	(8.65)	(7.34)	(7.89)	(7.99)	(5.35)	(7.83)
initial investment fraction	0.057***	0.0827***	0.0801***	0.0793***	0.0873***	0.0764***
	(2.67)	(3.16)	(3.09)	(3.11)	(2.88)	(2.92)
initial population growth rate	0.615***	0.5813**	0.5639**	0.2883	0.3133	0.2623
	(2.85)	(2.38)	(2.41)	(1.59)	(1.40)	(1.45)
initial human capital	0.0015**	0.1637**	0.1608**	0.1509**	0.1536**	0.1714***
	(2.23)	(2.46)	(2.35)	(2.27)	(2.38)	(2.65)
initial log GDP per capita	-0.032	-0.0009	-0.0097	0.0041	-0.0008	-0.0355
	(-0.62)	(-0.02)	(-0.45)	(0.15)	(-0.01)	(-0.75)
first lag of log GDP per capita	0.84***	0.7426**	0.6590*	0.7761**	0.7935**	0.6793**
	(2.76)	(2.17)	(1.94)	(2.28)	(2.19)	(2.02)
second lag of log GDP per capita	-1.13***	-1.0788***	-0.9807***	-1.1076***	-1.1209***	-0.9742***
	(-3.86)	(-3.40)	(-3.01)	(-3.44)	(-3.40)	(-2.95)
trend	0.015*	0.0169**	0.0178**	0.0199**	0.0210**	0.0188***
	(1.77)	(2.40)	(2.45)	(2.71)	(2.38)	(2.31)
trend squared	0	0.0001	-0.0002	-0.0004	-0.0011	-0.0004
	(-0.00)	(0.025)	(-0.07)	(-0.12)	(-0.36)	(-0.14)
post-1973 trend	-0.00029	-0.0004	-0.0004	-0.0001	0.0001	0.0002
	(-0.24)	(-0.38)	(-0.35)	(-0.12)	(0.09)	(0.19)
post-1973 dummy	-0.0255***	-0.0257***	-0.0264***	-0.0312***	-0.0295***	-0.0322***
	(-6.62)	(-7.11)	(-7.13)	(-7.81)	(-7.72)	(-7.87)
Summary of variance estimates (all variance numbers are multiplied by 1000):						
Mean variance	NA	0.87	0.88	0.95	0.89	0.995
Lowest variance country	NA	0.19 (France)	0.18 (France)	0.24 (France)	0.20 (France)	0.25 (France)
Highest variance country	NA	3.11 (Turkey)	3.10 (Turkey)	3.06 (Turkey)	3.03 (Turkey)	3.29 (Turkey)
Log of likelihood function	NA	1883.1	1862	1823.7	1855.4	1806.8

*,** and *** denote significance at 10%, 5% and 1% levels respectively. Numbers in parentheses are t statistics.