

Simulating The Global Economic Transition with the Global Gaidar Model

Seth Benzell, Guillermo Lagarda, Maria Kazakova, Laurence Kotlikoff,
Kristian Nesterova, Marco Solera, Victor Ye, Andrey Zubarev

September, 2018

The Global Gaidar Model

- 17-Region, 90-Period Global OLG Simulation Model
- Single Good (so far).
- Perfect Foresight
- Built to Study Demographic, Fiscal, and Technological Transition
- Big Questions: Which Regions Will Dominate the World Economy in 2100? Will We See Convergence in Per Capital GDP Across Regions? Will Labor-Saving Technological Change and Robotization Help Or Hurt Our Kids?

The GGM Blocks

- Walliser Demographics
- Households
- Production sector
- Government sector
- Oil endowment
- Catch Up and Secular Productivity Growth
- Robotization (Coming)

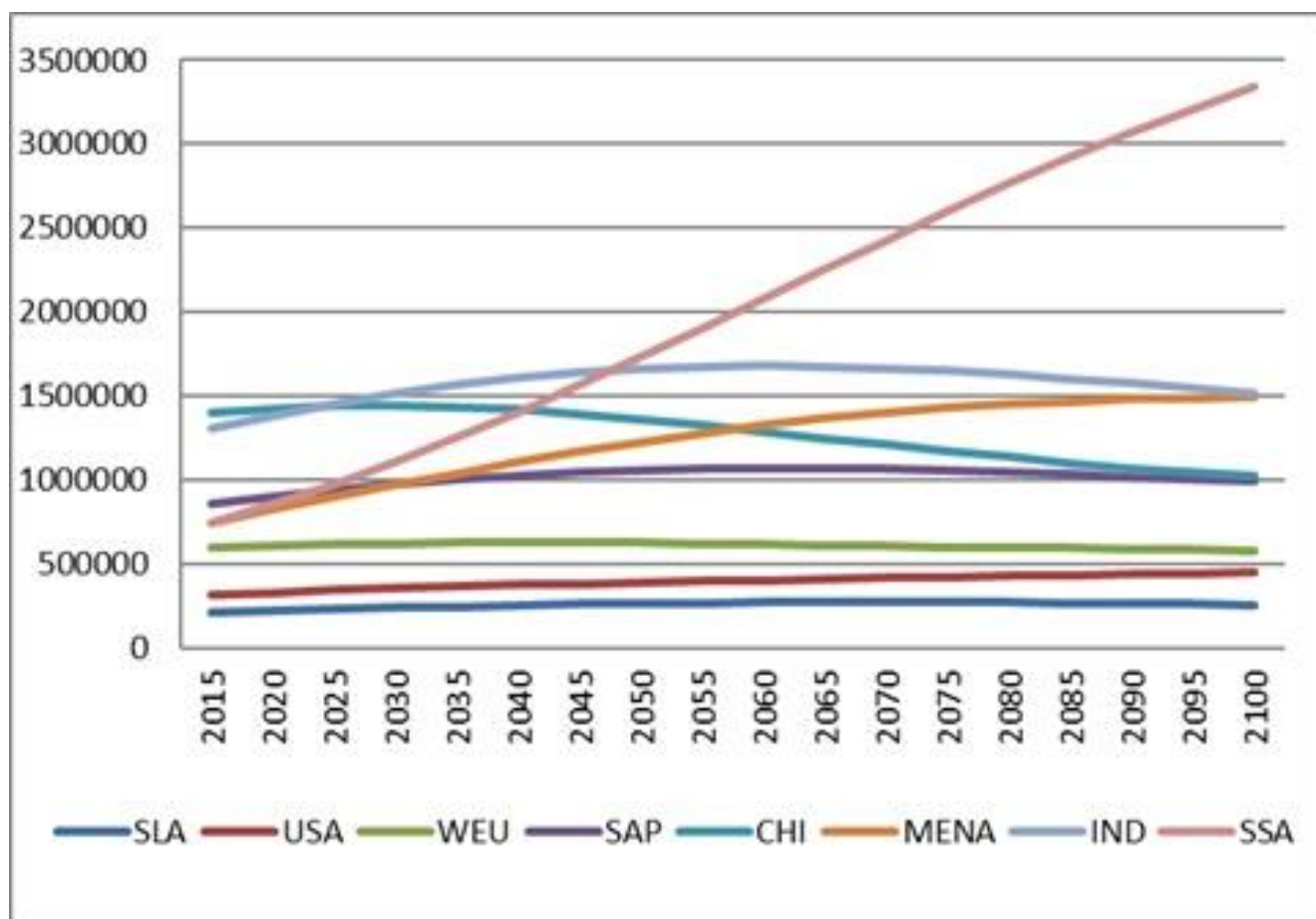
The Composition of Regions in The Global Gaidar Model

Notation	Region	Countries
USA	United States	United States
UK	United Kingdom	United Kingdom
CHI	China	China
IND	India	India
BRA	Brazil	Brazil
MEX	Mexico	Mexico
SAF	South Africa	South African Republic
RUS	Russia	Russia
JKSH	JKSH	Japan, Korea, Rep., Singapore, Hong Kong
CAN	Canada	Australia, Canada, New Zealand
WEU	Western Europe	Austria, Belgium, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Greece, Croatia, Hungary, Ireland, Iceland, Israel, Italy, Lithuania, Luxembourg, Latvia, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Sweden, Turkey
SLA	Latin America and Caribbean	Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, Paraguay, Uruguay, Venezuela
SAP	South Asia and Pacific	Bangladesh, Fiji, Indonesia, Cambodia, Sri Lanka, Myanmar, Malaysia, Nepal, Philippines, Thailand, Vietnam, Taiwan
MENA	Middle East and North Africa	Afghanistan, United Arab Emirates, Bahrain, Algeria, Egypt, Ethiopia, Iran, Iraq, Jordan, Kuwait, Lebanon, Morocco, Mali, Oman, Pakistan, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, Yemen
SSA	Sub-Saharan Africa	Nigeria, Rwanda, Sudan, Senegal, Sierra Leone, South Sudan, Swaziland, Togo, Tonga, Tanzania, Uganda, Zambia, Zimbabwe
SOV	Central Asia	Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, Uzbekistan
EEU	East Europe non EU	Albania, Armenia, Bulgaria, Bosnia and Herzegovina, Belarus, Moldova, Montenegro, Serbia, Ukraine, Kosovo

Total Population and Share of Population Over 60

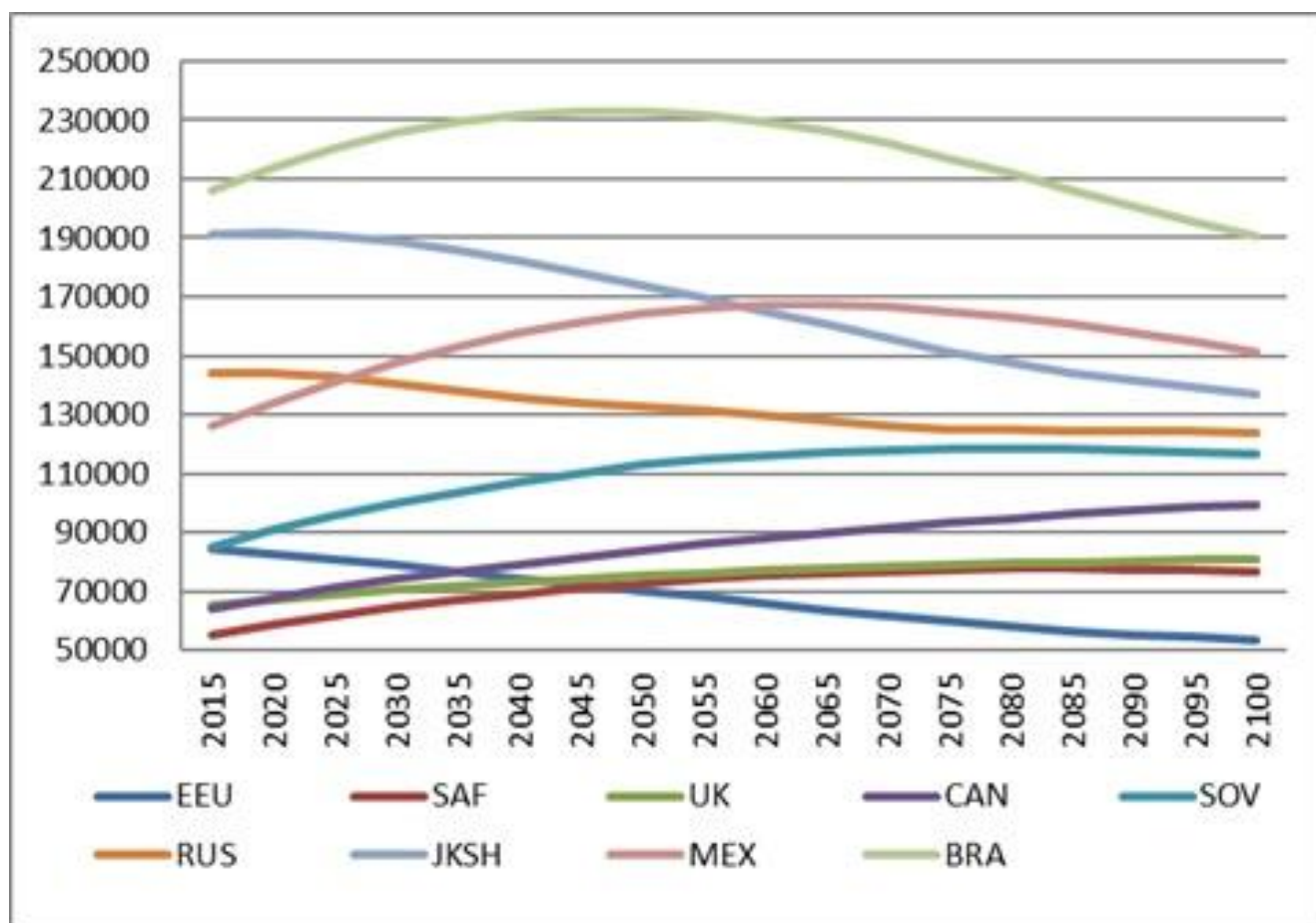
	Population in 2014			Population in 2100		
	Millions	% World	% Over 60	Millions	% World	% Over 60
USA	317.5	4.5	19.7	447.6	4.2	32.6
WEU	594.1	8.3	22.5	581.6	5.4	36.6
JKSH	188.0	2.6	27.3	134.0	1.2	42.9
CHI	1367.6	19.2	14.6	1003	9.3	39.6
IND	1294.3	18.1	8.6	1658.5	15.4	34.1
RUS	143.1	2.0	19.4	117.2	1.1	27.6
BRA	205.8	2.9	11.2	200	1.9	38.9
UK	63.8	0.9	22.3	81.7	0.8	35.1
CAN	63.3	0.9	20.6	97.6	0.9	36.1
EEU	84.8	1.2	21.5	49.7	0.5	35.5
MENA	726.8	10.2	6.5	1491.4	13.8	31.4
MEX	125.1	1.8	9.5	148.1	1.4	39.8
SAF	53.9	0.8	7.6	65.7	0.6	27.8
SAP	820.3	11.5	8.6	963.5	8.9	34.6
SLA	278.9	3.9	10.6	360.5	3.3	35.4
SOV	82.8	1.2	8.3	106.5	1.0	29.8
SSA	723.1	10.1	4.6	3272.9	30.4	19.8
Global	7133.2	100.0	14.3	10779.5	100.0	34.0

Population Dynamics in Regions that Will Be More Populated by 2100



Source: UN population projections, medium variant.

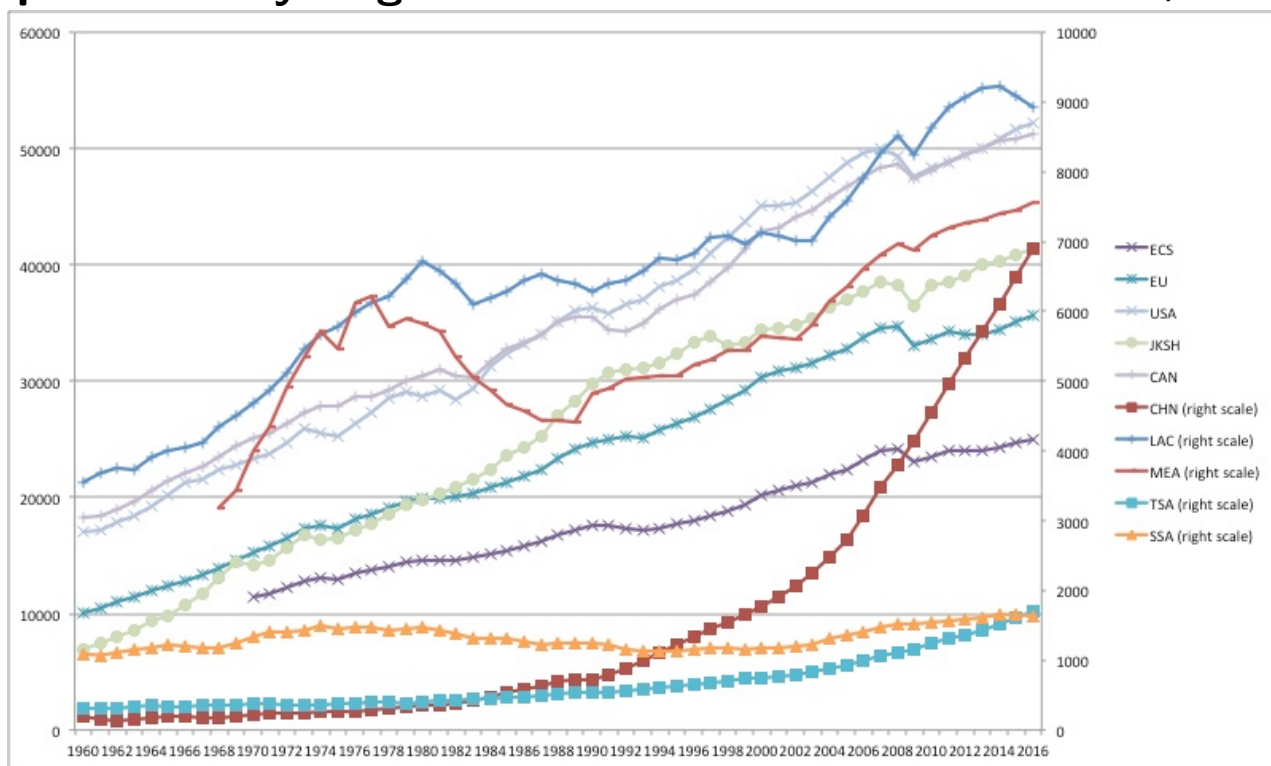
Population Dynamics in Regions that Will Be Less Populated by 2100



Source: UN population projections, medium variant.

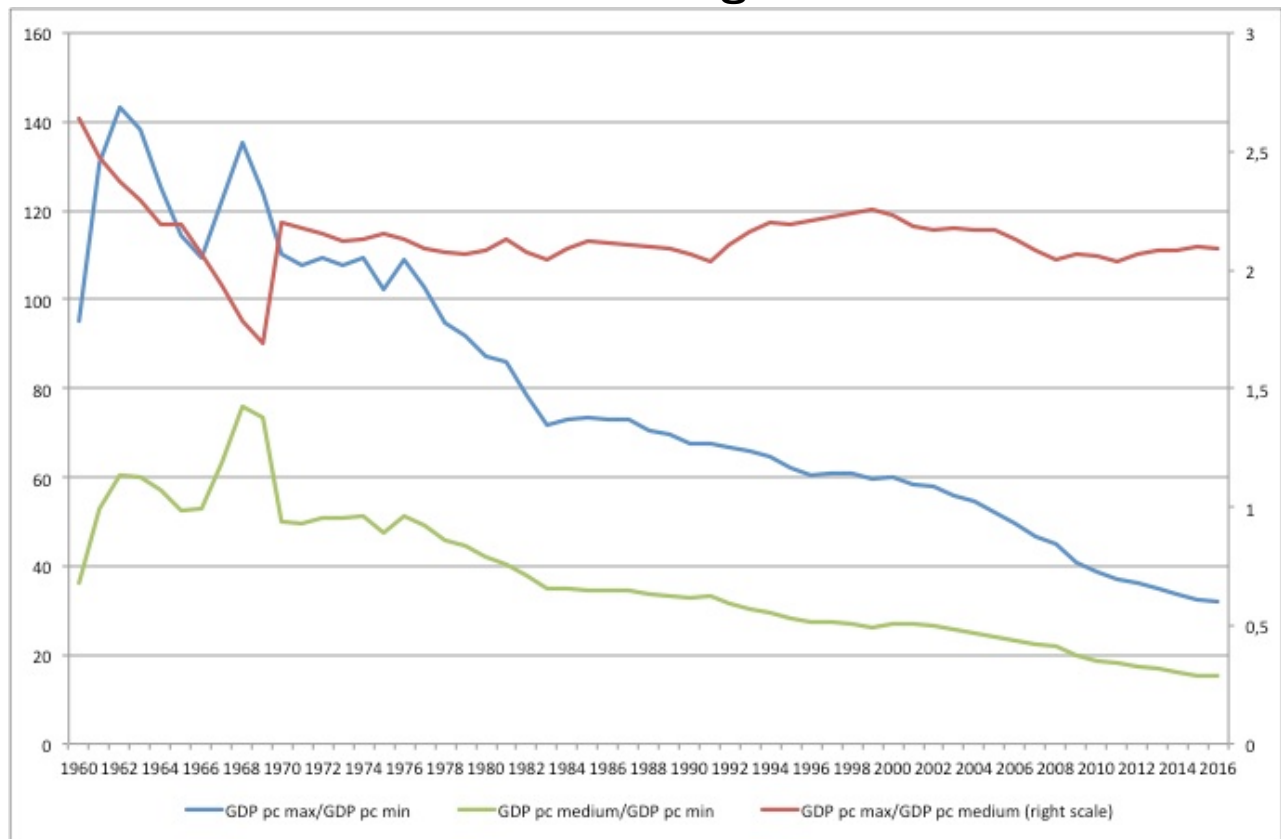
Per Capita GDP by Region in Constant 2010 U.S. Dollars,

1960-2016



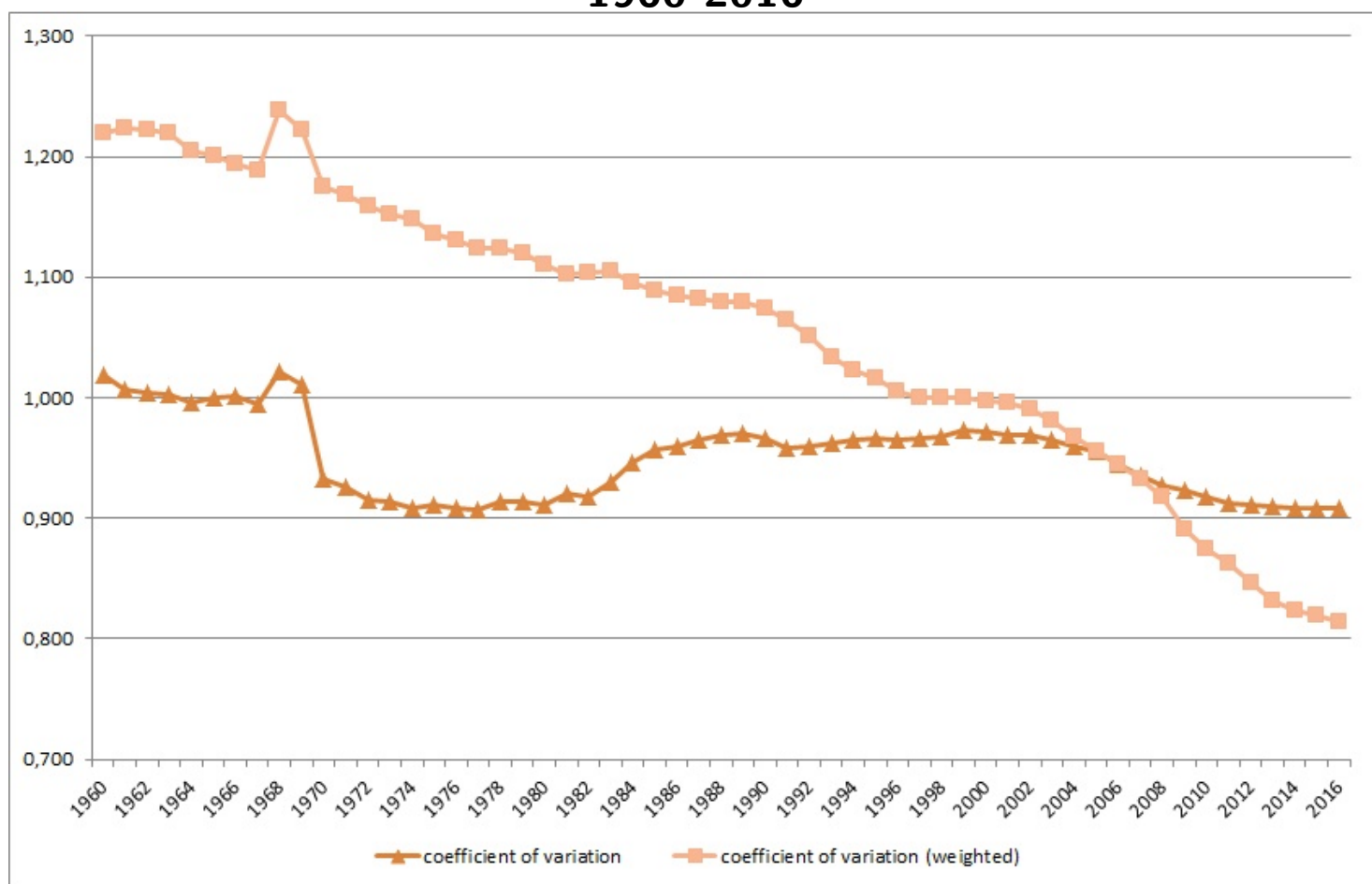
Source: WDI database, World Bank

Ratios (Max to Min, Max to Median, Median to Min) of Per Capita GDP in World Bank Regions, 1960-2016



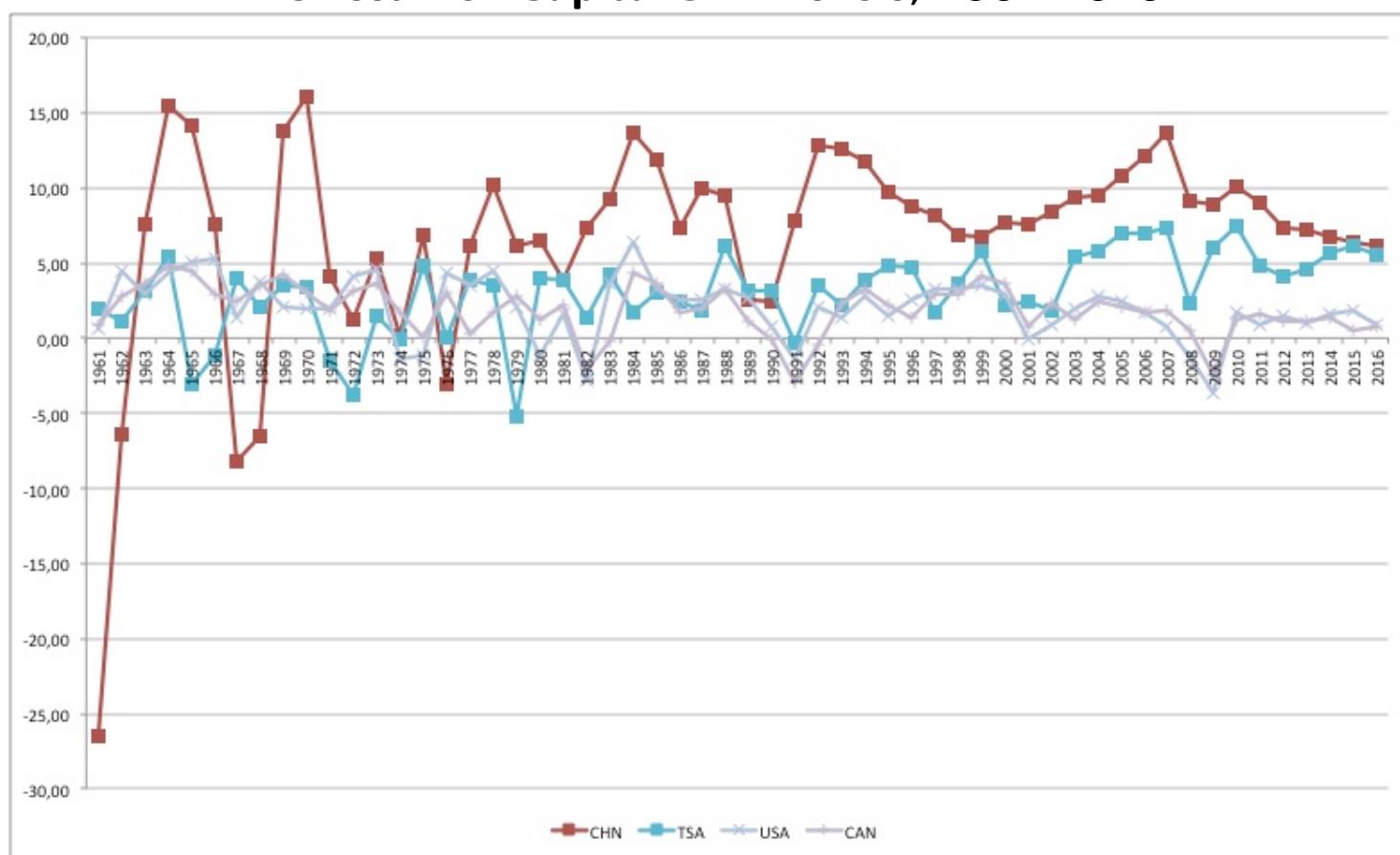
Source: WDI database, World Bank

Coefficient of Variation of Per Capita GDP in World Bank Regions, 1960-2016



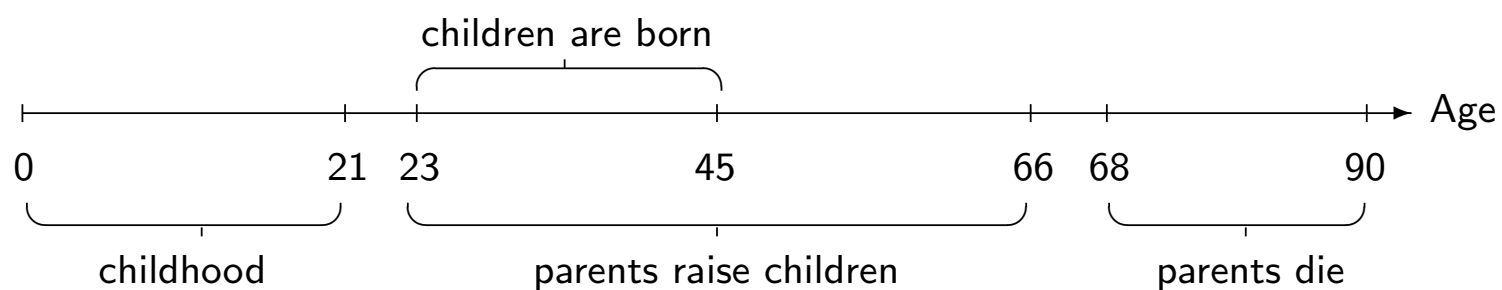
Source: WDI database, World Bank

Annual GDP Per Capita Growth Rates in Regions with Highest and Lowest Per Capita GDP levels, 1961-2016



Source: WDI database, World Bank

The Individual Life-cycle



Consumer's Optimization Problem

$$V_{a,t,k} = \frac{1}{1 - \frac{1}{\gamma}} \sum_{i=a}^{90} \left(\frac{1}{1 + \delta} \right)^{i-a} P_{a,i,t} \left[c_{a,i,t+i,k}^{1-\frac{1}{\rho}} + \varepsilon \ell_{a,i,t+i,k}^{1-\frac{1}{\rho}} \right]^{\frac{1-\frac{1}{\gamma}}{1-\frac{1}{\rho}}} \quad (1)$$

$$H_{a,t,k} = \frac{1}{1 - \frac{1}{\gamma}} \sum_{i=a-23}^{22} \left(\frac{1}{1 + \delta} \right)^{i-a} K_{a,i,t,k} c_{K_{a,i,t,k}}^{1-\frac{1}{\gamma}} \quad (2)$$

$$A_{a+1,t+1,k} = (A_{a,t,k} + I_{a,t,k}) R_{t+1} + w_{a,t,k} (h_{a,t,k} - \ell_{a,t,k}) - T_{a,t,k} - C_{a,t,k} \quad (3)$$

Production Sector

Each region's GDP, Y_t , equals the sum of an energy-endowment flow X_t and aggregate non-energy output Q_t :

$$Y_t = X_t + Q_t \quad (4)$$

Non-energy output is produced via a Cobb-Douglas technology that uses capital, K_t , and two types of labor, $L_{1,t}$ and $L_{2,t}$, i.e.:

$$Q_t = \phi K_t^\alpha L_{1,t}^{\beta_l} L_{2,t}^{\beta_h}, \quad (5)$$

Profit Maximization Conditions

$$w_{1,t} = \beta_l \phi K_t^\alpha L_{1,t}^{\beta_l-1} L_{2,t}^{\beta_h} \quad (6)$$

$$w_{2,t} = \beta_h \phi K_t^\alpha L_{1,t}^{\beta_l} L_{2,t}^{\beta_h-1} \quad (7)$$

$$r_t = (1 - \tau_t^k) \left(\alpha \phi K_t^{\alpha-1} L_{1,t}^{\beta_l} L_{2,t}^{\beta_h} - \delta_K \right) \quad (8)$$

where τ_t^k references the METR.

Government Sector

- Government collects taxes from households of both skill groups and all ages (consumption tax, income tax, payroll tax), corporate tax revenues net of rebate T_t^k , energy-sector revenue X_t^g , and new borrowing ΔB_t .
- Government expenditures consist of purchases of goods and services (healthcare, education, pension benefits, disability benefits, other spending), C_t^g , transfer payments that are not financed via payroll taxes, and interest on existing debt $r_t B_t$:

$$\sum_{k=1}^2 \sum_{a=21}^{90} T_{a,t,k} N_{a,t,k} + T_t^k + X_t^g + \Delta B_t = C_t^g + \varrho B_t + r_t B_t, \quad (9)$$

Solution

- Guess r_t
- Guess assets S_{it}
- Guess high and low skilled labor L_{it}^H and L_{it}^L
- Call $\sum K_{it}$ from $\sum S_{it} = \sum K_{it} + \sum D_{it}$
- Use r_t equation + guesses r_t + guesses L_{it}^H, L_{it}^L to get K_{it}^N for non US
- Use $\sum K_{it} = \sum K_{it}^N + K_{it}^{US}$ to get K_{it}^{US}
- Use wage equations to get wages in each region
- Use r_t equation for US to get new r_t path
- Use supply side to get new guesses for L_{it}^H, L_{it}^L and S_{it}

U.N. and GGM Population Projections

Total Population (millions)																	
USA		WEU		JKSH		CHI		IND		RUS		BRA		UK		CAN	
	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	
Model	317.5	446.1	594.1	576.9	188.0	135.8	1367.6	978.9	1294.3	1614.1	143.1	112.3	205.8	195.5	63.8	81.8	63.3
Official	317.5	447.6	594.1	581.6	188.0	134.0	1367.6	1003.0	1294.3	1658.5	143.1	117.2	205.8	200.0	63.8	81.7	63.3
EEU		MENA		MEX		SAF		SAP		SLA		SOV		SSA			
	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	
Model	84.8	48.9	726.8	1398.9	125.1	142.8	53.9	67.2	820.3	903.1	278.9	362.2	82.8	108.2	723.1	3424.5	
Official	84.8	49.7	726.8	1491.4	125.1	148.1	53.9	65.7	820.3	963.5	278.9	360.5	82.8	106.5	723.1	3272.9	

U.N. and GGM Fertility Rates

UN Fertility Rate (Children per Woman)																	
USA		WEU		JKSH		CHI		IND		RUS		BRA		UK		CAN	
	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	
Model	2.65	3.28	1.95	1.73	2.05	2.16	2.20	2.27	2.40	2.18	1.75	1.93	2.20	1.95	2.80	1.86	3.10
Official	1.89	1.93	1.65	1.84	1.30	1.69	1.55	1.81	2.48	1.80	1.66	1.91	1.82	1.79	1.92	1.89	1.86
EEU		MENA		MEX		SAF		SAP		SLA		SOV		SSA			
	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	
Model	1.03	1.98	4.00	3.74	2.05	2.25	1.30	2.00	2.55	3.20	2.50	2.33	3.10	2.33	5.85	2.86	
Official	1.54	1.83	3.25	1.82	2.29	1.79	2.40	1.80	2.51	1.83	2.37	1.82	2.60	1.89	4.93	2.09	

Model Age Structure (% of Total Population)																			
		USA		WEU		JKSH		CHI		IND		RUS		BRA		UK		CAN	
		2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100
0-9	Model	12.70	15.63	11.52	9.87	8.74	11.11	11.74	12.61	19.46	13.18	11.70	11.55	15.00	9.50	12.41	12.37	11.82	17.17
	Official	12.7	10.8	11.5	9.7	8.7	8.2	11.7	8.8	19.5	9.7	11.7	11.2	15.0	9.1	12.4	10.1	11.8	9.8
10-19	Model	13.12	11.68	11.46	10.08	10.09	10.98	11.55	12.13	19.24	13.03	9.31	11.59	16.97	9.48	11.47	12.57	11.89	16.31
	Official	13.1	11	11.5	10	10.1	8.6	11.6	9.4	19.2	10.2	9.3	11.8	17	9.5	11.5	10.4	11.9	10.2
20-29	Model	14.14	10.92	12.83	10.53	11.51	11.01	17.49	11.73	17.71	12.66	15.72	11.80	16.67	9.45	13.60	13.00	14.16	14.47
	Official	14.1	11.3	12.8	10.4	11.5	9.1	17.5	9.9	17.7	10.7	15.7	12.2	16.7	9.9	13.6	10.8	14.2	10.5
30-39	Model	13.03	11.57	13.88	11.30	13.77	10.14	14.21	11.17	14.79	11.40	15.53	12.03	16.33	9.39	12.97	13.48	13.64	11.21
	Official	13	11.4	13.9	10.7	13.8	9.9	14.2	10	14.8	11.2	15.5	11.8	16.3	10.4	13	10.9	13.6	10.9
40-49	Model	13.18	10.12	14.46	14.96	15.23	9.79	17.80	9.87	11.51	15.33	12.96	12.60	13.20	13.51	14.27	16.04	13.72	7.22
	Official	13.2	11.5	14.5	11.1	15.2	10.4	17.8	10.7	11.5	11.9	13	12.5	13.2	10.9	14.3	11.3	13.7	11.3
50-59	Model	14.11	9.72	13.42	14.71	13.43	10.40	12.65	9.64	8.69	11.99	15.40	11.93	10.60	15.74	13.02	12.94	14.23	7.55
	Official	14.1	11.3	13.4	11.5	13.4	10.9	12.7	11.6	8.7	12.3	15.4	12.9	10.6	11.4	13	11.4	14.2	11.3
60-69	Model	10.69	9.51	10.87	12.67	12.88	11.04	8.97	7.55	5.31	8.02	10.15	8.42	6.53	13.98	11.05	7.14	10.90	7.97
	Official	10.7	10.9	10.9	11.2	12.9	11.6	9	11.6	5.3	12.4	10.2	10.8	6.5	11.9	11.1	10.9	10.9	11
70-90	Model	9.03	20.84	11.56	15.88	14.35	25.53	5.58	25.30	3.28	14.40	9.24	20.08	4.69	18.97	11.21	12.45	9.65	18.09
	Official	9	21.7	11.6	25.4	14.4	31.3	5.6	28	3.3	21.7	9.2	16.8	4.7	27	11.2	24.2	9.7	25.1
		EEU		MENA		MEX		SAF		SAP		SLA		SOV		SSA			
		2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100		
0-9	Model	10.65	12.88	23.93	16.91	18.61	11.19	20.15	11.66	18.38	13.03	18.56	12.64	31.59	20.66	19.77	15.59		
	Official	10.7	9.6	23.9	10.1	18.6	8.9	20.2	10.9	18.4	9.9	18.6	9.8	19.8	10.9	31.6	14.1		
10-19	Model	9.99	12.99	19.82	12.37	19.00	10.55	19.22	11.92	18.34	10.06	18.28	12.11	23.04	19.95	16.27	15.12		
	Official	10	10.3	19.8	10.6	19	9.3	19.2	11.4	18.3	10.3	18.3	10.3	16.3	11.5	23	14.2		
20-29	Model	14.81	13.14	18.52	10.12	17.32	10.27	19.60	12.07	17.10	8.86	17.29	11.52	16.75	17.16	19.59	14.28		
	Official	14.8	10.6	18.5	11.3	17.3	9.7	19.6	12	17.1	10.7	17.3	10.6	19.6	11.8	16.8	14.0		
30-39	Model	14.94	13.28	14.57	10.09	15.15	10.37	14.57	10.81	15.47	9.07	14.58	10.76	11.78	12.48	14.48	12.84		
	Official	14.9	10.5	14.6	11.9	15.2	10.1	14.6	12.4	15.5	11	14.6	10.8	11.8	13.6	14.5	11.6		
40-49	Model	13.47	8.53	9.92	10.95	12.41	12.73	10.90	7.77	12.80	9.52	11.69	13.88	11.64	16.13	7.46	9.52		
	Official	13.5	11.4	9.9	12.2	12.4	10.8	10.9	12.7	12.8	11.4	11.7	11.4	11.6	12	7.5	12.8		
50-59	Model	14.56	10.16	6.75	10.75	8.38	12.28	7.97	9.36	9.29	11.17	9.06	12.72	9.93	11.45	4.82	6.86		
	Official	14.6	12.1	6.8	12.4	8.4	11.4	8	12.7	9.3	12.1	9.1	11.8	9.9	12.5	4.8	11.5		
60-69	Model	10.93	9.83	3.89	8.86	5.11	12.74	4.42	10.94	5.13	11.32	5.89	11.15	4.61	5.30	2.91	5.15		
	Official	10.9	11.5	3.9	11.5	5.1	12	4.4	11.8	5.1	12.2	5.9	11.8	4.6	10.9	2.9	9.6		
70-90	Model	10.64	19.20	2.59	19.95	4.02	19.87	3.18	25.48	3.47	26.98	4.65	15.21	3.70	9.29	1.66	8.20		
	Official	10.6	24	2.6	19.9	4	27.8	3.2	16	3.5	22.4	4.7	23.6	3.7	18.9	1.7	10.2		

IMF and GGM 2014 Macro Indicators

		USA	WEU	JKSH	China	India	Russia	BRA	UK	CAN
GDP PPP,	Data	100.0	93.2	41.4	105.4	42.3	21.1	18.9	15.0	16.4
share of U.S.	Model	100.0	93.4	40.8	105.4	42.6	22.1	18.6	16.8	17.2
Private Consumption	Data	68.5	55.9	53.5	36.6	60.4	54.4	63.4	64.4	56.2
(% of GDP)	Model	68.4	55.4	53.0	36.3	60.7	53.9	62.9	65.7	56.6
Gov. Consumption	Data	19.3	24.8	15.3	19.1	16.6	24.3	24.6	25.9	23.4
(% of GDP)	Model	19.2	26.0	15.3	19.5	17.1	25.5	26.2	27.0	23.2
Share of Total Assets	Data	31.2	26.1	11.2	8.2	1.3	0.8	1.2	5.8	6.0
	Model	32.0	23.0	11.0	8.0	1.0	1.0	1.0	6.0	5.0
Fossil Fuel Rents	Data	0.9	0.2	0.0	1.2	1.1	13.8	2.4	4.7	3.8
(% of GDP)	Model	0.9	0.3	0.0	1.2	1.2	14.9	2.9	4.6	4.4
		MENA	MEX	SAF	SAP	SLA	SOV	SSA	EEU	
GDP PPP,	Data	38.2	12.5	4.1	34.9	22.0	4.1	12.3	5.1	
share of U.S.	Model	37.7	13.1	5.0	35.6	22.5	5.1	12.4	4.2	
Private Consumption	Data	51.3	68.6	60.6	59.3	64.8	52.7	70.4	51.0	
(% of GDP)	Model	51.2	68.9	61.1	59.5	65.0	53.6	68.6	51.0	
Gov. Consumption	Data	24.7	14.8	20.0	14.0	19.1	20.5	20.7	22.7	
(% of GDP)	Model	25.2	14.0	19.4	13.8	19.2	19.7	20.2	23.5	
Share of Total Assets	Data	2.0	0.9	0.3	2.9	1.1	0.2	0.4	0.4	
	Model	3.0	1.0	0.0	2.0	1.0	0.0	0.4	0.3	
Fossil Fuel Rents	Data	25.3	5.9	0.0	1.2	4.2	2.2	9.4	14.3	
(% of GDP)	Model	26.8	6.9	0.0	1.5	4.9	3.2	9.8	13.8	

Government Finances in 2014: Model and Real Data

	USA		WEU		JKSH		CHI		IND		RUS	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Total Expenditures	33.5	32.8	44.1	45.3	25.1	25.5	24.3	24.3	27	26.8	37.9	39.3
Health	7.8	8	5.6	5.9	3.5	3.6	1.5	1.5	1.0	1.1	3.9	4.1
Education	5.1	5.0	4.6	4.9	1.4	1.4	3.9	3.9	2.8	2.9	4.4	4.8
Purchases of G&S excl. Health, Educ.	6.4	6.2	14.6	15.2	10.4	10.3	13.8	14.1	12.8	13.1	16.0	16.7
Pension Benefits	8.5	8.2	13.4	13.3	7.7	7.7	2.6	2.5	4.1	4.2	8.9	9.2
Transfers and Ben. excl. Pensions	5.1	4.8	3.9	4.1	2.7	2.8	2.4	2.2	1.7	1.8	3.9	4.1
Net Payment on Debt	0.6	0.5	2.0	1.9	-0.5	-0.3	0.2	0.2	4.5	3.7	0.7	0.5
General Gov. Revenues	27.8	32.5	38.5	45.0	20.0	25.5	22.7	24.3	19.8	25.3	36.6	39.2
Tax Revenues	21.8	26.7	27.4	34.0	14.3	23.4	20.9	22.5	17.6	23.2	18.2	19.7
Corporate Tax	3.2	3.1	2.9	3.0	3.6	3.6	4.1	4.1	3.9	3.8	3.1	3.5
Consumption Tax	9.8	12.4	16.8	18.1	6.4	9.5	15.7	17.2	11.7	16.4	11.3	12.1
Income Tax	8.8	11.2	7.6	12.9	4.4	10.3	1.1	1.2	2.0	2.9	3.8	4.1
Non Tax Revenues	6.0	5.8	11.1	11.1	5.7	2.1	1.8	1.8	2.2	2.2	18.4	19.5
SS Contributions (Pensions)	5.7	5.5	11.0	11.0	5.7	2.1	1.5	1.5	1.9	1.9	7.2	7.4
Other	0.3	0.3	0.1	0.1	0.0	0.0	0.3	0.3	0.3	0.3	11.1	12.1

Government Finances in 2014: Model and Real Data

	BRA		GBR		CAN		MENA		MEX		SAF	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Total Expenditures	37.3	38.2	43.7	45.6	35.6	34.7	33.2	33.8	22.6	21.1	32.1	30.7
Health	2.6	3	7.6	8	6.7	6.7	0.9	1.0	3.5	3.3	1.4	1.3
Education	5.4	5.9	5.2	5.4	5.1	5.1	1.2	1.2	4.4	4.2	1.9	1.8
Purchases of G&S	16.6	17.4	13.1	13.6	11.6	11.5	22.6	23.1	6.9	6.5	16.7	16.2
excl. Health,Educ.												
Pension Benefits	6.9	6.9	13.9	14.1	9.7	9.3	2.1	2.0	3.2	3.2	4.8	4.7
Transfers and Ben.	1.0	1.1	2.6	2.8	1.5	1.5	5.0	5.3	2.1	2.0	4.2	4.0
excl. Pensions												
Net Payment on Debt	4.8	4.0	1.3	1.6	1.0	0.6	1.4	1.3	2.5	2.0	3.1	2.6
General Gov. Revenues	30.6	36.3	38.0	45.4	32.1	34.4	35.0	33.0	18.8	19.8	28.0	28.5
Tax Revenues	22.9	28.4	26.6	36.0	28.7	30.8	14.6	11.4	12.9	13.5	23.9	24.4
Corporate Tax	4.1	4.4	6.0	6.0	4.5	4.5	2.9	2.7	2.1	2.0	5.3	4.4
Consumption Tax	16.4	20.9	13.0	25.4	11.7	13.4	10.3	7.6	8.4	8.9	9.7	10.5
Income Tax	2.5	3.1	7.6	4.7	12.4	12.9	1.4	1.1	2.4	2.6	8.9	9.6
Non Tax Revenues	7.7	7.9	11.4	9.4	3.4	3.6	20.4	21.6	5.8	6.3	4.1	4.1
SS Contributions	6.0	5.9	7.6	7.7	1.5	1.5	1.0	0.9	2.8	2.9	4.1	4.0
(Pensions)												
Other	1.7	2.0	3.8	1.7	1.9	2.1	19.4	20.6	3.0	3.5	0.0	0.0

Government Finances in 2014: Model and Real Data

	SAP		SLA		SOV		SSA		EEU	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Total Expenditures	20.5	20.0	28.1	28.0	32.3	31.3	27.2	25.7	40.7	41.1
Health	0.6	0.6	4.1	4.2	0.8	0.8	1.0	1.0	1.9	1.9
Education	0.6	0.6	4.0	4.2	1.4	1.3	1.4	1.5	2.1	2.2
Purchases of G&S excl. Health, Educ.	12.8	12.7	10.9	10.7	18.3	17.5	18.3	17.6	18.7	19.4
Pension Benefits	1.5	1.6	5.8	5.8	7.5	7.4	0.8	0.8	14.3	14.5
Transfers and Ben. excl. Pensions	3.0	3.0	1.9	1.8	3.3	3.3	4.0	3.6	1.9	1.5
Net Payment on Debt	1.9	1.6	1.3	1.3	1.0	0.9	1.7	1.1	1.9	1.5
General Gov. Revenues	18.6	18.8	23.6	27.4	24.8	31.0	23.9	24.7	38.3	40.7
Tax Revenues	17.6	17.7	17.1	20.4	20.9	26.1	19.9	20.5	24.9	24.7
Corporate Tax	3.9	3.8	3.0	2.9	3.7	3.8	2.8	2.8	4.1	3.9
Consumption Tax	11.8	11.9	13.3	16.4	13.6	17.7	14.2	14.8	16.2	16.2
Income Tax	1.9	1.9	0.8	1.1	3.5	4.6	2.8	2.9	4.6	4.6
Non Tax Revenues	1.0	1.1	6.5	7.0	4.0	4.9	4.1	4.2	13.4	16.1
SS Contributions (Pensions)	0.5	0.6	3.6	3.6	2.1	2.1	0.1	0.1	10.2	10.3
Other	0.5	0.6	2.9	3.5	1.9	2.8	4.0	4.1	3.3	5.8

Country Specific Initial Labor Productivity and Catchup Rates

	Initial Labor Productivity	Years to Catch-up
USA	1.000	-
WEU	0.310	25
JKSH	0.470	25
CHI	0.112	35
IND	0.056	100
RUS	0.270	60
CAN	0.580	25
EEU	0.060	60
SAP	0.075	30
BRA	0.170	50
MEX	0.200	50
SAF	0.180	100
MENA	0.068	100
SLA	0.150	100
SSA	0.035	100
SOV	0.100	100
UK	0.700	25

Baseline GDP

	2014		2100	
	Share of the US 2014	Share of Global	Share of the US 2014	Share of Global
USA	1.00	16.86	2.91	4.99
WEU	0.93	15.73	3.52	6.04
JKSH	0.41	6.90	0.65	1.12
CHI	1.06	17.79	5.29	9.08
IND	0.43	7.18	9.54	16.37
RUS	0.23	3.79	0.82	1.41
BRA	0.19	3.15	1.66	2.85
UK	0.17	2.83	0.62	1.06
CAN	0.17	2.90	0.64	1.09
EEU	0.04	0.71	0.35	0.61
MENA	0.38	6.36	7.45	12.79
MEX	0.13	2.21	1.04	1.78
SAF	0.05	0.84	0.33	0.56
SAP	0.36	6.00	4.70	8.07
SLA	0.22	3.78	2.19	3.76
SOV	0.05	0.86	0.66	1.13
SSA	0.12	2.09	15.91	27.29
Global	5.93	100.00	58.28	100.00

Different Catch Up Rates Compared to the Baseline GDP

	Baseline				Zero Catch Up				Catch Up Twice As Long				Catch Up Twice As Long For 8 Regions			
	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP	2014 GDP	2100 Share of Global GDP
USA	1.00	16.86	2.91	4.99	1.00	16.76	2.87	22.32	1.00	16.81	2.94	6.62	1.00	16.85	2.96	6.11
WEU	0.93	15.73	3.52	6.04	0.94	15.79	1.80	13.96	0.94	15.75	3.70	8.34	0.93	15.74	3.64	7.50
JKSH	0.41	6.90	0.65	1.12	0.42	7.02	0.40	3.14	0.41	6.92	0.67	1.50	0.41	6.91	0.67	1.37
CHI	1.06	17.79	5.29	9.08	1.07	17.85	1.01	7.83	1.06	17.78	5.30	11.96	1.06	17.80	5.40	11.14
IND	0.43	7.18	9.54	16.37	0.43	7.14	1.13	8.82	0.43	7.16	5.96	13.44	0.43	7.16	9.64	19.88
RUS	0.23	3.79	0.82	1.41	0.23	3.86	0.30	2.34	0.23	3.90	0.64	1.43	0.23	3.79	0.83	1.72
BRA	0.19	3.15	1.66	2.85	0.18	3.08	0.39	3.06	0.19	3.13	1.25	2.82	0.19	3.15	1.26	2.60
UK	0.17	2.83	0.62	1.06	0.17	2.85	0.47	3.63	0.17	2.84	0.62	1.40	0.17	2.83	0.63	1.29
CAN	0.17	2.90	0.64	1.09	0.17	2.92	0.44	3.41	0.17	2.91	0.65	1.45	0.17	2.92	0.65	1.33
EEU	0.04	0.71	0.35	0.61	0.04	0.70	0.04	0.30	0.04	0.71	0.25	0.57	0.04	0.71	0.26	0.53
MENA	0.38	6.36	7.45	12.79	0.38	6.32	1.03	8.00	0.38	6.34	4.71	10.62	0.38	6.35	4.74	9.78
MEX	0.13	2.21	1.04	1.78	0.13	2.16	0.31	2.39	0.13	2.20	0.82	1.85	0.13	2.21	0.83	1.71
SAF	0.05	0.84	0.33	0.56	0.05	0.84	0.11	0.85	0.05	0.84	0.23	0.53	0.05	0.84	0.24	0.49
SAP	0.36	6.00	4.70	8.07	0.36	6.05	0.58	4.52	0.36	6.02	4.67	10.52	0.36	6.00	4.75	9.79
SLA	0.22	3.78	2.19	3.76	0.22	3.70	0.65	5.01	0.22	3.75	1.53	3.45	0.22	3.78	1.54	3.18
SOV	0.05	0.86	0.66	1.13	0.05	0.84	0.14	1.08	0.05	0.86	0.44	1.00	0.05	0.86	0.45	0.92
SSA	0.12	2.09	15.91	27.29	0.13	2.10	1.20	9.35	0.13	2.10	9.98	22.49	0.12	2.09	10.01	20.66
Global	5.93	100	58.28	100	5.97	100	12.86	100	5.95	100	44.35	100	5.93	100	48.47	100

Scenarios Compared to the Baseline GDP

	Baseline				Capital Share Changing				Retirement Age Rising by 10 Years			
	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100	2014	2100
	GDP	Share of Global GDP	GDP	Share of Global GDP	GDP	Share of Global GDP	GDP	Share of Global GDP	GDP	Share of Global GDP	GDP	Share of Global GDP
USA	1.00	16.86	2.91	4.99	0.98	16.68	3.43	4.81	1.00	16.87	2.91	4.97
WEU	0.93	15.73	3.52	6.04	0.93	15.70	3.83	5.37	0.93	15.76	3.53	6.02
JKSH	0.41	6.90	0.65	1.12	0.40	6.76	0.70	0.98	0.40	6.72	0.70	1.19
CHI	1.06	17.79	5.29	9.08	1.05	17.75	6.11	8.57	1.06	17.80	5.30	9.04
IND	0.43	7.18	9.54	16.37	0.43	7.27	12.05	16.90	0.43	7.19	9.55	16.30
RUS	0.23	3.79	0.82	1.41	0.23	3.86	1.04	1.45	0.23	3.88	0.80	1.37
BRA	0.19	3.15	1.66	2.85	0.19	3.23	2.05	2.87	0.19	3.16	1.66	2.84
UK	0.17	2.83	0.62	1.06	0.17	2.82	0.76	1.06	0.17	2.83	0.62	1.06
CAN	0.17	2.90	0.64	1.09	0.17	2.87	0.75	1.05	0.17	2.90	0.64	1.09
EEU	0.04	0.71	0.35	0.61	0.04	0.71	0.44	0.61	0.04	0.71	0.35	0.60
MENA	0.38	6.36	7.45	12.79	0.38	6.40	9.56	13.40	0.38	6.36	7.46	12.72
MEX	0.13	2.21	1.04	1.78	0.13	2.24	1.29	1.80	0.13	2.23	1.29	2.20
SAF	0.05	0.84	0.33	0.56	0.05	0.87	0.82	1.14	0.05	0.84	0.33	0.56
SAP	0.36	6.00	4.70	8.07	0.36	6.03	5.78	8.10	0.36	6.01	4.71	8.03
SLA	0.22	3.78	2.19	3.76	0.23	3.84	2.75	3.86	0.22	3.78	2.19	3.74
SOV	0.05	0.86	0.66	1.13	0.05	0.87	0.45	0.63	0.05	0.86	0.66	1.12
SSA	0.12	2.09	15.91	27.29	0.12	2.11	19.53	27.40	0.12	2.09	15.91	27.16
Global	5.93	100	58.28	100	5.89	100	71.30	100	5.93	100	58.60	100

Region Specific per Capita GDP for Different Transitions

		Baseline	Zero	Catch Up	Catch Up Twice as	Capital	Rise in
			Catch Up	Twice as Long	Long in 8 regions	Share Rise	Retirement Age
USA	2014	54772	54772	54772	54772	53786	54772
	2100	113485	111926	114538	115395	133601	113602
WEU	2014	27308	27572	27425	27337	27045	27337
	2100	106176	54113	111572	109643	115431	106357
JKSH	2014	37837	38762	38114	37929	36819	36819
	2100	83267	51754	85445	85189	89544	89544
CHI	2014	13416	13543	13454	13428	13288	13416
	2100	91862	17490	92105	93807	106139	91983
IND	2014	5724	5724	5724	5710	5751	5724
	2100	102790	12217	64243	103803	129789	102877
RUS	2014	27335	27943	28186	27335	27578	27943
	2100	127410	46598	98460	129113	160385	124469
BRA	2014	15802	15549	15718	15802	16056	15802
	2100	147741	34956	111095	111895	181985	147919
CAN	2014	47238	47787	47512	47512	46414	47238
	2100	115076	79375	116888	117069	136097	115257
UK	2014	45770	46315	46043	45770	45225	45770
	2100	131610	99292	132248	133311	160526	131610
EEU	2014	8614	8614	8614	8614	8614	8614
	2100	125535	13514	89617	90684	154696	125535
MENA	2014	9020	9020	9020	9020	9020	9020
	2100	92647	12791	58524	58897	118802	92672
MEX	2014	18207	17929	18207	18207	18346	18346
	2100	126659	37510	99866	100962	156740	156740
SAF	2014	16120	16120	16120	16120	16442	16120
	2100	84855	28199	60536	61054	211101	84855
SAP	2014	7547	7653	7589	7547	7526	7547
	2100	90537	11206	89863	91384	111198	90595
SLA	2014	13969	13782	13907	13969	14094	13969
	2100	105158	30971	73419	73899	132096	105206
SOV	2014	10713	10502	10713	10713	10713	10713
	2100	105774	22344	71213	71695	71695	105774
SSA	2014	2982	3006	3006	2982	2982	2982
	2100	80768	6104	50654	50847	99196	80808

Catch up

