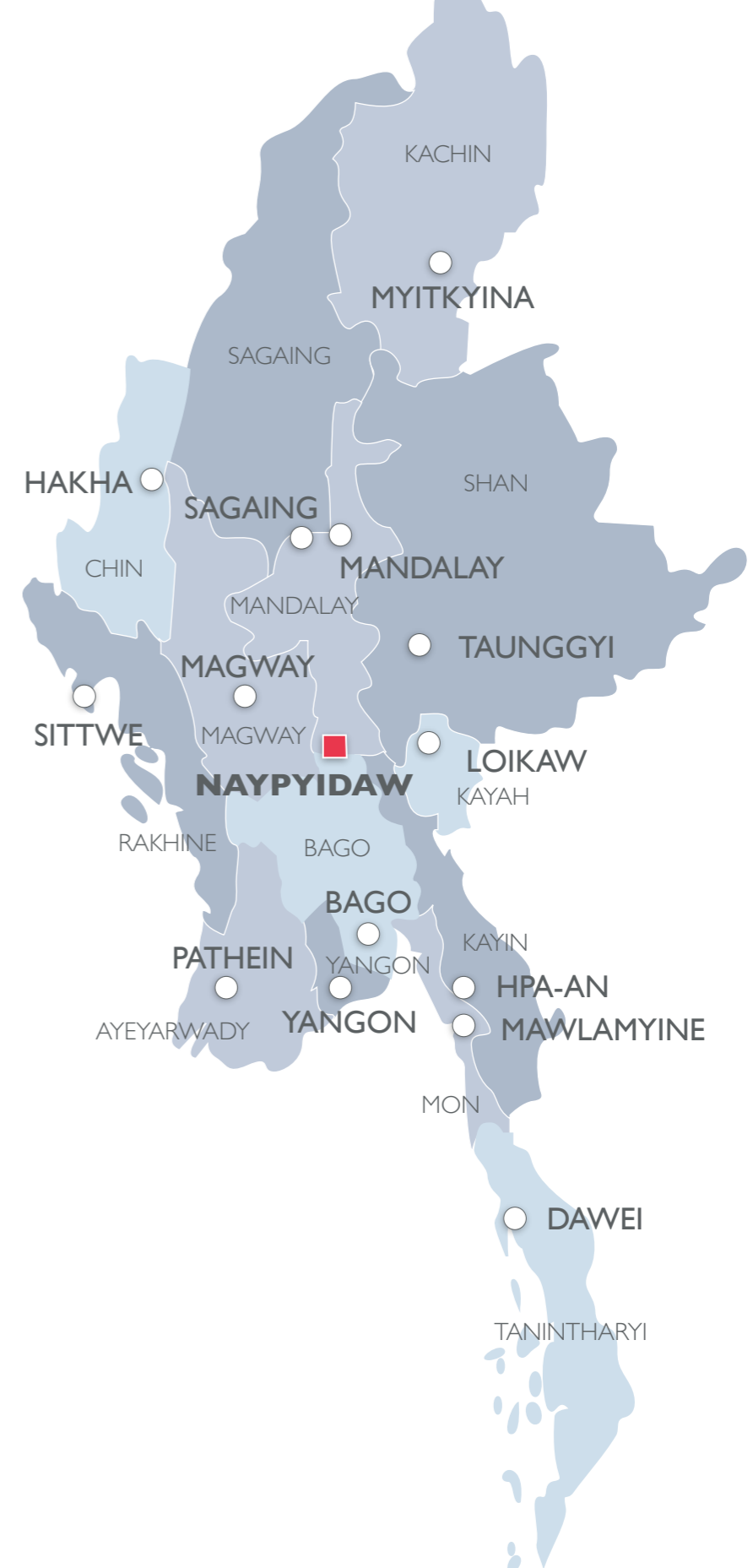


Estimating economic impact of ICTs for small Island States in the Pacific

- Dr Christoph Stork

Why bother?

- ▶ Policy and development planning - decide on how to allocate scarce resources
 - roads, bridges, schools, clinics, fibre networks....
- ▶ Convince policy makers of the importance on ICTs
- ▶ Estimate payoffs for investments into ICTs
- ▶ Return on investment: Economic growth and employment increase = increase in tax income



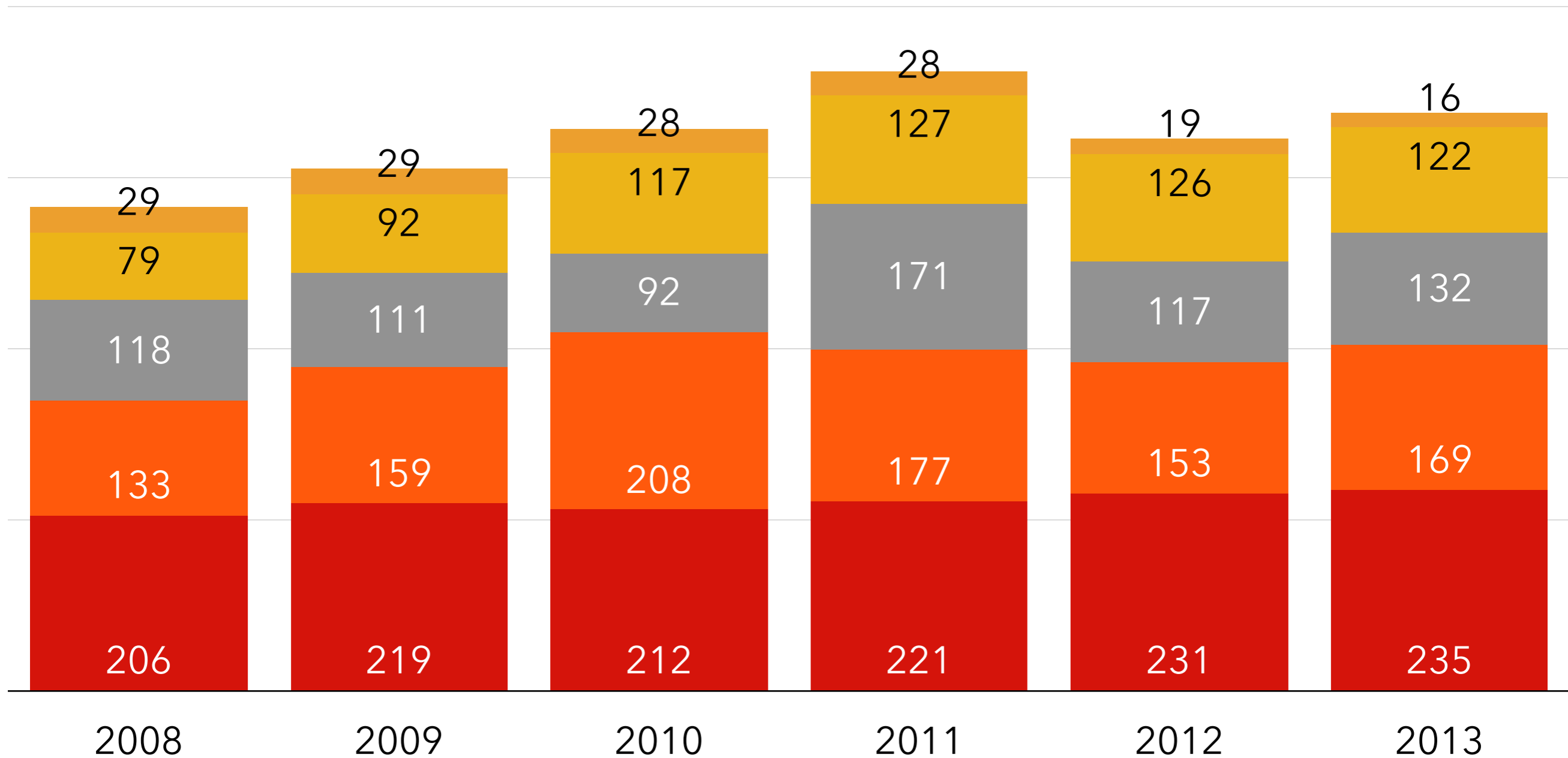
Myanmar - Hakha: 2nd bridge or broadband coverage?

Direct Macro Economic Impact

- ▶ National accounts: GDP contribution of communication sector
- ▶ Different measurements:
 - Communications Sector
 - Information and Communications Sector
 - Communication and Transport Sector
 - ISIC 3.1 or ISIC 4
- ▶ ICT sector not an ISIC sector (like tourism) hence
 - ▶ retailing handsets, computers and airtime not captured e.g.
 - ▶ satellite accounts are required to capture direct impacts

Direct GDP per capita contribution of Communications Sector in USD

Fiji Samoa Vanuatu Tonga Solomon Islands



Indirect Macro Economic Impact

- ▶ Productivity gains through ICTs in other sectors
- ▶ Two way causality between economic growth and mobile broadband penetration is undisputed
- ▶ Supported by economic theory and anecdotal evidence
- ▶ Exact amount is more complex to estimate
 - ▶ Change in total factor productivity
 - ▶ Change in GDP growth (excluding ICT sector)

Estimating Indirect Impact

- ▶ Country specific modelling:
 - ▶ Most appropriate for policy and regulatory purposes
 - ▶ Requires quarterly GDP, employment, investment and price data
- ▶ Cross section modelling:
 - ▶ Effect size = average of selected countries
 - ▶ More data by including more countries
- ▶ Panel data modelling:
 - ▶ Is a combination of time series data and cross country analysis
 - ▶ maximises data availability (countries and years)
 - ▶ allows to derive country specific results
 - ▶ allows to derive year specific results

Country Specific model - Simultaneous Equation model Katz & Koutroumpis (family of models)

IMPACT MODEL OF INCREASING BROADBAND PENETRATION ON GDP GROWTH

FUNCTION	EQUATION
Aggregate Production Function	$\Delta GDP_{it} = \alpha_1 \Delta Fixed\ Capital_{it} + \alpha_2 \Delta Labor\ Force_{it} + \alpha_3 \Delta Oil\ Price_{it} + \alpha_4 \Delta Broadband\ Penetration_{it} + \epsilon_{it} + Year\ Fixed\ Effect_t$
Demand function	$\Delta Broadband\ Penetration_{it} = \alpha_1 \Delta Broadband\ Price_{it} + \alpha_2 \Delta Household\ Income_{it} + \epsilon_{it} + Year\ Fixed\ Effect_t$
Supply function	$\Delta Revenues\ of\ Broadband\ Companies_{it} = \alpha_1 \Delta Household\ Income_{it} + \alpha_2 \Delta Urban\ Population_{it} + \epsilon_{it}$
Output function	$\Delta Broadband\ Penetration_{it} = \alpha_1 \Delta Revenues\ of\ Broadband\ Companies_{it} + \epsilon_{it}$

Cross country model - Qiang et al. (2009)

- ▶ impact of mobile penetration on economic growth in developing countries
- ▶ Period averages and initial values and not annual data - thus suffering to an lesser extent from data unavailability

$$\mathbf{GDP}_{8006} = \mathbf{a}_0 + \mathbf{a}_1 * \mathbf{GDP}_{80} + \mathbf{a}_2 * (\mathbf{I}/\mathbf{Y}_{8006}) + \mathbf{a}_3 * \mathbf{TELEPEN}_{8006} + \mathbf{a}_4 * \mathbf{PRIM}_{80} + \mathbf{a}_6 * \mathbf{SSA} + \mathbf{a}_7 * \mathbf{LAC} + \mu,$$

\mathbf{GDP}_{8006} = Average growth rate of real GDP per capita in US\$ for the period 1980-2006

\mathbf{GDP}_{80} = Real GDP per capita in 1980

$\mathbf{I}/\mathbf{Y}_{8006}$ = Average share of investment in GDP for 1980-2006

$\mathbf{TELEPEN}_{8006}$ = Average telecommunications penetration per 100 people over 1980-2006
(Number of main lines or mobile subscribers or Internet users or Broadband subscribers)

\mathbf{PRIM}_{80} = Primary school enrolment rate in 1980

\mathbf{SSA} = Dummy variable for countries in the Sub-Saharan Africa Region

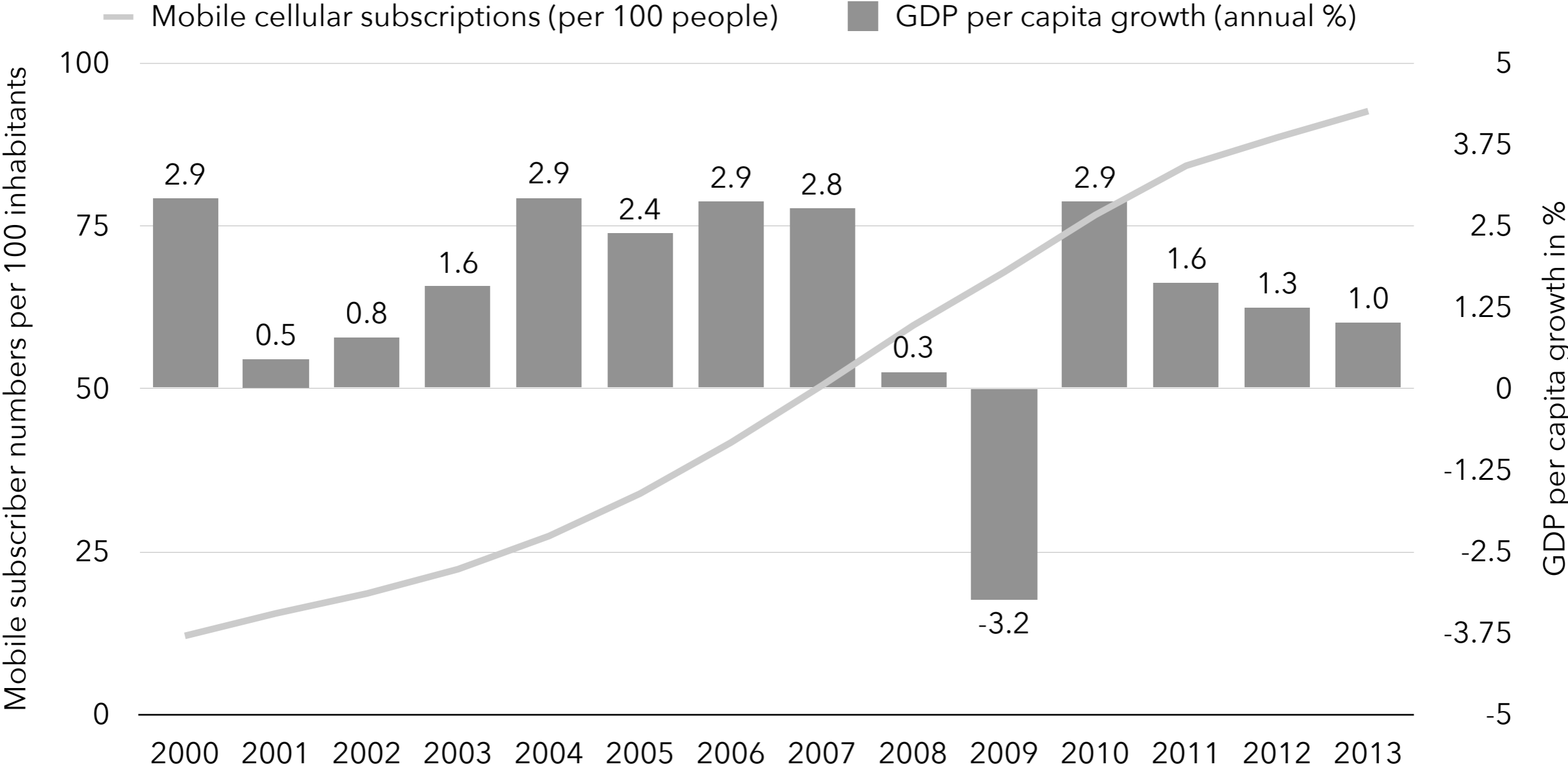
\mathbf{LAC} = Dummy variable for countries in the Latin America and Caribbean Region

Data Availability

		Fiji	Vanuatu	Tonga	Samoa	Solomon Islands
Capital Stock	NSO	No	No	No	No	No
Gross fixed capital formation	NSO	Annual 2005-2012	Annual 1998-2012	Annual 2002-2012	No	Annual 2007-2012
Telco Capital Expenditure (CAPEX)	From operators	2000-2013 ATH & Digicel	2007-14 Digicel only	2007-14 Digicel only	2007-14 Digicel only	No
GDP	NSO	Annual: 2008-2013	Annual: 1998-2012	Annual 1993-2012	Quarterly	Annual 2007-2012
Labour force with secondary education	NSO	Estimates for selected years based on Labour force and HIES surveys				

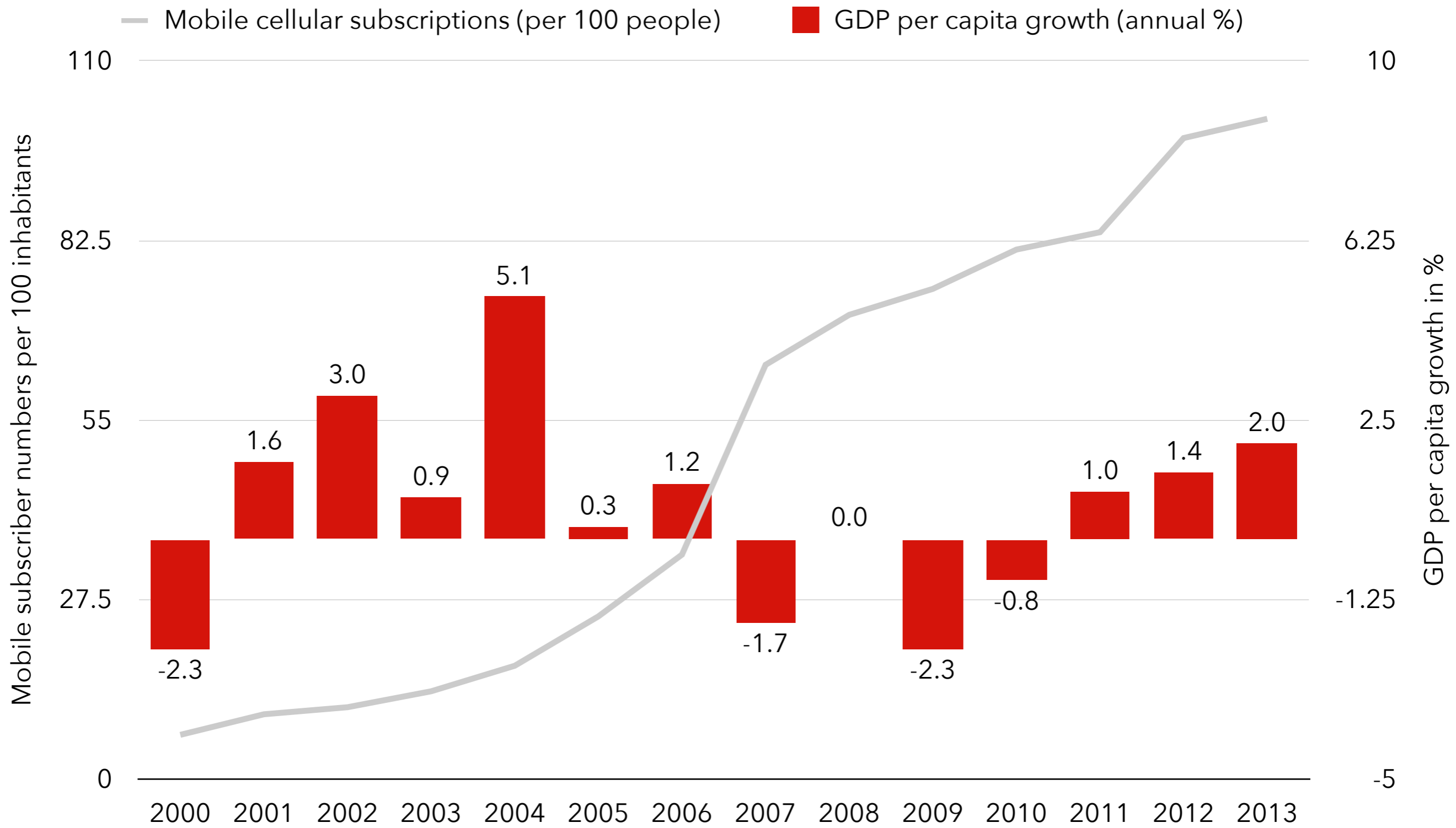
- ▶ Katz & Koutroumpis (family of models) could not be applied due to data limitation
- ▶ Qiang et al. (2009) is across countries and requires large number of countries.
 - ▶ Data availability means that pacific countries drop out of analysis in large numbers
 - ▶ Sensitive to global shocks

World's GDP growth compared to World's mobile subscriber numbers

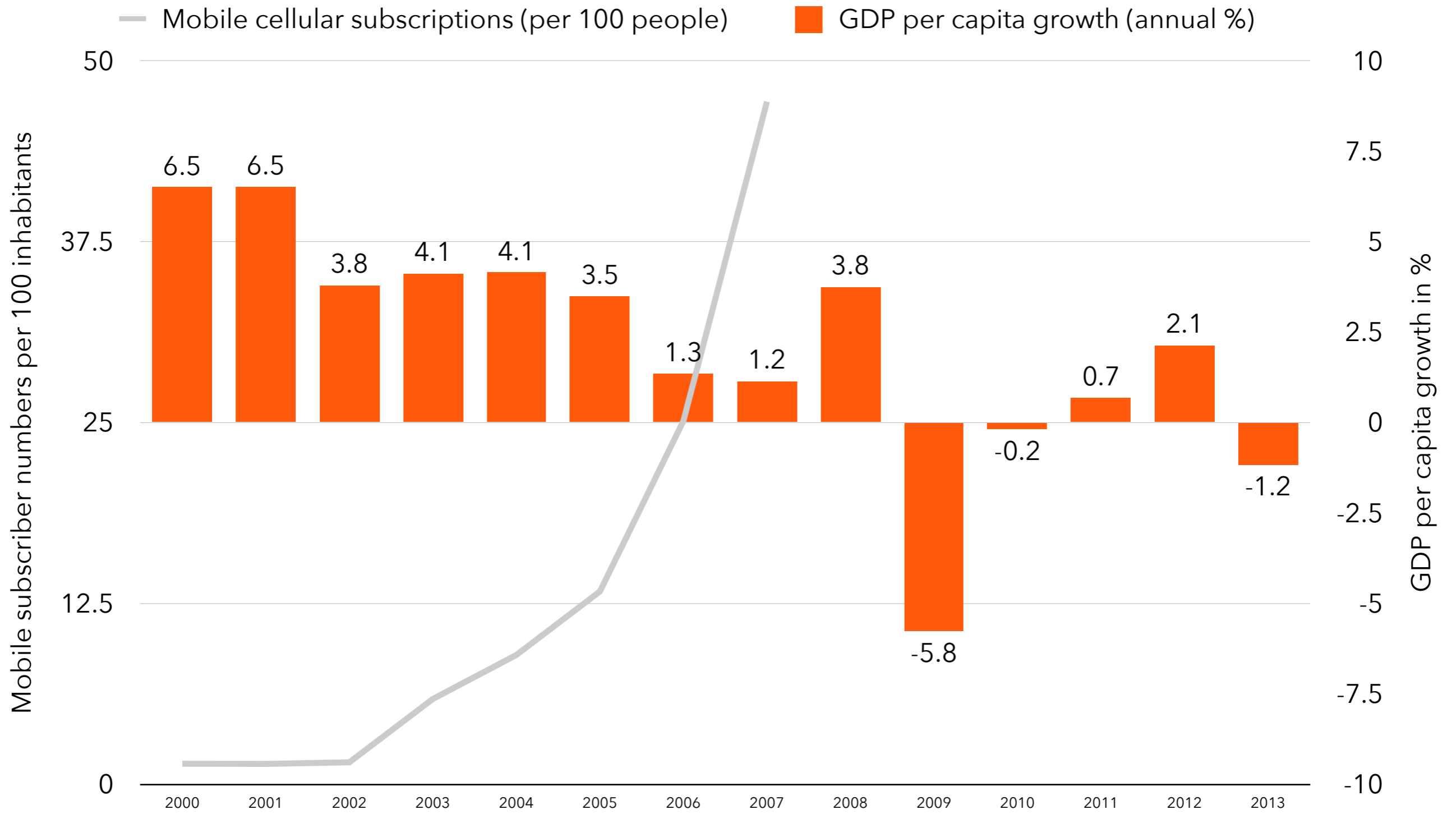


Global Financial Crisis

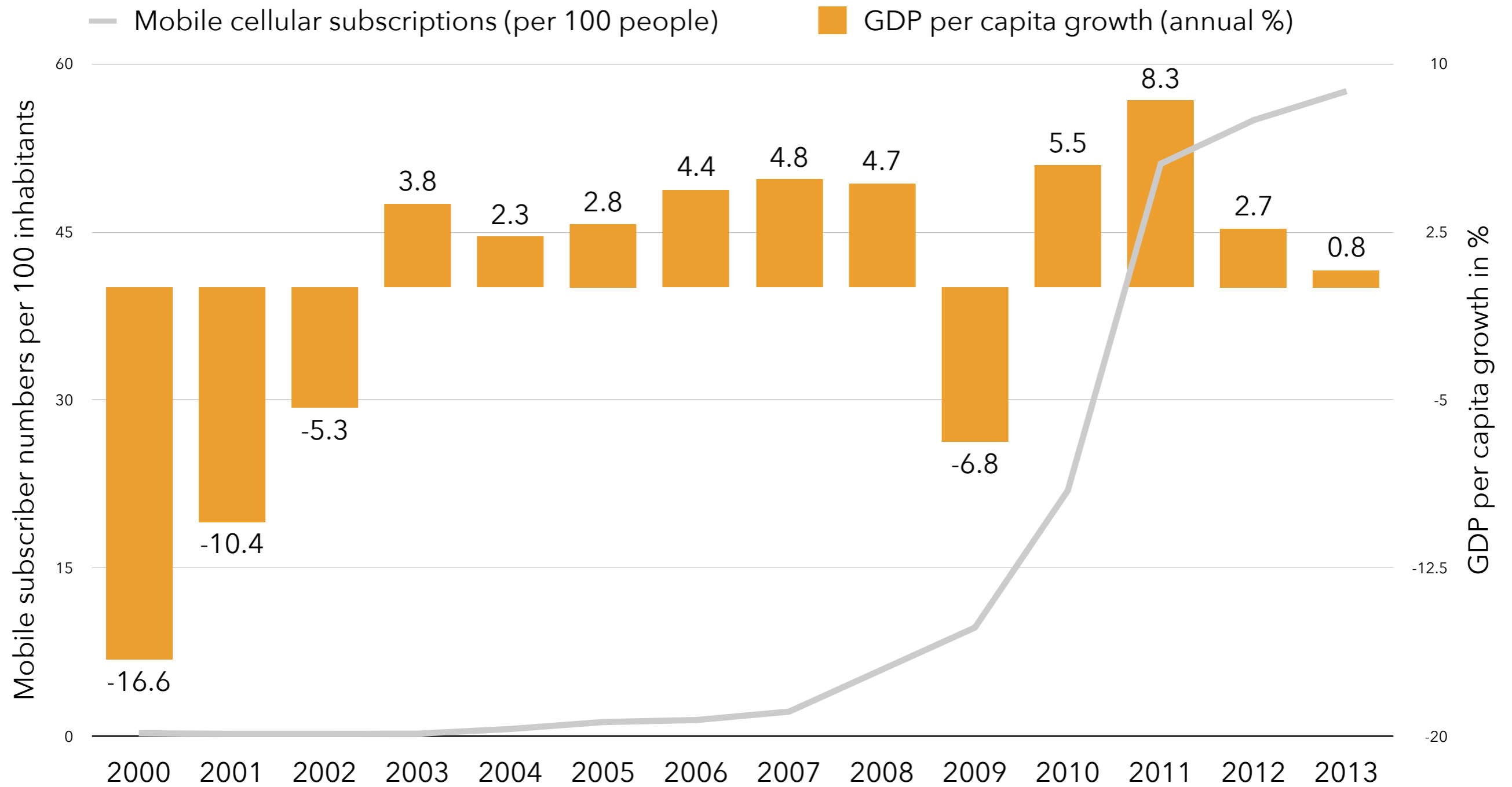
Fiji



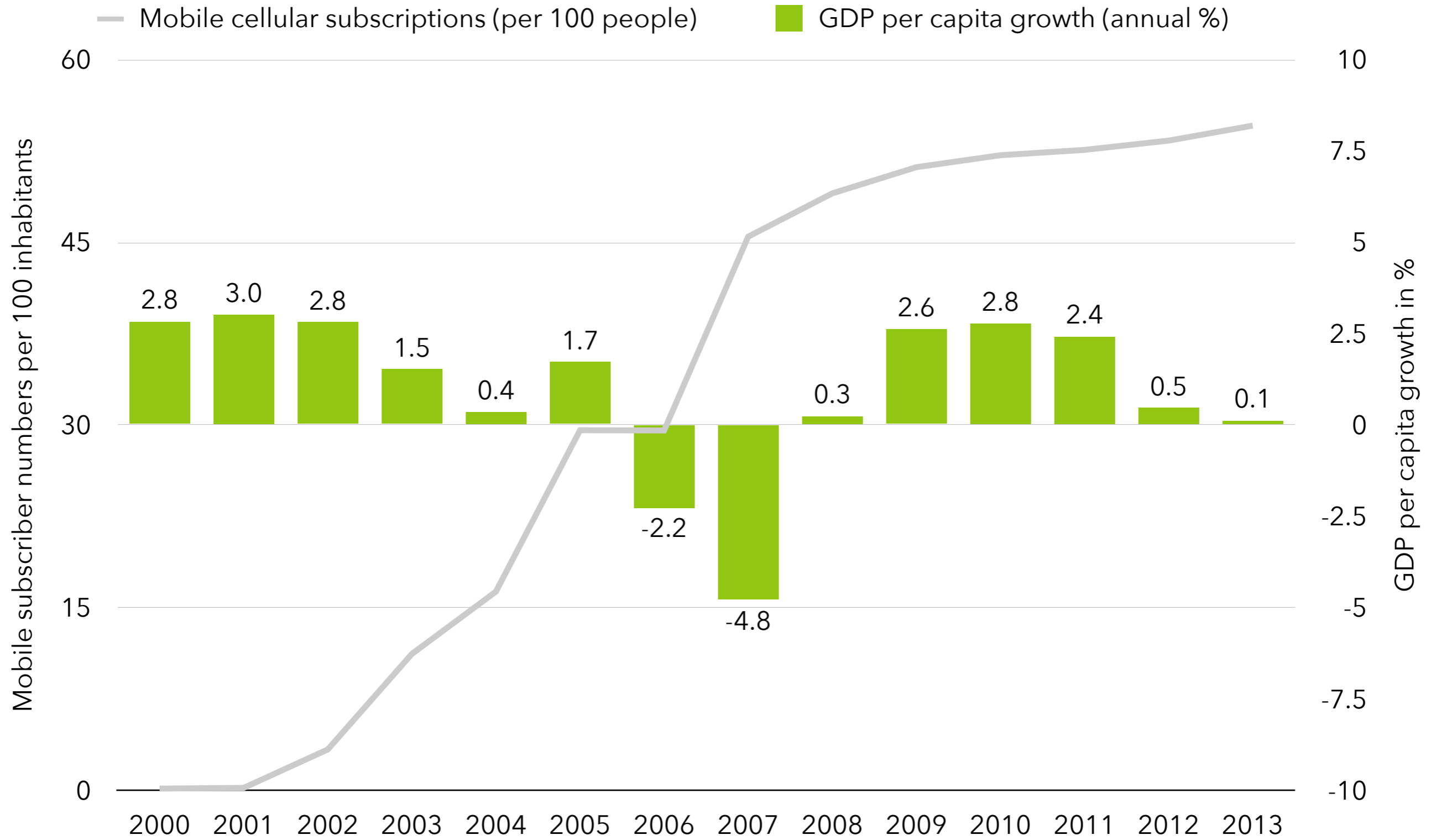
Samoa



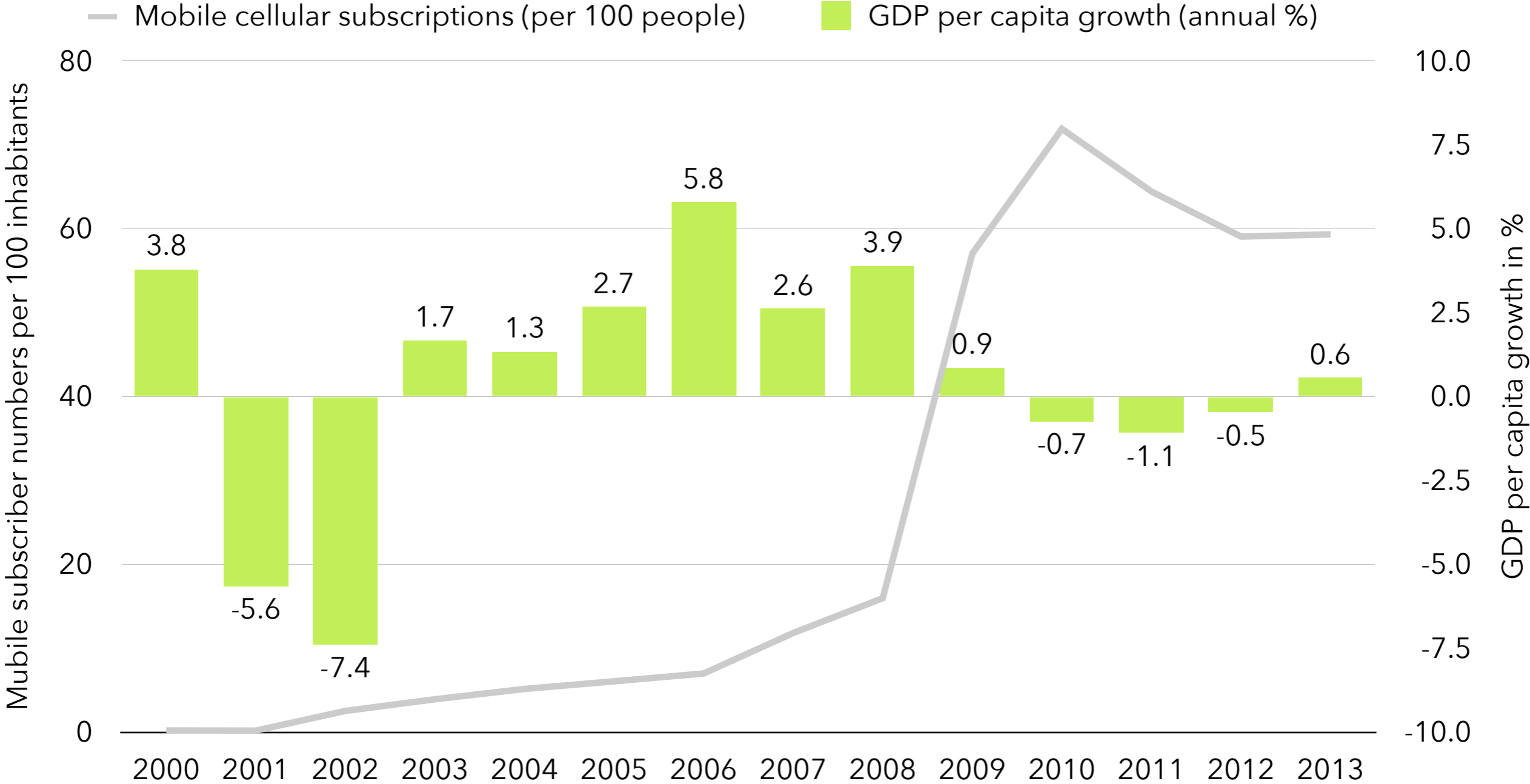
Solomon Island: GDP growth compared to mobile subscribers



Tonga



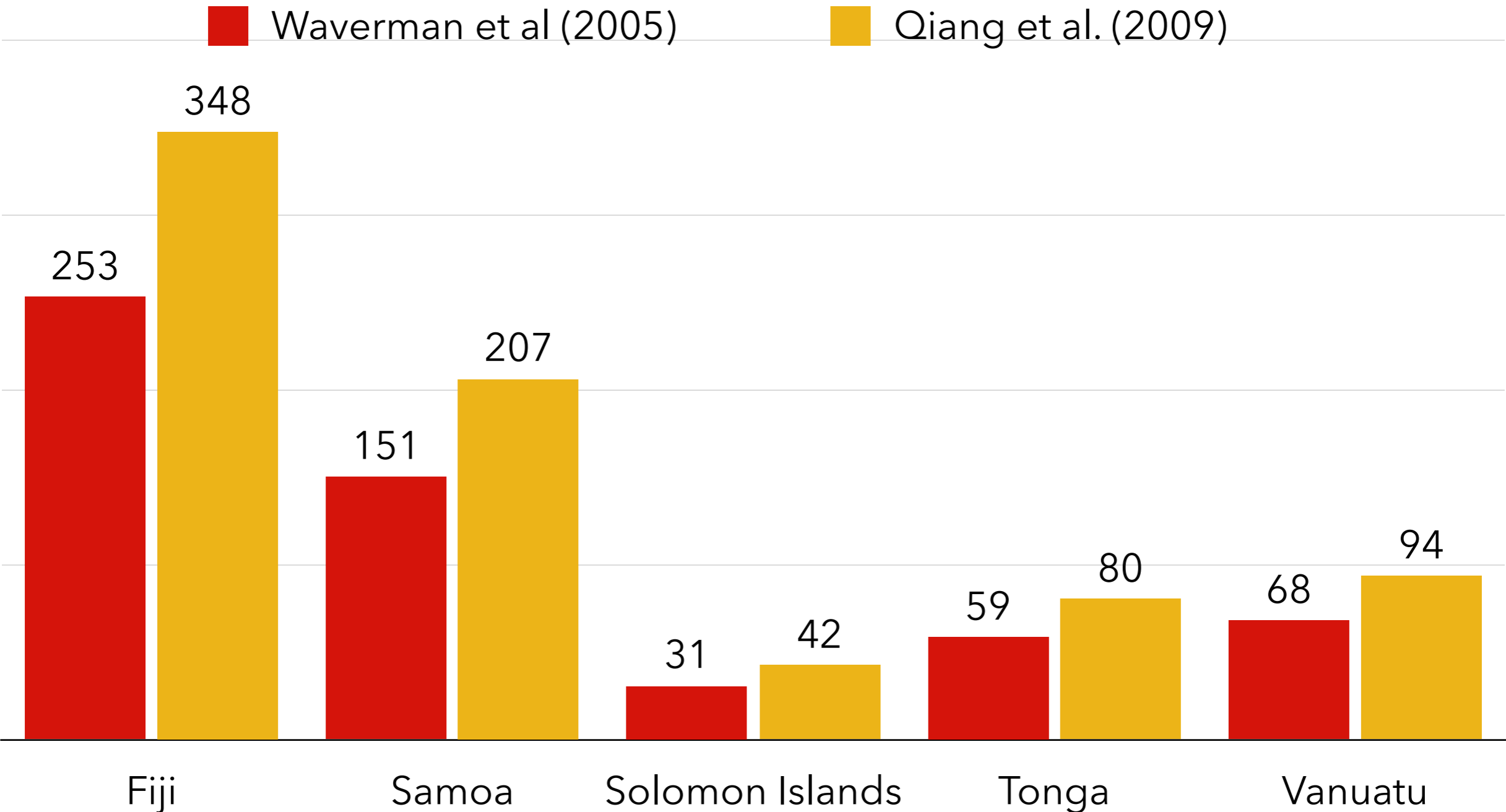
Vanuatu: GDP growth compared to mobile subscribers



Applying Effect Sizes to the Pacific

- ▶ Applying the $x\%$ increase for $y\%$ higher increase
- ▶ Short cut in absence of data
- ▶ Effect size from global studies = average
 - (no-one is average)
- ▶ Fixed -line: no relevance in Pacific
- ▶ Mobile Broadband:
 - fairly new, last 5 years
 - increased with submarine cable rollout

Additional GDP Per Capita in US\$ through mobile penetration increase for period 2005 - 2014

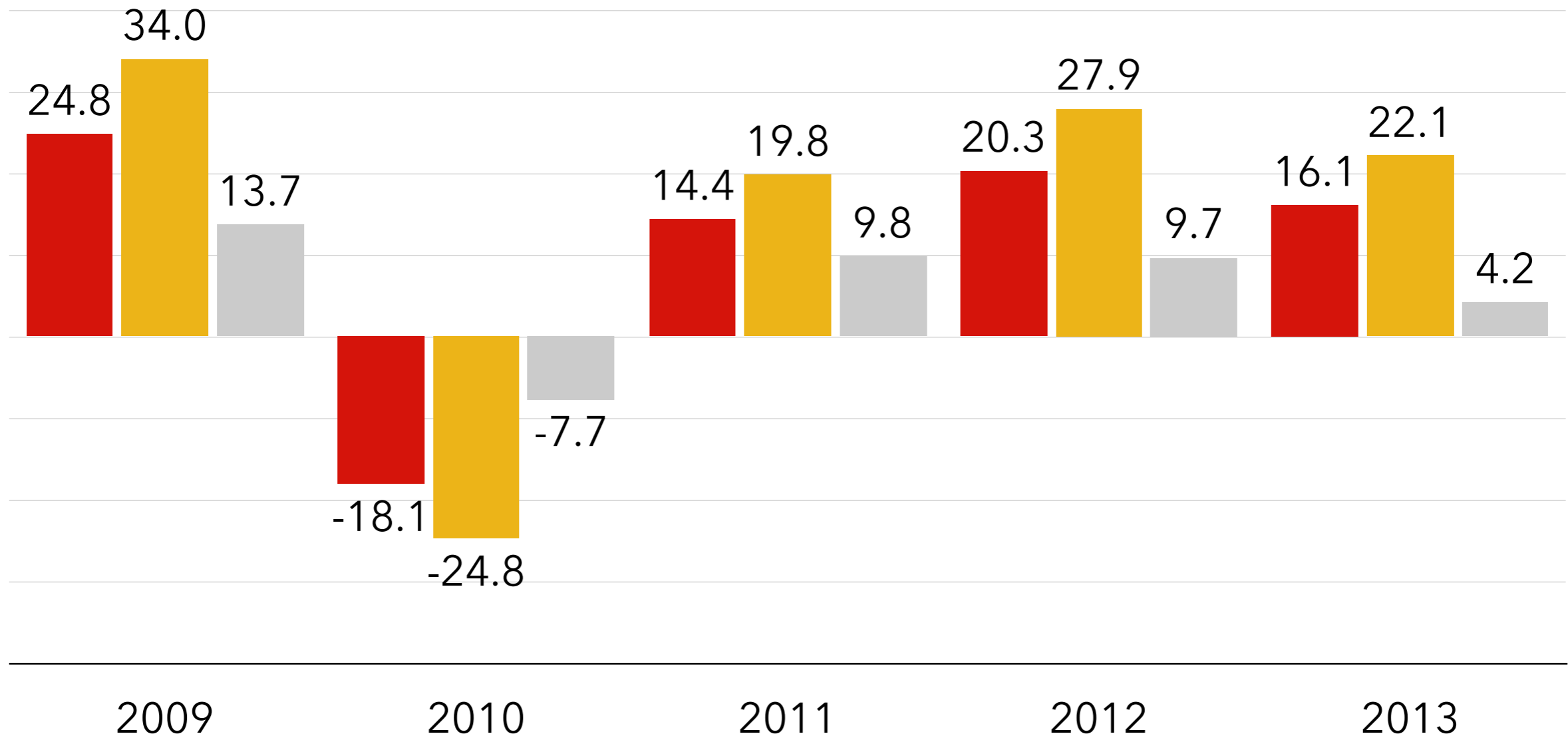


Direct and indirect impact!

Fiji: Comparing effect sizes (direct and indirect impact) to national accounts (direct impact)

Change in GDP per capita USD

- GDP per capita USD growth based on Waterman et al (2005)
- GDP per capita USD growth based on Qiang et al. (2009)
- Change in direct GDP per capita in USD for Information and communication sector



Effect size tracks the direct impacts closely

Conclusion

- ▶ Regulators should monitor KPIs and prices quarterly and require all licensees to furnish audited financial statements
- ▶ Effective regulation without data is hardly possible
- ▶ Statistical agencies may need to expand their data collection:
 - Labour force surveys and national income and expenditure surveys can deliver crucial ICT indicators
 - ICT satellite accounts would greatly enhance the measurement of direct impacts of the ICT sector
- ▶ The indirect impacts can be best measured by separating direct and indirect impacts.
 - Katz and Koutroumpis (2012) etc. would ideally be run to test for indirect impact only
 - The direct GDP contribution should to be excluded from the models