

**LAPSE OF  
TIME**

SM/17/136

June 2, 2017

To: Members of the Executive Board

From: The Acting Secretary

Subject: **Costa Rica—Selected Issues and Analytical Notes**

Board Action:	Provides background to SM/17/134—Staff Report for the 2017 Article IV Consultation
Publication:	Yes*
Questions:	Mr. Figliuoli, WHD (ext. 38355)
Document Transmittal in the Absence of an Objection and in accordance with Board policy:	Monday, June 12, 2017—WTO After Board Consideration—European Commission, European Investment Bank, Food and Agriculture Organization, Inter-American Development Bank, United Nations Development Programme

**\*Unless an objection from the authorities is received prior to the conclusion of the Board's consideration, the document will be published.**





# COSTA RICA

## SELECTED ISSUES AND ANALYTICAL NOTES

May 31, 2017

Approved By  
**Western Hemisphere**

Prepared by Valentina Flamini, Gerardo Peraza, Dmitry Plotnikov, Jaume Puig, Roany Toc Bac, and Victoria Valente, with editorial support from Carolina Friend.

## CONTENTS

<b>IMPLICATIONS OF THE NEW U.S. ADMINISTRATION'S ECONOMIC PLANS FOR CENTRAL AMERICA</b>	<b>3</b>
A. Potential Policy Changes in the United States	3
B. Costa Rica's Main Exposures	4
C. Estimations and Results	5
D. Conclusions	8
References	9
<b>SELECTED FISCAL SECTOR ISSUES</b>	<b>10</b>
A. Distributional Impact of Tax Reforms	10
B. Efficiency of Public Expenditure	17
C. Long-term Fiscal Gaps from Population Aging	25
References	39
<b>FIGURES</b>	
1. Education Spending and Outcomes	21
2. Health Spending and Deficiency	23
3. Contribution Rates, Replacement Rates, and Passive Coverage of Pension	30
<b>ANNEX</b>	
I. Costa Rica Pension System Structure	38
<b>SELECTED FINANCIAL SECTOR ISSUES</b>	<b>40</b>
A. Credit Cycle and Countercyclical Capital Buffers in Costa Rica	40
B. Banking Sector Vulnerabilities and Stress Testing	49
C. Assessing Liquidity Buffers	56
D. Spillovers from Stress in International Banks	63
References	66

**FIGURES**

1. Stress Test Results _____	54
2. System-Wide Cash Flows in Medium-Term Liquidity Stress Scenario _____	61

**TABLES**

1. Early Warning Properties of Credit Gap and Robustness Check _____	46
2. Stress Test Results _____	55
3. Medium-Term Liquidity Stress Scenario Assumptions _____	62

**ADDRESSING INFRASTRUCTURE BOTTLENECKS TO BOOST COMPETITIVENESS\_ 67**

A. Lacking Infrastructure Weighs on Competitiveness _____	67
B. Logistics Becomes Harder with Inadequate Infrastructure _____	72
C. Stepping Up the Game to Compete _____	73
References _____	77

**FIGURES**

1. Global Competitiveness Index (GCI) _____	68
2. Infrastructure Indicators _____	70
3. Latin America: Qualitative Infrastructure Indicators, 2016 _____	71
4. Logistics Performance Index _____	72
5. Public Investment Efficiency Frontier _____	74
6. Public Investment Management _____	75

**CLIMATE CHANGE, ENVIRONMENTAL POLICIES AND OUTPUT TRADE-OFFS \_\_\_\_ 78**

A. Introduction _____	78
B. Effects of Climate Change on Growth _____	81
C. Environmental Policies and Growth _____	86
D. Conclusion and Policy Discussions _____	88
References _____	90

**FIGURE**

1. Estimated Global Response of GDP Growth _____	83
--	----

# IMPLICATIONS OF THE NEW U.S. ADMINISTRATION'S ECONOMIC PLANS FOR CENTRAL AMERICA<sup>1</sup>

*This note describes Costa Rica's vulnerabilities to potential policy changes in the United States after the November 2016 Presidential election and its effects on Central America. In the near term, the most likely U.S. policy shift is for a change in the macroeconomic policy mix, involving an expansionary fiscal policy, implemented initially through tax cuts, and a tighter than previously expected monetary policy stance. The results suggest that Costa Rica may potentially be more affected through the FDI and trade channels, contrary to the rest of Central America, where the remittances and immigration channels play a key role.*

## A. Potential Policy Changes in the United States

1. **The outcome of the 2016 U.S. Presidential elections may mark a strategic shift in U.S. policies along several key dimensions that will have cross-border implications.** In the near term, staff's baseline scenario assumes a change in macro policy mix, essentially: (i) an expansionary fiscal policy, implemented initially through tax cuts; and (ii) a tighter-than-previously-expected monetary policy stance, leading to a steeper path for future increases in the Fed funds rate. U.S. economic activity is projected to expand solidly by 2.3 and 2.5 percent in 2017 and 2018, respectively, as private consumption and fixed investment should benefit from actual and anticipated fiscal stimulus. Potential ramifications for countries in the Central America region will vary depending on trade exposures to the U.S., financial interlinkages, and changes in migration and remittances flows.
2. **In the medium-term a structural overhaul of the U.S. tax system is expected to involve the simplification of the corporate income tax (CIT).** One proposal under consideration seeks to replace the current CIT with a cash flow tax with border adjustment and a lower tax rate for U.S. firms. The idea is to reduce the tax burden and relevant distortions by transforming the current 35 percent CIT—the highest among OECD economies<sup>2</sup>—to a 20 percent destination-based cash flow tax (DBCFT) to encourage investment and employment in the United States. However, the border adjustment inherent in a DBCFT may prove inconsistent with existing WTO rules which could precipitate trade disputes and possible retaliation from trading partners. Other options being considered are less comprehensive and involve reducing the rate of the CIT while eliminating some exemptions and special treatments.
3. **On the trade side, the United States intends to renegotiate existing trade agreements, including the North American Free Trade Agreement (NAFTA).** If well executed, such efforts could potentially generate growth dividends for all the signatories of the agreement. However, if

<sup>1</sup> Prepared by Victoria Valente.

<sup>2</sup> The effective rate is considerably lower however, owing to various provisions narrowing the base of the CIT. OECD Tax Database.

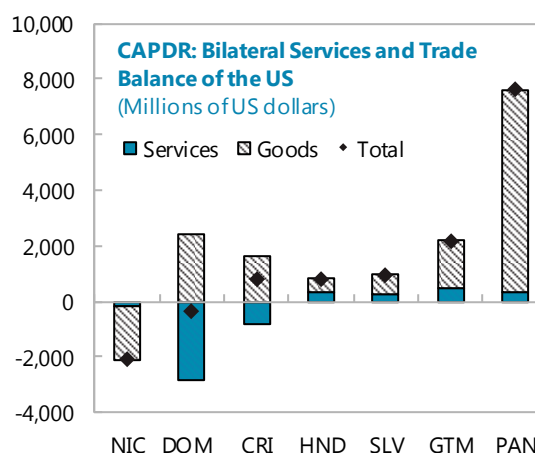
there were a unilateral imposition of tariffs on imports, this could prove damaging for both the United States and its trading partners, resulting in weaker trade, higher production costs, more expensive imported consumer goods, and eventually lower potential growth.

**4. There is also a risk that more restrictive migration policies could negatively affect Central America.** Potential changes in migration policies include stiffening immigration controls, increasing deportations of unauthorized immigrants, and an imposition of a tax on remittances that would likely dampen such flows. The net impact on the region due to changes in migration and remittances is likely to be negative. This is because the adverse impact of a decline in remittances from abroad is unlikely to be offset by the increase in labor participation at home that could be expected from a reversal of migration, particularly given that most migrants from Central America are low skilled and their re-absorption in their home labor markets could take time.

## B. Costa Rica's Main Exposures

**5. Central America and especially Costa Rica are highly exposed to the United States through trade.** The United States accounts

for close to 40 percent of total goods exports from Central America, and the indirect exposure of these countries to the U.S. is also high through intra-regional trade—at about 20 percent. In CAFTA-DR, the trade agreement between the U.S. and Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and the Dominican Republic, the U.S. has a trade surplus in goods, but a trade deficit in services. Notably, Costa Rica had a services surplus with the U.S. of US\$820 million in 2015.<sup>3</sup> Exports of services to the U.S. have been growing at a faster pace than imports, reaching 12.6% in 2015, while imports have grown only at 1.2%. On the other hand, Costa Rica trade balance with the U.S. had a deficit of US\$1.7 billion in 2016.

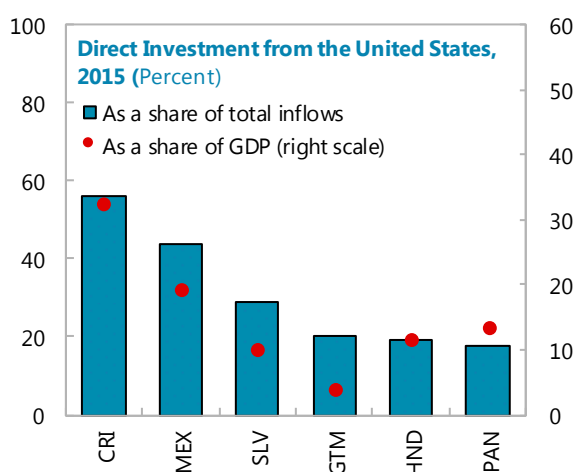
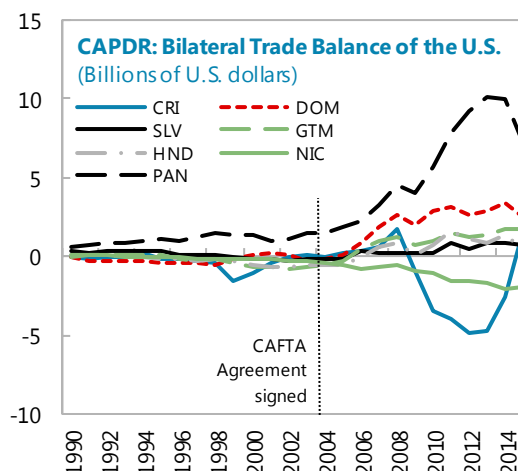


<sup>3</sup> U.S. Bureau of Economic Analysis. Latest value available.

**6. U.S. and Mexico represent almost half of Costa Rica's total exports of goods.** While there is less concern about modifications in the CAFTA-DR agreement, because the U.S. has a surplus, the NAFTA agreement may suffer modifications, which would have a negative impact on Costa Rica.

**7. FDI flows and stocks in North and Central America are concentrated mainly in Costa Rica and NAFTA US-counterparts.** For Costa Rica on the one hand and for Mexico and Canada on the other, out of their total FDI stock, the U.S. represents 60 percent and 50 percent, respectively (over 30 percent and 18 percent of GDP respectively).

**8. On the other hand, remittances and immigration are not relevant channels for Costa Rica.** In contrast with the rest of Central American countries, remittances from limited migration to the U.S. do not play a critical role in Costa Rica's economy—these accounted for less than 0.5% of GDP in 2015.



## C. Estimations and Results

### C1. Partial Elasticities approach

**9. Spillovers from higher U.S. growth resulting from expansionary U.S. fiscal policy are larger for partners with higher trade exposures, such as Costa Rica.** Previous studies indicate that NAFTA countries, plus Costa Rica and Honduras, have been historically more sensitive to U.S. growth shocks than other countries in Central America or Latin America. These countries therefore are more likely to benefit from higher demand from the United States—i.e., the direct impact of U.S. fiscal expansion.

**10. Higher global interest rates, resulting from tighter U.S. monetary policy may partially offset positive spillovers from U.S. higher growth.**

Financially integrated economies in the region like Costa Rica are likely to face higher external funding costs (both public and private) due to higher global interest rates following a faster normalization of monetary policy by the Federal Reserve and/or the increase in risk premium. While the financial channel is weak for most Central American countries—because of thin financial markets and less financial integration—the EMBI spreads of Costa Rica, Panama and El Salvador are more reactive than those of other neighboring countries to global shocks.



**11. Greater U.S. trade protectionism through higher tariffs would hurt export volumes from Central America, including Costa Rica.**

Possible policy changes include modifying some of the provisions of NAFTA, CAFTA-DR, and other bilateral trade agreements—including by raising tariffs for imports of some manufactured goods from U.S. companies operating in foreign countries. To quantify the impact of such scenarios, one can look at the increase in effective tariff rates if NAFTA and/or CAFTA-DR were repealed and tariffs were increased to WTO MFN (most favored nation) levels.<sup>4</sup> In this scenario, the effective tariff rates for Central America would increase by 2–8 percentage points (more only in the Dominican Republic). Staff estimates that this would reduce real exports by about 1–7 percent<sup>5</sup> in the short run and by 1-16 percent in the long run (for Costa Rica 0.2 and 1.3 percent respectively).

**12. A shift of corporate taxation to a lower rate could lead to a reallocation of FDI flows away from Costa Rica.** Modifications in the U.S. corporate income tax could generate incentives for U.S. companies to repatriate a larger share of current and future foreign profits, if the marginal effective tax rates in the foreign countries become higher than those on profit repatriation and distribution in the U.S. This could also result from other types of CIT reform in the U.S.

<sup>4</sup> In current usage, MFN tariffs are those that countries commit to impose on imports from other members of the WTO, unless the other country is part of a preferential trade agreement (such as a free trade area or customs union).

<sup>5</sup> To gauge the impact on exports to the U.S. from the repeal of CAFTA and the associated increase in tariffs to the level of WTO (MFN tariffs), a VECM model is used as in Hooper and others (2000). The model relates the log volume of a specific product import by the U.S. from a CAPDR country to the log relative price of this good in relation to U.S. PCE price index as well as to the log of U.S. GDP. The model is estimated on monthly data for 9 individual product categories. The three variables in the model were found to be integrated of order 1 for almost all the combinations (good, country). The number of lags was chosen according to several lag length selection criteria (AIC, BIC). For Mexico and Canada, the elasticities are obtained from the estimated import price elasticities of Hooper and others (2000).

**13. Costa Rica may be more vulnerable to reductions in the U.S. CIT rate, as taxation might have played a bigger role in U.S. companies' decision to invest there.** Average effective tax rates during 2010-13 in Costa Rica (9 percent) and Honduras (11 percent) were relatively low compared to other Central American countries (Guatemala, El Salvador, and Nicaragua: 20 percent). In addition, some U.S. corporations in CAPDR countries operate from free enterprise zones, with essentially zero corporate tax rates (and low other taxes, particularly if their production is exported). This fact makes it even more complex to understand the final implications for the region if CIT in the U.S. were finally to be modified. If all the currently generated income from FDI by U.S. companies is repatriated, this could amount to annual outflows of 0.2-2 percent of GDP, but this seems unlikely.

**14. However, taxation is not the only consideration in companies' decision to invest abroad, and Costa Rica may benefit from these other factors.** Long-term profit considerations, based on relative labor costs, other costs, logistics and infrastructure, proximity to markets, global value-added chains, security, rule of law, and, more generally, "optimal" international distribution of productive capacity should also be taken into consideration and are likely to be more important than just the corporate tax rate.<sup>6</sup> Costa Rica seems overall to be doing pretty well along several of these dimensions. This may mitigate vulnerabilities to tax policy spillovers from the U.S.

**15. Overall, vulnerabilities to changes in U.S. policies appear elevated across Central America.** Most countries in the region are highly exposed to possible changes toward more restrictive migration policies and to trade shocks from more protectionist trade policies in the U.S. Costa Rica is not affected by this channel, and also has high exposure to upside risks from higher growth from expansionary fiscal policies and deregulation in the U.S. On the other hand, the country faces greater downside risks than other countries in Central America from tighter external financial conditions, given its relatively stronger financial linkages with the U.S.

## C2. Model Simulations

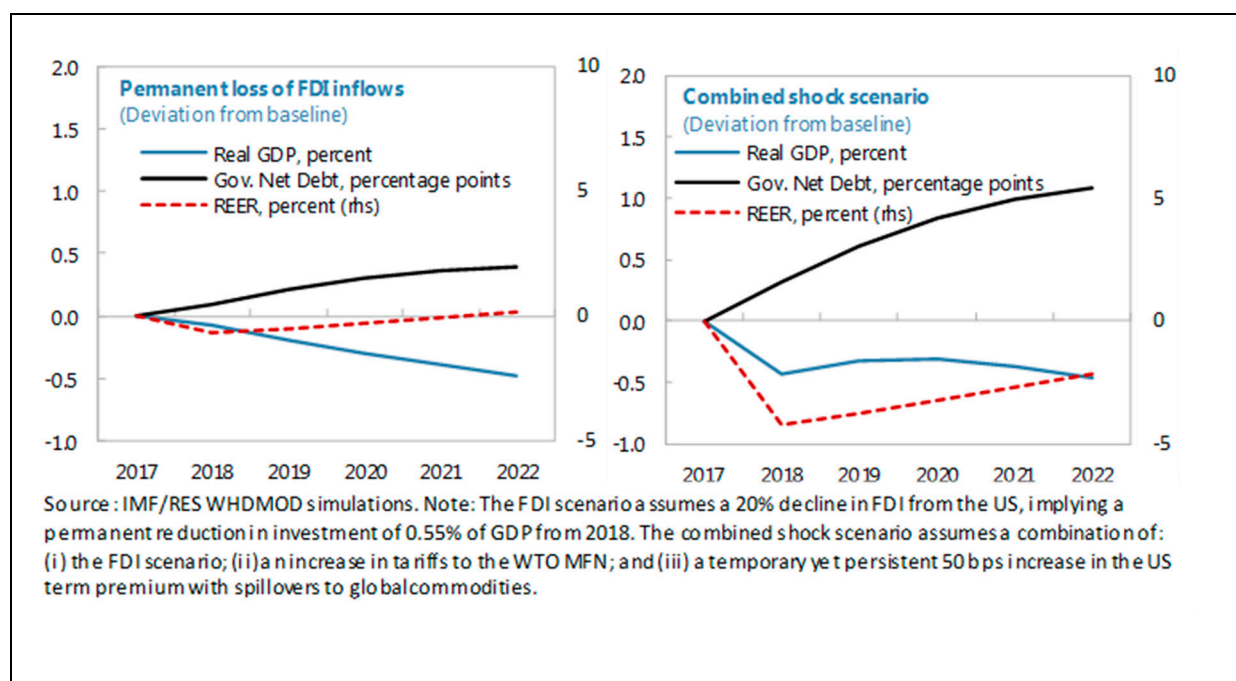
**16. IMF's Flexible System of Global Models (FSGM) was used to simulate the effect of various financial shocks on macroeconomic variables in Costa Rica.** The model was developed by the Economic Modeling Division of the IMF's Research department for policy analysis (Andrle and others, 2015). It comprises a system of multi-region globally consistent general equilibrium models combining micro-founded and reduced-form relationships for various economic sectors.

**17. Model simulations suggest that changes in U.S. policies could decrease GDP growth by ½ percent over the medium term.** FDI could suffer from sizable reductions in the U.S. effective corporate tax rate, although the impact is likely to be contained given the importance of other pull factors, including an educated workforce, security, rule of law, and geographical location. Assuming a 20 percent reduction in FDI to Costa Rica originating from the U.S., GDP growth would be reduced by ½ percent over the medium term. The decline would take place gradually given the existing pipeline of FDI projects at different stages in the investment decision process. Simulations of a

---

<sup>6</sup> Auguste et al. (2015).

combined scenario with the same decline in FDI, increases in tariffs to WTO MFN levels, and a 50 basis points increase in the U.S. term premium (related to concerns about the U.S. fiscal position) would have a similar but more immediate negative impact on GDP growth of almost  $\frac{1}{2}$  percent. The impact would remain fairly constant over the medium-term, as the authorities would likely respond with an easier monetary stance than in the baseline scenario, thereby mitigating the impact of the combined external shock on growth through both lower policy rates and associated currency depreciation.



## D. Conclusions

**18. Uncertainties about U.S. policies weigh on the economic outlook for Central America, including Costa Rica.** Much will depend on the actual nature and extent of possible future changes to U.S. tax, trade and immigration policy, and financial and business regulations. These uncertainties create important spillovers and risks. Isolationist measures in the U.S. and retaliatory responses would lower global growth through reduced trade, migration, and cross-border investment flows. Risks from more protectionist trade policies are greater in Mexico and Central America. Possible policy changes include modifying some of the provisions of NAFTA, CAFTA-DR and other bilateral trade agreements—including by raising tariffs for imports of some manufactured goods from U.S. and companies operating in foreign countries. In addition, sharper than expected tightening of global financial conditions driven by substantial further strengthening of the U.S. dollar, a more rapid monetary policy normalization, or rising concerns about a weaker fiscal position in the U.S. could inflict significant damage on more financially integrated emerging markets. The FDI channel is the main risk for Costa Rica, though the country's open economy is also vulnerable to weaker global growth and to tighter global financial conditions, given its weak budgetary situation, bank reliance on foreign funding, and high credit dollarization.

## References

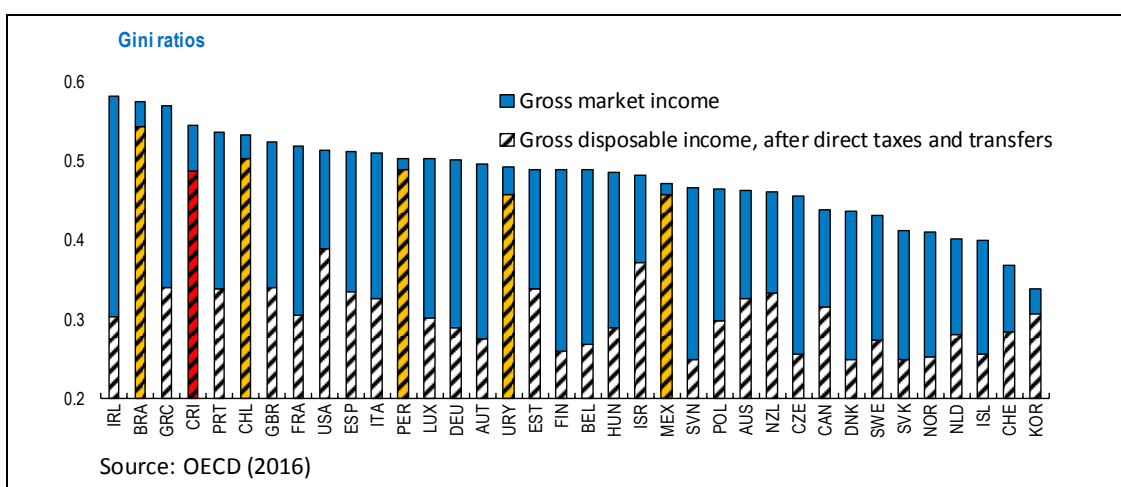
- Andrle, Michal and others, 2015, "The Flexible System of Global Models - FSGM", IMF Working Paper No. 15/64, Washington, D.C.
- Auguste, Sebastián, Mario Cuevas, and Osmel Manzano, 2015, Partners or Creditors? Attracting Foreign Investment and Productive Development to Central America and Dominican Republic, IDB.

## SELECTED FISCAL SECTOR ISSUES

### A. Distributional Impact of Tax Reforms<sup>1</sup>

*This note provides an assessment of the distributional impact of recent income tax and VAT reform proposals.<sup>2</sup> The main conclusions of the analysis are that proposed income tax and VAT reforms would contribute to reduce inequality and extreme poverty, though this would be conditional on smooth implementation of targeted transfers proposed as part of the VAT reform. The reduction in inequality would be greater under the main proposal with a higher marginal tax rate on higher income brackets, higher VAT rates, and larger share of population receiving proposed transfers.*

**1. Costa Rica has relatively high inequality of market income.** Costa Rica is an upper middle income country with low poverty levels by regional standards. However, inequality of market income, before taxes and transfers, is still high relative to OECD countries and to other more advanced countries in Latin America. In contrast with other countries in the region, inequality has increased since 2008, with rising public sector salaries—particularly of qualified workers in public agencies outside central government—making the largest contribution to this trend in recent years. The extent to which inequality is reduced through current tax and transfer policies is also limited in Costa Rica, reflecting both the country's relatively low tax pressure and relatively small cash transfers (OECD, 2016).<sup>3</sup>

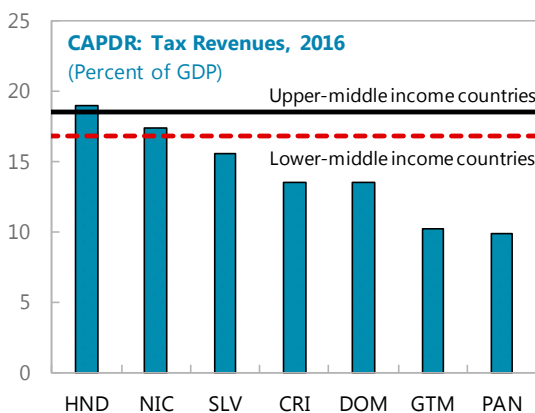


<sup>1</sup> Prepared by Valentina Flamini, Luis Ángel Oviedo, Jaime Puig, and Juan Diego Trejos.

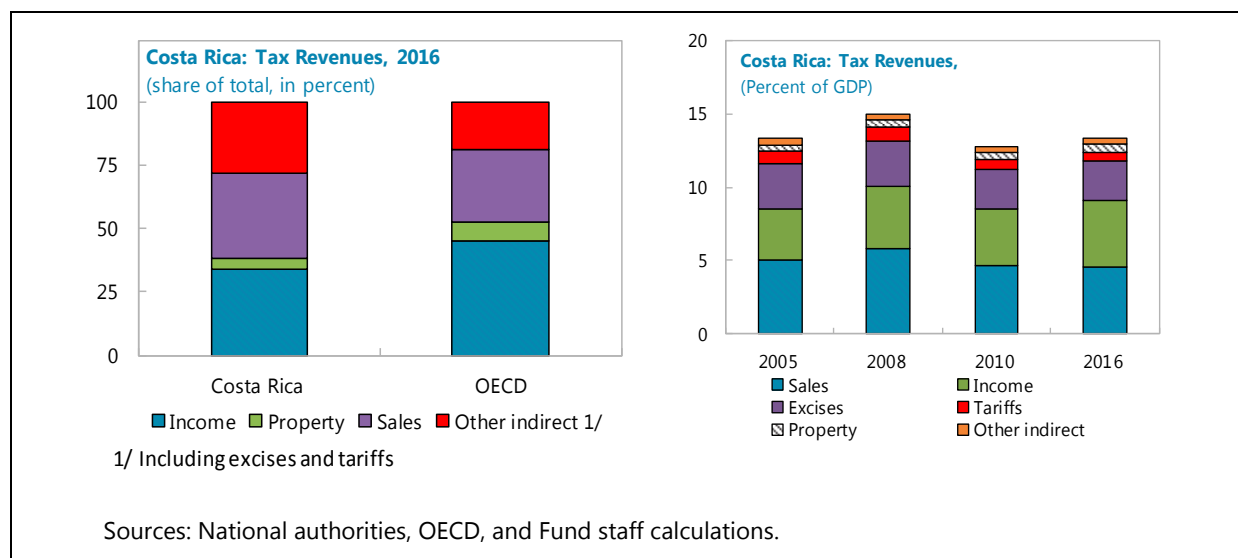
<sup>2</sup> This study is part of a collaborative effort between the IMF and the Commitment to Equity (CEQ) Institute. The CEQ project is an initiative of the Center for Inter-American Policy and Research (CIPR) and the Department of Economics, Tulane University, the Center for Global Development and the Inter-American Dialogue. For more details visit [www.commitmenttoequity.org](http://www.commitmenttoequity.org).

<sup>3</sup> Transfers in kind, including universal access to public education and healthcare services, make a much more significant contribution to reducing inequality in Costa Rica, but they are outside of the scope of the analysis in this note focused on the distributional impact of proposed income tax and VAT reforms combined with cash transfers.

**2. Costa Rica has relatively low taxation, with greater reliance on indirect taxes.** Like other countries in Central America, Costa Rica has a low ratio of tax revenues, at about 13 percent of GDP, compared to an average of about 19 percent in other upper-middle income countries. Also consistent with trends in the region,<sup>4</sup> the tax structure is biased toward indirect taxation, with the sales tax and other indirect taxes contributing over 60 percent of total tax revenue, compared to less than 50 percent on average in OECD countries. This share, however, has been declining steadily over the last decade—from a peak share of almost 75 percent in 2006. This is the result of both a decline in indirect taxation—driven by lower tariffs from gradual trade liberalization under CAFTA, as well as a decline in sales tax collections relative to GDP, possibly related to the greater contributions to growth from the exempted services sector—and an increase in direct taxation, mainly reflecting increased income tax collections efforts in recent years.



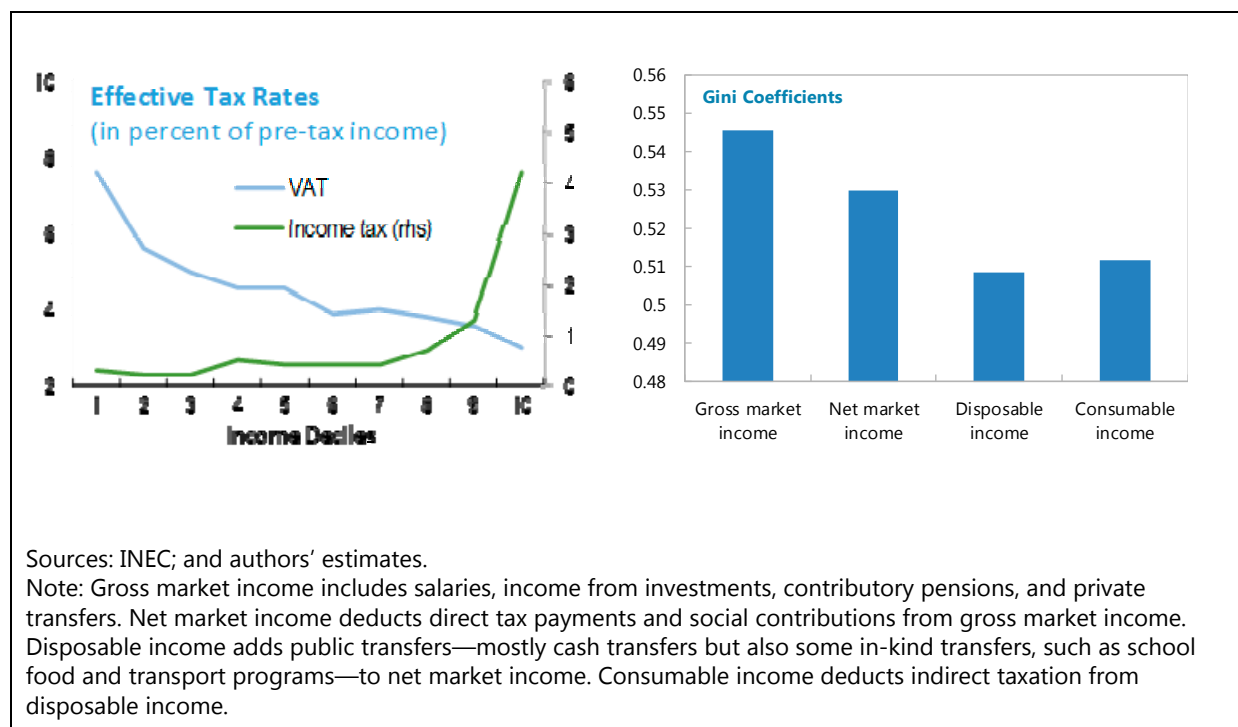
Source: WEO and Fund staff calculations.



**3. Costa Rica's tax system generally favors the middle class.** Greater reliance on indirect taxation in Latin America has negative implications for the progressivity of tax systems. In the case of Costa Rica, tax progression is U-shaped, with the lowest tax burden on the mid-section of the income distribution (Cubero and Vladkova Hollar, 2010). The strong concentration of income tax burden at the highest deciles of the income distribution is likely a reflection of the high tax-free threshold, at about two times the average wage in the private sector (OECD, 2016). As for the VAT,

<sup>4</sup> Cross-country comparisons of tax structures in Latin America are available in Cubero and Vladkova Hollar (2010).

in addition to the typical concentration of the tax burden—measured as taxes paid over pre-tax income—at the lowest deciles of the income distribution, the large basket of possibly poorly targeted basic goods and services could explain the comparatively low burden of VAT on the middle class. Overall, direct taxes and transfers have some limited impact on reducing inequality, which is not substantially reversed by indirect taxes. This reflects both the relative progressivity of fiscal provisions and their relatively small size by international standards.



#### 4. Tax reform proposals are aimed at increasing revenue collections without increasing inequality.

- The key elements of the main tax reform proposal are: i) conversion of the current sales tax into a VAT, widening its base to include services, and gradually increasing the tax rate to 15 percent;<sup>5</sup> while the exempted basic consumption basket would be drastically reduced, a new mechanism of targeted transfers would be introduced to compensate taxpayers in the lowest four deciles of the income distribution; and ii) introduction of new marginal tax rates of 20 and 25 percent on higher income brackets, elimination of exemptions on the 15 percent tax on income from investments, and introduction of a new capital gains tax at the same rate.<sup>6</sup>

<sup>5</sup> VAT simulations presented in this note look at the distributional impact once the transition to the 15 percent tax rate is completed.

<sup>6</sup> The distributional impact of the capital gains tax is not modelled in the simulations below due to lack of survey data on capital gains.

- The government has also presented an alternative tax proposal viewed as a second-best revenue mobilization option that it considers could have greater probability of Congressional approval ahead of the 2018 elections. The main differences in this alternative plan relative to the main proposal are: i) the absence of VAT rate increases, restriction of transfers to the first three deciles of the income distribution, and reduced VAT rates on private education and healthcare services mostly exempted in the original proposal; and ii) limiting the increase in marginal income tax rates to a new 20 percent rate, and reducing the tax rate on income from investments and on capital gains to 12 percent.

## **5. The impact of proposed reforms can be assessed with simulations based on household survey data.**

The simulations presented in this note are based on data from the household survey carried out by the *Instituto Nacional de Estadística y Censos* (INEC) in 2013. The analysis is static, reflecting the estimated impact of amendments to income tax and VAT provisions without any assumptions about possible dynamic adjustments in tax payers' behavior in response to the reforms. The simulations also assume full compliance of new tax obligations and perfect targeting of transfers aimed at mitigating the impact of VAT payments on lower income households.<sup>7</sup> While income and direct taxation are simulated at the individual level given the schedular nature of income tax in Costa Rica, expenditures and related indirect taxation are simulated at the household level. The distributional impact of tax reforms is assessed by looking at changes in the income distribution caused by the per capita impact of reforms. The key measure is the difference between estimated Gini coefficients for relevant income definitions before and after the reforms.<sup>8</sup> The impact on poverty is assessed based on national poverty lines by region estimated by INEC, with national averages of \$7 and \$3 of daily per capita income for poverty and extreme poverty respectively.

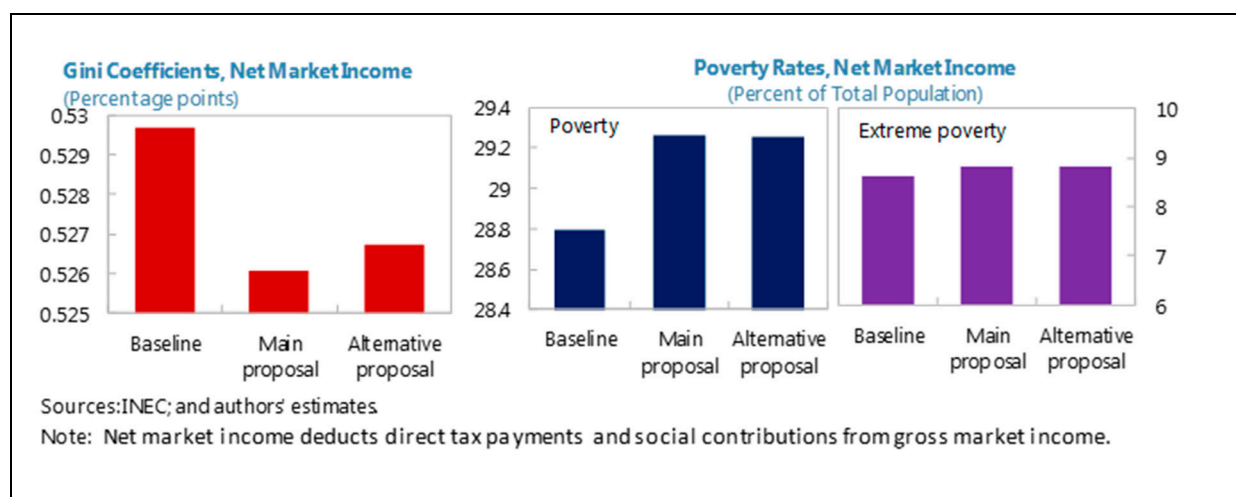
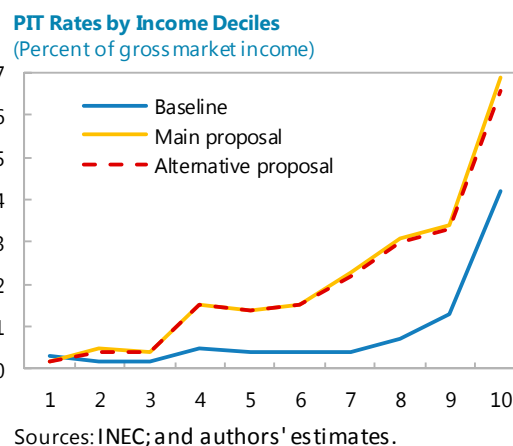
## **6. The proposed reforms of Personal Income Taxes (PIT) would decrease the inequality of income distribution.**

To evaluate the distributional impact of the PIT reform, we compare Gini coefficients under the baseline Net Market Income (NIM) with those under the two reform proposals. The Gini coefficient decreases compared to the baseline under both reform scenarios—pointing to a more equal distribution of income after the reforms—but to a bigger extent under the main proposal. Intuitively, this result is due to the introduction of the new marginal rates on higher income brackets under the main proposal, and the limitation to only one additional bracket under the alternative. Overall, the reform scenarios increase the average PIT rate from 2.2 percent under the current system to 4.3 and 4.1 percent respectively under the main and alternative scenarios, by reducing rates at the bottom decile, and increasing them in the rest of the income distribution, with the main increases concentrated in the 7<sup>th</sup> and 8<sup>th</sup> income deciles.

<sup>7</sup> The assumption about tax compliance implies a possible bias toward assessment of less progressivity/more regressivity of tax reforms if informality and tax evasion are greater among taxpayers at the lower end of the income distribution. The assumption about perfect targeting of transfers could be subject to biases in both directions depending on extent of errors of inclusions and exclusion in the transfers system.

<sup>8</sup> The relevant income definitions are net market income for income tax reforms and post-fiscal income for VAT reforms.

**7. However, poverty could marginally increase.** The incidence of poverty measured on NMI following the reform would marginally increase from 28.8 percent to 29.3 percent under both scenarios, and extreme poverty would also rise from 8.6 to 8.8. Such increases are largely due to the generalization of the tax on investment income, but are also partially attributable to our estimation method, as we use actual tax collections under the baseline and theoretical payments under the reform scenarios. The latter may overestimate payments by not taking into account tax evasion or avoidance that can be widespread at the very bottom of the income distribution. Theoretical tax payments are also attributed to individuals by source of income without controlling for the composition of the households, thus not incorporating the small deduction for each dependent—a factor which is particularly relevant at the bottom of the income distribution where the household size and number of dependents tend to be higher. Hence the poverty increases under the reform scenarios are likely to be overstated.



**8. Absent the envisioned mitigating measures, the VAT reform would worsen the progressivity of indirect taxation.** From a distributional perspective, indirect taxation is generally regressive. The conversion of the current sale tax into a VAT would worsen the distributional impact of indirect taxation by widening its base to include services under both proposals, and gradually increasing the tax rate to 15 percent under the main plan. The average VAT rate as a share of gross market income would increase from 3.6 percent in the baseline, to 6.4 and 5.9 percent in the main and alternative reform scenarios respectively. Although the total amount collected would be largely paid by high income households (over 60 percent of the total amount collected contributed by the top three deciles) due to their absolute higher consumption, the relative rate increase would be particularly high at the bottom of the income distribution, where consumption accounts for most of

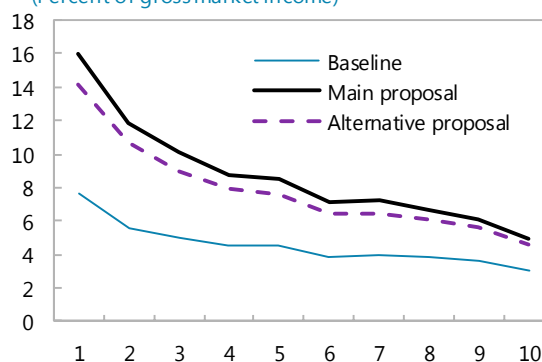
income, with the first income decile paying 16 and 14.2 percent of gross income under the main and alternative reform scenario, compared to 7.6 in the baseline.

**9. Income inequality and poverty would increase accordingly, if compensation is not provided to poor households.** The cumulative

distributional impact of the income and VAT reforms can be measured by comparing Gini coefficients for consumable income (CI, which adds public transfers and deducts indirect taxation from NMI) net of the proposed VAT refunds.<sup>9</sup>

These coefficients would marginally increase under both reforms scenarios compared to the baseline (from 0.5118 to 0.5134 and 0.5124 under the main and alternative proposals respectively), more so under the main reform plan due to the higher rate absent in the alternative one. Poverty and extreme poverty measured on CI net of VAT refunds would also worsen as the purchasing power of households in the bottom deciles is eroded by the tax, with the share of generally (extreme) poor people increasing by 3.2 (1.5) and 2.6 (1.3) percent of the total population under the main and alternative plan respectively.

**VAT Rates by Income Deciles**  
(Percent of gross market income)



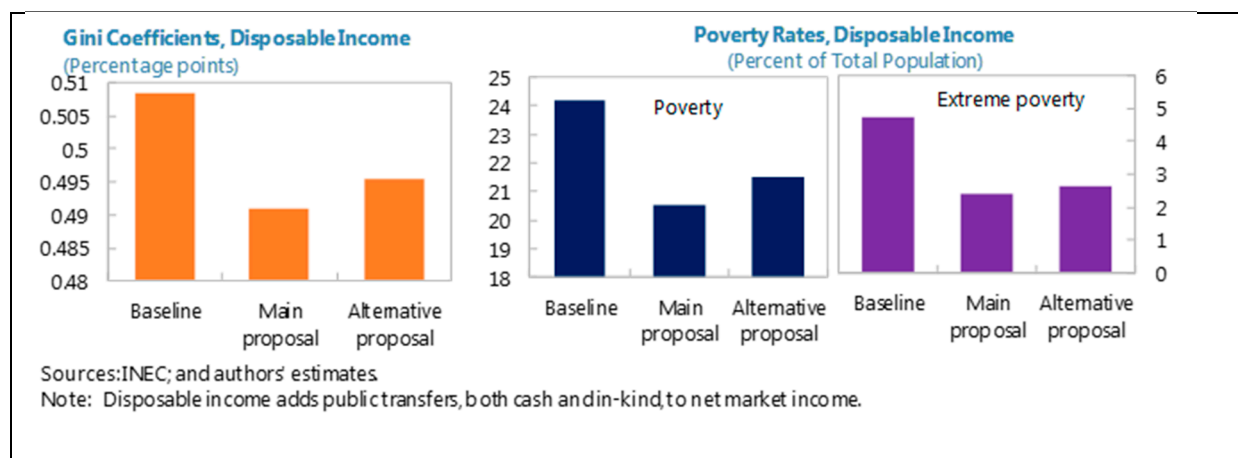
Sources: INEC; and authors' estimates.

**10. However, the VAT refunds to lower incomes largely offset the VAT impact on income distribution.** Both reform scenarios envisage a system of public transfers to compensate poor households for VAT payments. Such transfers would be distributed to the bottom 40 and 30 percent of the population under the main and alternative reform plans respectively. According to both proposals, all beneficiaries would receive the average amount spent by individuals in the second and third income deciles, resulting in over- and under- compensation in the first and fourth deciles respectively. Our estimates assume perfect targeting of such transfers—without errors of inclusions and exclusion—and do not discount the administrative cost of their distribution, hence they show the maximum potential redistributive effect of the refunds.

**11. As a result, disposable income inequality would substantially fall and so would poverty.** The Gini for disposable income (DI, which adds government transfers to NMI) decrease substantially under the reform scenarios compared to the baseline, and so do poverty and extreme poverty. In particular, poverty measured on DI would fall from 24.2 percent in the baseline to 20.6 percent according to the main proposal, and extreme poverty would almost halve from 4.7 to 2.4 percent of population. This suggest that the cumulative effect of the PIT reform and VAT refunds

<sup>9</sup> Technically, the CI also includes the effect of government transfers other than VAT refunds, and other direct and indirect taxation, in both the baseline and reforms scenarios. However, as these components are not changed under the reforms, they do not bias the comparison.

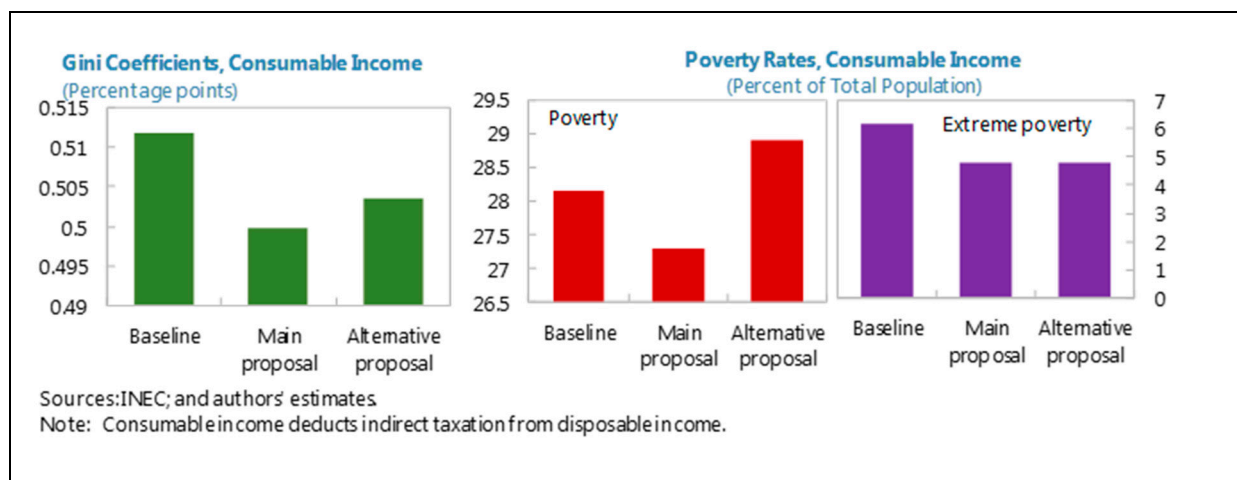
would be highly progressive and poverty reducing under both proposals, although to a lesser extent under the alternative one.<sup>10</sup>



**12. Overall the proposed reforms would improve the progressivity of the Costa Rican tax system and reduce income inequality, beside increasing tax revenues.** The overall effect of the reform can be assessed by looking at the distribution of CI including the effect of VAT refunds, which were netted out to analyze the impact of the VAT reform alone. When looking at the overall CI, the Gini coefficient would fall from 0.51 in the baseline, to 0.49 and 0.5 under the main and alternative proposals respectively, suggesting that the progressivity of the VAT refund more than offsets the regressivity of the “core” VAT reform. This means that both proposals would increase the progressivity of the system and reduce income inequality while at the same time providing much needed tax revenues to the government.

**13. Although extreme poverty is reduced under both reform scenarios, overall poverty decreases under the main proposal, but not under the alternative one.** The tax reform would decrease extreme poverty from 6.2 to 4.8 percent of the population, under both plans. Overall poverty measured on CI, however, would fall from 28.2 in the baseline to 27.3 under the main proposal, but slightly increase to 28.9 under the alternative proposal. Hence, the alternative proposal would result in lower government revenues, a smaller decrease in income inequality compared to the main reform plan, and an absolute increase in overall poverty.

<sup>10</sup> Although VAT refunds are conceived to compensate households from the erosion of purchasing power caused by the VAT, from an income classification perspective, they are transferred to households before the latter spend the corresponding amount of disposable income in consumption. Hence, DI incorporates the redistributive effect of the PIT reform and VAT refunds, while CI net of VAT refunds show the effect of PIT and VAT reforms.



## B. Efficiency of Public Expenditure<sup>11</sup>

*This note provides an assessment of the efficiency of public expenditure in Costa Rica.<sup>12</sup> The main conclusion regarding economic classification of expenditure is that containment of salary increases in the public sector could support needed consolidation efforts and rebalancing of expenditure toward capital investment over the medium-term. From a functional perspective, efficiency of expenditure in the education and healthcare sectors are critical given their large share in the budget. Increased focus on raising the efficiency, rather than the level, of expenditure on education would be critical to achieve higher educational outcomes and further enhance the economy's growth potential. While efficiency of expenditure on healthcare appears high, continued gains will also be important given long-term pressures from aging trends. The authorities should take advantage of the upcoming Public Expenditure Review by the World Bank to make advances in these areas.*

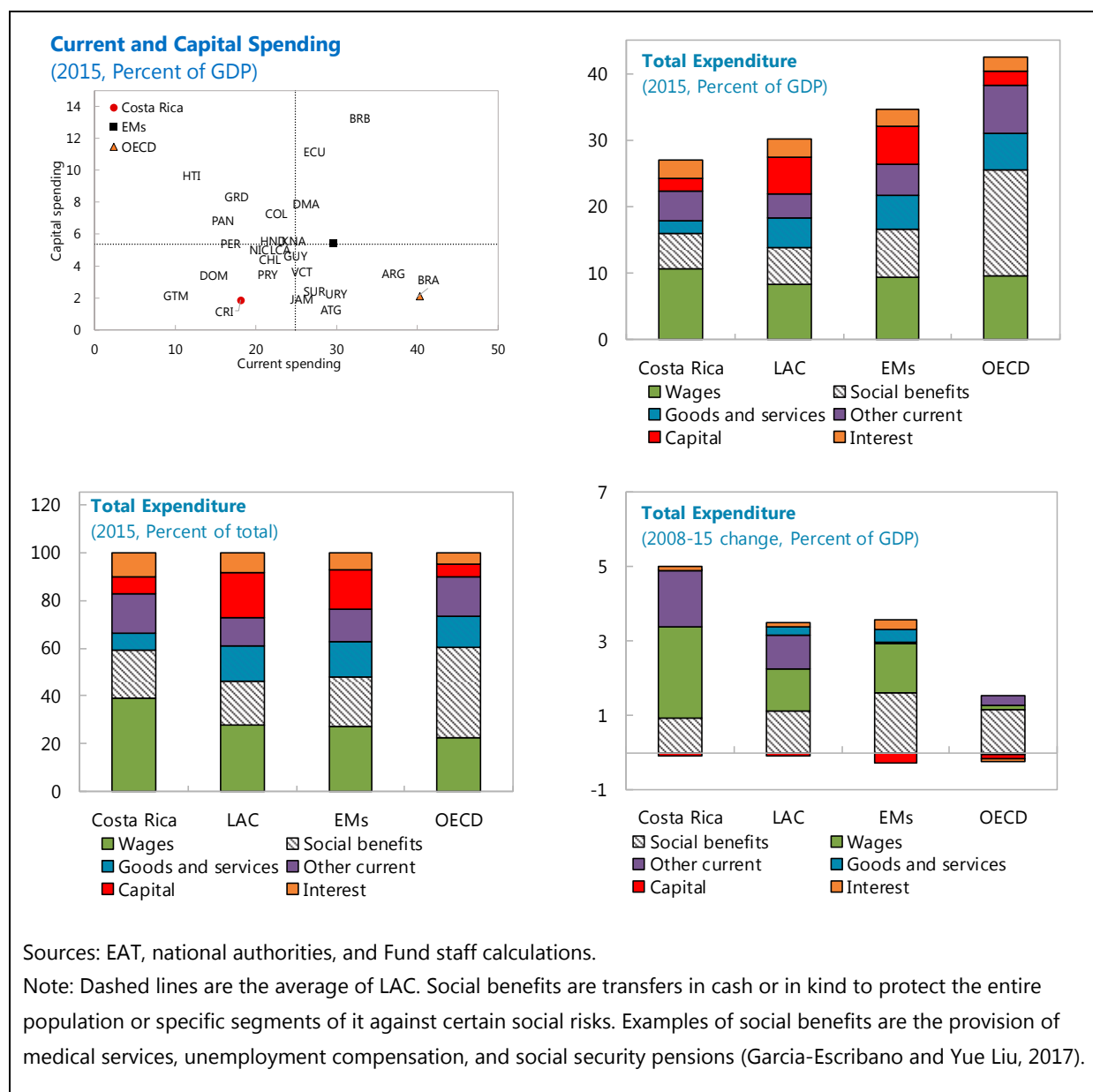
**14. Public spending is low by international standards, but has increased sharply in recent years, especially the wage bill.** Costa Rica has a low level of public spending as a share of GDP. Capital spending in particular is one of the lowest in Latin America, highlighting the need to allow some room for increases in public investment in any fiscal consolidation plan aimed at ensuring fiscal sustainability.<sup>13</sup> The economic classification of expenditure shows that the wage bill is high by international standards, both in percent of GDP and as a share of total expenditure—almost 40 percent of the total, compared to less than 30 percent in emerging markets and Latin America in particular, and to just over 20 percent in OECD countries. This was aggravated by the counter-

<sup>11</sup> Prepared by Jaume Puig.

<sup>12</sup> The analysis is based mainly on cross-country comparisons of expenditure levels and measures of efficiency relative to key policy outcomes available from the Expenditure Assessment Tool (EAT) developed by the IMF's Fiscal Affairs Department. The tool focuses on expenditure at the general government level as reported in the IMF's WEO. Expenditures of the social security administrator, which are typically included in general government but are not part of the data reported in the WEO for Costa Rica, have also been included in the analysis.

<sup>13</sup> Efficiency aspects of public capital expenditure are covered in AN IV on addressing infrastructure bottlenecks to boost competitiveness.

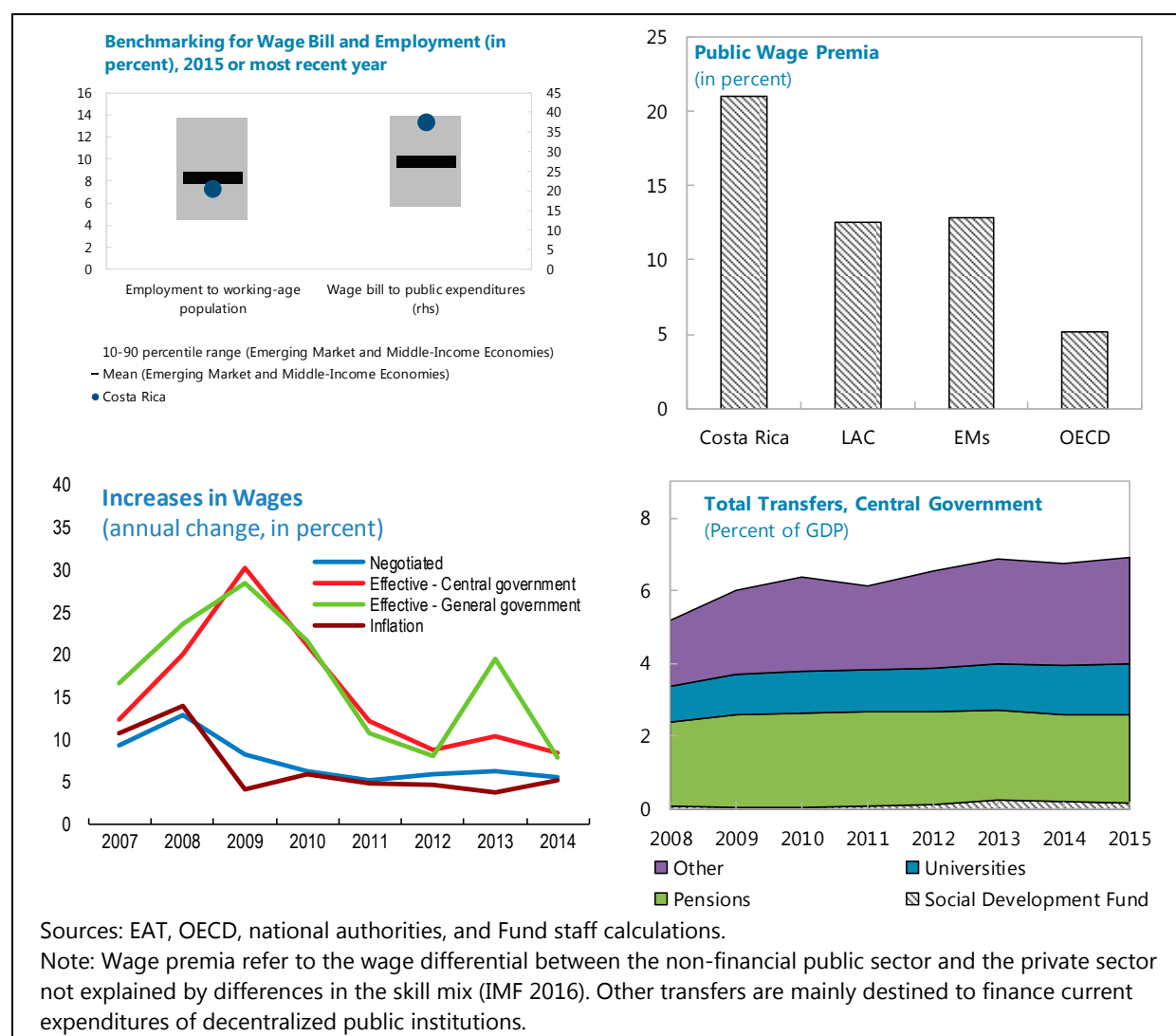
cyclical response of expenditure policy to the onset of the global financial crisis. In addition to being significantly more pronounced than in other countries in LAC and other regions, the stimulus was focused to a much larger extent on expanding the wage bill to the detriment of social benefits.<sup>14</sup>



**15. International comparisons suggest scope to contain wages in the public sector while still attracting highly qualified employees needed to deliver high quality public services.** While the share of the public sector in total employment is in line with other emerging market countries, the share of the wage bill in total public expenditure is comparatively high. The large wage premium

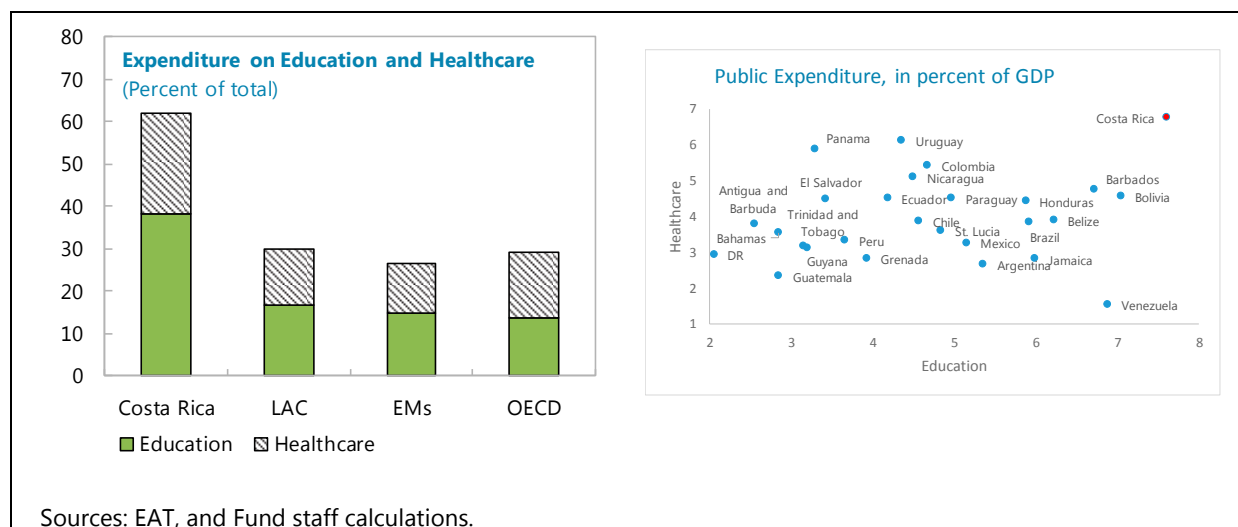
<sup>14</sup> The also comparatively high increase in other current expenditures since 2008 was mostly driven by current transfers to decentralized institutions, which are in a significant part also destined to pay salaries.

paid in the public sector relative to employees in the private sector with similar skills suggests significant scope to contain wage growth in the public sector without negatively affecting policy outcomes due to the loss of skilled labor to the private sector. Rationalization of public compensation bonus schemes that have contributed to total salary increases well above inflation could be particularly important. Increases in salaries in other decentralized entities of the public sector that finance part of their current expenditures with transfers from the central government (CG) have also contributed to the deterioration in the fiscal situation since the global financial crisis. Going forward, savings in the public-sector wage bill would be important to support needed consolidation efforts and rebalancing of expenditure toward capital investment over the medium.



**16. Efficiency of expenditure in the education and healthcare sectors are critical given their large share in the budget.** From a functional perspective, Costa Rica's budget is dominated by expenditures in the education and healthcare sectors. Expenditure on these two sectors represents over sixty percent of the total budget, more than double the share in emerging markets and the OECD on average. Within Latin American, Costa Rica has the largest expenditures on both

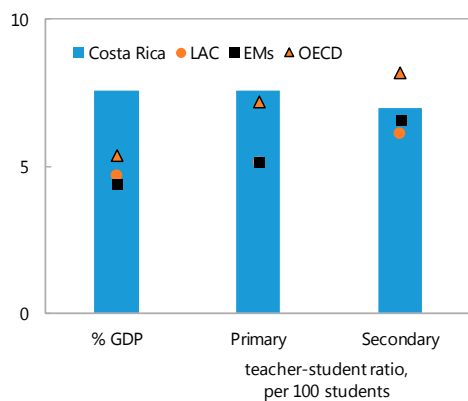
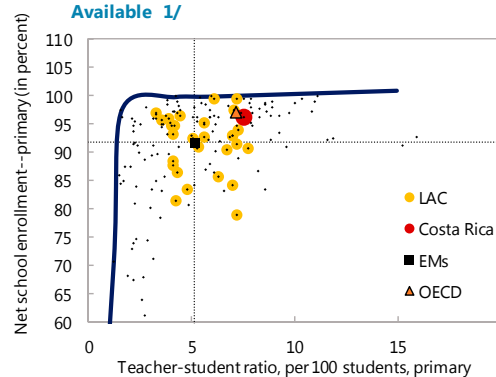
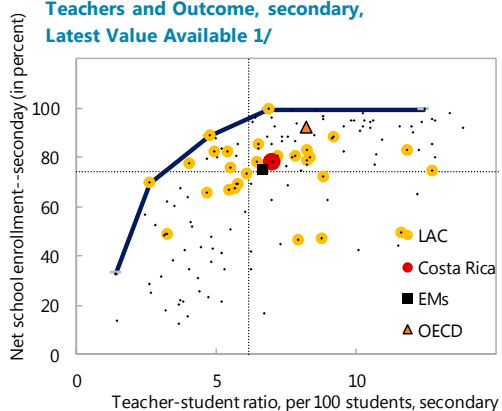
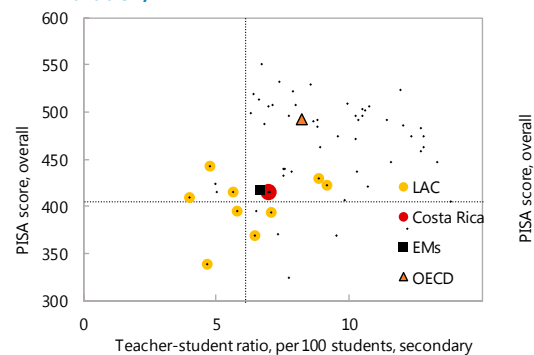
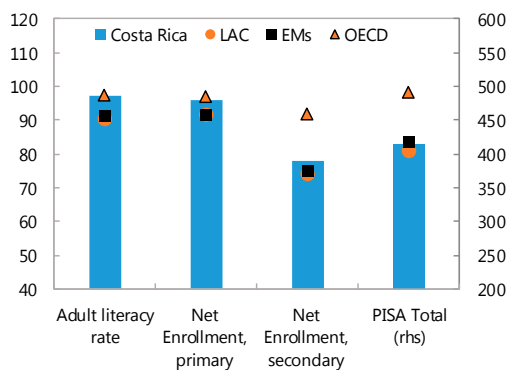
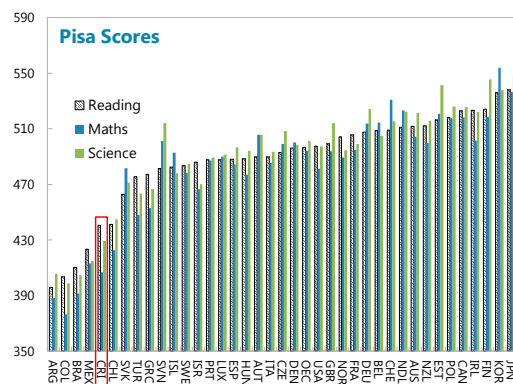
education and healthcare as a share of GDP.<sup>15</sup> Attaining efficiency gains in these sectors could yield potentially large benefits in terms of expenditure rationalization over the long-term. This note focuses on benchmarks of spending levels and composition against comparators, as well as a high-level assessment of spending relative to outcomes to get a sense of spending efficiency. The authorities should take advantage of the detailed recommendations from the upcoming Public Expenditure Review of the World Bank to increase efficiency in these key sectors.



## 17. Education outcomes do not reflect the high level of public spending on education.

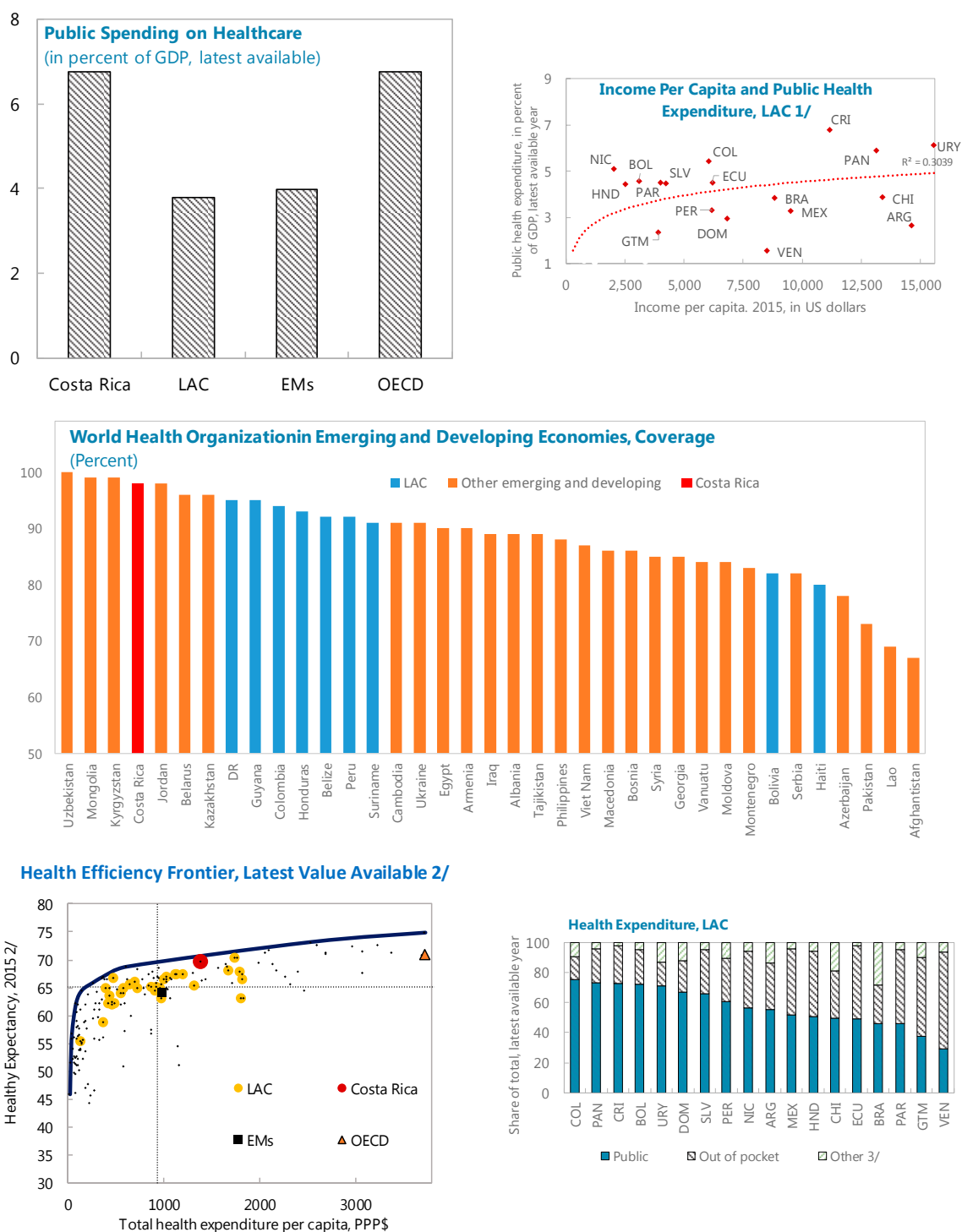
Notwithstanding the country's high expenditure on education, only behind Denmark and Sweden among advanced economies, education outcomes are not significantly better than in other emerging markets. In secondary school, teacher-student ratios are only slightly higher than the average in emerging markets, pointing to relatively elevated salaries of teachers by international standards. Regarding policy outcomes, while school enrollment ratios in primary education are in line with OECD countries, they are not significantly higher than in other emerging markets in secondary school. OECD standardized test (PISA) scores for secondary school students are also broadly consistent with those of other emerging markets that spend much less on education, suggesting significant scope for improving efficiency. Scores are well below those of advanced economies consistently for PISA tests on reading, math, and science. In terms of policy recommendations, the authorities should move away from an exclusive emphasis on increasing spending toward establishing better educational outcomes as the main policy target. Specific recommendations made by the OECD in the context of the evaluation for accession included improving evaluation mechanisms and enhancing accountability for teachers, as well as improving their professional development and harmonizing their qualifications. Reinforcing the vocational technical track would also contribute to reduce drop-outs at secondary level and tackle high youth unemployment (OECD, 2016).

<sup>15</sup> Long-term fiscal sustainability of healthcare spending is covered as part of the analysis of the long-term fiscal implications of aging in Section C of this note.

**Figure 1. Costa Rica: Education Spending and Outcomes****Government Education Expenditure,  
Latest Value Available****Teachers and Outcome, primary, Latest Value Available 1/****Teachers and Outcome, secondary, Latest Value Available 1/****Teachers and Outcome, secondary, Latest Value Available 1/****Education Indicators, Latest Value Available****Pisa Scores**

Sources: EAT, OECD, and Fund staff calculations.  
1/ Dashlines are the average of LAC.

**18. The scope for early gains in efficiency appear much more limited in the healthcare sector.** Public spending on healthcare as a share of GDP is high relative to the country's level of development, significantly higher than the average for emerging markets, and also higher than in richer countries in the region like Chile, Uruguay, and Mexico. Efficiency of public spending on healthcare also appears to be elevated, with near universal coverage and health outcomes close to OECD levels despite significantly lower total health expenditure per capita. These favorable outcomes are not explained by significant additional private sources of health spending, as Costa Rica has one of the lowest shares of out-of-pocket and other private health expenditures in the region. Notwithstanding this favorable assessment, with Costa Rica being one of the countries in the region where population aging is more advanced, health expenditures are projected to double over the next 50 years if universal access and current service levels are to be maintained (Section C). This highlights the need for measures to gradually increase efficiency. OECD recommendations include updating information systems to better monitor performance indicators, forward-looking allocation of resources that considers changing demographic patterns and disease trends, and introducing diagnosis-related funding schemes that provide stronger incentives to control spending than fee-for-service schemes that can result in service oversupply (OECD, 2016).

**Figure 2. Costa Rica: Health Spending and Deficiency**

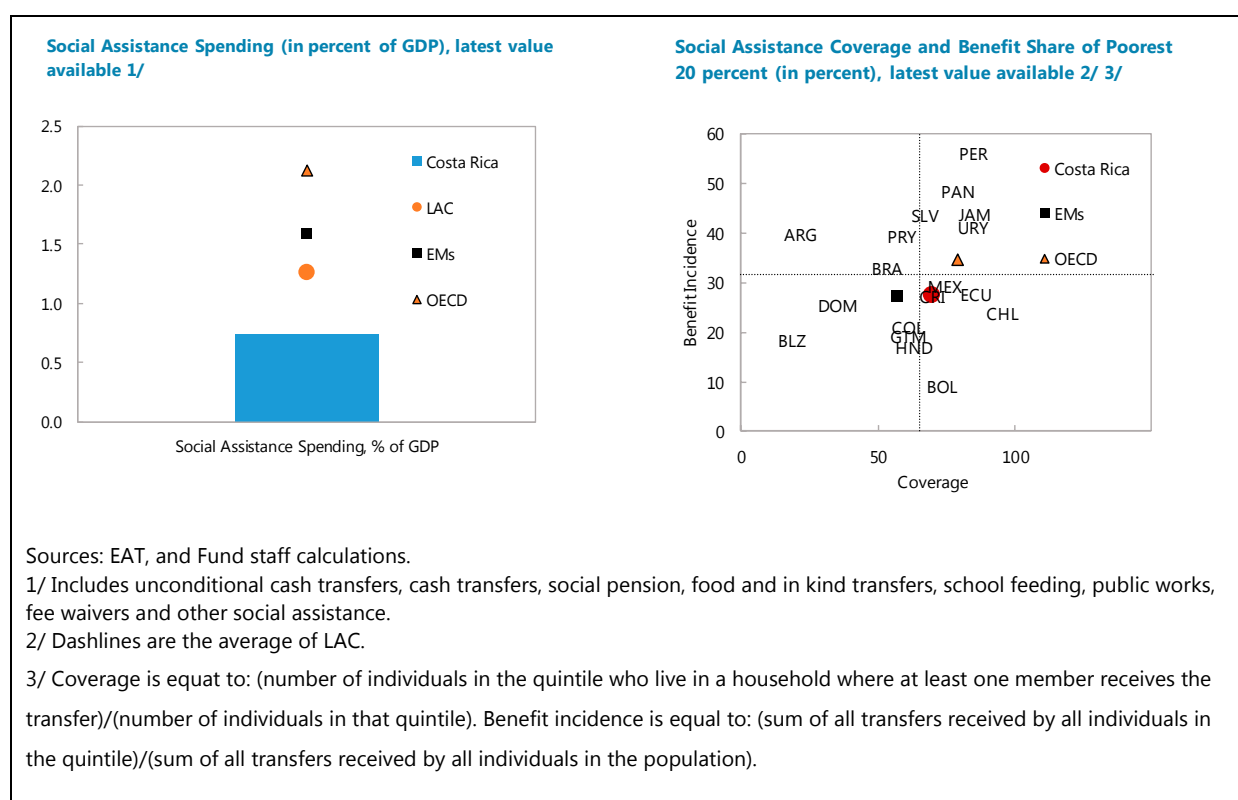
Sources: EAT, WEO, World Health Organization, and Fund staff calculations.

1/ Trendline based on worldwide distribution of countries.

2/ Dashlines are the average of LAC.

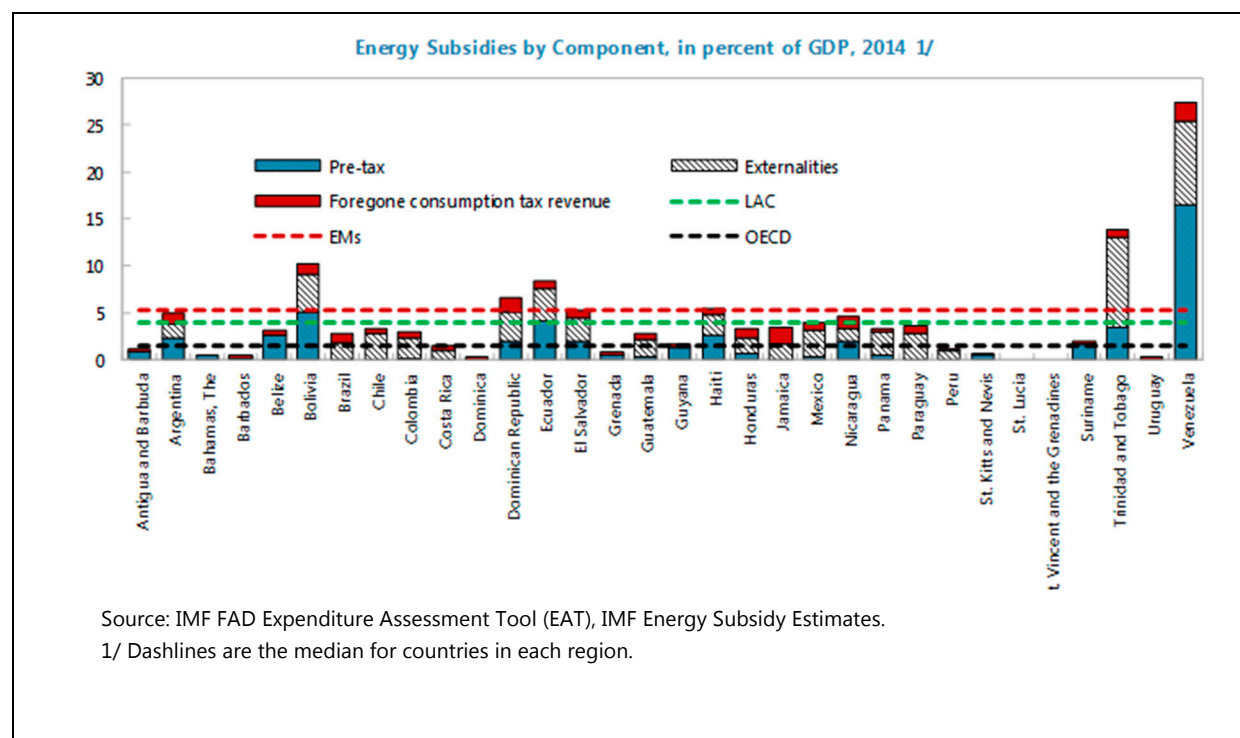
3/ Includes expenditures covered by private plans and the non-profit sector.

**19. Expenditure on social protection is relatively low, reflecting the country's low poverty levels and universal coverage of basic services by the public sector.** Transfers directly aimed at alleviating poverty and addressing income inequalities are comparatively low in Costa Rica, at  $\frac{3}{4}$  percent of GDP, about half the average in emerging markets. This is likely a reflection of Costa Rica's relatively low poverty levels—22 percent of the population as of 2015—as well as its social model aspiring to universal coverage in the education and healthcare sectors, which reduces the need for large social assistance spending. The OECD finds that benefits in the form of healthcare and education services provided by the state reduce inequality, as measured by the Gini coefficient, by almost one-fourth, a larger reduction than in other Latin America countries covered in the analysis (OECD, 2016). Efficiency of expenditure on social protection spending, as measured by the extent of targeting of lower income households achieved, is close to the average in other emerging and OECD countries.



**20. The absence of subsidies to energy avoids a typical drag on expenditure efficiency in some other countries in the region.** Movements in international oil prices are automatically passed through to domestic petroleum product prices, avoiding the use of government subsidies to cushion the impact on consumers that produce fiscal costs, economic inefficiencies, and environmental damages in some other countries in the region. Implicit post-tax subsidies from foregone consumption tax—as petroleum products are taxed at lower rates than other consumption products—and estimated externalities on the environment are also fairly low, in line with the OECD average and consistent with the country's environment-friendly policies (AN V). At the same time, efficiency could be enhanced by replacing cross-subsidization of lower-income households (through

exemptions from VAT for low residential consumption customers) with more transparent targeted social transfers.



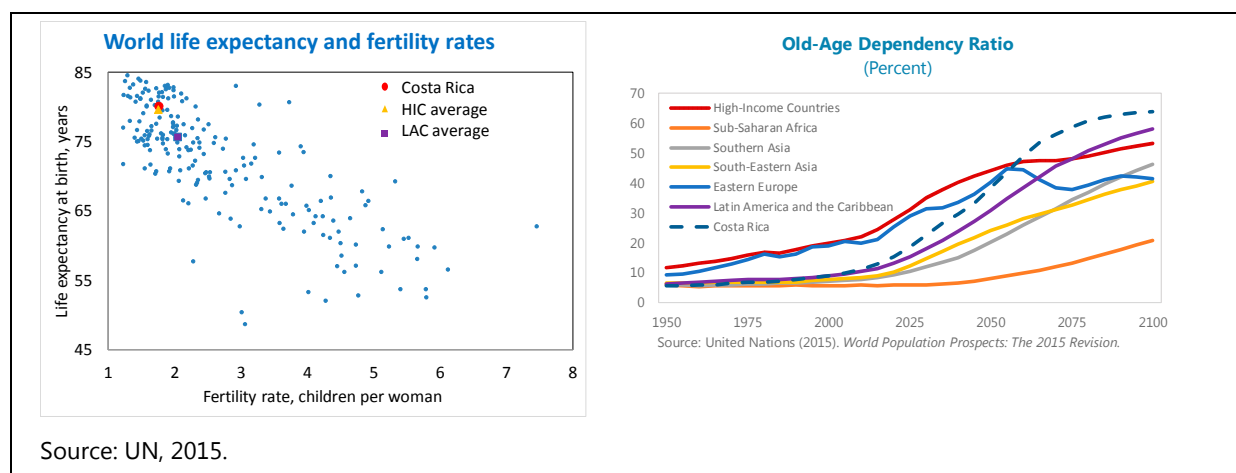
## C. Long-term Fiscal Gaps from Population Aging<sup>16</sup>

*This note estimates the fiscal costs of population aging in Costa Rica and provides recommended reforms to make these costs manageable. The main finding is that demographic trends make Costa Rica one of the region's most vulnerable countries to long-term fiscal pressures from population aging. Under current policies, expenditure on pensions and healthcare would reach 16 and 25 percent of GDP respectively by 2100, generating one of the largest long-term fiscal gaps in the region. As indicated in the recent independent actuarial report, significant parametric reforms will be needed in the PAYG pension system to meet the objectives of maximizing coverage, while maintaining socially acceptable benefits and preventing at the same time the emergence of large long-term fiscal gaps. Stricter budget controls and improved incentives systems are also required to contain healthcare spending growth while preserving access to high-quality healthcare.*

**21. Costa Rica is one of the countries of Latin America with more advanced population aging.** Costa Rica's fertility and life expectancy are broadly in line with the averages for high income countries (HIC), and significantly below and above, respectively, Latin American averages. While the share of the old in total population is currently similar to the average in Latin America, it is expected to rise sharply over the long-term, surpassing the average for HICs from 2060, according to the

<sup>16</sup> Prepared by Jaume Puig, based on a study of long-term fiscal gaps in Latin America and the Caribbean by a team led by Lorenzo Figlioli.

United Nations' long-term population projections. This will directly affect fiscal sustainability by putting pressure on public pension and healthcare systems.



**22. The main purpose of this note is to quantify the long-term fiscal gaps from population aging by projecting public expenditure on pensions and healthcare.** These projections can be produced through a stylized exercise that requires limited parametrization, based on country-specific system characteristics. The exercise draws on demographic projections from the United Nations and methodologies developed by the IMF (Clemens et al, 2015) to derive spending projections. Notwithstanding the large uncertainties surrounding these long-term projections, they provide a useful basis for the necessary discussion on the fiscal implications of population ageing based on a consistent analytical framework across countries.

- Pension expenditures are projected based on the following identity:

$$\frac{PE}{GDP} = \frac{\text{population 65+}}{\text{population 15-64}} \cdot \frac{\text{pensioners}}{\text{population 65+}} \cdot \frac{\text{average pension}}{\text{average wage}} \cdot \frac{\text{population 15-64}}{\text{workers}} \cdot \frac{\text{labor income}}{GDP}$$

Old-age dependency ratio      Elderly coverage ratio      Replacement rate      Inverse employment ratio      Labor share of GDP

where  $PE/GDP$  denotes the ratio of pension spending to GDP, *population 65+* is the population aged 65 years or older, and *population 15 – 64* is the population between ages of 15 and 64. The employment ratio (labor force participation) and the labor income share of GDP are typically assumed to be constant over time. Hence, future pension spending growth is essentially determined by parametric changes in the system (that is, changes in the elderly coverage ratio or the replacement rate) and demographic changes captured by the old-age dependency ratio.

- Health expenditures are computed using the following formula:

$$\frac{HE_t}{GDP_t} = \left( \sum_i Population_{i,t} \cdot \frac{\frac{HE_{i,t}}{Population_{i,t}}}{\frac{HE_{ref,t}}{Population_{ref,t}}} \right) \cdot \underbrace{\frac{HE_0}{GDP_0}}_{\text{Generosity of current health system}} \cdot (1 + excess\_cost\_growth)^t$$

Age spending profile

where  $HE_t$  denote public health expenditures to GDP at time  $t$ , the subscript  $i$  corresponds to the specific age-group  $i$ , and the  $ref$  subscript indicates the age-group used as reference to compute the age-spending profile (assumed to be the 40–44-year group),  $excess\_cost\_growth$  represents the excess growth in health spending in real per capita terms over real GDP per capita not due to demographic changes, for instance due to costly medical innovation. This is assumed to be constant over time and equal to 1 percent based on historical trends in advanced economies, which in many cases already had universal coverage like Costa Rica (IMF, 2012). Population aging affects the first term of the product as the population in older age groups, for which health spending per capita is higher relatively to the health spending per capita in the reference group, increases compared to the population in younger groups.

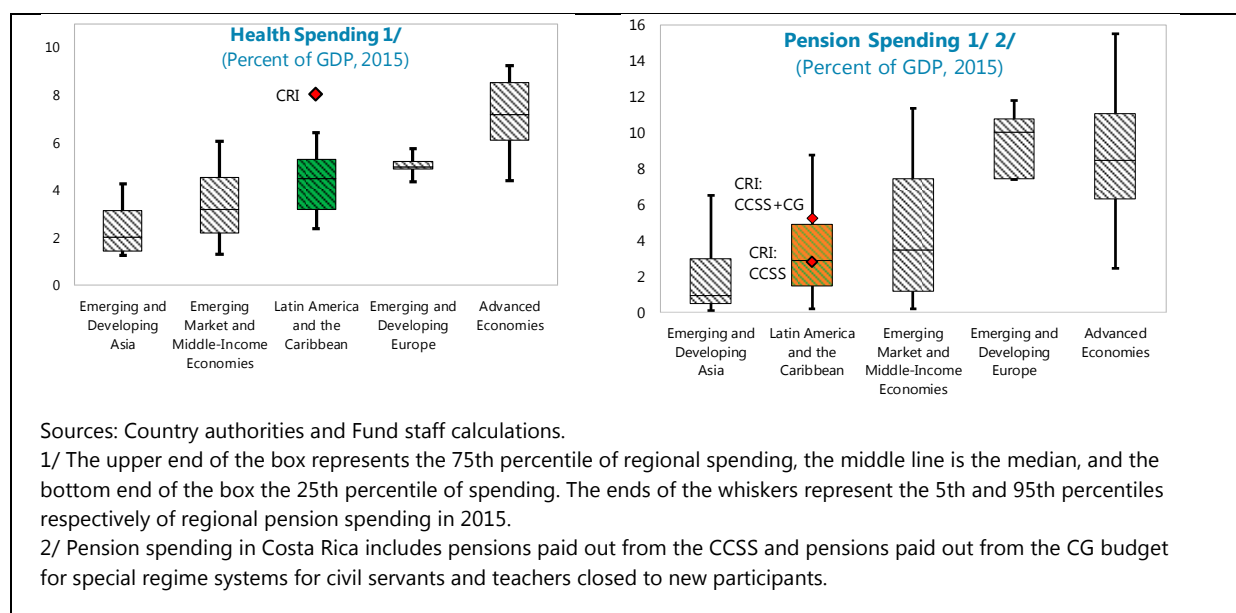
- Long-term fiscal gaps can in most countries be measured by the present discounted value (PDV) of projected government pension spending increases, assuming constant revenue ratio to GDP. In the case of Costa Rica, given already approved increases in the contribution rate for the main pay-as-you-go (PAYG) system, from current 8.5 percent rate to 10.5 percent by 2035, the PDV of projected pension system deficits provided a more accurate measure of long-term fiscal gaps.<sup>17</sup>

### 23. Age-related public spending is already high by regional standards reflecting legacy costs from closed pension systems in the public sector and universal coverage in healthcare.

Despite having an old age dependency ratio broadly in line with the regional average, Costa Rica already ranks high in regional comparisons of expenditure on pensions and especially healthcare, the latter reflecting the universal coverage and high expenditure per capita identified in Section B. Regarding pensions, those paid out of the main PAYG pension system for private sector and active public sector workers administered by the *Caja Costarricense de Seguridad Social* (CCSS) are about 2¾ percent of GDP,<sup>18</sup> in line with current median pension expenditure levels in the region. However, total pension payments are almost double, nearing the 75<sup>th</sup> percentile in the region at 5¼ percent of GDP, including pensions paid out of the CG budget under special regimes for civil servants and teachers that have been closed to new participants since 1992. Costa Rica also has a mandatory individually funded pillar that was introduced in 2000.

<sup>17</sup> The exercise presented in this note does not include the impact of the recent decision to accelerate the pace of increases in the PAYG contribution rate, with an increase to 9.5 percent starting from June 2017, compared to previously approved increases of 0.5 percentage points every five years starting in 2020. The impact of this measure is limited relative to the size of the long-term fiscal gaps estimated below.

<sup>18</sup> This includes expenditure on non-contributory pensions of about ¼ percent of GDP, financed by transfers from the CG and public enterprises.



**24. The analysis in the remainder of this note focuses on long-term fiscal gaps from the main PAYG pension system and from the healthcare system that will be the main sources of long-term pension spending pressures.**

- Given an average age of participants of 62 years, expenditures on the special regimes covered by the budget are expected to gradually decline over the long-term and are therefore less relevant for the main exercise in this note, focused on potential contingent liabilities from increases in ageing pressures over the long-term, and related parametric reforms needed to contain these risks.
- In principle contingent fiscal liabilities could eventually arise in countries with low coverage and defined contributions pillars generating replacement rates below socially acceptable levels. In these countries, advised reforms would go in the direction of increasing coverage and benefits, with contribution rates also adjusted as needed to support these objectives. But this is not the case in Costa Rica, where coverage is already relatively high and combined projected replacement rates of the PAYG and the individually funded pillars are almost 80 percent of earnings, significantly above the regional and OECD averages.<sup>19</sup>

<sup>19</sup> Projected gross replacement rates are theoretical estimates based on a specific set of assumptions, including 100 percent contribution density. Actual replacement rates in all countries are lower, around 65 percent in Costa Rica reflecting actual contribution density closer to 75 percent.

- Therefore, our analysis of long-term gaps from pensions in the case of Costa Rica focuses on the main PAYG pension system administered by the CCSS where large fiscal gaps would emerge under current policies and projected demographic trends.<sup>20</sup> Despite low contribution rates of 8½ percent of earnings, compared to average of almost 15 and 20 in LAC and the OECD respectively, the PAYG system is currently still in surplus, with accumulated reserves of about 6½ percent of GDP. The current level of pension expenditures in line with the median regional level reflects the combination of a relatively low replacement rate compared to other regional PAYG systems—though still high by regional standards—and a desirable relatively high passive coverage among the current retirement-age population. This is projected to increase further over the long-term, following the significant welcome increase in active coverage during the last decade—from less than half of the economically active population contributing in the early 2000s to over 60 percent in recent years.<sup>21</sup>

---

<sup>20</sup> There are also separate special regimes for magistrates and teachers that joined the public sector after 1992. While these systems are currently in surplus, the special regime for magistrates is also deemed to be actuarially imbalanced. A recent reform proposal by the superintendence of pensions envisaged annual CG transfers of about 0.1 percent of GDP to cover pensions of current retirees over the next three decades (retirees would also pay an extraordinary contribution rate); under the same proposal, the system for current active contributors would undergo parametric reforms to reach actuarial balance, including an increase in the retirement age and an increase in the reference period to determine pensions.

<sup>21</sup> While increases in labor formality and active coverage of pensions reduce fiscal gaps in the short term, they lead to higher long-term deficits over the long-term. While revenues increase relative to expenditures as long as new contributors remain in the labor force, as they retire, passive coverage increases proportionately, and the additional pension benefit increases offset previous gains in contributions. In the case of Costa Rica with an actuarially imbalanced contributory system and limited coverage and generosity of non-contributory pensions—which the elderly would have received if they remained in the informal sector—the net effect of higher coverage by contributory pensions on the long-term fiscal gaps is negative.

**Figure 3. Contribution Rates, Replacement Rates, and Passive Coverage of Pension Systems in Latin America**



Sources: IDB, OECD, World Bank Pension database, and Fund staff calculations.

1/ Gross replacement rates are theoretical estimates based on a specific set of assumptions, including 100 percent contribution density and equal earnings in percent of economy-wide earnings throughout a worker's career; while actual replacement rates are lower—reflecting rising earnings of individuals over time due to career advancement—this set of assumptions allows for consistent cross-comparison of generosity of statutory characteristics under different pension systems (see OECD/IDB/The World Bank, 2014). The OECD average gross replacement rates refer in both charts to combined defined benefit and defined contribution systems.

Key Pension System Parameters in LAC						
Country	Type of System <sup>1</sup>	Statutory Pensionable Age <sup>2</sup>	Vesting Period	Contribution Rates, 2015		Gross Replacement Rate, 2014 <sup>2, 3, 4</sup>
				Total	Employer	
Argentina	DB	65 (60)	30	21.2	10.2	77.5 (70.3)
Bolivia	DC	58	10	15.2	3.0	41.0
Brazil	DB	65 (60)	35 (30)	28.0	20.0	58.3 (53.2)
Chile	DC	65 (60)	20	11.2	1.2	43.9 (34.4)
Colombia	DB/DC	62 (57)	25	16.0	12.0	70.8 (64.1)
Costa Rica	DB/DC	65	25	12.2	8.3	79.4
Dominican Republic	DC	60	30	10.0	7.1	22.8
Ecuador	DB	60 <sup>4</sup>	30	10.7	1.1	94.2
El Salvador	DC	60 (55)	25	13.5	7.3	46.6
Guatemala	DB	60	20	5.5	3.7	67.8
Honduras	DB	65 (60)	15	6.0	3.5	64.9 (60.9)
Mexico	DC	65	24	8.7	6.9	29.5 (28.6)
Nicaragua	DB	60	15	13.0	9	94.2
Panama	DB/DC	62 (57)	20	13.5	4.3	78.4 (72.8)
Paraguay	DB	60	24	23.0	14.0	104.1
Peru	DB/DC	65	20	13.0	0.0	70.6
Uruguay	DB/DC	60	30	22.5	7.5	52.5
Venezuela	DB	60 (55)	15	13.0	9.0	94.2 (89.5)
<b>OECD Average</b>	<b>N/A</b>	<b>64.7 (63.5)</b>	<b>N/A</b>	<b>19.6</b>	<b>11.2</b>	<b>52.9</b>

Sources: OECD, *Pensions at a Glance 2013* (OECD average contribution rates); OECD, *Pensions at a Glance 2015* (OECD average pensionable age); OECD/IDB/The World Bank (2014), *Pensions at a Glance: Latin America and the Caribbean* (type of system and gross replacement rates); United States Social Security Administration (2016), *Social Security Programs Throughout the World: The Americas, 2015* (pensionable age, vesting period, contribution rates).

1/ DC systems may include a DB pillar in the process of being phased out. For countries with fragmented systems, the largest single component is taken as a benchmark.

2/ Numbers in parentheses are for women, where different than men.

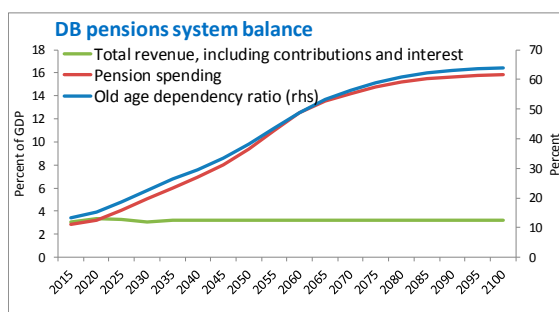
3/ Comparisons are based on a specific set of assumptions. See IDB for detailed information.

4/ Only includes old-age, disability, and survivors. Values for Argentina are net of location-based tax credit for employers.

**25. Costa Rica has one of the largest projected long-term fiscal gaps in the region, though the comparison also reflects low coverage and socially unsustainable benefits in some other countries in the region.** Under policies prevalent at end-2016, pension expenditures of the PAYG system would increase from around 2¾ percent of GDP in 2015 to over 13 percent of GDP by 2065 and almost 16 percent of GDP by 2100, driven by a sharp projected increase in the old age dependency ratio. Even with approved gradual increases in the contribution rate until 2035, reserves would run out between 2025 and 2030, when the system would start having cash deficits. The long-term fiscal gap measured by the PDV of projected government pension spending increases until the year 2100 is almost 400 percent of GDP. Considering projected increases in contributions from approved reforms, the PDV of pension system deficits would reach more than 350 percent of GDP.<sup>22</sup> While these estimated gap highlights the need for significant parametric reforms to ensure the

<sup>22</sup> Key assumptions, in line with the methodological approach described above include: 1) underlying demographic trends based on UN projections; 2) 45-year transition period assumed for system to mature—with gradual increase in coverage of pensioner age population up to current level of contributions' coverage among working age population; the latter is assumed to remain constant since it is already one of the highest in the region; 3) replacement rate assumed to remain constant (i.e. initial pension grows with average wages); 4) as mentioned above, projected increases in contribution rates only include the increase to 10.5 percent by 2035 approved in 2005—projections do not change materially with the planned 1 percent increase in worker contributions from June 2017 announced by the CCSS in early 2017 following the publication of an actuarial report by the Universidad de Costa Rica commissioned by the CCSS.

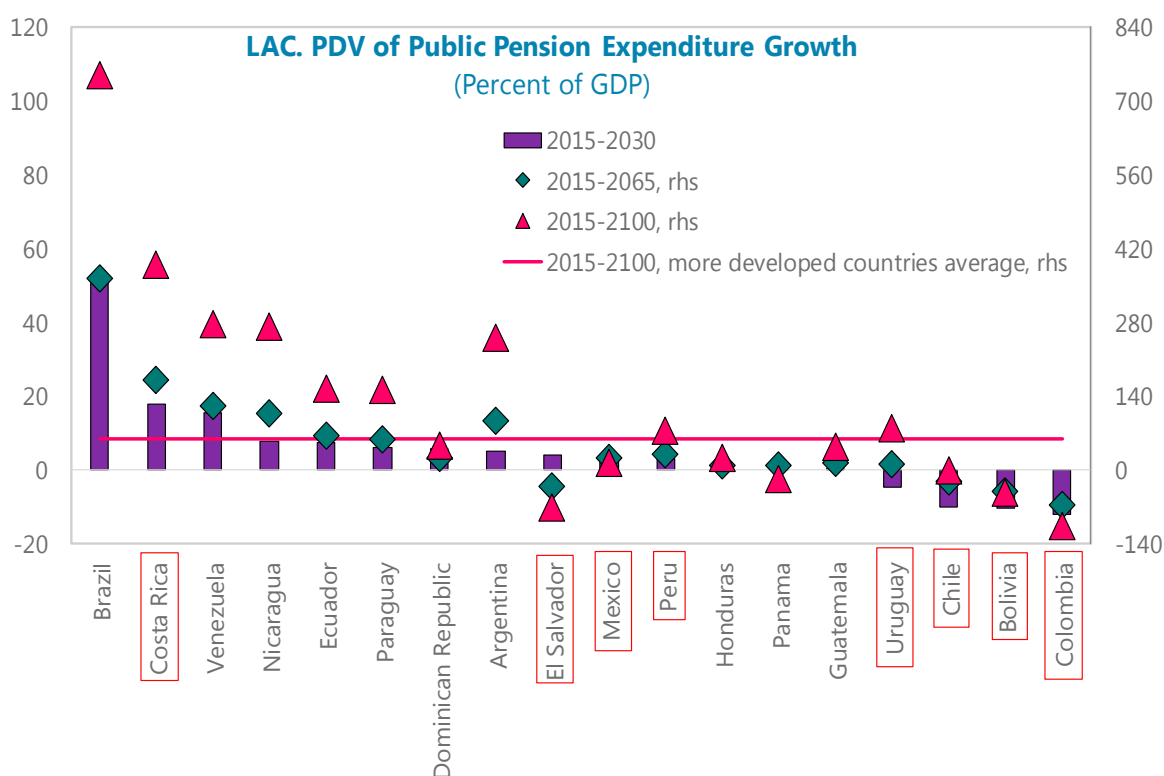
long-term fiscal sustainability of the system—while also ensuring socially acceptable coverage and replacement rates—the unfavorable comparison with other countries in the region also reflects the limited coverage of PAYG systems and socially unacceptable replacement rates of defined contribution systems in some of these countries.



**Costa Rica: Projections of Pension Imbalances**  
(excluding special regimes, in percent of GDP)

	2015	2030	2065	2100
Total pension expenditures	2.8	5.0	13.5	15.8
Non-contributory benefits	0.3	0.3	0.3	0.3
Contributory benefits	2.6	4.8	13.3	15.6
<i>PDV of pension spending increases</i>		18	172	391
Pension revenues <sup>1</sup>	3.1	3.1	3.2	3.2
Pension deficit	0.3	-2.0	-10.3	-12.6
<i>PDV of pension deficits</i>		-11	-155	-367

<sup>1</sup> Includes pension contributions, transfers from the budget and SOEs to fund non-contributory pensions, and interest earned on reserves.

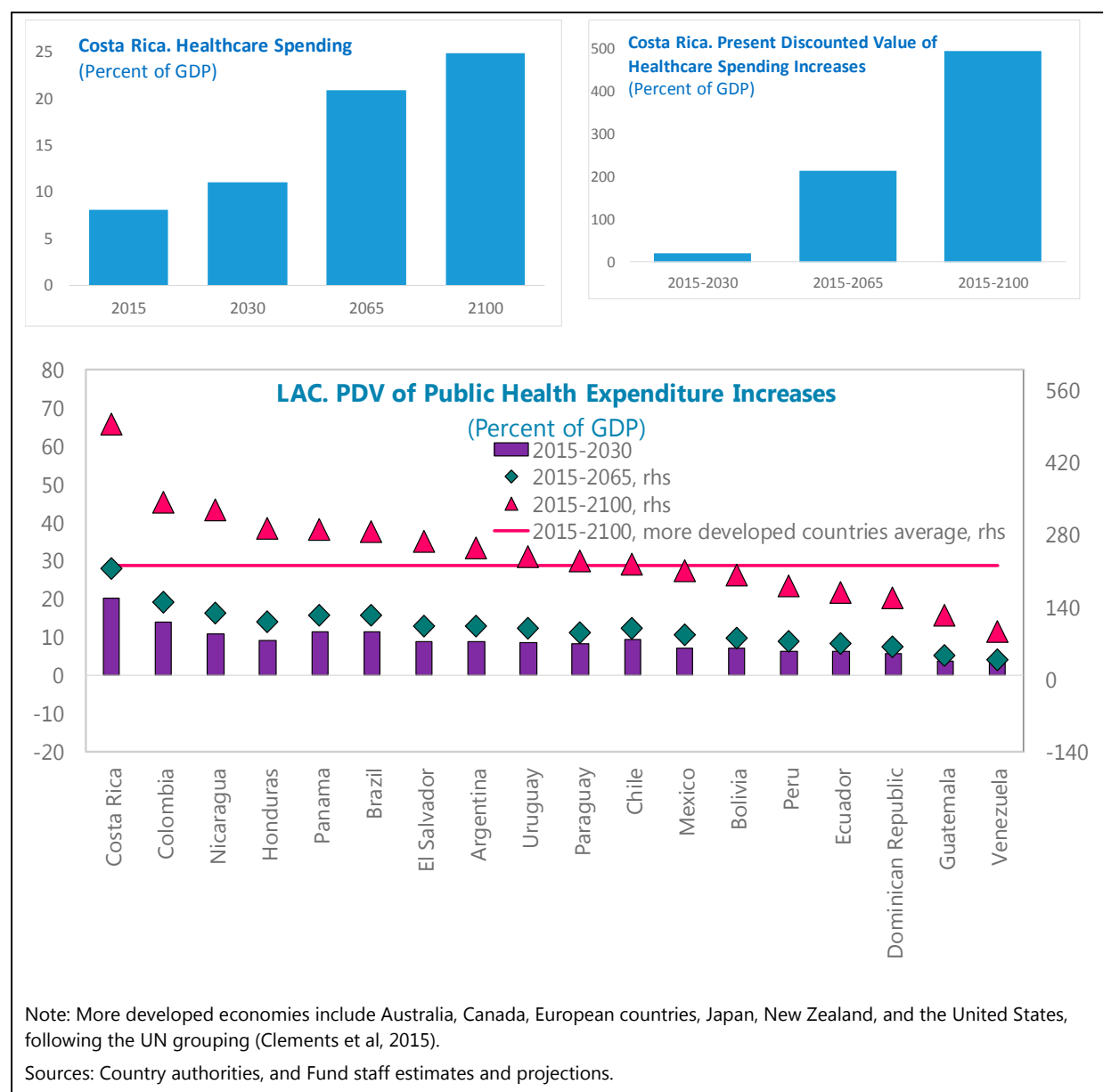


Note: Countries highlighted in red are countries with either DC systems or mixed DB/DC systems. More developed economies include Australia, Canada, European countries, Japan, New Zealand, and the United States, following the UN grouping (Clements et al, 2015).

Sources: Caja Costarricense de Seguro Social, and Fund staff estimates and projections.

## 26. The contribution of public healthcare costs to long-term fiscal gaps is even larger.

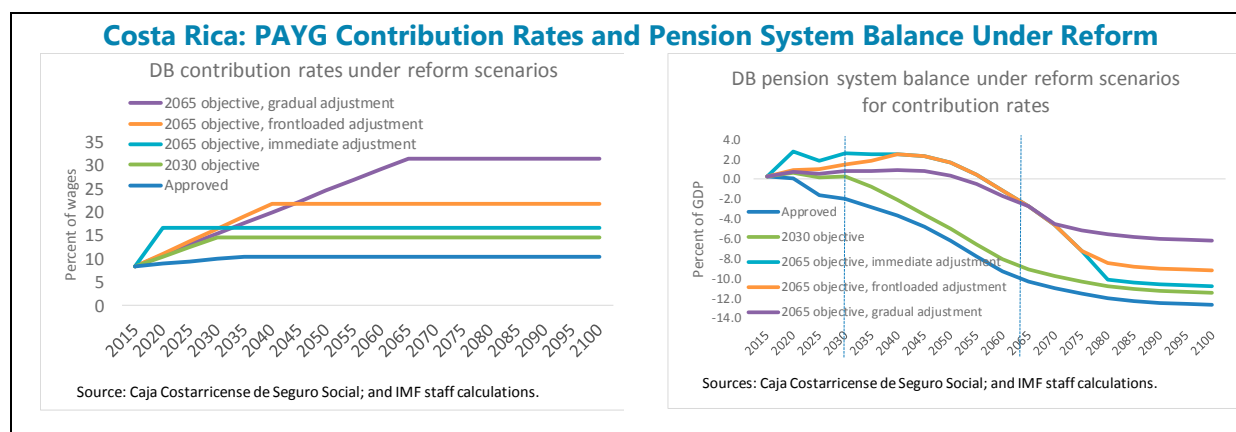
Costa Rica has the highest estimated long-term fiscal gap in the region from projected increases in healthcare spending. This reflects the impact of more severe aging trends as well as the higher starting spending level—consistent with desirable universal access and high quality aspects of the health system by regional standards—than in most other countries in the region. Total healthcare spending amounted to 8 percent of GDP in 2015 and is projected to increase to 25 percent of GDP by 2100, with a PDV of spending increases equal to almost 500 percent of GDP.



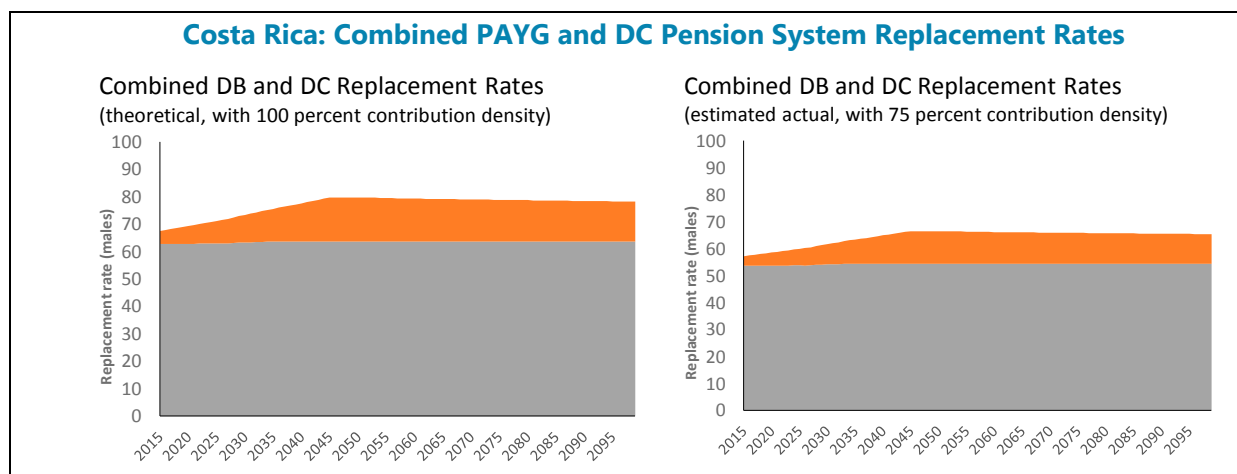
**27. Significant parametric reforms will be needed to eliminate the long-term fiscal gap arising from the PAYG pension system.** Consistent with the approach taken in the cross-country study cited above, two objectives are defined for parametric reforms: the first one aims at

maintaining the current balance of the pension deficit constant until 2030; the second limits the deterioration in the system balance to 3 percent of GDP by 2065. Multiple sets of parametric reforms would be consistent with these objectives, although the size of any adjustment is logically larger the longer it is delayed. For illustration purposes, the following simulations indicate the adjustments that would be needed to achieve the reform objectives if only one of the key system parameters were to be amended:

- A gradual increase in contribution rates to 14.5 percent of wages by 2030 would be sufficient to reach the first objective set above. While the second objective of limiting the increase in the deficit by 2065 could also be accomplished with an immediate increase to a not much higher contribution rate of 16.4 percent, more gradual reform scenarios could require increases in contribution rates of up to 31.5 percent by 2065. Under almost all these scenarios without reforms in benefits and retirement age, however, system deficits would continue to rise after 2065 as demographic pressures would eventually offset the buffers built with higher contribution rates.

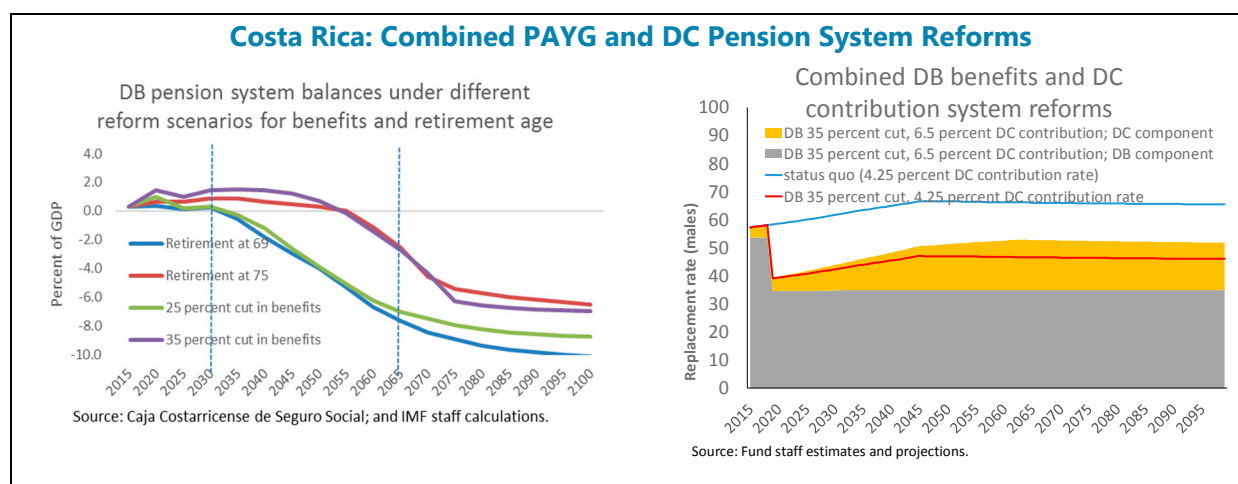


- Focus on reducing spending through cuts in replacement rates seems likely in the case of Costa Rica, where the introduction of a mandatory individually funded pillar in the early 2000s would lift the combined theoretical replacement rate of the two systems to 80 percent once the second pillar matures. Cuts in PAYG system benefits of about 25 and 35 percent would be sufficient by themselves to achieve the objectives of preventing an increase of the PAYG pension deficit by 2030 and limiting the deterioration to 3 percent of GDP by 2065, respectively.



- Gradual increases in the retirement age to 69 by 2030 and to 75 by 2065 would also be sufficient by themselves to meet the reform objectives set in this exercise. While the retirement age is not currently low by international standards and reforms are therefore likely to be less focused on the retirement age during the initial phase, some increases are likely in the longer-term in line with global trends as population ageing continues to advance.
- As an additional theoretical exercise, pension adequacy—defined as replacement rate around the OECD average—could be maintained even under the scenario where sustainability of the PAYG system is achieved solely through a cut of 35 percent in benefits if this were accompanied by a moderate increase in the DC contribution rate from 4.25 to 6.5 percent.<sup>23</sup> Actual future replacement rates under this scenario would logically be subject to the uncertainty of future market returns, and moving too far in this direction could increase the risk of not delivering socially acceptable levels of pensions. Alternatively, the same replacement rate around the OECD average could be achieved with a smaller 25 percent cut in benefits under the PAYG system, which would require an increase in the PAYG system contribution rate of about 3.5 percent to at the same time achieve the objective of limiting the increase in the PAYG system deficit to 3 percent of GDP by 2065.

<sup>23</sup> The simulation is for combined DB/DC replacement rates of male pensioners, assuming 75 percent contribution density.



**28. International comparisons suggest a greater initial focus of parametric reforms on raising contribution rates and cuts in benefits.** Given the comparatively high combined replacement rates of the PAYG and funded pension pillars, and the low contribution rates of the PAYG system in Costa Rica, a reform to ensure sustainability of the pension system is more likely to entail a combination of increases in contribution rates and cuts in benefits than substantial early increases in the retirement age, which is already relatively high in the region, consistent with the already mature stage of the demographic transition in the country. However, over the long-term as life expectancy continues to rise, increases in the retirement age are also likely both in Costa Rica and globally. The range of reforms delineated above represent extreme scenarios focused on reforms in single parameters, but are broadly in line with the refined recommendations made in an independent report commissioned by the pensions supervisor. The report included a menu of multi-parametric reform options with increases in the retirement age up to 70 years, cuts in the replacement rate of about one fifth, and gradual increases in contribution rates up to 25.9 percent by 2055 (Universidad de Costa Rica, 2016).

**29. Standard recommendations to contain healthcare costs in countries with more extensive healthcare coverage put the emphasis on enhancing budget controls.** While the upcoming World Bank Review of Public Expenditure can provide more specific proposals to enhance efficiency in the Costa Rican healthcare system, standard recommendations in countries with already high coverage focus on measures needed to contain costs and improve spending efficiency while preserving access to high-quality healthcare (Clements, Coady, and Gupta 2012). Typical measures include:

- Budget caps with central oversight: these should be based on reasonable and objective expenditure projections, as opposed to simply reimbursing all spending.
- Public management and coordination of healthcare services to control costs and screen out unnecessary services: For example, gatekeeping, through which a primary care physician manages a patient's healthcare services and coordinates referrals to specialists, is widely

considered crucial to constraining the growth of costly and often unnecessary hospital treatment.

- Local and state government involvement in key health resource decisions: this can help tailor services to local conditions, while also increasing incentives to avoid overruns when coupled with increased financial responsibility of local governments.
- Use of market mechanisms in the healthcare system: these include increasing patient choice of insurers, allowing greater competition between insurers and providers, and relying on more private services. Moving away from simple reimbursement of provider costs toward contracting systems with built-in incentives for providers to minimize waste and improve services also enhances efficiency.
- Increasing the share of costs borne by patients: either higher copayments or expanded private insurance—accompanied by targeted measures to ensure access to health services by the poor and chronically ill—has also been successful in containing the growth of public health spending.

## Annex I. Costa Rica Pension System Structure

	Sources of funds	Qualifying conditions	Benefits	Coverage	Administratio
<b>0 pillar</b>	Budget, program cost is about 2¾ percent of GDP; about 2 percent for the closed special regime for teachers, about ½ for the closed special regime for other civil servants, and about ¼ percent of GDP for non-contributory pensions—this is financed by the fund social development Fund (FODESAF), which is by employers with a 5 percent payroll tax; SOEs also make direct transfers to CCSS to cover the additional cost of non-contributory pensions not covered by budget transfers (about 0.1 percent of GDP in 2015)—subject to legal cap on SOE transfers of 15 percent of their profits.	Closed systems for teachers and other civil servants with acquired rights prior to 1992. For non-contributory pensions, adults over 65 and low-income disabled individuals not eligible to the contributory system.	Cash transfers. The non-contributory pension is about \$150 a month.	Closed regimes for teachers and civil servants cover about 11 percent of the population over 60 years old. Non-contributory pensions cover about 1 percent of the population above 60 years old (in 2012).	Labor Ministry for closed systems for teachers and civil servants, and CCSS for non-contributory pensions.
<b>1<sup>st</sup> pillar (defined benefit, PAYG)</b>	Employers' contributions (5.1 percent of payroll), workers' contributions (2.8 percent of gross earnings)—self-employed contribute 7.9 percent of gross earnings—and government (0.6 percent of gross income of all workers and self-employed). Contributions are scheduled to increase 0.5 percent every five years, reaching 10.5 percent by 2035.	Old age: 65 years of age and 25 years of contributions. Reduced pension possible after 65 years of age and 15 years of contributions, or after 25 years of contributions and 62 years of age for men and 60 for women—though this early retirement option is being phased out between 2015 and 2018. Late retirement is possible, except for civil servants. Disability pension: Assessed loss of at least 2/3 in earning capacity, with additional requirements of minimum contributions depending on age. Survivor pension: Widow(er), children of up to 18 years of age, or dependents parents or siblings.	Old age and disability pensions determined as a percentage of average earnings in the last 20 years of contributions, with percentage falling from 52.5 percent to 43 percent as average salary of last 5 year rises from less than 2 times the minimum wage to 8 or more; replacement rate increased by about 1 percent with each year of contributions exceeding 240 months, and by about 1.5 percent with each year of additional work beyond the age of 65. Pensions are indexed to the CPI. There is a minimum contributory pension of about \$250 monthly, and a maximum pension of almost \$3,000. Survivor pension: 20 to 70 percent of old-age or disability pension of the deceased, depending on relation and age of the beneficiary.	Contributors: About 65 percent of the economically active population. Beneficiaries: about 50 percent of the population above 65 years of age is currently receiving old age pension.	CCSS for most contributors. Special funds for teachers who joined after 1992, as well as for magistrates and firefighters.
<b>2<sup>nd</sup> pillar (defined contribution, individually funded)</b>	Contributions in percent of wages, with 3.25 percent paid by the employer and 1 percent by the worker (self-employed persons are excluded).	Same as for pillar 1 for the share contributed to the mandatory pension system (minimum 2 percent out of 4.25 percent total contributions), and its earned interest. The remaining part can be withdrawn every 5 years or when changing employers.	Old-age, disability and survivors' pensions.	Same as pillar 1.	CCSS, Banco Popular, BNCR, BCR, and BAC.

Sources: OECD/IDB/World Bank (2014) and SSA (2016).

## References

- Clements, B., D. Coady, S. Gupta, 2012, “The Economics of Public Health Care Reform in Advanced and Emerging Economies”, International Monetary Fund, Washington.
- Clements, B., K. [Dybczak](#), V. Gaspar, S. Gupta, and M. Soto, 2015, The Fiscal Consequences of Shrinking Populations. IMF Staff Discussion Note, October 2015.
- Cubero, R., Vladkova Hollar, I., 2010, “Equity and Fiscal Policy: The Income Distribution Effects of Taxation and Social Spending in Central America,” IMF Working Paper No. 10/112 (Washington: International Monetary Fund).
- Garcia-Escribano, M, Yue Liu, C., 2017, Expenditure Assessment Tool (EAT), Technical Notes and Manuals (Washington: International Monetary Fund).
- OECD, 2013, Public Spending on Health and Long-term Care: A New Set of Projections, OECD Economic Policy Papers No. 6.
- OECD/IDB/The World Bank, 2014, Pensions at a Glance: Latin America and the Caribbean, OECD Publishing, [http://dx.doi.org/10.1787/pension\\_glance-2014-en](http://dx.doi.org/10.1787/pension_glance-2014-en).
- OECD, 2016, OECD Economic Surveys: Costa Rica 2016: Economic Assessment, OECD Publishing, Paris. [http://dx.doi.org/10.1787/eco\\_surveys-cri-2016-en](http://dx.doi.org/10.1787/eco_surveys-cri-2016-en)
- SSA, 2016, Social Security Programs Throughout the World: The Americas, 2015. SSA Publication No. 13-11802, March 2016.
- UN, 2015, World Population Prospects: The 2015 Revision. Key Findings and Advance Tables. United Nations.
- Universidad de Costa Rica, Facultad de Ciencias, Escuela de Matemáticas, “Estudio Actuarial del seguro de invalidez, vejez y muerte administrado por la Caja Costarricense de Seguro Social,” Diciembre, 2016.

# SELECTED FINANCIAL SECTOR ISSUES<sup>1</sup>

## A. Credit Cycle and Countercyclical Capital Buffers in Costa Rica<sup>2</sup>

*This note investigates the financial stabilization properties of the Basel III Countercyclical Capital Buffers and the early warning power of the credit gap in Costa Rica. We find that Countercyclical Capital Buffers activated based on a normalized version of the credit gap would have an effective cushioning effect on the financial system, largely due to the robust early warning properties of the normalized credit gap. However, implementation of Countercyclical Capital Buffers as part of a gradual adoption of Basel III standards, is likely to involve non-negligible challenges.*

### Introduction

**1. Costa Rica is gradually adopting Basel III standards.** The Basel III Liquidity Coverage Ratio (LCR) has been introduced in 2015 and the authorities are planning to issue a regulation to implement the Net Stable Funding Ratio (NSFR) by the beginning of 2018. They also expect to finalize regulations to introduce the Basel III definition of regulatory capital and leverage ratio by end-2017, and implemented in 2016 countercyclical provisions based on the growth of bank-specific loan portfolios. In general, banks are well placed to comply with Basel III capital requirements: the minimum capital requirement is 10 percent, and the Capital Adequacy Ratio (CAR) of banks and cooperatives satisfies Basel III requirements when adjusted for the new capital guidelines, although it declines due to increases in Risk Weighted Assets (RWA). Supervisory authorities have also advanced in implementing risk-based supervision (Pillar 2) and adopting a cross-border consolidated scheme that allows for the identification of risks taken by financial conglomerates.

**2. The Countercyclical Capital Buffer (CCyB) is one of the major conceptual innovations of the Basel III framework.** Along with the Capital Conservation Buffer (CCoB), the CCyB is a key macroprudential policy (MaPP) tool to promote the conservation of capital and the build-up of adequate buffers above the minimum that can be drawn down in periods of stress. Their aim is to prevent dysfunctions in the banking system and to avoid strains to the credit supply. According to Basel III guidelines, the CCoB is to be set at 2.5 percent of RWA and it can be drawn down when losses are incurred, to avoid the breach of minimum capital requirements. The CCyB varies between zero and a 'non-binding' cap of 2.5 percent of RWA: authorities should increase the buffer rate when risks associated with excessive credit growth build-up, and should lower it when risks materialize to sustain the flow of credit to households and corporations, and contain the risk of systemic deleverage.

**3. The CCyB introduces a countercyclical dimension in banks' capital requirements, contributing to both macroeconomic and financial stability.** This tool adds an additional layer of

<sup>1</sup> The authors thank Oscar Mario Morales Berrocal, Jairo Dávila Castañeda, Jaime Odio Chinchilla, Grace Hernández Loría, and Guillermo Olivier Cruz Mendez for providing the data needed for these analyses.

<sup>2</sup> Prepared by Pierluigi Bologna, Valentina Flamini, and Rasool Zandvakil.

capital during credit booms to create loss absorbing capacity to use in case of a banking crisis. Thus, its main purpose is to enhance the stability of the banking system, with any reduction in the volatility of the financial and business cycles being a welcome side effect, contributing to both macroeconomic and financial stability. However, given its methodological implications and the call for policymakers' judgement on how buffers are built up and released, the CCyB is likely to entail nontrivial implementation challenges, hence the focus of this note.

**4. The concept of *credit-to-GDP gap* plays a central role in guiding CCyB policies.** Basel III uses the gap between the credit-to-GDP ratio and its long-term trend as a guide for setting the CCyB. This should be activated when there is excessive credit growth and the financial cycle is in its expansion phase, or equivalently when the “credit gap” is significantly positive. Similarly, CCyB policies should be loosened when signs of financial distress in the banking system appear and the financial cycle enters its downturn period, that is when the credit gap declines or turns negative. However, estimation of the credit gap crucially depends on the method that is used to back out the trend in the credit-to-GDP ratio, which could be a nontrivial task, especially when sufficiently long time series are unavailable. Hence, the Basel Committee on Banking Supervision (BCBS, 2011) recommends using this measure in conjunction with other financial indicators of excessive credit growth to guide CCyB policies, and in general assigns a significant role to the judgment of policy makers.

## Methodology

**5. Following the Basel III framework, we estimate the credit gap as a guide for calibrating the CCyB.** The Basel Committee (BCBS 2010, 2011) selected the credit gap as the main indicator for setting the CCyB mainly because of its out-of-sample forecasting power in predicting banking crises in a large sample of countries. Subsequent research by various authors has largely confirmed its properties for advanced countries while some have questioned its performance for samples of developing countries. In this methodology, credit is defined as aggregate credit extended to households and non-financial private businesses from banks and non-banks. Importantly, this measure of credit includes all credit that is extended to the private nonfinancial sector through nonbanks, corporate bond markets, and foreign intermediaries or investors, as such indicator proves to over-perform narrower definitions of credit (such as credit extended by banks only) in signaling future banking crises. Normally, this measure is constructed at quarterly frequency.

**6. We use a standard one-sided backward looking HP filter to estimate the long-run trend in the credit-to-GDP ratio.** This is consistent with BCBS (2010) and BCBS (2011) guidelines, although some studies have suggested that a two-sided filter might perform better. The one-sided HP filter estimates the trend as the solution to the following minimization problem:

$$\min_{Trend_t} \sum_{t=1}^T (CTG_t - Trend_t)^2 + \lambda \sum_{t=3}^T (Trend_t - 2Trend_{t-1} + Trend_{t-2})^2$$

which balances the trade-off between the size of the estimated cycles and the variation in trend growth rate, with the smoothing parameter  $\lambda$  establishing the relative weight of each of the two terms: the larger the smoothing parameter, the more importance is assigned to the second term,

and therefore the “smoother” the trend series would be. Since financial cycles are thought to operate at very low frequencies, for them the smoothing parameter is usually set at large values. BCBS (2010), based on Borio and Lowe (2002), suggests a smoothing parameter of 400000.<sup>3</sup>

**7. Since the usual credit gap measure is inconsistent with sustained fast credit growth, we consider a normalized indicator to reflect Costa Rica’s still ongoing financial deepening.**

The standard credit-to-GDP gap proposed by the BCBS is based on studies of countries with high levels of financial deepening, mostly with credit-to-GDP ratios above 100 percent. For countries with lower level of financial deepening such as Costa Rica, which had credit-to-GDP ratio at 60 percent as of January 2017, the standard credit gap might not be the most appropriate measure to inform decisions on CCyB. As an alternative, a percentage deviation of the credit gap relative to the trend of the credit-to-GDP ratio is proposed.<sup>4</sup> Hence the normalized credit gap is defined as:

$$(\widehat{\text{Credit Gap}})_t = \frac{CTG_t - \text{Trend}_t}{\text{Trend}_t}$$

**8. Drawbacks related to this methodology apply to Costa Rica as well as other emerging countries.** Chief among them are issues regarding the length of the available data and the presence of structural breaks in the series.

- *Length of the time series.* Edge and Meisenzahl (2011) argue that the backward-looking nature of the one-sided HP filter puts too much emphasis on the end points and therefore the estimated trend depends heavily on the most recent observations.<sup>5</sup> As noted by Seidler and Gersl (2012), the estimated trend changes very significantly with the starting point of the series, Drehmann and Tsatsaronis (2014) and Alessandri and others (2015) shows that this problem gets much worse as the length of available time series shrinks. Both drawbacks suggest that the longest available time series should be used to attain the best possible estimation of the credit gap. Borio and Lowe (2002) suggest that this calculation should not be done for time series with length of less than 10 years at least, while many others suggest 20 years of data is the minimum requirement.

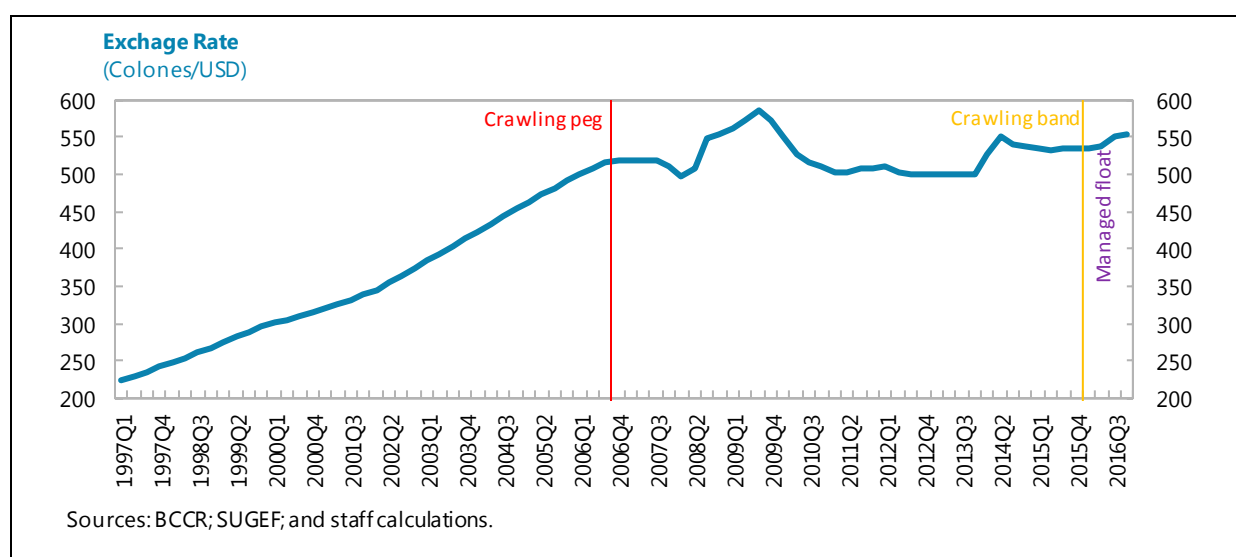
<sup>3</sup> This value should be compared to 1600, which is the value of the smoothing parameter used for estimating business cycles. The difference between the two reflects the idea that financial cycles are thought to be 4-5 times longer than business cycles.

<sup>4</sup> The motivation for the alternative measure can be better understood by going through an example. Consider two countries with different levels of financial deepening: country A with a credit-to-GDP ratio of 30 percent and a trend value of 20 percent, and country B with a credit-to-GDP ratio of 110 percent and a trend value of 100 percent. Per the BCBS standard approach, both countries have a credit gap of 10 percentage points. However, for country A to reach a credit-to-GDP ratio of 30 percent credit must grow about 50 percent faster than GDP, while in country B credit has to grow only about 10 percent faster than GDP. If one thinks that a constant fraction of the new credit extended above the trend value (10 percentage points in the case of country B) is excessive and increases systemic vulnerability, the increase in capital and loss absorbing capacity in country A should be much larger than that of country B, i.e., around 5 times larger. Using the percentage deviation of credit gap from the trend averts this issue.

<sup>5</sup> As shown by Orphanides and van Norden (2002).

- *Structural breaks.* The use of such credit gap measures may hinder the process of beneficial financial deepening undergone by many emerging market economies (Reserve Bank of India, 2013), because this measure essentially penalizes fast growth rates of credit-to-GDP, which could be a structurally desirable and positive outcome. This also induces a reverse problem: a sustained period of high growth in credit-to-GDP ratio translates to a faster trend growth estimate which could turn CCyB measures never binding. BCBS (2010) and BCBS (2011) recognize these issues and the limited information contained in the one-sided HP filtered credit gap and recommend using additional variables to guide the decision regarding CCyB rates.

For our estimates, we consider aggregate quarterly data on credit extended by banks—including foreign—cooperatives, and other financial institutions, but excluding corporate bonds (due to the shorter length of this time series). However, such aggregate credit data is only available since 1997, compared to 1987 for bank credit only, exposing a tradeoff between length and coverage of the credit series. It should also be noted that, besides the ongoing financial deepening process in Costa Rica, the shifts in exchange rate policy during the period in consideration also introduce structural breaks in the credit series given the high level of credit dollarization in the economy.



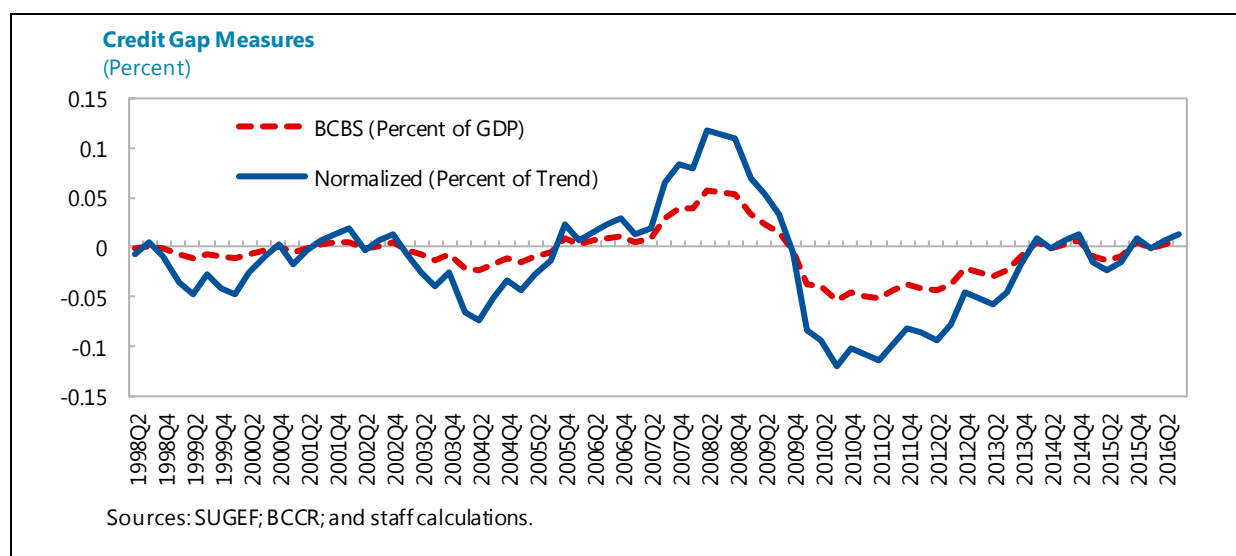
**9. The additional signals of financial risk build-up recommended by the BCBS include measures of excessive credit growth, lenient credit risk pricing, and measures of high leverage.** In contrast to credit gap, however, there are no specific definitional or numerical recommendations for these measures by BCBS.

- *Excessive credit growth:* credit growth rates at sectoral level, such as household and construction, and persistently large current account deficits;
- *Credit mispricing:* low risk premia for risky assets (low credit spreads), high equity valuations, high housing price growth rates or price to rent ratios;

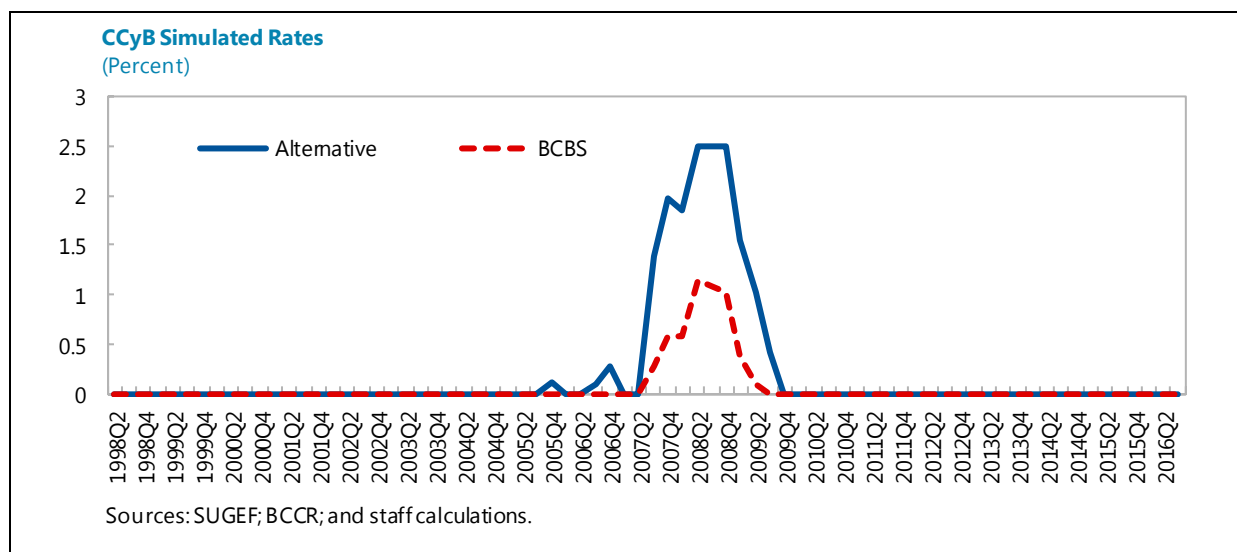
- *High leverage/ risk buildup*: high leverage ratio in the banking sector, high leverage ratios in the corporate sector, high loan to value ratios (LTV) or debt service to income ratio (DSTI) in the household sector.

## Credit gap and CCyB setting

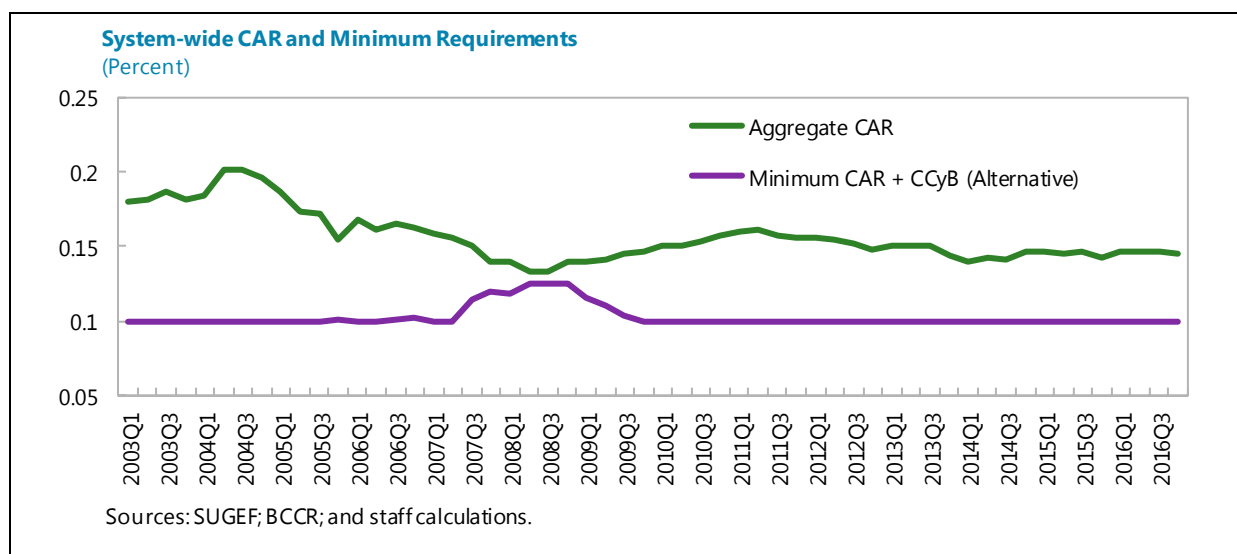
**10. Estimation results show that the absolute and normalized measures of the credit gap are highly correlated.** The two measures are scaled versions of one another, and the correlation between the two series is 0.99. This means that the early warning properties of credit gap do not depend on whether one uses the measure proposed by BCBS or the normalized one proposed here.



**11. CCyBs activated based on the normalized credit gap would have started to build up steadily one year before the global financial crisis, peaking at 2.5 percent in 2008Q2-Q4.** Using the standard credit-to-GDP gap and the BCBS thresholds to set CCyB rates, on the other hand, would have implied a less timely activation of the buffer, which would have never reached its maximum of 2.5 percent before the period of financial distress. The normalized measure proposed here entails a prompt use of the buffer: it would have been activated one year ahead of the global financial crisis, reached its maximum two quarters before the start of the great recession and released after Lehman's failure. It is worth noting that Costa Rica has not experienced a banking crisis in recent decades, although signs of financial distress were clear around the time of the financial crisis.



**12. However, the banks were well capitalized, hence a putative capital requirement of 10 percent plus the CCyB would not have been binding for the system as whole.** This does not suggest that CCyB policies are ineffective when they are not binding for the whole banking system. First, higher regulatory minimum requirements restrict the amount of capital subject to banks' voluntary decisions. Second, even when the system wide CAR does not breach the total capital requirement, some individual banks might fail to meet this requirement, and therefore would need to increase their capital levels.



### Early Warning Power of the Credit Gap

**13. An assessment of the early warning power of the credit gap is encumbered by the absence of recent systemic banking crises.** Costa Rica has not experienced systemic banking crises toward which to assess the credit-to-GDP gap. Hence, we carried out a preliminary

assessment of the signaling properties of the credit gap by adopting NPL rates as an alternative measure of financial distress.

**14. Regression results show that the normalized gap is a powerful predictor of systemic vulnerabilities for the Costa Rican banking system.** Our preliminary assessment shows that credit gap has significant predictive power for NPL rates at 1, 2 and 3-year horizons, with the maximum predictive power for the 2-years horizon (Table 1). This finding is consistent with the existing literature showing the early warning power of the credit gap for many countries.

**15. Robustness checks suggest that the credit gap retains considerable predictive power even in presence of other early warning variables for financial distress.** As a preliminary robustness check, we add other indicators which are among those that have been recommended by the BCBS and IMF guidelines as relevant early warning indicators of financial distress, such as: *capital to RWA* (as a measure of leverage); *money growth*; and *the credit to GDP (in level)*. Results show that, even after adding these measures, the normalized credit gap retains its predictive power.

**Table 1. Costa Rica: Early Warning Properties of Credit Gap and Robustness Check**

VARIABLES	(1) NPL 1 years ahead	(2) NPL 2 years ahead	(3) NPL 3 years ahead	(4) NPL 1 years ahead	(5) NPL 2 years ahead	(6) NPL 3 years ahead
Normalized Credit Gap	0.0265*** (0.000942)	0.0380*** (8.67e-05)	0.0413*** (0.000892)	0.0337*** (0.00825)	0.0538*** (0.00237)	0.0458** (0.0123)
Credit Gap				-0.00752 (0.530)	0.0186 (0.268)	0.0543*** (0.00341)
Regulatory Capital to RWA				-0.00243 (0.956)	0.0264 (0.673)	-0.0117 (0.859)
M3 Growth				-0.00374 (0.663)	-0.0163 (0.166)	-0.0152 (0.210)
Constant	-8.87e-05 (0.842)	-0.000169 (0.756)	-0.000432 (0.550)	0.00161 (0.784)	0.000108 (0.990)	0.00655 (0.459)
Observations	60	56	52	48	44	40
R-squared	0.173	0.250	0.200	0.425	0.501	0.594
pval in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

## Country Experiences

**16. The BCBS establishes that CCyB rate decisions should consider country specific conditions beside other measures of systemic risk buildup.** In general, it is understood that judgment is an integral part of CCyB policies and therefore no strict international rules exist. Below we overview a range of approaches in advanced and emerging economies with the interpretation and application of CCyBs.

### Advanced Economies

**17. Since the announcement of the BCBS guidance, most major advanced economies have adopted and activated CCyB.** While most countries have not set positive CCyB rates, they have established procedures for calibrating the CCyB rates so that markets can form well-anchored expectations regarding their future setting. Since advanced countries usually have long time series

data on credit and output, the credit gap can be estimated with more certainty, and therefore it serves as a good signal. In most of these countries, the credit gap was large and positive in the few years before the global financial crisis, which gives this measure more credibility. Nonetheless, authorities tend to refer to other financial indicators as well as inputs in their decision making.

- *The Czech Republic, Hong Kong, Norway, Sweden, and the UK* have actively used CCyB. The buffer rate is currently at 0.5 percent in the Czech Republic, 1.25 percent in Hong Kong, 1.5 percent in Norway, and 2 percent in Sweden.<sup>6</sup>
- The *UK* announced in 2016 a 0.5 percent CCyB rate—calibrated also by means of stress testing—to be implemented the following year. However, the Bank of England promptly discontinued the buffer to raise banks' capacity to lend to households and firms in response to the outcome of the referendum to leave the European Union.
- *Switzerland* is the first country to have used a sectoral CCyB, to enhance to banking system resilience to building vulnerabilities in the real estate sector. The buffer rate is currently set at 2 percent.<sup>7</sup> While not yet recognized by the BCBS international standards, the Swiss experience provides an interesting case for a more tailored use of the CCyB, which in this design could replace other sectoral tools as a more transparent and easier to communicate measure.
- In *Finland*, albeit the credit gap would have suggested to set a positive buffer rate, the authorities have discretionally kept the buffer at zero based on the information of a set of additional indicators and of the comprehensive MaPP stance adopted.
- To inform its CCyB decisions, *Italy* has introduced a real time two-sided filtered credit-to-GDP gap as an additional measure of the credit-to-GDP gap, based on the findings by Alessandri and others (2015). It provides a better representation of the credit cycle - with less volatile results - than the standard one-sided BCBS approach. The policy stance on the CCyB is communicated not only through the quarterly policy decision statements, but also through the Financial Stability Report to shape market expectations and enhance the predictability of future policy decisions.

## Emerging Economies

**18. Many emerging countries have also started introducing CCyBs but setting rates at zero.**<sup>8</sup> While these countries have largely adopted the credit gap as a guide to CCyB rate setting as in advanced economies, the exact procedure tends to be less articulated, and policy announcements are not followed or preceded by background papers detailing the underlying methodology. In this

<sup>6</sup> See the following links: [https://www.esrb.europa.eu/national\\_policy/ccb/applicable/html/index.en.html](https://www.esrb.europa.eu/national_policy/ccb/applicable/html/index.en.html) and <https://www.bis.org/bcbs/ccyb/>

<sup>7</sup> For more information on the case of Switzerland, please refer to the following link: [https://www.snb.ch/en/mmr/reference/ccb\\_20170224\\_baseI\\_III\\_countercyclical\\_capital\\_buffer/source/ccb\\_20170224\\_baseI\\_III\\_countercyclical\\_capital\\_buffer.en.pdf](https://www.snb.ch/en/mmr/reference/ccb_20170224_baseI_III_countercyclical_capital_buffer/source/ccb_20170224_baseI_III_countercyclical_capital_buffer.en.pdf).

<sup>8</sup> For a list of emerging countries that are members of the BIS refer to <https://www.bis.org/bcbs/ccyb/>

context, the experiences of *Slovakia* and *Peru* are substantially different from other developing countries.

- In *Slovakia*, the credit gap does not play the same central role as it does for most other countries; rather information is pulled across a range of financial indicators, much in line with the complementary variables described above (Rychtárik, 2014). Three major categories of indicators are covered: cycles (both economic and financial), banks, and customers. For each category, a set of core and supplementary variables are defined. Core variables are meant to capture excessive credit growth and the state of the financial and the business cycles in the whole economy, while supplementary variables are to capture the excessive credit growth in specific sectors. The current values of such indicators are compared to their historical distributions and given a value between 1 to 9 (9 meaning the highest percentile). These scores are then averaged to produce an indicator of systemic risk buildup. Both the single indicators and their average are considered in decisions regarding the policy rate, with very high values being indicative of excessive credit growth.
- In *Peru* instead of the credit gap as the main guiding tool for setting countercyclical capital buffers, the focus is on the economic cycle (Galindo, Rojas-Suarez, and del Valle, 2013). After running a stress scenario, the amount of RWA for each bank under stress is computed, and banks are asked to increase their capital to cover a specific fraction of the difference between the RWA under stress and the current RWA. Under this rule, the CCyB could potentially go above 2.5 percent. This procedure resembles the one in the UK in using stress test results to guide MaPP, but the procedure is not formally detailed in a publicly available paper and, as noted earlier, CCyB rates are currently at zero.

## Conclusions and Policy Implications

**19. CCyBs would exhibit effective countercyclical dynamics in Costa Rica, reflecting strong early warning properties of the normalized credit gap.** Our estimates show that CCyBs activated by a normalized credit gap measure—to take into account desirable financial deepening—would have reached its maximum of 2.5 percent two quarters ahead of the global financial crisis, providing cushioning room during the downturn. The early warning properties of the credit gap are difficult to assess in Costa Rica due to the absence of a banking crisis during the available time span. However, using NPLs as a proxy for financial distress, the normalized credit gap proves to be a strong and robust early warning indicator, even in presence of other signals of financial risk build-up. This suggest that adopting CCyBs as part of a broader transition to Basel III would improve the stability of the Costa Rican financial system

**20. However, CCyB implementation would entail non-trivial challenges, in particular, caution should be exercised in using the credit gap for determining CCyB rates.** Estimating the credit gap in Costa Rica is subject to caveats, given the short time span of the available data and its incompleteness in covering all sources of credit. Hence, in Costa Rica, and more generally in those cases where the length of available time series is short, credible complementary indicators should be considered in decision making to help better assess the state of the financial cycle.

**21. Other challenges to the implementation of CCyBs can be wide-ranging.** First and foremost, the activation of CCyBs requires amendments to the regulation on bank capital requirements to define how the buffer would work in practice (e.g., timing of decisions and implementations, quality of capital instruments to be used to satisfy the requirement, and how it should be communicated). In addition, proactive policy making will be needed for the implementation of the CCyB, including by conducting regular analysis based on which accountable and transparent decisions should be taken on a quarterly basis. Constrained discretion should be used to forestall inaction bias, allowing policy making to be discretionary but still systematic, transparent, and accountable reflecting predetermined constraints.

**22. Effective microprudential supervision is also a prerequisite for a consistent MaPP framework.** Strengthening the microprudential foundations of MaPP is key to ensure the fundamental resilience of individual institutions by dealing with issues that cannot be addressed by MaPP. Strong supervision—on a solo and consolidated basis—is essential both to ensure that macroprudential policymakers can draw on supervisory information in their risk assessment and to ensure that the MaPP stance adopted is effectively enforced across institutions. Improved regulatory frameworks and increased supervisory scrutiny are often useful prior steps to the tightening of macroprudential rules.

**23. Interaction with other policies can be synergic, but at times conflicts can emerge.** While in a benign macroeconomic environment both micro- and macroprudential policies act in the same direction, in a downturn phase the two policies could conflict with each other. Interactions between monetary policy, credit growth, and MaPPs and their implications for inflation and/or growth also need to be carefully considered. In this respect, a clear attribution of responsibilities and a ranking of the different policy objectives, with a preference for systemic stability, can smooth out institutional conflicts, while effective coordination mechanisms can contribute to exploit synergies among different policies.

## **B. Banking Sector Vulnerabilities and Stress Testing<sup>9</sup>**

*This note analyzes the financial stability risks of the Costa Rican banking sector based on stress tests assessing both the solvency and liquidity stance of banks in the face of potential shocks. Results suggest that the financial sector is particularly exposed to direct and indirect (through FX risk) credit risk, but well prepared to absorb a range of shocks with available buffers. However, under an extreme scenario featuring a combination of these shocks, six banks—accounting altogether for about 15 percent of market share—would need to be recapitalized, although the total capital shortfall would only amount to less than ½ percent of GDP.*

---

<sup>9</sup> Prepared by Valentina Flamini.

## Soundness of the Banking Sector and Risks

**24. The Costa Rican Financial sector is centered on banking intermediation.** As of December 2016, total assets of the financial sector accounted for 75 percent of GDP, of which 82 percent (or 61 percent of GDP) from deposit institutions (including the Central Bank, commercial banks, cooperatives, and other non-bank deposit institutions) and 18 percent (or 13 percent of GDP) from other financial institutions (including insurance companies, pension funds, and other financial intermediaries). Commercial bank assets account for 56 percent of the total financial sector assets and 42 percent of GDP.

**25. The banking sector remains concentrated and highly segmented.** Out of the total 16 commercial banks in the system, the 4 state-owned banks control 61 percent of market share by assets, compared to 36 percent of the 10 foreign banks, and 3 percent of the two domestic banks. At the same time, foreign banks attract about half of total deposits in foreign currency, while state-owned banks account for 77 percent of deposits in domestic currency, mainly due to the explicit unlimited state guarantee on all public banks deposits in national currency.

**26. Banks are well capitalized.** The CAR for the banking system was 19 percent as of December 2016, well above the 10 percent minimum regulatory requirements. State-owned banks are on average better capitalized than domestic private and foreign ones, largely because of a lower share of credit in FX (48 percent of total, compared to 92 percent in private and foreign banks), which carry higher risk weight. The latter are a result of recent increases aimed at integrating currency risk into banks regulation, and mostly targeted at FX loans to unhedged borrowers.

**27. Asset quality and liquidity indicators are robust but low profitability provides limited cushion.** On average, only less than 2 percent of total loans are non-performing, although this share is marginally higher for state-owned than private banks, including foreign banks. The system is liquid, with little variation across all banks. Profitability levels are low despite large intermediation margins, mostly due to quasi-fiscal operations of state-owned banks, and private banks' requirement to finance with 17 percent of their deposits the credit fund for development (*Sistema de Banca para el Desarrollo*).

### Costa Rica: Selected Banking Sector Soundness Indicators as of December 2016

	All Banks	State Owned	Domestic Private	Foreign
<b>Selected Banking Sector Ratios (Percent)</b>				
<i>Capital Adequacy</i>				
Total capital / RWA (CAR)	18.7	20.5	14.0	16.2
<i>Asset Quality</i>				
NPLs/ total loans	1.6	2.1	1.0	0.9
FX loans/total loans	63.6	48.4	99.6	84.9
<i>Funding</i>				
Deposits/total liabilities	87.5	86.8	89.2	88.7
Deposits/total loans	129.2	132.8	126.3	123.7
<i>Profitability</i>				
ROA (after-tax)	1.0	1.0	1.0	1.0
ROE (after-tax)	8.0	7.5	9.3	9.1
<i>Liquidity</i>				
Liquid assets/total assets	27.6	28.6	24.9	26.0
Liquid assets/short-term liabilities	82.6	77.6	98.5	93.1
<i>Sensitivity to Market Risk</i>				
Net FX exposure / capital	24.5	5.4	86.7	58.9

Source: SUGEF; and IMF staff calculations.

**28. Deposits are the main source of funding but the share of external financing is significant.** Deposits account for almost 90 percent of total liabilities across the system, with little difference among state-owned, private and foreign banks. The deposit to loans ratio is also well above 100 for all banks. However, at 30 percent of total, the share of foreign liabilities is significant and has been on an increasing path over the last years—from about 10 percent in 2010—exposing the system to rollover risks.

**29. Banks are mainly oriented towards lending activities.** On average, loans represent about two thirds of banks assets, the rest being comprised of cash and T-bills (22 percent), long-term bonds (8 percent) and other assets (4 percent). Given the composition of banks' balance sheets, most potential losses and risks to solvency are likely to come from direct and indirect credit risks in the loan book.

**30. FX induced risk remains an important vulnerability.** The high dollarization of both bank assets and liabilities remain the main source of risk to the system. About 70 percent of banks loans are denominated in foreign currency, and 60 percent of them are extended to un-hedged borrowers, exposing the system to FX risk through credit risk. At the same time, about half of bank deposits (74 percent on average for private and foreign banks) are denominated in foreign currency, exposing banks to FX risk in case of a large currency depreciation, although the system overall has positive net FX exposure, thus mitigating such risk.

## Stress Testing

**31. The stress test covers the main risks to solvency and liquidity faced by the banking sector.** The top-down solvency stress test includes: (i) credit risk, through an aggregate NPL shock as well as differentiated sectoral shocks; (ii) market risk, though interest and exchange rate risk; (iii) contagion risk through interbank exposure, and (iv) a set of reverse tests. The liquidity stress test models a simple liquidity drain that affects all banks in the system proportionally (the next section focuses on a more granular and longer term analysis of liquidity buffers in the system).

**32. The impact of single shocks to solvency is moderate and could be absorbed by existing buffers:**

- The *Credit risk shock* is modeled as a system-wide proportional increase in NPLs to 8.8 percent of currently performing loans; and sectoral shocks of 7 and 11 percent of performing loans in the construction and trade sectors respectively—which account together for 67 percent of total loans. Both shocks are calibrated to the mean value plus three standard deviations of NPLs over the last decade. Consistent with the composition of banks' balance-sheet data, results suggest that credit risk losses from a credit shock, both system-wide and sectoral, would materially affect banks capital adequacy, but losses would be limited: on average the CAR for the system would remain above 16 percent, although it would fall to 12 for private banks under the system-wide shock—still well above minimum requirements, and the CAR of two banks would fall below 10 percent.
- The *interest rate risk shock* assumes a nominal interest rate increase of 3½ percentage point, as the cumulative cut in the monetary policy rate in 2015. The analysis includes: (i) the flow impact from the gap between interest sensitive assets and liabilities; and (ii) the stock impact from bond repricing. While the simulated increase in interest rates would result in valuation losses on fixed income instruments, these would be largely offset by an increase in interest income as most banks have long cumulative interest sensitive positions across maturity buckets. Overall, the system-wide CAR would remain virtually unchanged, with a marginally negative variation for state-owned banks, and positive overall changes for private banks.
- The *FX risk shock* assumes an 18 percent nominal depreciation of the bilateral exchange rate with the US dollar, like the overall depreciation occurred in 2008-09, and looks at: (i) the direct exchange rate risk effect on FX exposures; and (ii) the indirect effect through credit risk assuming 11 percent of credit in FX (18 percent of the share of total FX loans extended to unhedged borrowers) becoming non-performing. Results indicate that the simulated FX depreciation would result in both direct and indirect losses, with significant indirect losses through credit quality. Overall, the CAR for the whole system would decrease by about 3 percent and fall to about 11 percent for private banks—still above the regulatory minimum.

**33. A combined solvency shock would require recapitalization of some banks, although the system would satisfy minimum CAR requirements.** The combined shock includes: (i) the proportional increase in NPLs, (ii) the interest rate shock, and (iii) the FX risk shock. It should be

noted that such combined shock represents a very extreme scenario with low probability of occurrence. Results show that, even subject to such extreme shock, on aggregate the system would only fall to 14 percent, thus remaining above the regulatory minimum. However, six individual banks would fall short of the minimum regulatory CAR thus requiring some recapitalization. However, even after such a severe combined solvency shock, the affected banks would only account for 15 percent of the market share, and the identified capital shortfalls would only amount to 0.3 percent of GDP.

**34. Contagion risks stemming from domestic interbank exposures are limited and there is no second-round effect following the combined macro-shock.** Contagion risks are assessed using a matrix of interbank exposures containing, for each bank, the net credit to every other bank in the system. The exercise illustrates what happens to other banks when one bank fails to repay its obligations in the interbank market as a result of the combined shock. Results show that there is no contagion stemming from domestic interbank exposures through second-round effects. This is because interbank lending is very thin in Costa Rica, and mainly constituted by deposits of private banks into two of the state-owned banks, equal to 8½ percent of their total deposit respectively, to finance the *Sistema de Banca para el Desarrollo*.

**35. The reverse test indicates that system-wide NPLs would need to increase enormously for the system-wide CAR to fall below minimum requirements.** The reverse stress test answers what would have to be the NPL increase necessary for: (i) the system-wide CAR, (ii) the CAR of at least 8 banks (half of total), and (iii) the CAR for 50 percent of the total market share, to fall below the regulatory minimum of 10 percent. While an increase to 39 percent would be necessary for the system-wide CAR to fall below 10 percent, NPLs would need to increase to 27 and 30 percent of currently performing loans for at least 8 banks or half of the total market share respectively to fall below the 10 percent regulatory minimum.

**36. The liquidity stress test suggests that liquidity shortfalls following a short-lived drain on deposits would be manageable.** The liquidity stress test assumes a widespread liquidity drain on all banks of 10 and 8 percent per day of demand deposits in domestic and foreign currency respectively; and a 5 and 3 percent per day withdrawal of time deposits in domestic and foreign currency respectively, affecting all banks. Results indicates that, although the share of liquid to total assets would tumble, all banks would remain liquid after 5 days, mainly because of maturing assets being rolled off and converted into new cash inflows.

**Figure 1. Costa Rica: Stress Test Results**

Source: SUGEF, and IMF staff estimates.

Notes: The sample includes a total of 16 banks, of which 4 state owned, 2 private and 10 foreign. The *System-Wide Credit Risk Shock* assumes 9 percent (3 s.d. over average NPLs during the last 10 years) of outstanding performing loans to become non-performing; and the *Sectoral Shock* assumes 7 and 11 percent (3 s.d. over average sectoral NPLs during the last 10 years) of outstanding loans in the construction and trade sectors (which account together for about 62 percent of total loans) becoming non-performing. The *Interest Rate Shock* assumes a 3.5 percentage points nominal interest rate increase. The *FX Shock* assumes a 18 percent depreciation of the FX rate, leading to 11 percent of FX loans becoming NPL. The *Liquidity Shock* assumes a 10 and 8 percent per day withdrawal of demand deposits in domestic and foreign currency respectively; and a 5 and 3 percent per day withdrawal of time deposits in domestic and foreign currency respectively.

Table 2. Costa Rica: Stress Test Results

	All Banks	State Owned	Domestic Private	Foreign
<b>Asset Quality</b>				
Non performing loans (NPLs, Percent of Total Loans))	1.6	2.1	0.9	0.9
Capital adequacy ratio (CAR) pre-shock	18.7	20.5	14.0	16.2
<b>Credit Risk Stress Test 1/</b>				
1. "Proportional increase in NPLs"				
Post-shock CAR (Percent)	16.8	18.7	12.2	14.3
CAR change (Pct Points)	-1.9	-1.8	-1.8	-2.0
2. "Sectoral shocks to NPLs"				
Post-shock CAR (Percent)	17.7	20.0	13.4	14.3
CAR change (Pct Points)	-1.1	-0.6	-0.6	-2.0
<b>Interest Rate Risk Stress Test 2/</b>				
1. Net interest income impact				
Post-shock CAR (Percent)	19.5	21.1	15.2	17.3
CAR change (Pct Points)	0.8	0.6	1.2	1.1
2. Repricing impact				
Post-shock CAR (Percent)	18.6	20.1	14.1	16.7
CAR change (Pct Points)	-0.9	-1.0	-1.1	-0.7
Overall change in CAR (NII and Repricing)	-0.1	-0.4	0.1	0.4
<b>FX Risk Stress Test 3/</b>				
1. Direct Foreign Exchange Risk				
Post-shock CAR (Percent)	17.5	19.0	13.1	15.6
CAR change (Pct Points)	-1.2	-1.5	-0.9	-0.6
2. Indirect Foreign Exchange Risk				
Post-shock CAR (Percent)	16.1	18.1	11.2	13.2
CAR change (Pct Points)	-1.5	-1.0	-1.9	-2.4
Overall change in CAR (Direct and Indirect)	-2.7	-2.5	-2.8	-3.0
<b>Interbank Stress Test</b>				
CAR (after the macroshocks)	14.7	16.6	10.0	12.2
CAR after the first iteration	14.7	16.6	10.0	12.2
<b>Liquidity Stress Test (# of liquid banks after 5 days) 4/</b>				
Simple liquidity test (run on all banks, fire-sale of assets)	16	4	2	10

Sources: SUGEF, and IMF staff estimates.

Notes: : The sample includes a total of 16 banks, of which 4 state owned, 2 private and 10 foreign.

1/ The *proportional increase in NPLs* assumes 9 percent (average NPLs over the last 10 years plus 3 s.d.) of outstanding performing loans to become non-performing; and the *Sectoral Shock* assumes 7 and 11 percent (average sectoral NPLs over the last 10 years plus 3 s.d.) of outstanding loans in the construction and trade sectors (which account together for about 62 percent of total loans) becoming non-performing.

2/ The *Interest Rate Shock* assumes a 3.5 percentage points nominal interest rate increase.

3/ The *FX Shock* assumes a 18 percent depreciation of the FX rate, leading to 11 percent of FX loans becoming non-performing.

4/ The *Liquidity Shock* assumes a 10 and 8 percent per day withdrawal of demand deposits in domestic and foreign currency respectively; and a 5 and 3 percent per day withdrawal of time deposits in domestic and foreign currency respectively.

## C. Assessing Liquidity Buffers<sup>10</sup>

*This note evaluates the Costa Rican banking sector liquidity stance by assessing banks' buffers vis-à-vis a short-term adverse funding shock as well as their resilience to a medium-term substantial loss of foreign funding. The latter is comparable in its effect to a potential withdrawal of corresponding banking relationships. Results show that the system as a whole is liquid and potential short-term liquidity gaps would be manageable, although there are pockets of vulnerability in FX liquidity. However, most banks would withstand a severe and protracted drainage of foreign funding in the medium-term by using liquid assets and available layers of counterbalancing capacity.*

### Short-term Liquidity Buffers

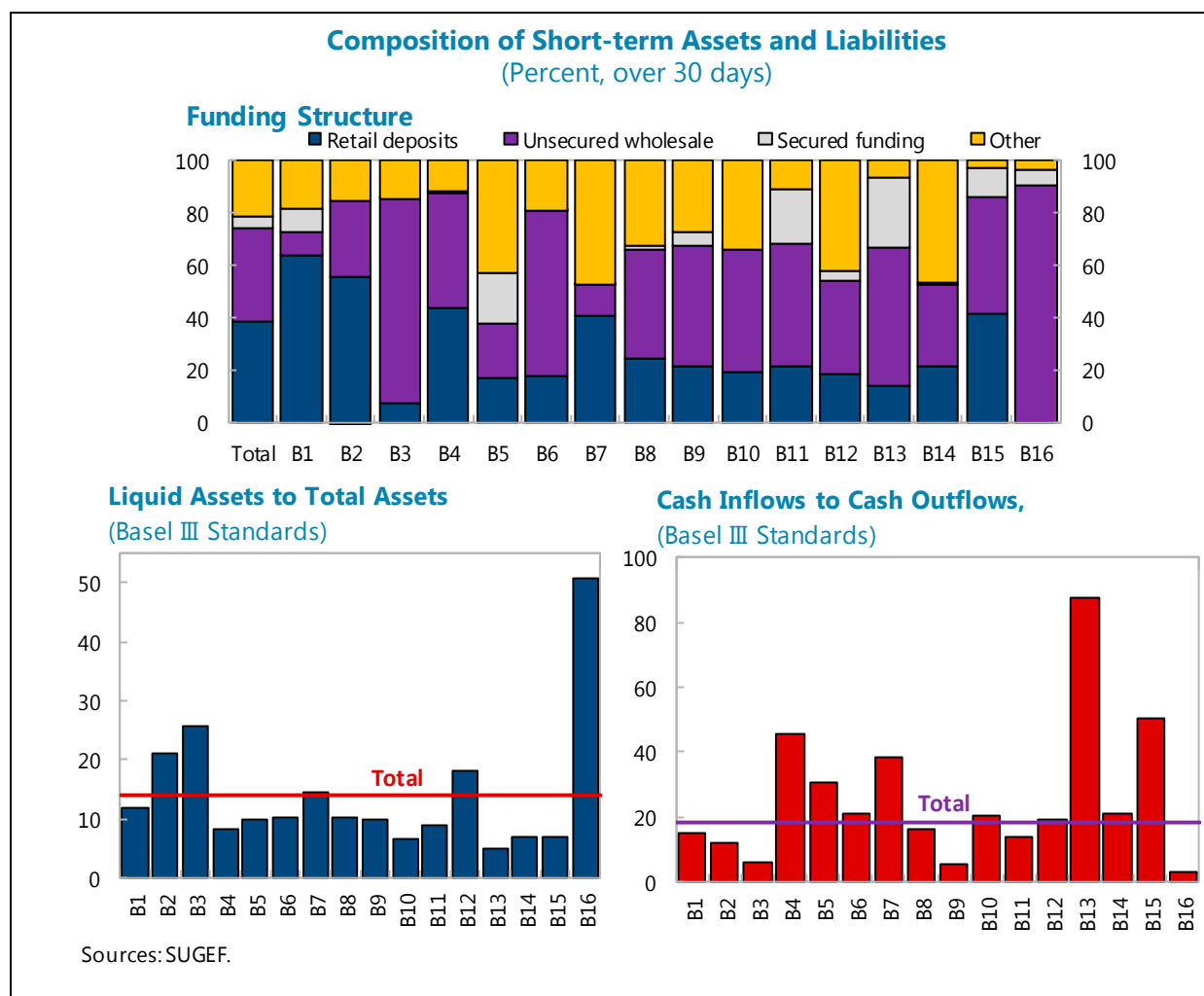
**37. We use the Basel III Liquidity Coverage Ratio (LCR) to evaluate banks' short-term liquidity buffers.** The LCR measures banks' potential net outflows over the next 30 days, and their counterbalancing capacity—i.e. the amount of available liquid assets to cover these potential outflows. Accordingly, the metric is defined as the value of liquid assets after haircuts as a share of net cash outflows. Basel III establishes that banks should maintain an LCR above 100 percent in normal times, but can use their stock of liquid assets—thereby falling below the minimum—during periods of stress. To minimize material disruption to the orderly strengthening of the banking system, and the ongoing financing of economic activity, Basel III provides for a phased introduction of the LCR, starting with 60 percent at the time of its introduction in 2015 and reaching its statutory value of 100 percent in 2019. This rule would place the LCR at 80 percent in 2017, but our analysis assumes the standard 100 percent threshold. To emulate stress conditions based on bank-by-bank balance sheet data, we use standard Basel III assumptions for deposit run-off rates, liquidity eligibility, and asset haircuts (see assumptions table below).

**38. The short-term funding structure and asset composition of the banking system point to limited vulnerabilities.** Retail deposits account, on average for the whole system, for about 40 percent of total funding up to 30 days, and funding sources secured by high quality collateral bring the ratio of stable funding to about 45 percent of total. Although unsecured wholesale funding accounts for a non-trivial share of the total, the bulk of it is represented by deposits from small businesses, which are typically subject to low volatility. The quality of assets is also high, with central bank reserves and domestic sovereign bonds accounting for about  $\frac{3}{4}$  of liquid assets, and a 95 percent ratio of level 1 to total liquid assets<sup>11</sup> for the system. At 14 percent, the share of liquid assets to total assets is within conventional metrics, considering the typically long maturity structure

<sup>10</sup> Prepared by Valentina Flamini.

<sup>11</sup> Level 1 assets generally include cash, central bank reserves, and certain marketable securities backed by sovereigns and central banks, among others. These assets are typically of the highest quality and the most liquid, and there is no limit on the extent to which a bank can hold these assets to meet the LCR. Level 2 assets include certain government securities, covered bonds and corporate debt securities, lower rated corporate bonds, residential mortgage backed securities and equities that meet certain conditions. Level 2 assets may not in aggregate account for more than 40 percent of a bank's stock of HQLA and are subject to lower eligibility criteria. See assumption table below for more information.

of bank assets and the short time horizon of this analysis. Overall, the composition of assets and liabilities places the share of cash inflows to cash outflows at 18 percent, although there is considerable variation across banks.



**39. However, the breakdown of funding and assets by currency points to pockets of vulnerability in foreign currency.** Unsecured and wholesale funding in FX accounts for a higher share of the total, at the expense of retail deposits and secured sources of funding. Wholesale funding in FX is also likely to be more volatile than deposits from small business in domestic currency, thus raising vulnerabilities. At 9 percent of total assets, the stock of liquid assets in FX is also lower and of inferior quality compared to the overall stock of liquid assets, and 95 percent of potential cash inflows would be subject to haircuts of between 50 and 100 percent according to Basel III assumptions. This suggests that bank balance sheets would be more vulnerable to short-term liquidity stress in FX.

**40. Results show that the system as a whole is liquid and potential liquidity shortfalls appear to be manageable.** At 142 percent of net cash outflows, the system-wide LCR is well above the 100 percent threshold, suggesting that the banking sector overall has enough liquidity.

However, 5 banks are not fully compliant with the LCR 100 percent threshold, suggesting that injection of some extra liquidity could be necessary in case of a severe drain. Nevertheless, the cumulative liquidity shortfall would amount to less than 1 percent of 2016 GDP, or 1.8 percent of broad money as of December 2016. Banks' liquidity position in FX appear more vulnerable to a short-term adverse funding shock, with an overall shortfall under the same assumptions of 1.2 percent of GDP, or about 9 percent of Net International Reserves as of December 2016.

**Summary of Short-term Liquidity Stress Test Results**  
(Billions of colones, unless otherwise noted)

	Overall
Net cash Outflows	2,275
Value of Liquid Assets after Haircut	3,241
System-wide LCR	142%
Liquidity Shortfall	281
Percent of 2016 GDP	0.9
Percent of Broad Money (Dec 2016)	1.8
Number of banks with LCR below 100 percent	5

Sources: SUGEF; and IMF staff estimates.

Notes: the sample includes a total of 16 banks.

**LCR Basel III Assumption**

<b>A. Eligibility of liquid assets</b>	<b>Basel III</b>
<b>Level 1 Assets</b>	<b>100%</b>
Coins and bank notes	
Qualifying marketable securities from sovereigns, central banks, PSEs, and multilat. dev banks	
Qualifying central bank reserves	
Domestic sovereign or central bank debt for nonzero risk-weighted entities	
<b>Level 2a Assets</b>	<b>85%</b>
Qualifying marketable securities from sovereigns, central banks, PSEs, and multilat. dev banks (w	
Qualifying corporate debt securities rated AA- or higher	
Qualifying covered bonds rated AA- or better	
<b>Level 2b Assets</b>	
Qualifying Mortgage Backed Securities	75%
Qualifying corporate debt securities rated between A+ and BBB-	50%
Qualifying common equity shares	50%
<b>B. Haircuts on Inflows of liquid assets (over 30 days)</b>	
Level 1 assets	0%
Level 2a assets	15%
Level 2b assets	
Eligible RMBS	25%
Other	50%
Margin lending backed by all other collateral	50%
All other assets	100%
Credit or liquidity facilities	0%
Operational deposits held at other financial institutions	0%

## LCR Basel III Assumptions (Concluded)

Other inflows, by counterparty	
<i>Retail counterparties</i>	50%
<i>Nonfinancial wholesale counterparties, transactions not listed above</i>	50%
<i>Financial institutions and central banks, transactions not listed above</i>	100%
Net derivative cash inflows	100%
Other (contractual) cash inflows	100%
<b>C. Outflows of liquid assets (over 30 days)</b>	
<b>Retail Deposits</b>	
Demand deposits	
<i>Stable deposits</i>	5%
<i>Less stable retail deposits</i>	10%
Term deposits, residual maturity > 30d	0%
<b>Unsecured Wholesale Funding</b>	
Demand and term deposits, residual maturity < 30d, small business	
<i>Stable deposits</i>	5%
<i>Less stable deposits</i>	10%
Operational deposits generated by clearing, custody, and cash management activities	25%
<i>Portion covered by deposit insurance</i>	5%
Cooperative banks in an institutional network	25%
Nonfinancial corporates, sovereigns, central banks, multilat development banks, PSEs	
<i>Fully covered by deposit insurance</i>	20%
<i>Not fully covered by deposit insurance</i>	40%
Other legal entity customers	100%
<b>Secured Funding</b>	
Secured funding with a central bank, or backed by Level 1 assets	0%
Secured funding backed by Level 2A assets	15%
Secured funding backed by non-Level 1 or non-Level 2a asset, with domestic sovereign, multilat dev banks, or domestic PSEs as a counterparty	25%
Fundign backed by RMBS eligible for Level 2B	25%
Funding backed by other Level 2B assets	50%
Other secured funding transactions	100%
<b>Additional Requirements</b>	
Valuation changes on non-Level 1 posted collateral securing derivatives	20%
Excess collateral held by bank related to derivate transactions that could be called anytime	100%
Liquidity needs related to collateral contractually due on derivatives transactions	100%
Increased liquidity needs related to derivative transactions allowing collateral substitution	100%
ABCP, SIVs, conduits, SPVs, or similar	
<i>Liabilities from maturing</i>	100%
<i>Asset backed securities</i>	100%
Undrawn but committed credit and liquidity facilities	
<i>Retail and small business</i>	5%
<i>Nonfinancial corporates, sovereigns, central banks, multilat dev. banks, PSEs</i>	
<i>Credit facilities</i>	10%
<i>Liquidity facilities</i>	30%
<i>Supervised banks</i>	40%
<i>Other financial institutions</i>	
<i>Credit facilities</i>	40%
<i>Liquidity facilities</i>	100%
<i>Other legal entity customers, credit and liquidity facilities</i>	100%
Other contingent funding liabilities	
<i>Trade finance</i>	5%
<i>Customer short positions covered by customers' collateral</i>	50%
Additional contractual outflows	100%
Net derivate cash outflows	100%
Any other contractual cash outflows (not listed above)	100%

## Medium-term Loss of Foreign Funding

**41. We assess the resilience of the system to a severe and protracted loss of foreign funding based on a conventional medium-term liquidity stress.** This test uses bank-by-bank data by maturity buckets in FX of up to 6 months and assumes strong run-off rates that extend beyond 30 days although declining over time (see table of assumptions below). Such scenario can be used also to simulate the effect of a protracted withdrawal of Corresponding Banking Relationships (CBR) which could in principle extend beyond the LCR 30-days horizon. For this purpose, we only consider funding is foreign currency, since the Central Bank could technically provide unlimited LOLR assistance to cover shortages in local currency. FX balances are converted in domestic currency at the bilateral exchange rate of 548,18 COL/USD. It should be noted that the assumed runoff of funding is arguably severe, but in line with international experience during crisis.

**42. The test assumes three layers of liquidity to meet projected cash outflows:**

- *Inflows from maturing investments and lending operations*, with roll-off rates (or share of usable inflows) decreasing with maturity;
- *The stock of cash and interbank loans*, although the latter is very thin in Costa Rica overall, and virtually non-existent is foreign currency; and
- *Sale of securities with longer residual maturity*, subject to fire-sale haircuts.

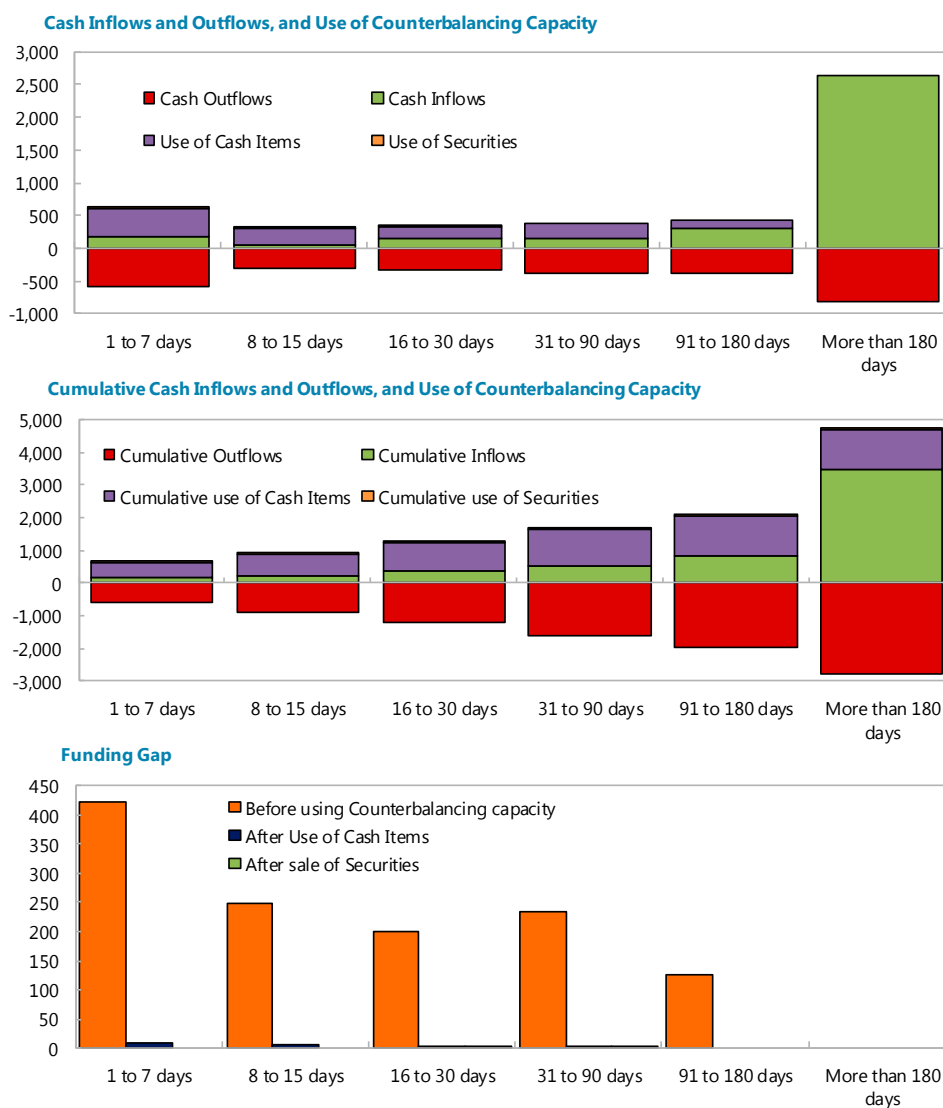
The first item represents banks' direct *liquidity buffer*, and the last two their *counterbalancing capacity*, i.e., the set of instruments with high liquidity generation capacity by which banks can cope with funding gaps. These three layers of liquidity are assumed to be accessed in a sequential way to cover shortfall left by the previous layer. In case of any remaining shortfall after the sale of securities, the bank is considered illiquid. Offset of liquidity shortfalls by excess liquidity at longer horizons is not permissible, hence outflows in each bucket must be met with the available liquidity in the same bucket. This could result in banks being considered illiquid even if its position would theoretically turn liquid again at longer horizons.

**43. Results show that funding gaps could generally be met using first and second layers.**

While system-wide shortfalls are considerable in the shorter maturity buckets, they tend to decrease with maturity, to the point that cash inflows more than offset simulated outflows at maturities beyond 6 months, resulting in no gap. Even at shorter maturities where liquidity shortfalls are larger, funding needs can generally be met after utilizing inflows from operations, and the gap generally disappears when accessing the available stock of cash. Only one bank fails to pass the test and remains illiquid after selling available securities, with the unfunded gap emerging at maturities between 16 to 90 days, and returning in a long liquid position afterwards. At about 4½ billion colones, however, the cumulative funding gap for the bank only amounts to 0.1 percent of the Central Bank's international reserves as of December 2016.

**44. There is also very limited risk of a simultaneous deterioration in both the liquidity and solvency position.** Reassuringly, the bank left illiquid after the sale of available securities displays a robust solvency position, and its CAR remains above the regulatory minimum even after a severe combined solvency shock. Hence, there is little risk that liquidity problems in the aftermath of a severe loss of foreign funding, including from the withdrawal of CBR, may spill over to solvency in the medium-term.

**Figure 2. System-Wide Cash Flows in Medium-Term Liquidity Stress Scenario**  
(Billions of Colones)



**Table 3. Medium-Term Liquidity Stress Scenario Assumptions**

(Foreign Currency Flows)

<b>Stress scenario - assumptions</b>						
<b>Run-off rates</b>						
	1	2	3	4	5	6
	1 to 7 days	8 to 15 days	16 to 30 days	31 to 90 days	91 to 180 days	More than 180 days
Retail funding: sight deposits						
Stable	8%	4%	4%	3.5%	0%	0%
Unstable	12%	6%	6%	2.5%	0%	0%
Retail funding: savings deposits						
Stable	8%	4%	4%	4%	0%	0%
Unstable	12%	6%	6%	3%	0%	0%
Retail funding: term deposits	35%	35%	35%	30%	25%	20%
Other deposits	35%	35%	35%	30%	25%	20%
Secured wholesale funding from other financial institutions	100%	100%	100%	100%	100%	100%
Unsecured wholesale funding from other financial institutions	75%	75%	75%	30%	30%	20%
Outflows from derivatives	100%	100%	100%	100%	100%	100%
Other obligations	100%	100%	100%	100%	100%	100%
Undrawn volume of committed credit/liquidity lines	10%	5%	5%	10%	20%	0%
<b>Roll-off rates</b>						
	1	2	3	4	5	6
	1 to 7 days	8 to 15 days	16 to 30 days	31 to 90 days	91 to 180 days	More than 180 days
Securities in trading book	100%	100%	100%	100%	100%	100%
Securities available for sale	100%	100%	100%	100%	100%	100%
Securities held to maturity	100%	100%	100%	100%	100%	100%
Inflows from derivatives	100%	100%	100%	100%	100%	100%
Loans maturing	37%	37%	37%	37%	37%	37%
Other	80%	80%	80%	80%	80%	80%
<b>Haircuts</b>						
Cash items	0%					
Securities in trading book	20%					
Securities available for sale	20%					
Securities held to maturity	20%					

## D. Spillovers from Stress in International Banks<sup>12</sup>

*This note uses the IMF Bank Contagion Module to estimate spillovers to Costa Rica from stress in international banks. We find that the upstream exposure of Costa Rica to BIS—reporting banks is higher than in other countries in the region. Hence, foreign credit availability in Costa Rica would be materially affected by spillovers from a severe shock originated abroad, with financial integration through Panama playing an important role in the transmission of shocks.*

**45. We assess the impact of financial spillovers to Costa Rica from stress in international banks based on the IMF Bank Contagion Module.** The model estimates potential rollover risks for Costa Rica stemming from both foreign banks' affiliates operating in Costa Rica that are funded by their parent system, and direct cross-border lending by foreign banks to Costa Rica borrowers. The analysis is based on BIS banking statistics and bank-level data as of June 2016.<sup>13</sup> In the scenario analyzed here, rollover risks are triggered by assuming substantial bank losses in the value of private and public sector assets in selected countries, resulting in uniform deleveraging across domestic and external claims. If the banks do not have sufficient capital buffers to cover the triggered losses, they have to deleverage by reducing both their foreign and domestic assets to restore their capital-to-asset ratios,<sup>14</sup> thus squeezing credit lines to Costa Rica and other countries. Our analysis includes the transmission of shocks through Panama, a non-BIS-reporting jurisdiction, given the country's importance as regional financial center.

**46. The upstream exposure of Costa Rica to BIS-reporting banks is higher than in other countries in the region.** The country's upstream exposure to BIS-reporting banks<sup>15</sup> captures the upper bound of rollover risks for Costa Rica in a worst-case scenario without any replacement, either domestic or external, of the loss of credit by BIS reporting banks to Costa Rican borrowers. This was about 10½ percent of GDP in June 2016, or 14 percent of total domestic and foreign credit to the non-bank private and public sector.<sup>16</sup> This value is marginally lower than the corresponding exposure as of October 2015 (11½ and 14½ respectively), even though the decrease may reflect changes in the number of banks reporting to the BIS disclosing bilateral positions. Although limited, the upstream exposure for Costa Rica is higher than for other countries in the region, with the

<sup>12</sup> Prepared by Valentina Flamini with model estimates provided by Paola Ganum (RES).

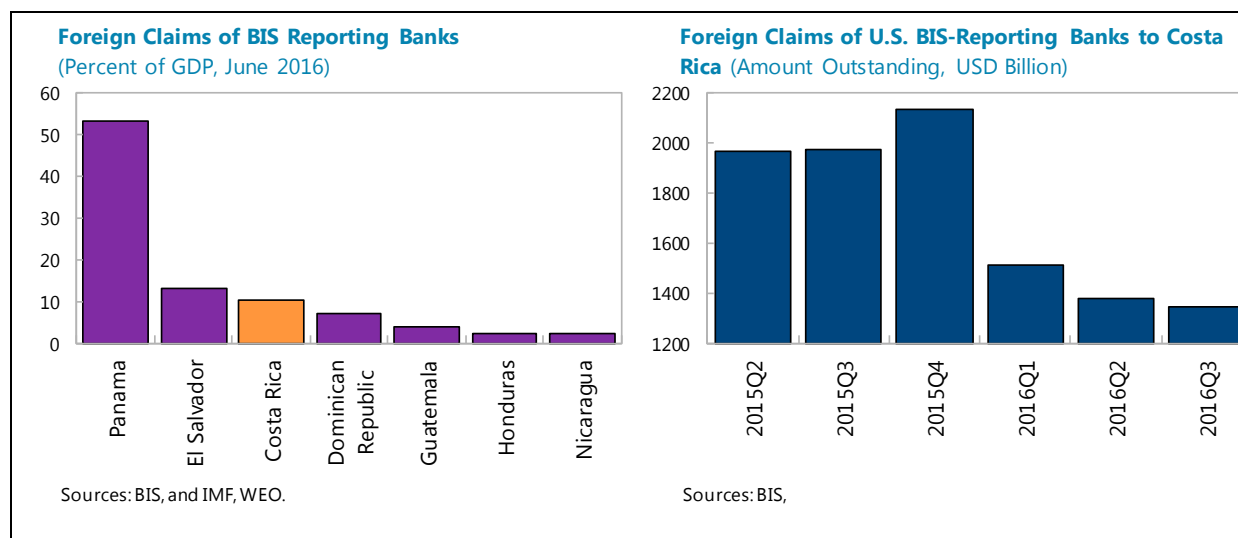
<sup>13</sup> For methodological details see Cerutti, Eugenio, Stijn Claessens, and Patrick McGuire, 2012, "Systemic Risks in Global Banking: What can Available Data Tell Us and What More Data are Needed?" BIS Working Paper 376, Bank for International Settlements.

<sup>14</sup> Bank recapitalizations as well as other remedial policy actions (e.g., ring fencing, monetary policy, etc.) at the host and/or home country level are not assumed.

<sup>15</sup> Based on consolidated claims on Costa Rica of BIS reporting banks—excluding domestic deposits of subsidiaries of these banks in Costa Rica.

<sup>16</sup> Total credit to the non-bank sectors in Costa Rica is calculated by adding IFS local (both domestic and foreign owned) banks' claims on non-bank borrowers and BIS reporting banks' direct cross-border claims on non-bank sectors (BIS Locational Banking Statistics Table 6B).

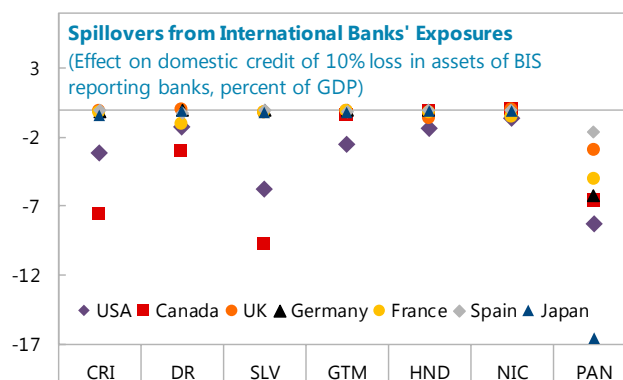
exclusion of Panama and El Salvador. The lion share of Costa Rica's total upstream exposure is accounted by foreign claims by Canadian and, to a lesser extent, U.S. bank lenders, although claims by U.S. banks in Costa Rica have been decreasing over the last two years (foreign claims by Canadian banks are not publicly disclosed).



#### 47. Foreign credit availability in Costa Rica would be materially affected by spillovers from a severe shock originated abroad.

For example, a 10 percent loss on assets of BIS-reporting banks in U.S. and Canada would reduce credit in Costa Rica by almost 8 percent of GDP. In contrast, a similar shock would reduce credit in the Dominican Republic and Guatemala by only about 3 percent of GDP, and about one percent of GDP in Honduras and Nicaragua. The most sizeable impact on foreign credit availability for Costa Rican borrowers would stem from losses in Canadian assets, which would result in a credit squeeze in Costa Rica of more than 7½ percent of GDP, compared to 6½ percent as of October 2015.

These calculations do not take into account the amount of local stable funding for Canadian banks from deposits in Costa Rica which would cushion banks' need to deleverage in the country.



Source: IMF/RES Bank Contagion Module, based on BIS data as of June 2016. Note: Includes the transmission of shocks through Panama. In Panama, the loss of credit includes credit by banks in the off-shore center with minimal links to the domestic economy.

**48. Financial regional integration is important in the transmission of shocks.** Almost three quarters and two thirds of the estimated credit losses in Costa Rica resulting from a shock originating in Japan and Europe would be transmitted through cross-border lending from Panama, which is more dependent on Japanese and European banks' funding. However, given the limited upstream exposures of Costa Rican borrowers to those countries, the overall reduction in foreign

credit from stress in these countries would be rather limited (less than one percent of GDP) in Costa Rica.

### Spillovers to Costa Rica from International Banks' Exposure as of June 2016

Creditor banking system	Magnitude of Shock to Creditor Banks' Exposures 1/	Impact on Credit Availability in Costa Rica (% GDP) 2/
USA	10	-3.13
Canada	10	-7.54
USA and Canada	10	-7.66
UK	10	-0.11
Germany *	10	-0.11
France	10	-0.22
Spain	10	-0.06
Italy	10	-0.03
Portugal *	10	0.00
Switzerland *	10	-0.04
Netherlands	10	-0.30
Japan	10	-0.42
Selected European countries 3/	10	-0.85

Source: IMF, Research Department Macro-Financial Division Bank Contagion Module based on BIS, ECB, IFS, and Bankscope data. Notes: Estimates include the transmission of shocks through Panama.

1/ Percent of on-balance sheet claims (all borrowing sectors) that default.

2/ Reduction in foreign banks' credit due to the impact of the shock on their balance sheet, assuming uniform deleveraging across domestic and external claims. All simulations are based on 2016Q2 data.

3/ Greece, Ireland, Portugal, Italy, Spain, France, Germany, Netherlands, and the UK.

\* These lender countries stopped disclosing bilateral positions with Costa Rica, estimates results only include the transmission of shocks through Panama.

## References

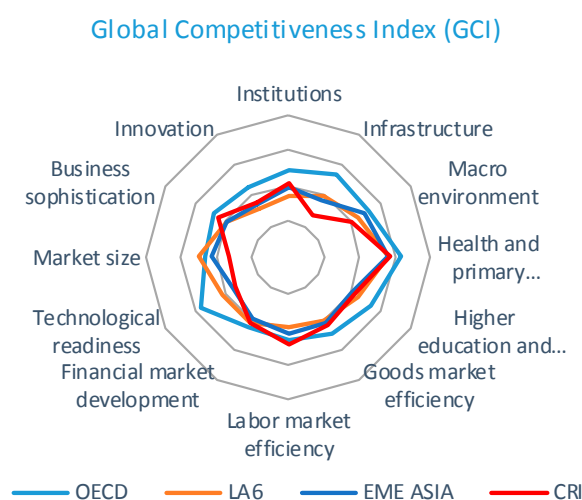
- Alessandri, P., Pierluigi Bologna, Roberta Fiori, and Enrico Sette, 2015, *A note on the implementation of a Countercyclical Capital Buffer in Italy*, Occasional Paper No. 278 (Rome: Banca d'Italia), [https://ideas.repec.org/p/bdi/opques/qef\\_278\\_15.html](https://ideas.repec.org/p/bdi/opques/qef_278_15.html).
- Basel Committee on Banking Supervision, 2010, *Guidance for National Authorities Operating the Countercyclical Capital Buffer* (Switzerland: Bank for International Settlements).
- Basel Committee on Banking Supervision, 2011, *Basel III: A global Regulatory Framework for More Resilient Banks and Banking Systems* (Switzerland: Bank for International Settlements).
- Borio, C., and Philip Lowe, 2002, "Assessing the Risk of Banking Crises," Bank for International Settlements Quarterly Review, (December).
- Drehmann, M., and Kostas Tsatsaronis, 2014, "The Credit-to-GDP Gap and Countercyclical Capital Buffers: Questions and Answers," Bank for International Settlements (March). [http://www.bis.org/publ/qtrpdf/r\\_qt1403g.htm](http://www.bis.org/publ/qtrpdf/r_qt1403g.htm).
- Edge, R., and Ralf R. Meisenzahl, 2011, "The Unreliability of Credit-to-GDP Ratio Gaps in Real Time: Implications for Countercyclical Capital Buffers," *International Journal of Central Banking*, Vol. 7 (December), pp. 261–98.
- Galindo, A., Liliana Rojas-Suarez, and Marielle del Valle, 2013, *Macro-prudential Regulations in Andean Countries* (Washington: Center for Global Development)
- Orphanides, A., and Simon van Norden, 2002, "The Unreliability of Output Gap Estimates in Real Time," *The Review of Economics and Statistics*, Vol. 84(4) (November), pp. 569–83.
- Reserve Bank of India, 2013, Implementation of Counter-cyclical Capital Buffer, (December).
- Rychtárik, Š, 2014, "Analytical Background for the Countercyclical Capital Buffer Decisions in Slovakia" *Bank of Slovakia BIATEC - Banking Journal*, (April), pp. 10–15.
- Gersl, A., and Jakub Seidler, 2012, "Excessive Credit Growth and Countercyclical Capital Buffers in Basel III: An Empirical Evidence from Central and East European Countries," *University of Finance and Administration's ACTA VSFS Journal*, Vol. 6 (July), pp. 91–107.

# ADDRESSING INFRASTRUCTURE BOTTLENECKS TO BOOST COMPETITIVENESS<sup>1</sup>

*This note examines Costa Rica's infrastructure main challenges and possible solutions going forward. To boost potential and inclusive growth, Costa Rica needs to address inadequate investment and other logistical shortcomings to ensure a more efficient integration into international supply chains. Although CRI has made significant progress in terms of business sophistication and innovation, large gaps exist in infrastructure, institutions and market efficiency. Costa Rica's accession process to the OECD provides an opportunity to implement best practices in terms of institutional arrangements that can help tackle these shortcomings. The authorities need also to address fiscal vulnerabilities, not least to make room for a well-focused and high-quality investment in infrastructure.*

## A. Lacking Infrastructure Weighs on Competitiveness

**1. Costa Rica remains one the most competitive countries in Latin America, however, there are factors holding back the country's growth potential, notably infrastructure.** According to the *Global Competitiveness Report 2016-17*, CRI fell slightly to 54<sup>th</sup> rank, only behind Chile (33<sup>th</sup>), Panama (42<sup>nd</sup>), and Mexico (51<sup>st</sup>). In particular, CRI leads the region in health and primary education (35<sup>th</sup>), and is second only to Chile (28<sup>th</sup>) in higher education. In addition, Panama and Costa Rica lead the region in business sophistication and innovation. Nevertheless, market size, macro environment, and especially infrastructure show the largest gaps compared with the best world performers.



Source: WEF, 2017.

<sup>1</sup> Prepared by Gerardo Peraza and Roany Toc Bac.

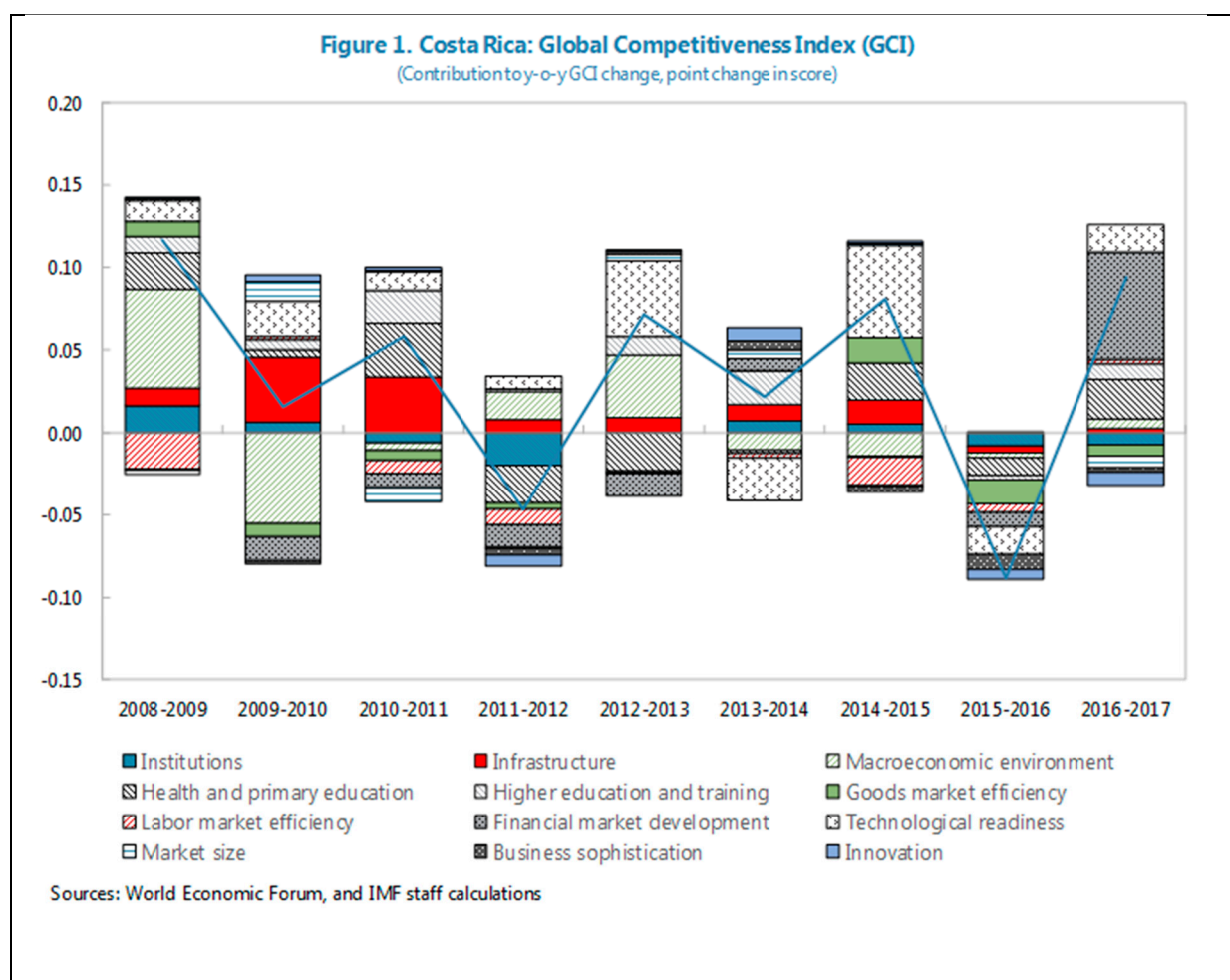
**2. Indeed, inadequate supply of infrastructure hinders doing business in Costa Rica under almost all dimensions** (WEF 2017). Costa Rica ranks 106<sup>th</sup> in the quality of overall infrastructure, 13 positions behind the top performer Barbados (out of 21 assessed LAC). Costa Rica ranks particularly poorly in roads where it is second to last, and ports where it scores worse than most of the countries in Central America. Only air transport seems to be relatively up to task.

**Global Competitiveness Index 2016 - Infrastructure Pillar**  
Ranking - Quality of Infrastructure

	<b>CRI</b>	<b>OECD</b>	<b>EME EUR</b>	<b>EME ASIA</b>	<b>LAC6</b>
Overall infrastructure	<b>106</b>	28	74	63	94
Roads	<b>125</b>	34	80	59	89
Railroad infrastructure	<b>97</b>	29	69	41	86
Port infrastructure	<b>102</b>	36	81	61	76
Air transport infrastructure	<b>59</b>	32	78	61	74
<b>GCI</b>	<b>54</b>	<b>28</b>	<b>70</b>	<b>48</b>	<b>66</b>

Sources: World Bank, and Fund staff calculations.

**3. Moreover, over the last decade, the improvement of CRI's competitiveness score and GCI rankings has not relied enough on infrastructure enhancements** (Figure 1). For example, technological readiness, higher education, and training constitute the main drivers of Costa Rica's



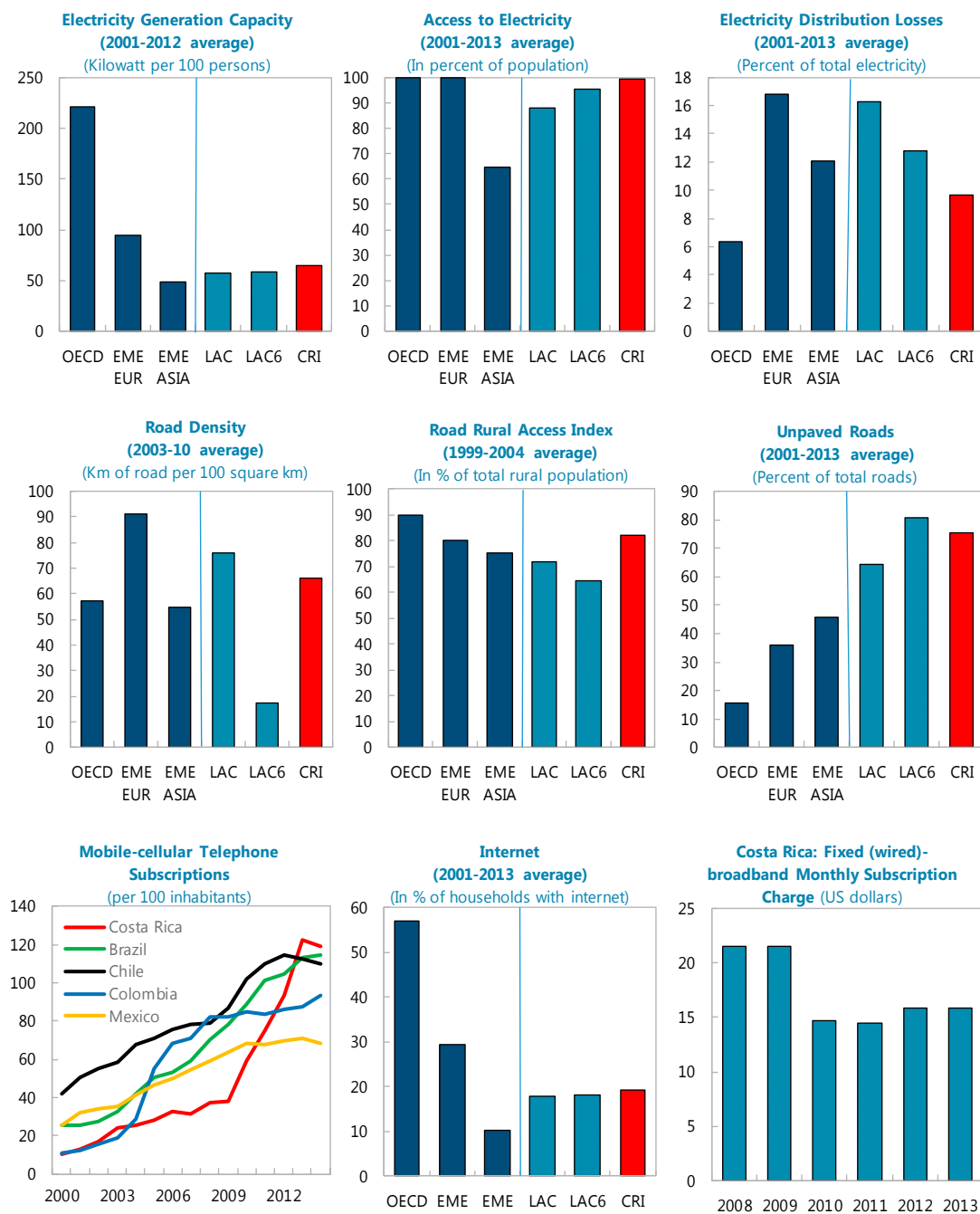
improvement in the competitiveness score. In contrast, the institutional environment, labor and goods market efficiency have continuously burdened Costa Rica's score performance. Macroeconomic environment was a drag during the slowdown of 2012-13 due to weakening of domestic demand and sluggish exports, and it has somewhat recovered since as the economy converges to its potential growth. Finally, improvement in infrastructure was strong at the beginning of the period, but it clearly stagnated thereafter. The latter is particularly worrisome as infrastructure investment has a complex and dynamic relationship with development outcomes such as job creation, market access, health and education (Ruiz-Núñez and Wei, 2015).

### **Stock, Access and Quality of Economic Infrastructure**

**4. Costa Rica's power generation capacity and telephone lines compare well with peers in other emerging markets, but road quality lags** (Figure 2). Moreover, as other LAC economies and emerging market regions, it still trails OECD economies in electricity generation capacity.

- a. Costa Rica's electricity generation is somewhat higher than in LAC and Emerging Asia, at 65 kilowatts per 100 persons, but it compares poorly with more than three times that level in OECD economies and one and a half times that level in Emerging Europe (EME). However, Costa Rica has matched OECD and EME's virtually full electricity coverage.
- b. Costa Rica's road infrastructure (as measured by the road density, Km of road per 100 square Km) exceeds Emerging Europe and Asia: for every 100 km<sup>2</sup>, Costa Rica has 72 km of road compared with 69 km in EME and 55 km in EMA. However, the quality of Costa Rica's roads (as measured by the share of unpaved roads to total roads) is worse than most regions except LAC6 (influenced by Brazil and Colombia) and Sub-Sahara Africa (not shown in Figure 2).
- c. Following the opening of the telecommunications sector to competition in 2009, the sector experience a large expansion of mobile-cellular subscriptions, even surpassing some of the LAC6 economies, while at the same time lowering subscription charges by 30 percent (OECD, 2016). Nevertheless, Costa Rica still lags Emerging Europe and OECD economies in the percent of households with internet.

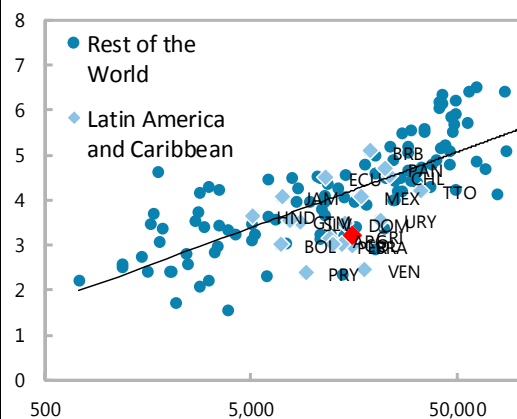
**5. The overall low quality of Costa Rica's transportation infrastructure is likely the result of chronic underspending and deficient planning (OECD, 2016).** Costa Rica shows lower-than-expected infrastructure quality compared with the country's level of economic development, such as the level of income per capita. Costa Rica tends to underperform relative to its peers particularly in the case of roads, railroads and ports (Figure 3).

**Figure 2. Infrastructure Indicators**

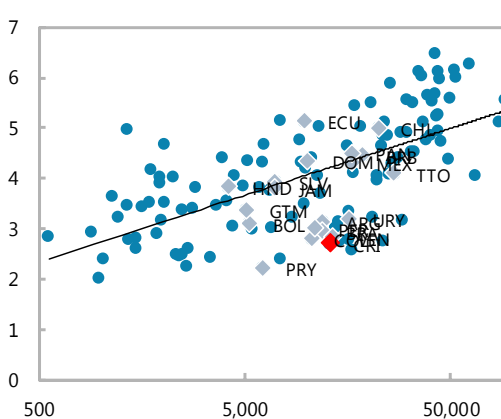
Sources: World Bank; Energy Information Agency; International Road Federation; OECD Economic Surveys Costa Rica 2016; International Telecommunication Union; World Telecommunications/ICT Indicators Database 2015; Cerra et al., 2016; and IMF staff calculations.

**Figure 3. Latin America: Qualitative Infrastructure Indicators, 2016**  
(x-axis, GDP per capita, current PPP U.S. dollars, 2015; y-axis, Infrastructure indices, 7 = best)

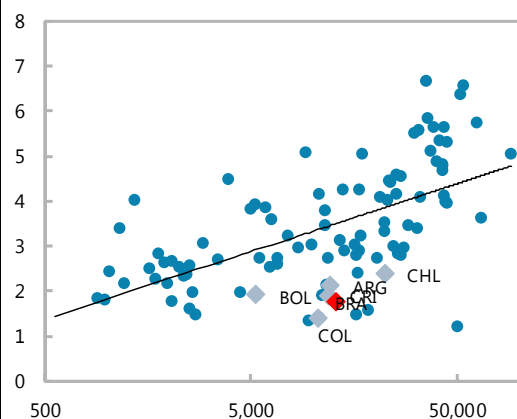
### Infrastructure



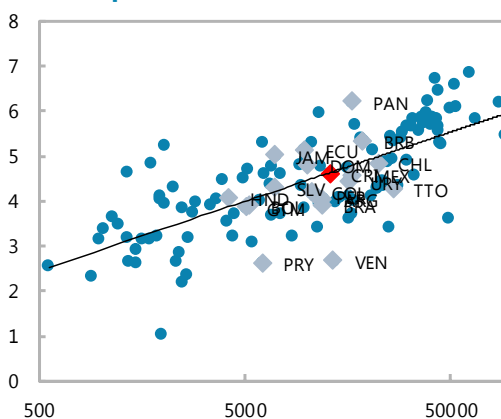
### Roads



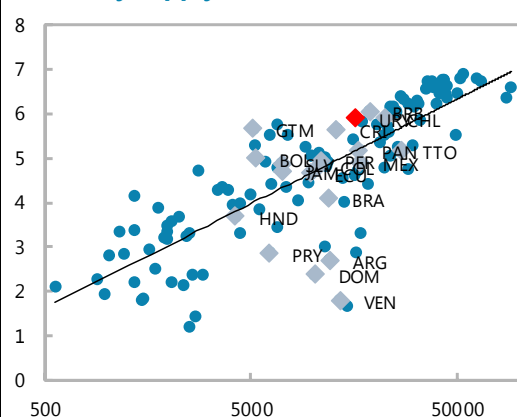
### Railroads



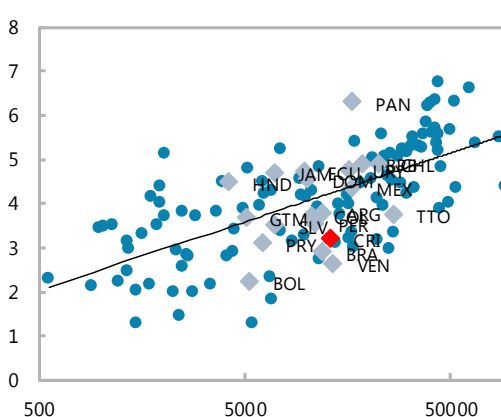
### Air Transport



### Electricity Supply



### Ports



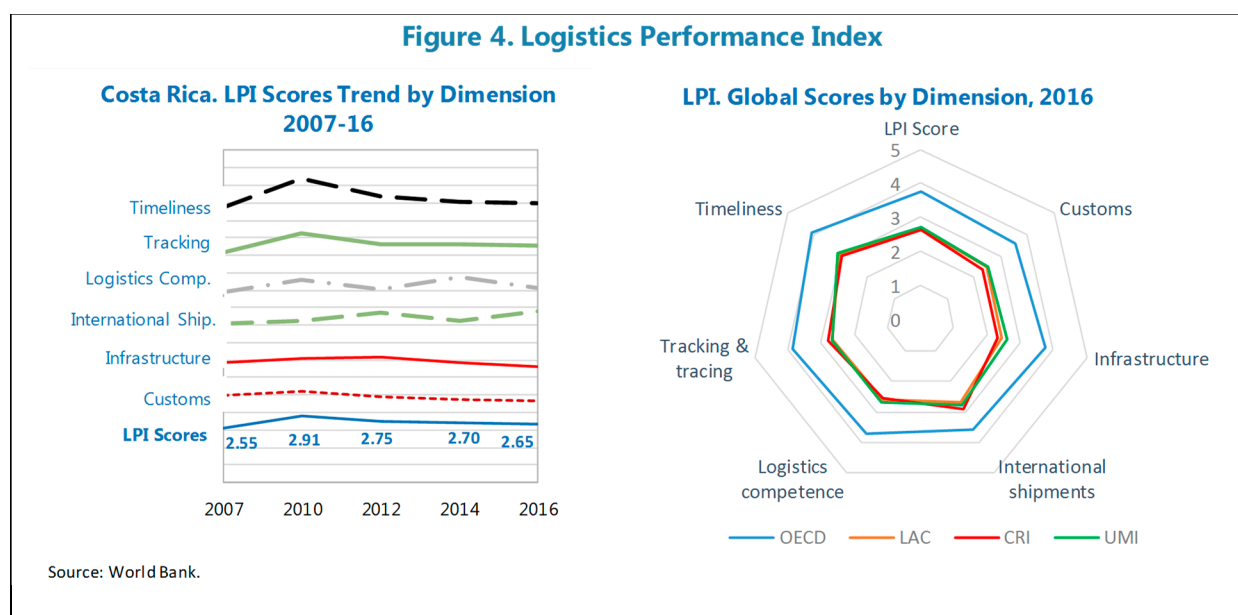
Sources: World Economic Forum and World Bank; Cerra et al., 2016; and IMF staff calculations.

Note: Costa Rica, red marker.

## B. Logistics Becomes Harder with Inadequate Infrastructure

**6. Infrastructure plays an important role in the supply chain service as facilitates connectivity and access to markets internally and externally (WB, 2016).** Costa Rica's inadequate infrastructure weighs on its logistics performance, ranging from delays to increased transportations costs due to inadequate conditions of roads and ports. While Costa Rica has made important progress in the relevant regulatory framework, such as the transparency of procedures (Cunha and Jaramillo, 2013), its logistics environment is suffering from the absence of modernization strategy that combines regulatory reform with investment planning and inter-agency coordination.

**7. Logistics indicators suggest that Costa Rica has been losing ground in recent years.** After an improvement in 2010, Costa Rica's LPI score has been trending down during the last few years, according to an international survey, customs and infrastructure being the dimensions more problematic compared with other regions (Figure 4). Although Costa Rica is equal or more competitive than LAC and upper-middle income (UMI) economies in other dimensions, it still stands far behind OECD's standards in general. High fees but low quality of infrastructure and services in ports and airports, solicitation of informal payments, major delays in customs and other official (e.g., sanitary inspection) clearance procedures and complex regulations related to logistics are the main obstacles perceived by local logistics agents.



**8. High logistics costs are weighing on the competitiveness of Costa Rica and the region.** Besides the inadequate infrastructure, the high costs in the logistic chain originating from transport services, customs efficiency, harmonization and standardization of procedures are affecting the competitiveness for both high and low value goods in Costa Rica and more generally in the region. Logistical bottlenecks include the limited road connectivity as well as border and port management facilities with insufficient physical capacity and contribute to markedly higher costs and delays for producers and exporters (World Bank 2012).

## C. Stepping Up the Game to Compete

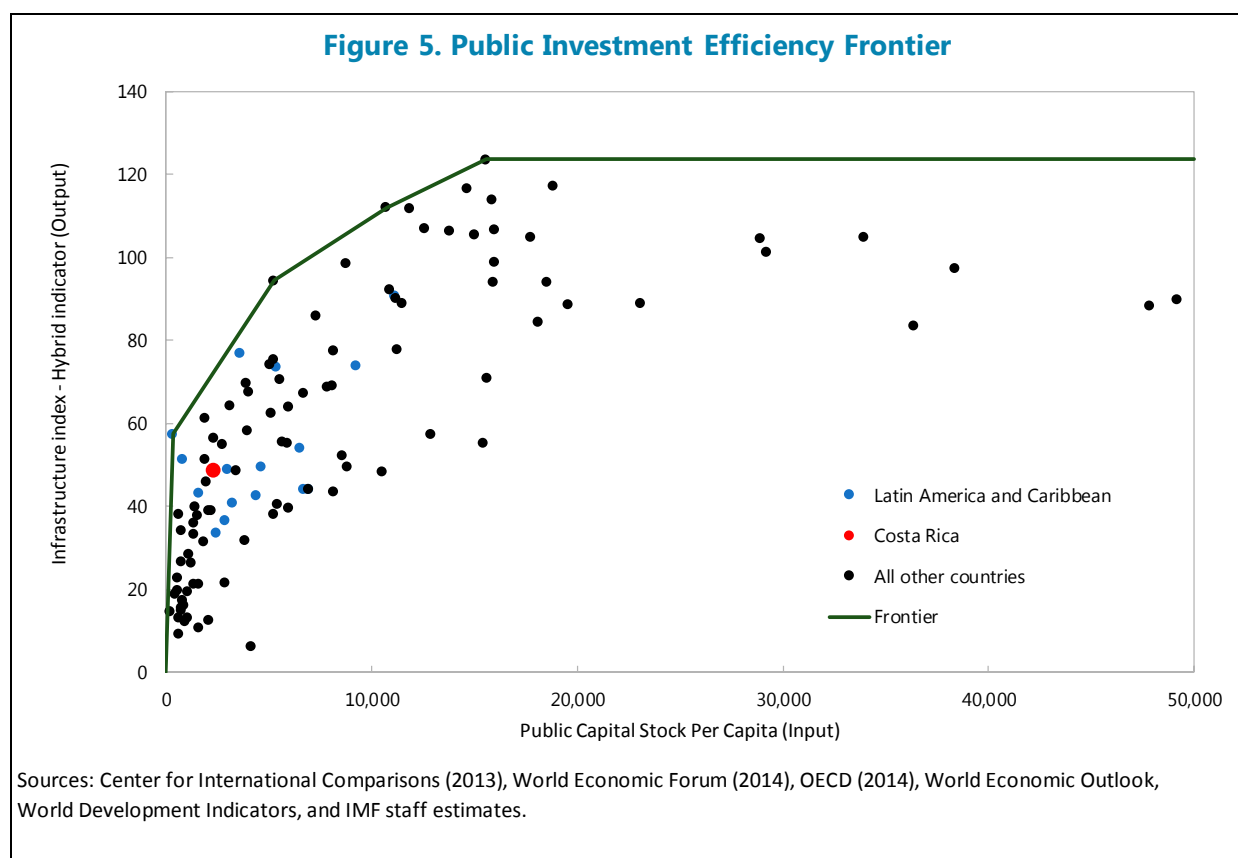
**9. Costa Rica will need to address economic infrastructure bottlenecks to boost its competitive edge.** Specifically, the low quality of transport infrastructure together with the broader logistical challenges mentioned in the previous section make it difficult for Costa Rica to ensure a more efficient integration into international supply chains. This section covers two possible action areas, namely improving investment efficiency on the one hand and the broader institutional framework on the other. First, putting strong systems in place to manage public investment is key for efficient allocation of public funds (Cerra et. al 2016). Second, Costa Rica's accession process to the OECD provides an opportunity to introduce best practices in terms of institutional arrangements that foster growth and inclusiveness through higher private investment.

### Investment Efficiency

**10. According to Fund estimates, Costa Rica has substantial scope for improving public investment efficiency.** We use the Public Investment Efficiency indicator (PIE-X) proposed by the IMF (2015), which estimates the relationship between the ratio of the public capital stock per capita and indicators of access to (and the quality of) infrastructure (it is thus a so-called hybrid indicator) (Figure 5).<sup>2</sup> Countries with the highest infrastructure coverage/quality for a given level of public capital stock per capita determine the efficiency frontier. The slope of the latter is decreasing, illustrating the decreasing marginal returns to additional investment. The efficiency of public investment generally increases with income per capita, but efficient countries do exist across all income levels. The hybrid indicator for Costa Rica is 49 index points, compared with above 70 points for the top performers in the LAC region. While LAC compares well with Emerging Economies, with an efficiency gap of around 26 percent, Costa Rica lags not far behind with a 30 percent efficiency gap. However, this still leaves much room for amelioration.

---

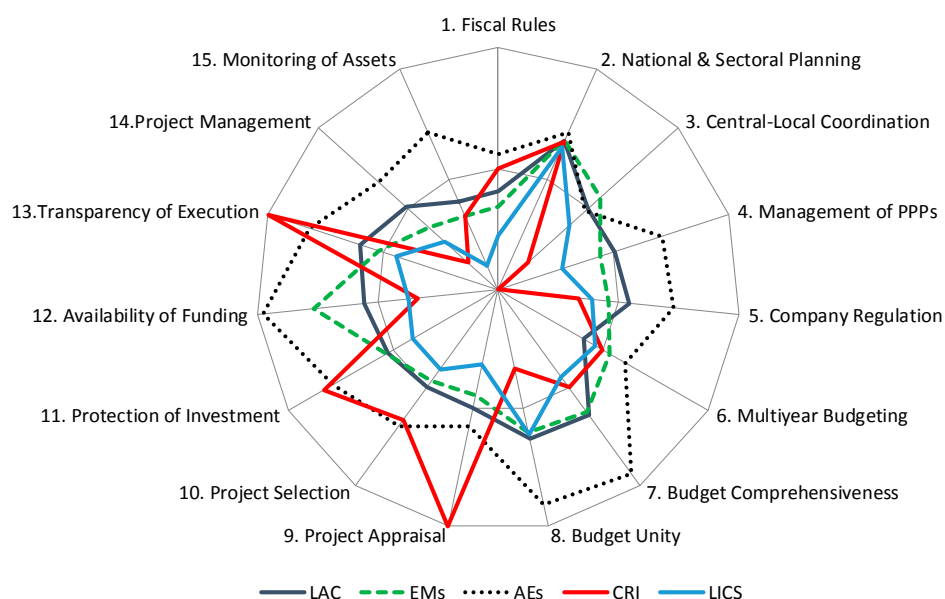
<sup>2</sup> For a detailed description of the methodology see IMF (2005), and its application for Latin America, Cerra et. al. (2016).



**11. Using the Public Investment Management Assessment (PIMA) it is possible to provide an assessment of Costa Rica’s public investment decision-making process.** The PIMA, as described in IMF (2015), evaluates 15 key institutions for planning, allocation, and implementing public investment.<sup>3</sup> The most striking feature of Costa Rica’s public investment management institutions is the wide variation in institutional strength. This contrasts with the case of AEs (Figure 6) where institutional strength (or weakness) is more uniform. Costa Rica’s institutional strengths are concentrated in the selection and appraisal of projects, the transparency during the execution, and national and sectoral planning. Clear institutional weaknesses appear in the management of projects, availability of funding, and not surprisingly, in the management of PPP.<sup>4</sup> While CRI performs better overall, some scores are worse off than those of LICs for several categories.

<sup>3</sup> Based on a sample of 25 countries, and using the PIMA tool, IMF (2015) found that the overall strength of PIM is strongly correlated with income, with PIM institutions being, on average, weakest in LIDCs and strongest in AEs. Also, average institutional strength tends to increase along the investment cycle, with planning being the weakest and implementing the strongest.

<sup>4</sup> Since the General Concession Law was enacted in 1998, only 4 projects involving PPP have materialized. Three are already in operation: the toll road Ruta 27 San José-Caldera, the port Terminal Granelera en Puerto Caldera, and the International Airport Daniel Oduber Quirós. The fourth is the port Terminal de Contenedores de Moín (under construction), Chacón (2016).

Figure 6. Public Investment Management<sup>1</sup>

Source: Fund staff calculations based on desk survey.

<sup>1</sup> Index, (0=worst, 10=best). Includes 25 advanced economies (AEs), 12 emerging countries (EMS), and selected LAC (Bahamas, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Grenada, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, and St. Lucia).

## Revisiting Institutional and Regulatory Frameworks

**12. Costa Rica ranks favorably in many business indicators and remains a regional leader in attracting FDI, but much can be done to strengthen its economic institutional set-up.** As noted, Costa Rica needs to address infrastructure bottlenecks to maintain the country's competitive advantage. The transportation infrastructure, the quality of which clearly is lagging with respect to other emerging economies, deserves special attention. As Costa Rica pursues accession to the OECD, it needs to take advantage of the technical reviews to tackle the complex institutional setting that weighs down on infrastructure investment.<sup>5</sup> In this respect, an important home-made model is the success of the opening-up of the telecom sector in terms of greater access and lower costs.

**13. Reforms of the institutional and legal framework of public-work agencies would improve policy design and execution in transport and other infrastructure sectors.** In particular, the OECD (2016) makes the following important points:

<sup>5</sup> On April 9, 2015, the OECD Council decided to open accession discussions with Costa Rica. OECD, C (2015) 93/FINAL, July 15, 2015.

- *Transport infrastructure.* The low quality of infrastructure is the result of chronic underspending compound by deficient strategic planning and lack of long-term vision.
- *Efficiency of public investment in transport infrastructure.* Simplifying the current complex institutional framework would enhance long-term transport infrastructure. A strengthened Presidential Council on Competitiveness and Innovation (CPCI) could design long-term transport infrastructure strategies and policies, consistent with other long-term economic and social objectives.
- *Public-private collaboration.* The CPCI may benefit from following a model such as the “Competitive Lab” to promote public-private collaboration, by bringing together representatives from different sectors, to devise actionable, long-term competitiveness agendas (WEF, 2016). This can be achieved by using the GCI as a tool to facilitate the identification of priority areas and the design of agendas to make progress in those areas.
- *Attraction of private investment.* There is scope to improve coordination and management capacity in Public Private Partnerships (PPP) projects. Costa Rica could explore the possibility of moving the National Concession Council (CNC) from the Ministry of Public Works to the Ministry of Finance. This move would eliminate the CNC’s conflict between promotion of public-funded infrastructure projects and private participation, while favoring the accounting of implicit liabilities arising from PPP projects.

**14. In sum, Costa Rica must address infrastructure shortcomings through a multi-pronged strategy.** Efforts should be channeled on three fronts: (i) increasing infrastructure investment, particularly, in transportation; (ii) improving the project management framework (especially for PPP); and (iii) enhancing the institutional and legal structures to match better long-term transport infrastructure decisions with economic and social objectives. At the same time, equally important is the need to create the fiscal space so that more public investment is possible without jeopardizing macroeconomic stability.

## References

- Cerra, Valerie, Alfredo Cuevas, Carlos Goes, Izabela Karpowicz, Troy Matheson, Issouf Samake, and Svetlana Vtyurina, 2016, "Highways to Heaven: Infrastructure Determinants and Trends in Latin America and the Caribbean," International Monetary Fund, 2016. IMF Working Paper No. WP/16/185, (September).
- Chacon, Ricardo, 2016, "Is Infrastructure Costa Rica's Achilles' heel?" Infrastructure Intelligence. August.
- Cunha, Barbara and C. Felipe Jaramillo, 2013, "Trade and Logistics in Central America," World Bank, (February).
- Guasch, Jose Luis, 2016, "Private and Public investments in infrastructure-PPP/Concessions: International experiences and identification of new practices and conditions for success," Professor of Economics, University of California, San Diego, USA, and Former Head of the PPP Global Expert Group at the World Bank, (October).
- Guasch, Jose Luis, 2016, "The Role of Infrastructure/Logistics in Inclusive Growth: Lessons from Latin America," XIV Regional Conference Central America, Panama and Dominican Republic, Antigua Guatemala, Conference Session, (November).
- International Monetary Fund, 2015, "Making Public Investment More Efficient," IMF Publication (Washington: International Monetary Fund).
- International Monetary Fund, 2016, "Costa Rica 2016 Article IV Consultation – Press Release; Staff Report; and Statement by the Executive Director for Costa Rica," IMF Country Report No. 16/131, (May).
- International Monetary Fund, 2016, "Costa Rica Selected Issues and Analytical Notes," IMF Country Report No. 16/132, (May).
- OECD, 2016, "OECD Economic Surveys: Costa Rica 2016: Economic Assessment", OECD Publishing, Paris.
- Ruiz-Núñez, Fernanda, and Zichao Wei, 2015, "Infrastructure Investment Demands in Emerging Markets and Developing Economies," Policy Research Working Paper No. 7414, Public-Private Partnerships (PPPs) Group, World Bank, (September).
- Straub, Stéphane, 2008, "Infrastructure and Growth in Developing Countries: Recent Advances and Research Challenges," The World Bank Development Research Department Research Support Team (January).
- World Bank, 2012, "Logistics in Central America, The Path to Competitiveness," Economics Unit, Sustainable Development Department, Central America Country Management Unit, (June).
- World Bank, 2016, "Connecting to Compete 2016, Trade Logistics in the Global Economy," (June).
- World Economic Forum, 2016, "The Global Competitiveness Report 2016-2017," (September).

# CLIMATE CHANGE, ENVIRONMENTAL POLICIES AND OUTPUT TRADE-OFFS<sup>1</sup>

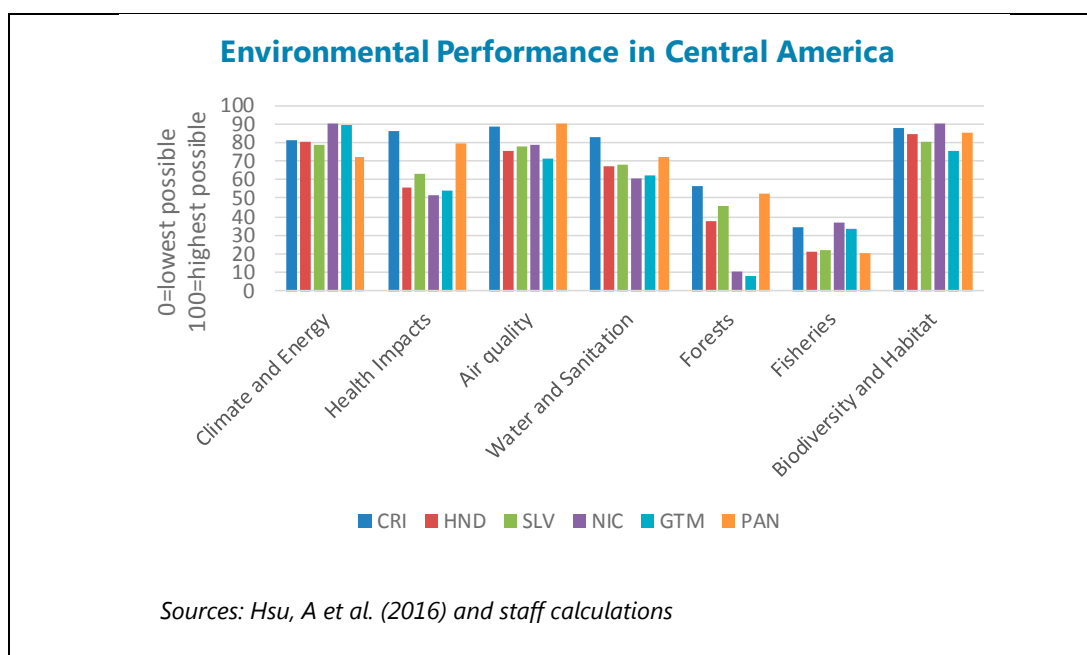
*This note evaluates the vulnerabilities of Costa Rica to global warming, drawing lessons from the relationship between Costa Rica's ambitious environmental policies and its record of strong economic growth. First, the paper shows that due to the geographical position of the country, any significant increase in temperature due to global warming will put serious downward pressure on growth. Second, because in the past environmental policies included financial incentives to transition away from agriculture towards services, such as tourism, as the primary driver of growth, economic activity was not harmed. Going forward, it will be important to ensure that the legal and regulatory framework stimulates the growth of those sectors that are more resilient to climate change.*

## A. Introduction

**1. Costa Rica remains one of the leaders in environmental policy in Central and also Latin America.** According to the Environmental Performance Index (EPI) data compiled by the Yale Center for Environmental Law & Policy, Costa Rica performs better than other countries in Central America overall in outcomes of environmental policy (see chart below). Specifically, Costa Rica has the highest quality of water and sanitation in the region, the lowest risk of water and air pollution to human health (labeled "Health Impacts"), and the highest forest coverage (54 percent of land area in 2015). The overall air quality is on par with Panama, while the percentage of protected areas and species (labeled "Biodiversity and Habitat") is just below Nicaragua's (25 percent of all forested area). The category Climate and Energy, in which Costa Rica holds the third place, depends on the ratio of emissions to GDP, which has been going down with the highest rate in the region, and the emissions from electricity production that increased in the past (however, as of 2016 more than 98 percent of energy is generated from renewable sources). Overall, the composite index placed Costa Rica in 42nd place in the ranking of all countries in 2016, above all other Latin American economies.

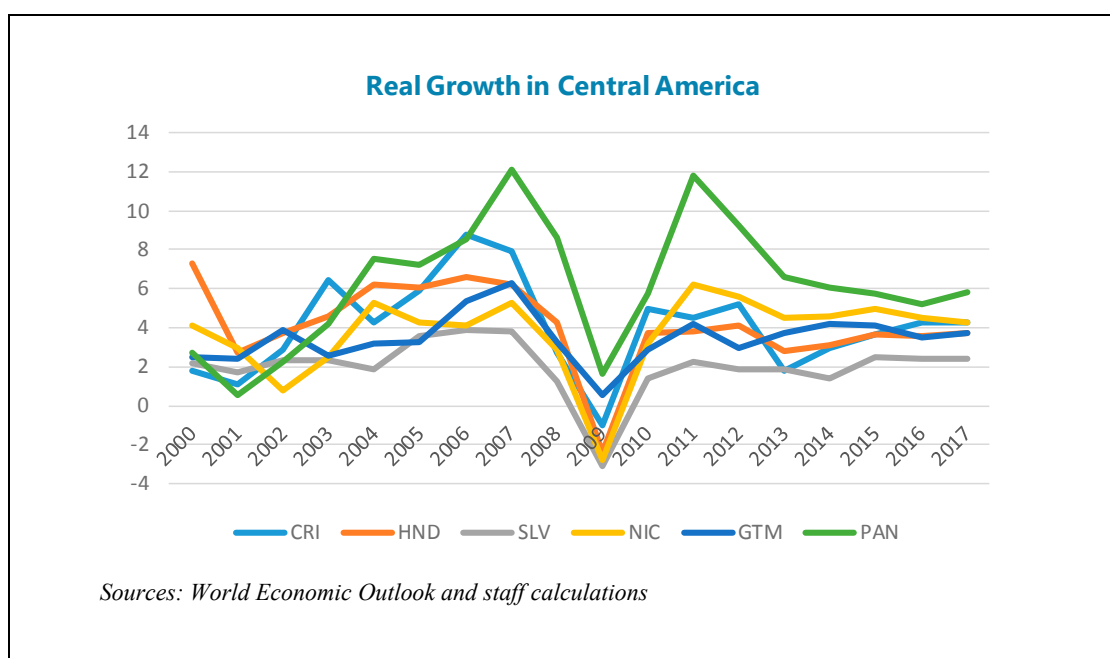
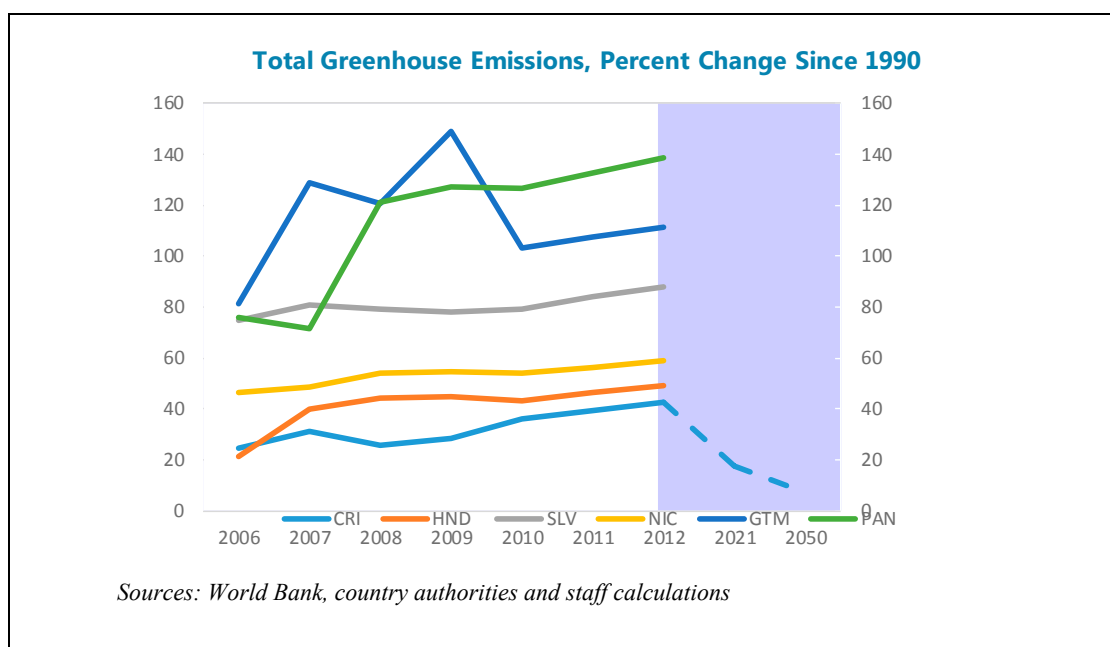
---

<sup>1</sup> Prepared by Dmitry Plotnikov.



**2. In the future, the country aims to maintain an ambitious environmental agenda and reach carbon neutrality by 2021.** Out of all Central American countries, Costa Rica has experienced the lowest growth in total greenhouse emissions since 1990. The Ministry of Energy and Environment committed voluntarily to reduce emissions further in absolute terms to reach 2005 levels by 2021 (see chart below). After 2021, the projected emission trajectory is consistent with the agreement reached at the United Nations Framework Convention on Climate Change (UNFCCC), which would result in an average global temperature increase below 2°C if all countries comply.

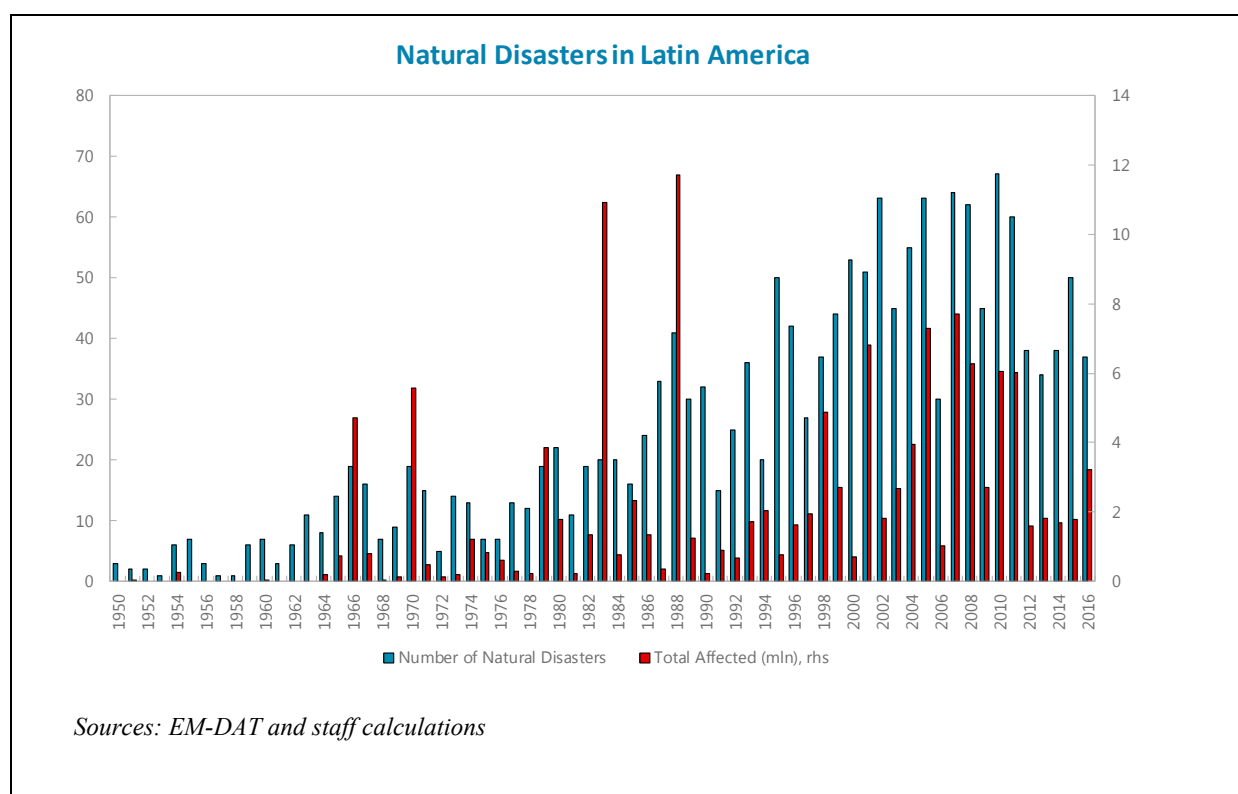
**3. Under such ambitious environmental policies, Costa Rican growth has persisted as one of the highest in the region and elevated in global comparison too.** Because environmental policies may increase regulatory burden and constrain certain types of on economic activity, they are often criticized as detrimental to economic growth and employment. Nevertheless, except for 2013 and 2014, Costa Rican real growth remained close to 4 percent, above the average of emerging markets and more than double the rate of advanced economies in 2016.



**4. Costa Rica's ambitious environmental policies have likely had historically positive effects on economic growth and will continue to mitigate the effects of global warming.** First, the geographical position of the economy and the already relatively high, although so far stable, yearly temperature implies a higher negative impact of global warming on economic activity, especially on agricultural output. Second, the paper shows that the reason why the environmental policies have not harmed growth is that they were implemented together with financial incentives for a structural transformation of the economy away from agriculture and towards services - tourism in particular - as the primary driver of growth.

## B. Effects of Climate Change on Growth

**5. Climate change affects Costa Rica through multiple channels.** First, more frequent natural disasters may directly destroy private and public capital, resulting in a temporary declines in output and increases in unemployment. Therefore, Costa Rica's already weak fiscal position may further deteriorate both due to a reduced tax base and increased expenditures on disaster relief and infrastructure rebuilding (Acevedo, 2014, IMF, 2016). Since areas prone to be affected tend to be poor, higher incidence of natural disasters can increase inequality. Second, Costa Rica is also moderately exposed to a permanent sea level rise. Even though the share of land area where elevation is below five meters is only 0.6 percent, the area is characterized by high tourism and real estate activity. Third, global warming can indirectly reduce economic activity through lower labor productivity, labor supply and agricultural crop yield as these variables negatively depend on the surrounding temperature (Graff Zivin, J. and Neidell, M., 2014).



**6. Since mid-20<sup>th</sup> century both the frequency and intensity of natural disasters has increased in Latin America** (see chart above). According to the international database of natural disasters, EM-DAT, both the frequency of climate change-related natural disasters as well as the number of people affected by disasters increased multifold since the 1950s world-wide and in Latin America in particular.<sup>2</sup> IMF (2016) estimates that in the post-1990 period relative to the entire post-1950 period both the average direct damage annual cost in constant 2010 US dollars and the

<sup>2</sup> These natural disasters include floods, storms, landslides and extreme temperatures.

frequency per square kilometer of natural disasters doubled. As a percentage of GDP, the annual expected cost for a country like Costa Rica increased from 0.3 to 0.4 percent of GDP.

**7. To evaluate the impact of global warming, staff estimated a global non-linear effect of rising temperature on annual economic growth.** Following the approach suggested in Burke, Hsiang and Miguel (2015), staff estimated the following panel regression on annual data:

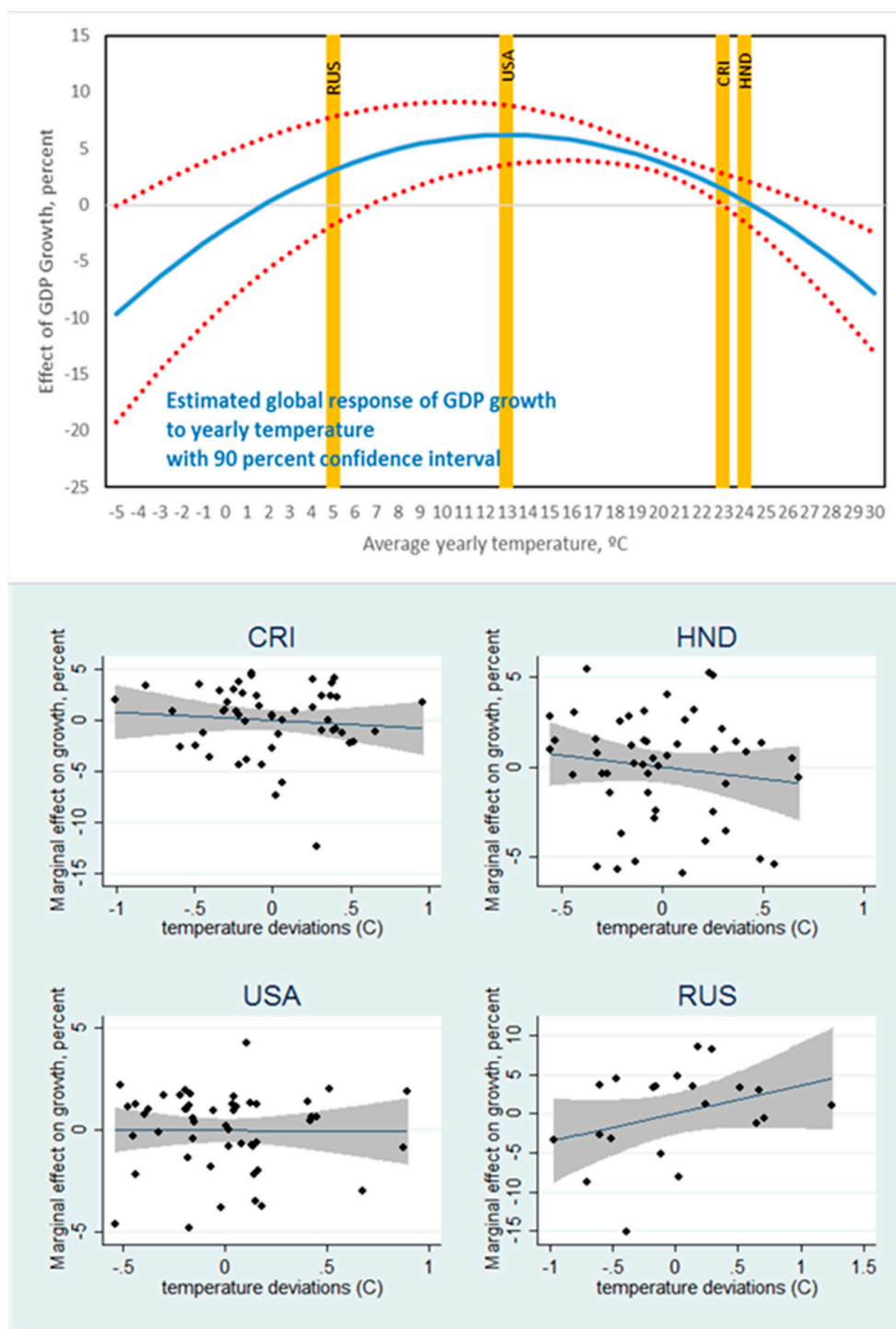
$$y_{it} = f_1(T_{it}) + f_2(P_{it}) + g_i(t) + \beta_t + \varepsilon_{it}$$

where  $y_{it}$  is annual GDP growth in country  $i$  and year  $t$ ,  $f_1(T_{it})$  is the function of interest - a quadratic function of average annual country-specific population-weighted temperature  $T_{it}$ ,  $f_2(P_{it})$  is a quadratic function of average annual country-specific precipitation,  $g_i(t)$  is a country-specific quadratic trend function which by definition includes country-specific fixed effects,  $\beta_t$  are time fixed effects and  $\varepsilon_{it}$  are random disturbances. The data set includes observations since the earliest period available (1961 for Costa Rica) to 2013 and covers 165 countries. Given the rich structure of time and country specific effects, the only coefficients that are common for all countries are the parameters of functions  $f_1(T_{it})$  and  $f_2(P_{it})$ .

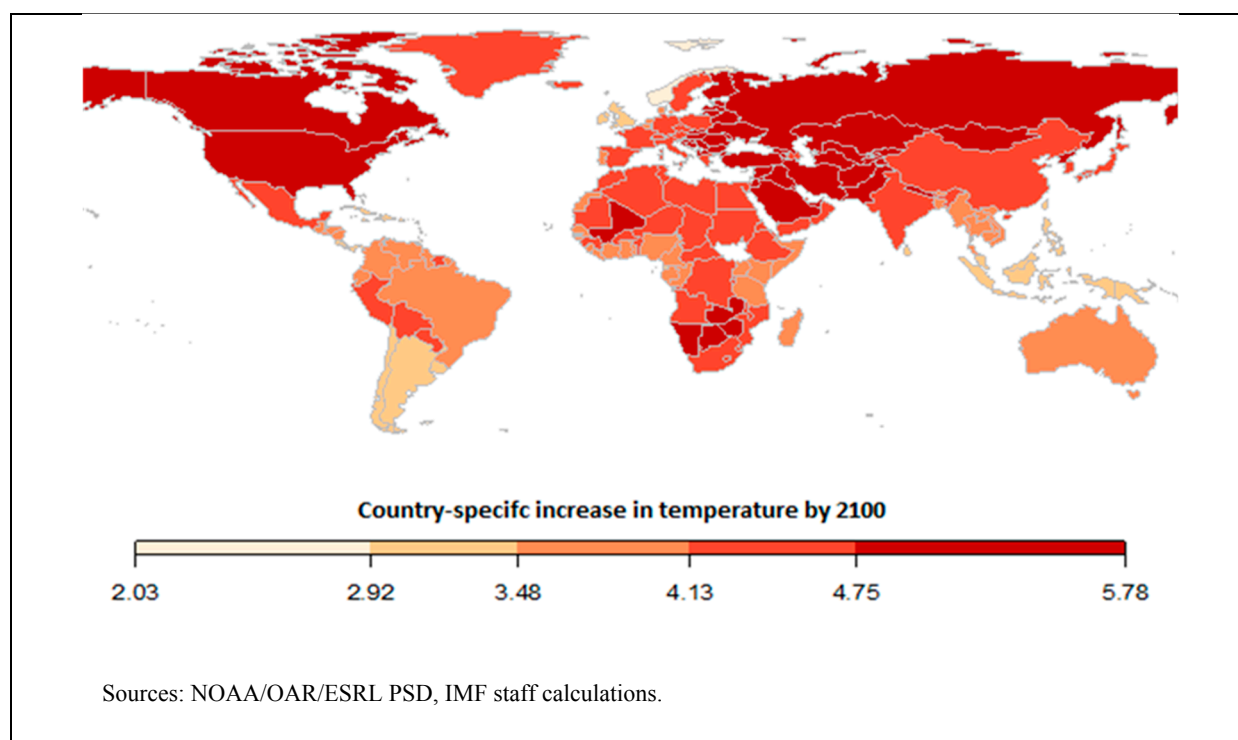
**8. Based on the microeconomic evidence, aggregate economic activity should be a concave function of annual temperature, consistent with the specification above.** The literature showed that an individual sectorial production function as a function of the surrounding temperature is approximately piece-wise linear (Graff Zivin and Neidell(2014)). Specifically, the output response to temperature is either flat or slightly increasing with temperature up to a threshold after which it is declining with temperature. Burke, Hsiang and Miguel (2015) show that if one aggregates individual sectorial production functions over time and across sectors, the resulting aggregate production function should be concave. Therefore, the chosen parametric specification for  $f_1(T_{it})$  as a quadratic function is consistent with this observation.<sup>3</sup>

**9. According to the estimated global response of economic activity to temperature, Costa Rica's GDP will be unambiguously negatively affected by global warming.** The chart below plots the estimated function  $f_1(T_{it})$  together with the 90 percent confidence interval and the position of selected countries in the most recent year. The chart demonstrates that if the global temperature were to increase, it will have very different effects on different countries. For a country like Russia, which had an average yearly temperature of 5°C in 2013, a higher temperature will unambiguously increase economic activity. However, for Costa Rica, with average yearly temperature of 23 °C, global warming will lead to a decline in GDP growth. For Honduras, a slightly warmer country than Costa Rica, the outlook is even worse. The current country-specific marginal effects that correspond to the position on the estimated function are plotted above.

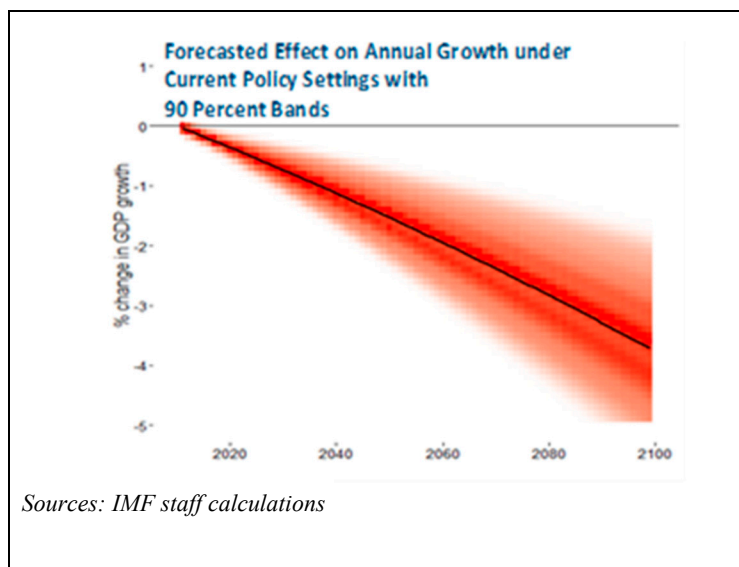
<sup>3</sup> Burke, Hsiang and Miguel (2015) conduct many robustness checks and show that the estimates of the global response function  $f_1$  are indeed robust. These include including lags of growth on the right-hand side, using a different data source, estimating the equation on different subsamples etc. See the paper for details.

**Figure 1. Estimated Global Response of GDP Growth**

Sources: IMF staff calculations

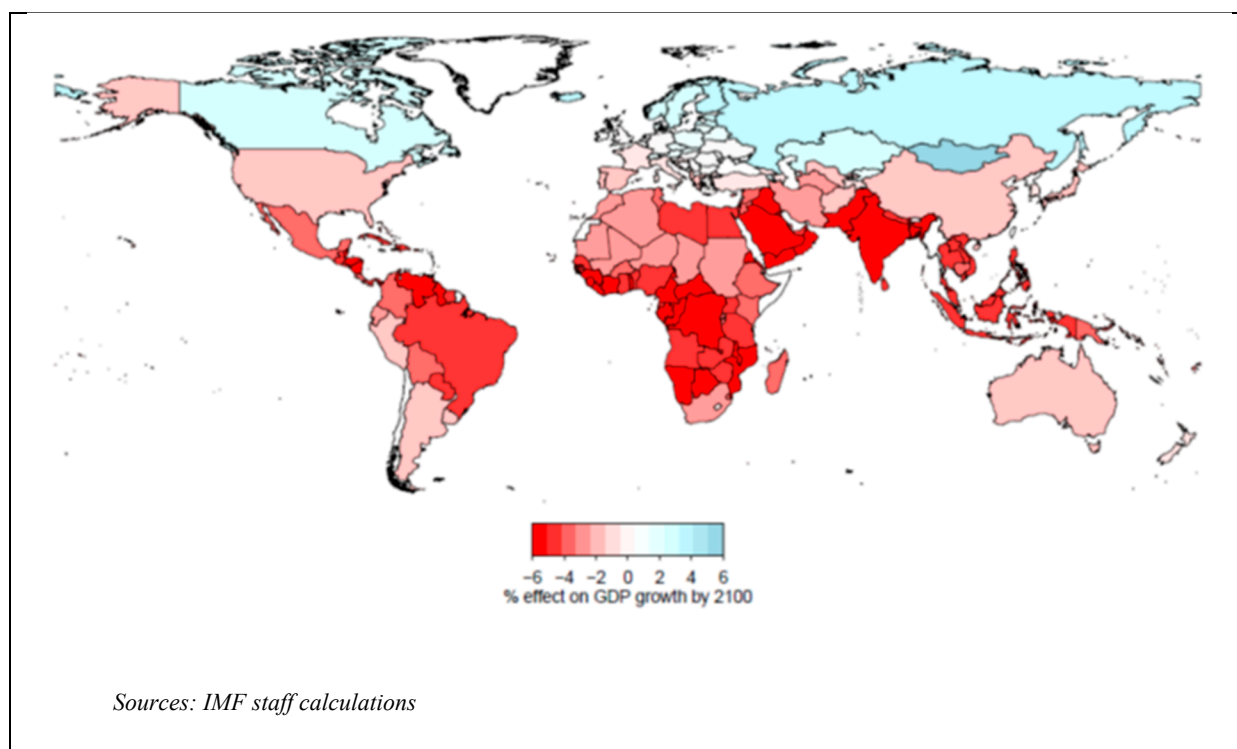


**10. The quantitative effects of rising temperature on the Costa Rican economy do not assume major changes in global emissions dynamics.** This scenario, often referred to as “Business as Usual” represents the current state of policies regarding emissions. The scenario also has become



more likely when on March 28 the U.S. rolled back Obama-era greenhouse regulations (Popovich, 2017). The scenario foresees 4.3°C increase in population-weighted global temperature. The country-specific temperature increases by 2100 are plotted on the chart. The Costa Rican average yearly population-weighted temperature under such scenario is expected to go up by about 3½°C.

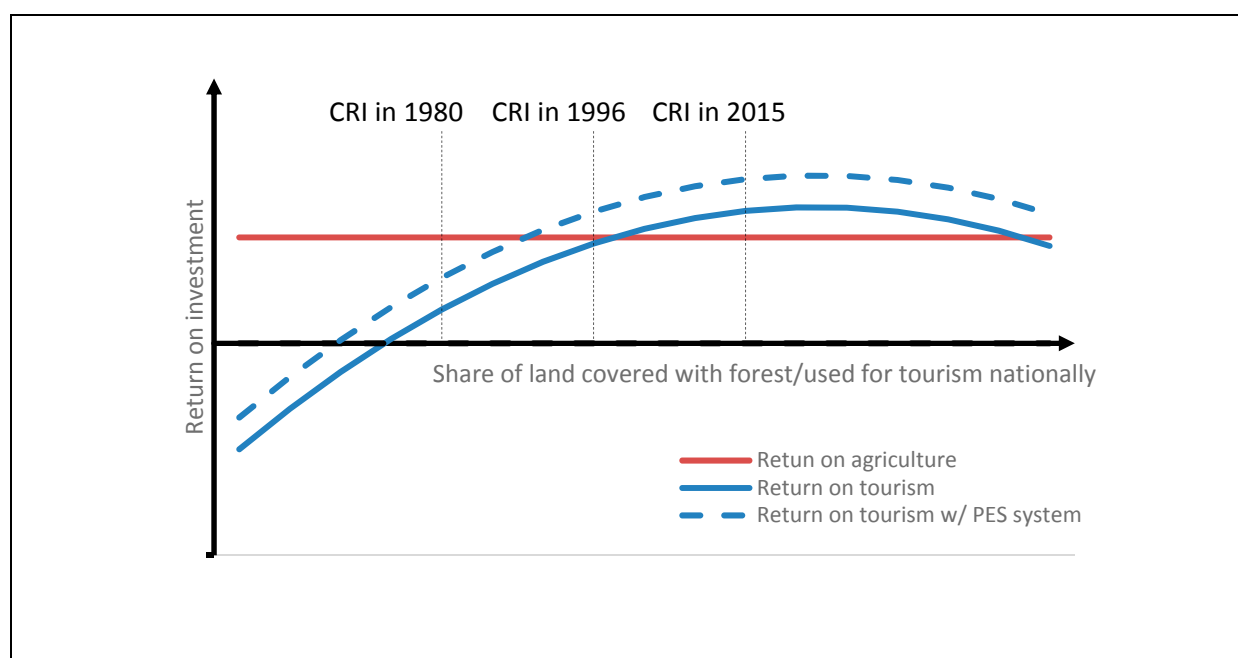
**11. By 2100, the adverse effect of climate change on annual Costa Rican growth is estimated to be about 3½ percent.** To estimate the effect on growth one can substitute temperature projections into the estimate of  $f_1(T_{it})$ , linearly interpolating temperature projections between years. Even though the temperature projection takes Costa Rica outside the historically experienced average yearly temperatures, it stays within the global distribution of historically observed temperatures. This means that the implied effect is not extrapolated out of the global sample, which makes the estimation more conservative. The fan chart with the 90 percent confidence interval derived from bootstrapping estimated parameters of  $f_1(T_{it})$  across countries is presented above and the estimated global effects by 2100 are presented below. By 2100 the negative effect on Costa Rican growth is significant and large at about 3½ percent. Economically, if average annual temperature increases by about 3½°C, Costa Rica may be unable to continue to produce agricultural goods at lower elevations and potentially lose its attractiveness as a tourism destination. Globally, the most negatively affected regions are Middle East, Sub-Saharan Africa, South Asia, and northern Latin, including Central America. The global response map also shows why the largest emitters - the United States and China - are not keen on constraining their emissions: the negative effect of the global warming for them is relatively mild.



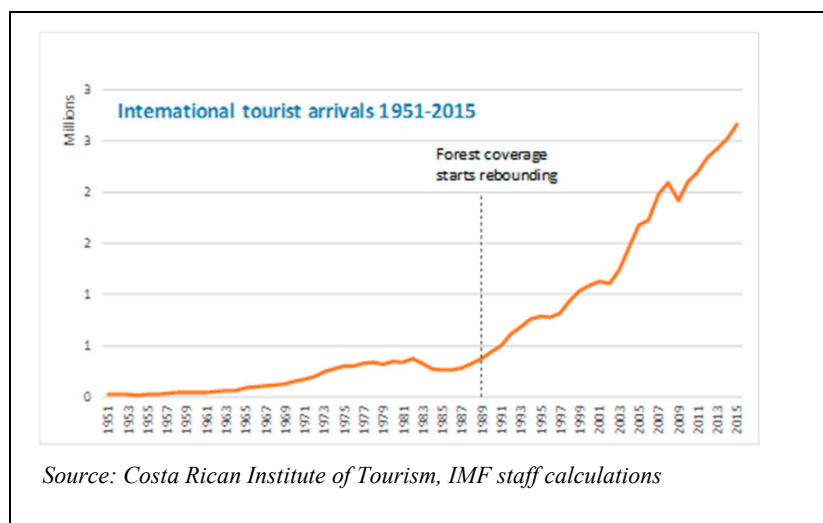
## C. Environmental Policies and Growth

**12. Historically, Costa Rica has had to overcome significant environmental problems such as rapid deforestation.** Apart from some variability, all estimates of forest cover in the 1980s point to a value between 20 and 25 percent (Kleinn et al., 2002). The deforestation at its peak reached 1 percent of the land area per year (UN environment, 2005). The deforestation was a result of conversion of land into agricultural and cattle-ranching areas as a response to high international prices of Central American beef and expansive crops such as coffee, sugar and bananas. The expansion of agricultural land was fueled by inexpensive government loans (Porrás et al., 2013). The sharp decline in the international prices for these commodities in the 1980s and political instability in Central America brought the expansion of farm land to a halt and the forest cover rebounded naturally somewhat. The 1990s marked the beginning of relatively ineffective reforestation efforts via tax breaks that eventually lead to the introduction of the Payment for Environmental Services (PES) system.

**13. Key legislation that supported reforestation, promoted the services sector, and led to the structural reorientation of the economy was enacted in 1996.** Forestry law 7575 forbade land cover changes and limited the use of forested area for timber extraction. Most importantly the law created the PES program which rewards landowners for environmental services such as mitigation of emissions, protection of water, protection of ecosystems or scenic natural beauty for tourism or science. Among other issues, the law additionally established the Forest Fund for capacity building and research activities regarding how to protect and prevent damages to natural resources as well as the National Forest Financing Fund (FONAFIFO) to pay for reforestation and land restoration activities. The main source of financing for the PES program and the two funds is one third of the total fuel and hydrocarbon tax.



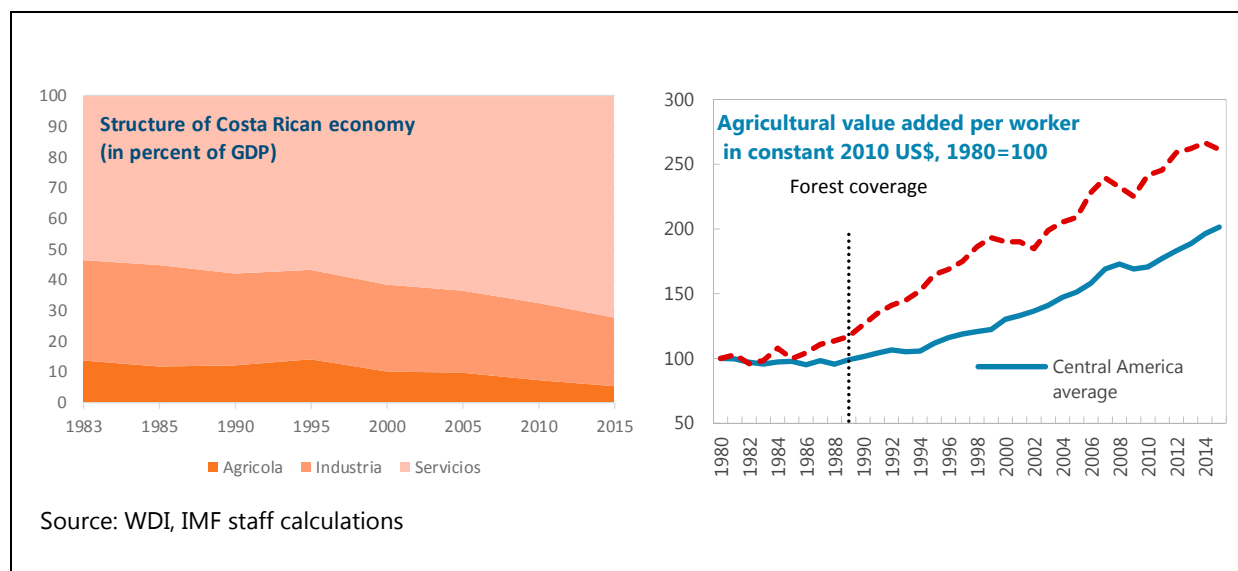
**14. By rewarding conservation efforts, the PES system made the tourism sector more attractive than agriculture for an average landowner.** To illustrate this idea, the chart below represents an individual landowner's choice between investing in agriculture or tourism. The x-axis represents the share of land already used by tourism sector (or, as a proxy, the share of land area covered by forest). The y-axis represents the return on each of the two activities as a function of the share of land already used by the tourism sector. The return on agriculture should not depend on the activities of other landowners, unless the share of agricultural land is very small. However, the return on tourism activity, especially ecotourism, should have increasing returns to scale up to some saturation point. The increasing returns could be due to higher diversity of flora and fauna as forest area increases, higher attractiveness for tourists that want to visit several regions, higher likelihood of public investment in better infrastructure and lower crime, etc. In 1980, due to high international prices on agricultural goods, the return on agriculture was higher than on tourism resulting in an equilibrium with a larger share of agricultural sector and a smaller share of the tourism sector (see chart below). The introduction of the PES system in 1996 made tourism and conservation efforts more profitable than agriculture for enough individual landowners (the segment of the red line between the dashed blue and solid blue lines). That through increasing returns to scale tourism became more attractive for other individuals as well. Thus, the country started converging to a new equilibrium marked by the third vertical line by moving rightward along the blue lines.<sup>4</sup> The shows that the number of international tourist arrivals took off at about the same time when the forest cover started recovering and was flat during the 1970s and 1980s.



<sup>4</sup> This setup can be made more realistic if one incorporates dispersion of skills across the two activities. This will eliminate possibility of zero shares of services or agriculture in GDP.

**15. As a result of the mechanism described above, the services sector became the main driver of economic growth.** In 1983, agriculture represented 14 percent of the total value added, while the services sector represented 54 percent (see below). By 2015 the agriculture sector's share in GDP had decreased to 5 percent, while the services sector's share had increased to 72 percent. In 2017 Costa Rica leads the U.S. News ranking in ecotourism in the world and is a top-10 destination for adventure tourism. Higher forest cover also increased population density in the rest of Costa Rica which further facilitated expansion of office jobs, including exports of back-office services.

**16. Even though the share of agriculture value added in GDP declined, since 1990 agriculture productivity has increased faster than in other countries in Central America** (see chart). With less land available for agriculture and inability to expand it at the forested area expense, the agricultural good producers seemed to have started to use available resources more efficiently. The chart above shows the value added of agricultural sector in constant 2010 U.S. dollars for Costa Rica and the average for the other Central American countries. The value in 1980 is normalized to 100 for all countries.<sup>5</sup> The chart implies that the productivity of Costa Rica accelerated when the forest cover started recovering around 1990 and was very close to the Central America average when forest coverage was low.



## D. Conclusion and Policy Discussions

**17. Going forward, it will be important to ensure that the economy is flexible enough to adjust its composition toward those sectors that are less affected by climate change.** For example, one can re-estimate the regression described in the first part of this paper for agricultural sector growth instead of overall GDP growth as the dependent variable. In this specification, at current temperatures, the agricultural sector in Costa Rica is about 50 percent more vulnerable to

<sup>5</sup> The data for Nicaragua are available only starting in 1994. The series for Nicaragua are normalized to 100 times the average of other countries in 1994.

increases in temperature than the economy overall. Therefore, it would thus be crucial to continue the structural transformation of the economy towards the sectors that are more resilient to the global warming.

**18. The sectors that generate the largest amounts of emissions are agriculture and transportation.** To meet the carbon neutrality goal by 2021, it will be important to maintain a high percentage of electricity generated using renewable sources, which in 2016 benefited substantially from abundant rains and reached 98 percent according to the Costa Rican Institute of Energy, ICE. Therefore, it is important to have an alternative generation plan if rainfall decreases in the future. As for agriculture, the Environmental Performance Index database states that Costa Rica has the highest excess use of nitrogen in the region, one of the main sources of emissions. Quantitatively, sugar production contributes about 5 times more to the total emissions than the ground transportation sector including taxis. To alleviate the problem, the authorities can consider schemes that financially incentivize low emissions of individual farmers. Regarding transportation, as the economy and population grow, it would be important to increase quality and quantity of public transportation options to keep the number of personal cars, the main source of emissions in the transportation sector, sufficiently low. However, to make public transportation more attractive it would be critical to address existing weaknesses in road infrastructure (AN IV).

**19. Given the importance of environmental performance for exports and economy overall, it is desirable to incorporate it in the public policy framework.** An important step in this direction is monitoring and publication of environmental accounts by the Central Bank jointly with the World Bank and other governmental agencies. The accounts include detailed information on water use, extraction, losses and efficiency; geographical land cover changes; and energy and emission dynamics. The public investment cost-benefit analysis should include environmental impact as one of its determinants. Since Costa Rica is expected to see the negative effect of global warming relatively soon, the authorities should step up capacity building efforts in this direction.

## References

- Hsu, A. et al., 2016, 2016 Environmental Performance Index. New Haven, CT: Yale University.  
Available: [www.epi.yale.edu](http://www.epi.yale.edu).
- Ministerio de Ambiente y Energía de Costa Rica, 2015, Contribución Prevista y Determinada A Nivel Nacional de Costa Rica.
- IMF, 2016, Small States' Resilience to Natural Disasters and Climate Change – Role for the IMF.
- Graff Zivin J. and M. Neidell, 2014, Temperature and the Allocation of Time: Implications for Climate Change, *Journal of Labor Economics*, 1-26.
- Acevedo, S., 2014, "Debt, Growth and Natural Disasters: A Caribbean Trilogy", IMF Working Paper No 14/125, International Monetary Fund.
- D. Guha-Sapir, R. Below, Ph. Hoyois - EM-DAT: International Disaster Database – [www.emdat.be](http://www.emdat.be) – Université Catholique de Louvain – Brussels – Belgium.
- Burke M., S. M. Hsiang and E. Miguel, 2015, Global Non-linear effect of temperature on Economic Production, *Nature*, doi:10.1038/nature15725.
- Dell M., Jones B.F. and B. A., Olken, 2012, Climate Change and Economic Growth: Evidence from the Last Half Century, *American Journal of Macroeconomics*.
- Popovich N., 2017, Trump's Executive Order Pushes the U.S. Climate Pledge Further Out of Reach, *New York Times*.
- Kleinn C., L. Corrales, D. Morales, 2002, Forest Area in Costa Rica: A Comparative Study of Tropical Forest Cove Estimates Over Time.
- Porras, I., D. Barton, A. Chacon-Cascante and M. Miranda, 2013, Learning from 20 years of Payments for Environmental Services, International Institute for Environment and Development, United Kingdom.
- Schlenker, W. and M. Roberts, 2009, Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change, *Proceedings of the National Academy of Sciences*.
- Willmott, C. J. and K. Matsuura, 2001 Terrestrial Air Temperature and Precipitation: Monthly and Annual Time Series (1950-99)