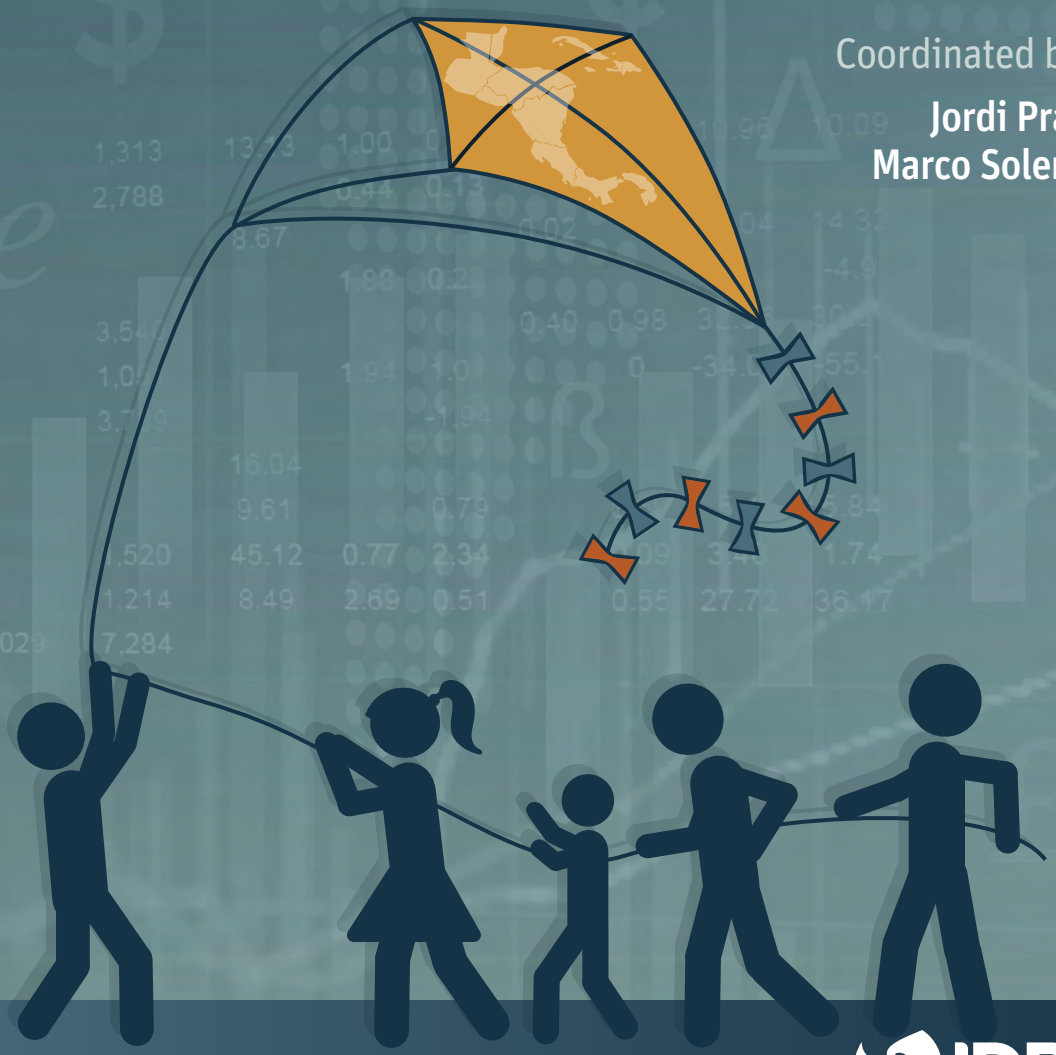
# Running Out of Tailwinds

## Opportunities to Foster Inclusive Growth in Central America and the Dominican Republic

Coordinated by
**Jordi Prat**
**Marco Solera**



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# CONTENTS

# FOREWORD

During 2016, Central America and the Dominican Republic grew by an average of 3.7%, similar to the rate reached on previous years. This positive performance continued to be supported by the economic growth of the United States, low prices of oil and other commodities, and efforts toward stimulating private consumption and exports, factors which have enabled the region to keep inflation and interest rates low and stable. Economic sectors such as construction, services and manufactures, output growth and had important contributions to employment growth. In 2017, growth is expected to slightly accelerate, though in an international context of higher uncertainty.

The downward adjustment in the world economic forecast for third consecutive year, together with a lower dynamism in investment and trade, suggest a world demand weakening in the medium term, which could result in a decline in potential output of Central America and the Dominican Republic. Additionally, the interest rate increase by the Federal Reserve of the United States, together with increase of foreign and trade policy uncertainty in some developed economies, and the potential increase of commodities prices, would increase the region's medium term growth risks.

In "Running Out of Tailwinds. Opportunities to Foster Inclusive Growth in Central America and the Dominican Republic" we analyze how this international context of weak demand and high uncertainty, could affect Central America and the Dominican Republic, and explore some of the opportunities to accelerate and make more sustainable and inclusive medium-term economic growth. In first instance, the report evaluates the current economic situation and analyzes the vulnerabilities of the economies to changing external conditions. Secondly, it examines opportunities to take advantages of the low prices of oil in the transformation of the energy sector, and explores ways to increase its contribution to strenghtening public finances. Finally, it evaluates the demographic transition of the Central American countries and the Dominican Republic and the advantages of allocating resources to strengthen the skills of

the population, which will support a growth strategy based on productivity improvements. The findings highlight the benefits of promoting national and regional policies that enable countries to transform the positive economic international juncture into output gains.

The recommendations and conclusions of this report are intended to be a starting point on the path this region could follow to archieve sustainable growth, and an input for dialogue among policymakers of the region.

***Gina Montiel***
General Manager
Country Department of Central America,
Mexico, Panama, and
the Dominican Republic
Inter-American Development Bank

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# EXECUTIVE SUMMARY

For Central America and the Dominican Republic (CADR), 2016 was marked by positive expectations thanks to economic recovery in the United States, low commodity prices and stable international interest rates. In 2015, U.S. economic growth had been expected to rally during the following years, but subsequent forecasts have been adjusted downward. Nonetheless, thanks to better terms of trade and low interest rates, CADR has enjoyed higher growth than the rest of Latin America.

Chapter 1 looks at the regional economic context and analyzes the countries' growth potential in the near future. The favorable external environment of recent years allows for a policy agenda to tackle unresolved challenges, such as better exporter performance and thus greater competitiveness, the sustainability of public finances and encouragement for private saving. Much of the external shock (from lower commodities prices) was diverted to domestic consumption. Public finance consolidation has been slow, and some countries continue mired in the dynamics of rising debt. As a result, reforms to increase competitiveness have not advanced as hoped.

Given the external environment, the regional growth observed during the past decade appears likely to converge to historical rates. There are positive aspects: in lockstep with the fall in commodities prices and a prudent monetary policy, inflation remained stable. With lower inflation, real passive interest rates facilitated credit expansion. Nevertheless, this occurred in a context where commodities prices appear to have hit bottom, thus curbing expansive momentum in the real sector. In addition, a higher external financing cost plus the accumulation of external liabilities would impact on revenue payment and require a greater adjustment in order to stabilize the liabilities, hence calling for an additional effort by the region to increase savings.

In the fiscal sector, consolidation continues to be slow. No important changes have taken place in fiscal revenues, while spending is at the same level observed in previous periods.

Constant fiscal deficits have spiked public debt, narrowing fiscal buffers and expanding vulnerability to shocks. Thus, significant challenges to the consolidation of public finances still remain.

Chapter 2 examines the potential benefits of low prices in the energy context, wherein greater pass-through could signify as much as half a percentage point rise in growth at the end of a year, and enhanced wellbeing for households and producers. Taking advantage of such benefits entails a new energy agenda, mainly in terms of subsidies, transmission channels to economic agents, the development of alternative energy sources and the boost that the Regional Electricity Market can provide.

Chapter 3 addresses demographic transition in CADR. Currently the region has a relatively young population, which represents a window of opportunity for higher economic growth. In itself, this change in the population structure can generate greater economic dynamism, but this could be bolstered through a series of crosscutting policies to train future workers and provide the tools needed to raise productivity, so they can obtain employment generating more value-added. At the same time, countries need to foster suitable conditions for the type of investment that creates labor demand capable of absorbing this new group of workers.

Finally, Chapter 4 presents a series of scenarios related to the region's performance in response to possible external shocks. Its economic integration with the rest of the world exposes CADR to changes in international conditions. Suffice it to say that changes in global growth forecasts, shifts in trade policy of developed nations, fluctuations in commodity prices, and the Federal Reserve's decisions about interest rates, are just some of the many variables that can affect the economic outlook of the region.

# 1 MACROECONOMIC CHALLENGES IN THE REGION

## EXPECTATIONS FOR 2015

In 2015, Central America and the Dominican Republic (CADR or the region) were immersed in a scenario of favorable expectations, primarily based on economic recovery in the U.S., their main trading partner, and the effect of low oil prices (see Box 1.1).

The international situation generated an optimistic environment in the region, facilitating a 4.1% expansion in 2015. This provided some space on the policy agenda to tackle certain structural challenges, such as improving the regional foreign balance putting on the agenda such issues as competitiveness, boosting of private savings, and fiscal consolidation for stabilizing public debt (see, for example, Lagarda *et al*., 2015, and Manzano and Maldonado, 2016).

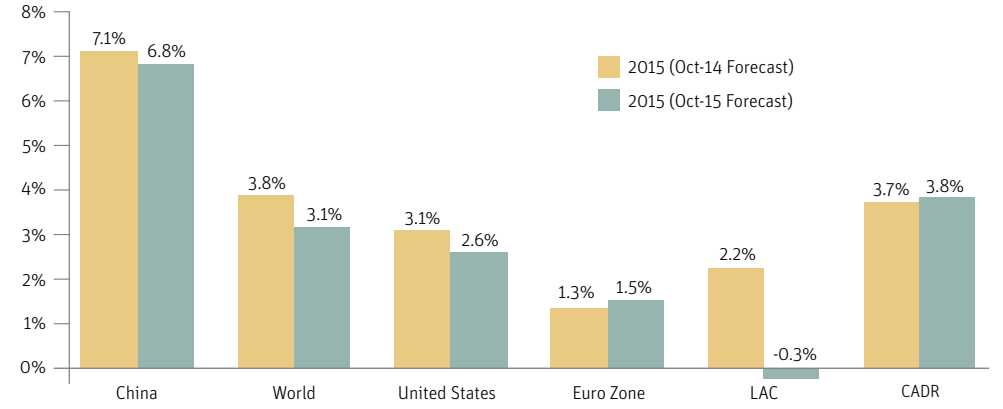
### Box 1.1 Expectations in the International Context in 2015

There was an auspicious environment for the region. In 2015, the United States, its main trading partner, was expected to continue consolidating its recovery after the 2008-2009 global crisis. Although the International Monetary Fund (IMF) review of gross domestic product (GDP) growth rates on October 2015 showed a downward adjustment in the U.S. rate (2.6%),[1] the rate continued to surpass previous figures observed after the crisis. Expectations for expansion in CADR, unlike the rest of the world, including Latin America and the Caribbean (LAC), were maintained and even slightly improved (see Figure 1.1.A).

*Continue...*

[1] In October 2014, the IMF forecasted the United States would grow 3.1% in 2015. This was adjusted to 2.6% after the October 2015 review.

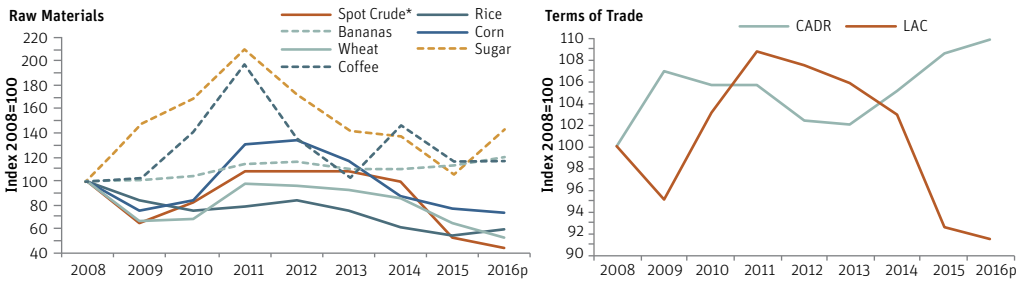
## Figure 1.1.A Projected Growth for 2015, by Geographic Area




*Source*: CID/IDB Staff using data from IMF, WEO (October 2014 and 2015).

This occurred in an environment where the international price of raw materials declined significantly, improving the region's terms of exchange for goods (see Figure 1.1.B).

## Figure 1.1.B Commodity Prices and Terms of Trade




*Source*: CID/IDB Staff using data from IMF.

*Note*: p=preliminary *Average of Brent, Dubai and West Texas Intermediate.

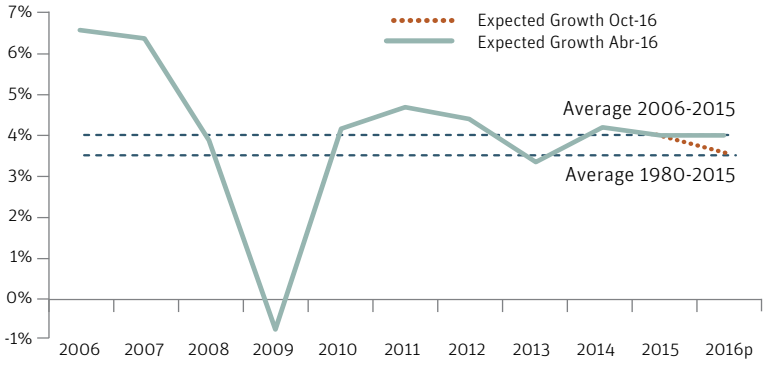
The international price of products such as rice, sugar, coffee, corn, and wheat slid, as a whole, by 18%, on average. Nonetheless, among commodities the price of oil took the greatest plunge, retreating 47.2% between 2014 and 2015.[2] The average price of goods imported by the region fell at a higher rate than that of exported goods, stimulating the relative improvement in terms of trade.

[2] Cooling global demand, weak demand by China along with its diminished activity in the world marketplace and the popularization of fracking, among other causes, were important factors stimulating that reduction.

Over the course of 2016, however, global growth expectations were progressively adjusted downward. At the end of 2015, global growth of 3.6% was expected for 2016, higher than the current expectation of 3.1%. This reaffirms a prolonged period of slow growth with forecasts steadily trending downward. Growth of the U.S. economy, projected at 2.8% at that time, has now been lowered to 1.6% (below pre-global crisis results).

This international scenario impacts the regional growth rate (see Figure 1.1). The region is now expected to grow more slowly than 2006-2015 average (4.1%), converging at its historical 1980-2015 rate of 3.7%. This comes in an environment where commodity prices are less sensitive to adjustments, which could reduce the expansive drive of the real sector. In this context, the region's previous room for maneuvering is changing.

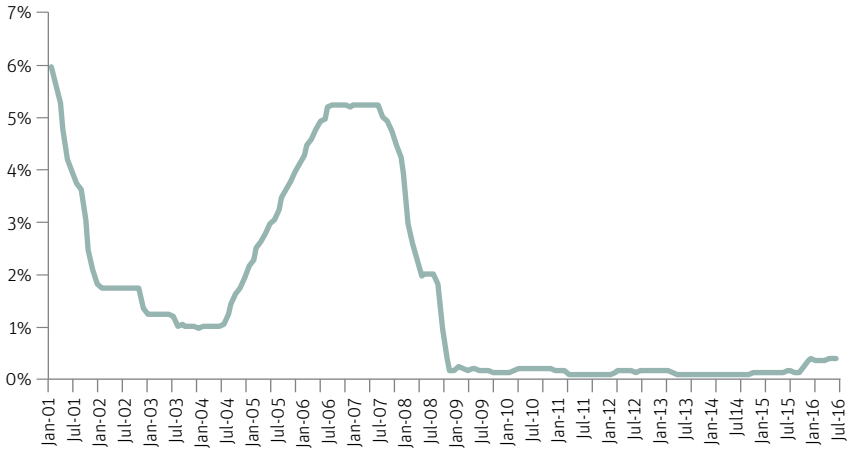
**Figure 1.1** Adjustment of Annual Real GDP: CADR




*Source*: CID/IDB Staff using data from IMF, WEO (April and October, 2016).
*Note*: p=preliminary.

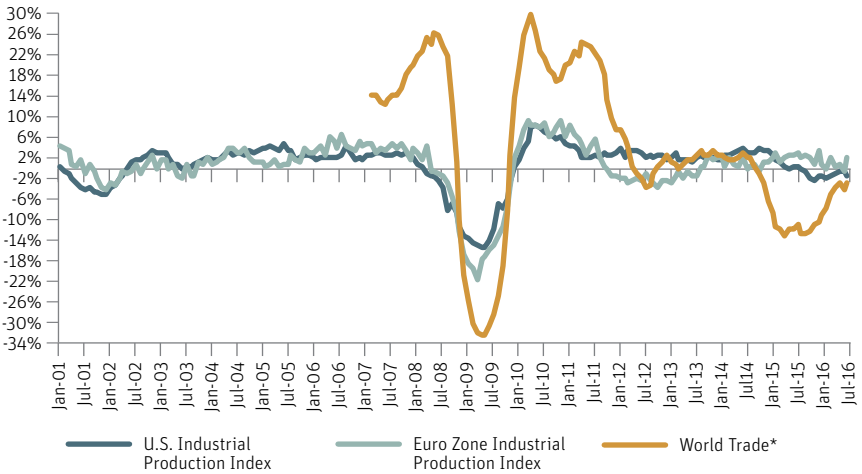
These revised expectations are unlike others, because the lower growth is accompanied by historically low monetary policy rates, such as the interest rate of the United States Federal Reserve (see Figure 1.2). This considerably limits the economies' room for expansion. In particular, the continued contraction of U.S. industrial production warrants special attention (see Figure 1.3).

## Figure 1.2 Federal Reserve Interest Rate




*Source*: CID/IDB Staff using data from United States Federal Reserve.

## Figure 1.3 Annual Growth of Global Trade and the Industrial Production Index (USA and Euro Zone)




Source: CID/IDB Staff using data from EuroStats and World Trade Organization.

*Note*: *Three-month moving average of annual growth in exports and imports.

In particular, this decrease on trade comes in a context where development economies have more pressure to generate local employment opportunities and behave more averse to trade. Nevertheless, these pressures have not yet translated into concrete policy decisions.[3] This has occurred in a context with significant debt accumulation and where, at global level, net national savings are positive, reflecting a lower propensity for real investment (a situation observed prior to the 2008-2009 crisis; see Figure 1.4). The world economy is thus more exposed to

[3] At the time of sending this report to print, with the intention to deal directly with individual countries on a one-on-one (or bilateral) basis, on January 23 2017 the new U.S. administration sign a withdrawal memorandum from Trans-Pacific Partnership Negotiations and Agreement, as a first step to permanently being excluded from these negotiations

negative shocks and more prone to stagnation. Aggregate world demand seems to be falling, and with this, countries may grow at lower than historical rates in upcoming years.

Figure 1.4 Net National Savings in Investment: World


*Source*: CID/IDB using data from IMF, WEO (October, 2016).
*Note*: p=preliminary.

In this context, the region would face a new challenge in the real sector, and the possibility of a potential slowdown cannot be ruled out. A growth agenda therefore becomes increasingly important.

## 2016 ECONOMIC PERFORMANCE

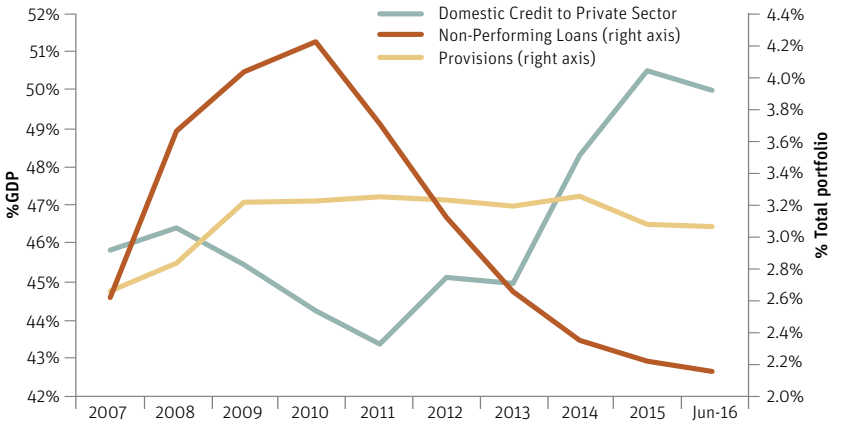
Given this international situation, what are the macroeconomic conditions in our region? On the plus side, inflation is still not a problem in CADR countries. During recent years, declining commodity prices have helped lend stability to local price levels in the real market. Figure 1.5 reveals a slight uptick in inflation over last year, predicted to average out at 2.4% in 2016. Despite this increase, however, the average rate of inflation remained significantly below its historical 1980-2015 value (9.4%, excluding Nicaragua), a circumstance accompanying the slowing average inflation rate for food and non-alcoholic beverages (3.7% in 2015 versus 1.8% in October 2016).

This monetary scenario goes hand-in-hand with banking systems that are generally stable and solvent. As can be observed in Figure 1.6, credit leveraging by the private sector represents 50% of regional GDP, in a context where non-compliance with payment obligations is on the decline. Bank provisions are consequently at a commensurately low level, though more than sufficient to deal with the non-performing loans. All of this adds up to signs of capitalized banking systems. In this sense, the generally lower inflation rates as well as the positive real interest rates have facilitated credit portfolio expansion.

## Figure 1.5 Inflation Rate: CADR


*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).
*Note*: p=preliminary.

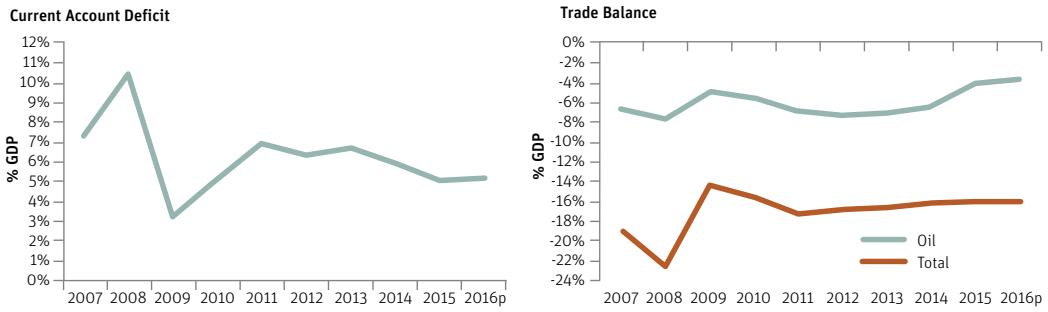
## Figure 1.6 Quality of the Loan Portfolio: CADR




*Source*: CID/IDB Staff using data from Central Bank of Belize, World Bank and Executive Secretariat of the Central American Council.

Externally, savings from the positive effects of oil prices on the sector do not appear sufficient. Even though the oil trade deficit shrank and continues to shrink, albeit more slowly (in 2016 it will amount to 3.8%, 0.5 percentage points below 2015), this was offset by non-oil accounts to the point that their total trade deficit closed at 16.2% (versus 16% in 2015), which will keep the current account deficit at levels similar to last year (5.1%; see Figure 1.7). The rising cost of foreign debt and accumulation of net external liabilities could continue driving rent payments, which would make a larger accounts adjustment important for stabilizing liabilities. The region consequently needs to increase savings (see Manzano and Maldonado, 2016).

## Figure 1.7 Current Account Deficit and Total and Oil Trade Balance: CADR




*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).

*Note*: p=preliminary.

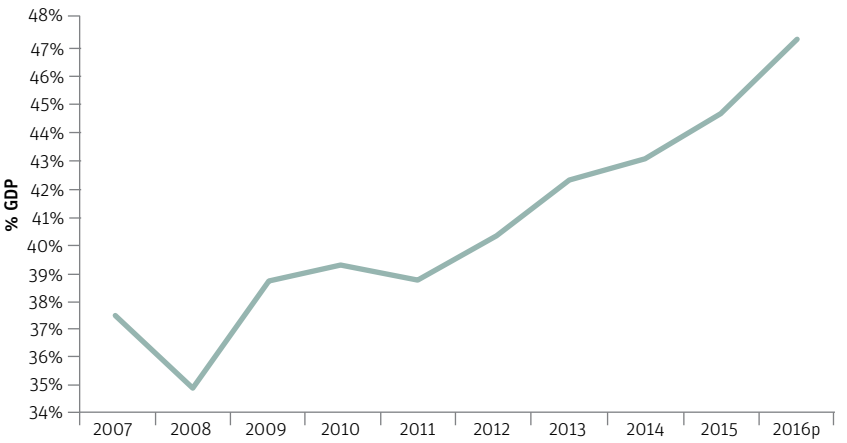
From a fiscal stance, consolidation has been slow (see Figure 1.8). Revenues continue without upward structural movements. The governments will receive around 19.6% of regional GDP in revenues (similar to though less than last year's 20%), of which 15.4 percentage points would be captured through tax collection. Likewise, public spending will remain at the same level, representing an expected 22.9% of regional GDP at year end. With this, the fiscal deficit would be at 3.3% of GDP.

## Figure 1.8 Fiscal Deficit: CADR


*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).

*Note*: p=preliminary.

## Figure 1.9 Gross Public Debt: CADR




*Source*: World Economic Outlook, International Monetary Fund (October 2016).
Note: p=preliminary.

The region's persistent fiscal debt has led to a progressively higher volume of public debt since 2008, currently representing 47.2% of regional GDP (see Figure 1.9), reducing fiscal maneuverability and increasing vulnerability to less sunny skies. It is worth pointing out, however, that this exposure to external risks varies intra-regionally, with increasingly evident differences among the countries. For example, fiscal space has shrunk in Belize, Costa Rica and El Salvador due to rising public debt, while Nicaragua and Panama are showing signs of greater stability (at the end of 2016, they are the only countries in the region expected to have a debt ratio lower than in 2007, that is, prior to the global crisis). Hence, to greater or lesser degree depending on the country, strengthening fiscal balances, stabilizing debt and bringing stability to external accounts remain challenges and must be addressed. As will be seen in the last chapter of this report, room for coping with possible negative shocks is reduced.[4]

It should be noted that obtaining immediate positive fiscal results would significantly affect investor expectations in the region. This would also facilitate debt stability, generate robust country conditions to cushion external shocks, and serve to support future strengthening of local institutions, the productive structure and the financial sector (see Lagarda *et al.*, 2015, for example).

Izquierdo and Manzano (2012) remind us that for a fiscal balance adjustment to be beneficial, CADR must tackle not only long-run reformed tax collection goals, but also the rigid public expenditure structure. It is also important to examine the effects of less favorable scenarios on the region and consider existing spaces for adjusting economic policies. The region needs to take advantage of its maneuvering room, less ample but still significant thanks to the relatively improved terms of trade, in addition to the particularities of each country's policy space.

[4] That chapter will examine the different transmission channels of external risks to the region, as well as countries' exposure to potential less favorable scenarios.

Reduced intervention costs, the political will to focalize social spending, and the rethinking of subsidy strategies (especially in energy) should be key items on the agendas of our countries, but without overlooking measures to strengthen the spaces obtained for expanding trade and fortifying external balances.

It is necessary to take advantage of the lower oil prices. Izquierdo and Manzano (2012) suggested paying special attention to energy subsidy policies (designed in response to rising oil prices), which have eroded the public accounts of CADR and made them more rigid.[5] These policies confirmed that the region has an energy matrix biased toward the use of imported fossil fuels. Therefore, taking better advantage of the current potential for benefits means structurally reconsidering the strategy of energy subsidies, examining main transmission channels for transferring benefits to economic agents (lower costs of production/services, competitive improvements, greater investment and private consumption, less fiscal pressure), assessing potential for developing alternative energy sources (presence of renewable sources), reexamining their market structure, and analyzing the scope of the regional electric market (MER, its acronym in Spanish) in promoting electrical interconnection and national generation projects. We will take a detailed look at those themes in the second chapter.

## A NEW "NORMAL"?

All of the aforementioned, along with an already prolonged period of slow growth, seem to indicate the onset of lower aggregate demand and reduced recovery capacity in the global economy– often overestimated- which could translate into slower potential growth. This seems to reveal a new "normal" oriented by so-called secular stagnation,[6] or a lasting state of weak demand with episodes of full employment that are few and far between, wherein countries could grow at lower than historical rates or negative natural rates.

The macroeconomic behavior of developed countries after the 2008-2009 crisis (e.g., slow recovery of the U.S. and European economies) facilitated reflection on this theme: Are we looking at a new normal, a secular stagnation? Recently, secular stagnation is understood as not only the need for negative real interest rates to equal out savings with investment under full employment, but also the difficulty of achieving simultaneous financial stability and high growth rates with full employment through conventional monetary policy operations. The idea that we are in the presence of this phenomenon has been gaining ground in macroeconomic studies and comes up more and more frequently as material for debate.[7]

[5] For example, according to Catena and Navajas (2012), between 2003 and 2010 the higher fuel prices generated additional direct costs of close to 0.9% of regional GDP through subsidies for transportation and fuel for public transportation, and, generalized or focalized, for liquefied gas, as well as cross subsidies and social tariffs on electricity.

[6] The term "secular stagnation" was first employed by Alvin Hansen in 1934 in the context of the Great Depression, and further elaborated in Hansen (1938). The concept fell into oblivion after the extensive period of expansion leading up to World War 2, but was "rediscovered" by Lawrence Summers, economist and former U.S. Secretary of the Treasury, at an International Monetary Fund conference in 2013.

[7] For example, see Summers (2013 and 2014); Caballero and Farhi (2014); Krugman (August 2014); Bernanke (March 2015a and 2015b); Eichengreen (2015); and Gordon (2015), among others. A major compilation of work on this topic can be obtained in the e-book edited by Baldwin and Teulings (2014).

This reasoning has centered on developed countries, but the inherent dynamics of emerging countries and their strong dependence on external ups and downs make it possible to think of this as a worldwide phenomenon, one that is highly important for CADR to address since the region is comprised of small countries that are highly dependent on foreign trade and, in many cases, remittances. While the region has little influence on the economic performance of the rest of the world, the rest of the world has a great influence indeed on this region. This chapter thus attempts to address concerns about the immediate future of the CADR countries' growth potential.

Bearing in mind that growth potential is an unobserved variable, there is no viable precise method for its calculation.[8] Studies on this issue usually distinguish four methodologies: (i) direct methods based on surveys,[9] (ii) non-structural methods focusing on statistical procedures, (iii) structural methods focusing on specific economic theories, and (iv) multi-methods or mixed methods, which introduce structural elements into non-structural ones.[10]

To simplify, estimation exercises based on the data available for our countries (and sometimes other countries in the world), were separated into two groups: (1) those with a statistical approach, with full or recurrent use of statistical tools or filters,[11] and (2) those with a structural approach, with processes producing specifications using variables representing country structure.[12] The idea is to estimate growth potential through a panel data regression,[13] both with and without fixed country effects.[14] Figure 1.10 shows the average outcome for the region.

[8] For example, each country has particular characteristics and each method has its own advantages and disadvantages, lending uncertainty to all of the estimations (see Miller, 2003).

[9] Identify installed capacity of companies, actual electric consumption, labor indicators, and others.

[10] Such as, for example, the inclusion of relationships such as Okun's Law and the Phillips Curve

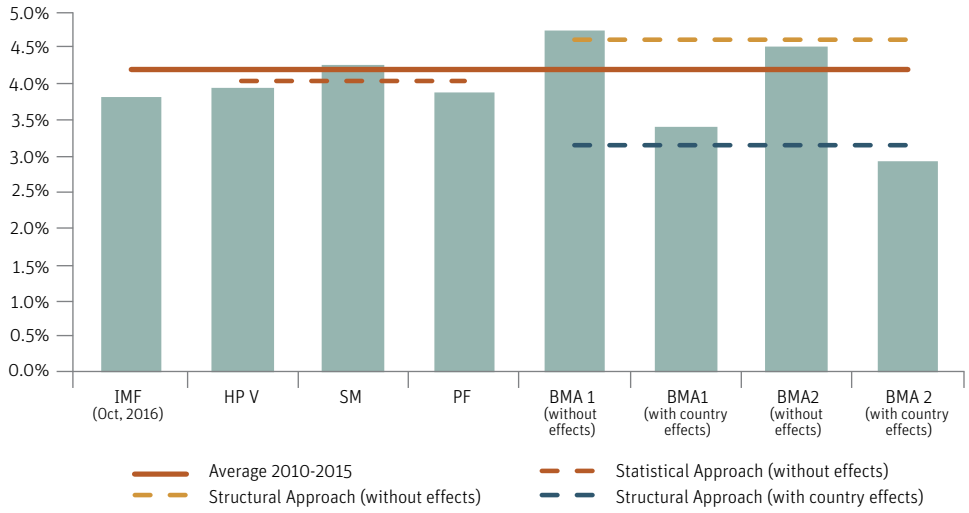
[11] Three methods were applied: a) Hodrick-Prescott filter according to constrained minimization, following the relative variability of the trend acceleration (HP V) method based on Marcet and Ravn (2003); b) regime-switching models (SM), based on three growth scenarios: recession or moderate, sustainable, and overheated, following the approach applied by Johnson (2013) for our countries; and c) production function (PF), standard Cobb-Douglas with skill-adjusted labor (human capital) according to Ferreira et al. (2011), Johnson (2013) and Sosa et al. (2013). For details on the process carried out in the statistical approach methods, see Annex 1.1.

[12] These last processes are based on an array of variables falling into six categories per country: growth theories (usually considered in theoretical models); convergence, associated with the educational system; economic opening; institutional quality; and economic structure. For the summary of the variables used in the structural approach methods, see Annex 1.2.

[13] This regression is done after reduction using Bayesian model averaging (BMA). In this case, given the significant number of variables compiled, two processes of reduction were involved (BMA 1 and BMA 2), utilizing in one of them variables not included in the other. For details on the process carried out in the structural approach methods, see Annex 1.3.

[14] These processes are based on Lanzafame et al. (2016) and the Harrod-Domar approach (where potential growth is explained on the basis of weakened growth of the workforce and labor productivity).

Figure 1.10 Potential Annual Growth Expectations (2016-2020 Average) according to Various Methodologies: CADR




*Source*: CID/IDB Staff estimates using data from IMF, WEO (October, 2016).

*Note*: Hodrick-Prescott filter methods were used according to constrained minimization (HP V), regime-switching (SM), production function (PF), and structural with reduction through Bayesian model averaging (BMA).

In general, most of the outcomes coincide in that the growth potential is below the observed value from 2010 to 2015 (3.9% compared to 4.2%, after the crisis). Statistical approaches place potential growth at 4%, or slightly less than in 2015 (4.1%). The average result of structural approaches with, as compared to without country effects, is lower (3.1% and 4.6%, respectively).

These outcomes underscore two stylized facts. First, statistical methods point to higher expected growth than in structural models. This could indicate that up to now the environment has been favorable for the region, and in a less positive environment we might be closer to the structural growth. Second, country effects are negative. This implies country-specific factors making expected growth lower than it should be, given particular structural components compared to other countries in the world.

In this regard, the outcomes of structural models recognize the importance of the technological gap with the United States (through capture of production gains from technology transfers) and labor force growth for accelerating world expansion. In turn, institutional, opening (of trade and real exchange rate), and economic structure (agricultural jobs) variables are also significant in the models. In particular, efforts toward greater political stability, impacting favorably on the legal structure and reducing government size (for example, addressing cost efficiency in the provision of public services), could be beneficial in the world country aggregate, as well as those achieving solid exchange rate policies geared to expanding international trade portfolios in products with competitive advantages.

Exchange rate policy does not provide relevant margins of action to accelerate growth in CADR and it is the structural reform agenda that should be given priority.[15] In this case, the emphasis should be on taking advantage of production gains, reducing the impact of government size on the economy, and consolidating a sound legal system (with respect for contracts and protection of property rights).

It should be noted that country results are mixed.[16] When all outcomes are averaged, three distinctive groups emerge: Belize, Costa Rica and Guatemala (with expected growth potential approximating that observed between 2010 and 2015); El Salvador and Honduras (expected growth potential higher than what was observed); and Nicaragua, Panama and the Dominican Republic (expected growth potential below what was observed; with the last two having contributed the greatest growth to the regional average). However, a close look at these results reveals the conceivably favorable effect a revision of the countries' structural particularities would have in encouraging potentially higher rates (see Table 1.1), since for the most of them the sign is negative. In Belize, for example, the methodology with individual country effect leads to an expected potential growth of 2.4%, but correction of the effect could head it toward potential rates similar to the growth obtained years prior to the global crisis.

**Table 1.1** Growth Potential by Country

| Country | 2016-2020 vs. 2010-2015 | Fixed Effect |
|---|---|---|
| Belize | ≈ | – |
| Costa Rica | ≈ | – |
| Dominican Republic | < | + |
| El Salvador | > | – |
| Guatemala | ≈ | – |
| Honduras | > | – |
| Nicaragua | < | – |
| Panama | < | + |

*Source*: CID/IDB Staff estimates.

An examination would have to be made of which country-specific factors could be generating negative effects. To mention a few, Guasch et al. (2011) identify innovation, knowledge transfers, infrastructure and logistics, education and human capital, and crime and weak governance as critical areas that, if addressed, could generate competitive improvements, poverty reduction and more growth in the Central America countries. For Belize, Martin (2015) points to the high costs of capital, the anti-export bias[17] and the poor road and port infrastructure as the main

[15] This conclusion confirms what Manzano and Maldonado (2016) indicated regarding misalignment of the real exchange rate for CADR.
[16] See Annex 1.4, which includes outcome figures by country.
[17] Greater incentive is given to activities aimed at the domestic market than those in the export sector.

factors limiting growth. In the case of Costa Rica, Beverinotti et al. (2014) find that infrastructure is one of the main curbs on growth, as well as the scarcity of skilled labor in strategic areas, skimpy production linkages of small and medium companies with transnationals in free trade zones, and the fiscal deficit. In El Salvador, coordination problems between investment-promoting agencies, business training institutions, and universities and the private sector, as well as problems of crime and violence and low productivity in the tradable goods sector, have hampered an appropriation of the benefits of investing and in turn restricted its growth.[18] Sánchez et al. (2015) recall that Guatemala's serious socioeconomic fragmentation, limited job opportunities, problematic human capital accumulation, limited capacity for provision of public goods, and exposure to natural disasters have a negative effect on inclusive growth (a performance largely shared with El Salvador, Honduras and Nicaragua).

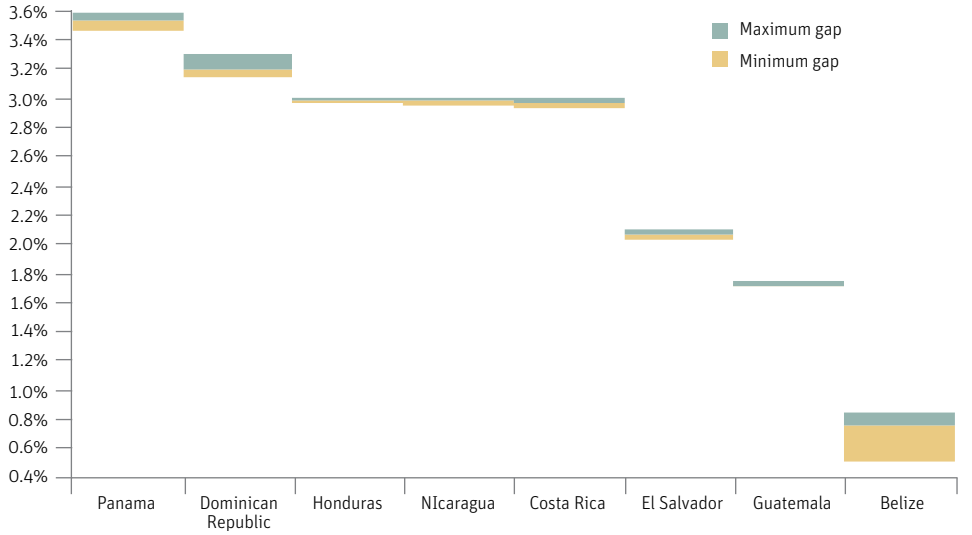
Countries with their own positive factors are not exempt from internal challenges which, if addressed, could once again drive growth rates. On the one hand, according to Cárdenas and Salazar (2007), market defects (from low incentives deriving from local protectionist policies), labor legislation, and infrastructure (especially electricity and transportation costs) have affected Panama's growth, while Fanelli and Guzmán (2008) signal declining competitiveness in the Dominican Republic, indicating a need to seek fiscal sustainability and tackle infrastructure issues (particularly in the electrical sector).

In low productivity scenarios, economic performance is compromised (see Pagés, 2010). Equally, a potential low growth scenario heightens the risk of significant productivity losses and increases setbacks in economic development. In fact, the results of the production function model used in this report confirm the findings in studies by Schipke (2007), Sosa et al. (2013) and Quijada and Sierra (2014),[19] in that production differences exist among the countries but, in general, the region's productivity levels have not been sufficient to drive greater growth. Greater gains in productivity are therefore needed.

In this context, one could wonder whether expected potential growth will be enough to offset this risk in the region. A simplified way to see this is by adjusting potential growth expectations according to population growth (see Figure 1.11).

[18] See, for example Inchauste et al. (2009) and Asocio para el Crecimiento (APC, 2011).
[19] The first two studies present results for Central America and the last focuses on Honduras.

**Figure 1.11** Expectations of Potential Annual Real Growth Per Capita (2016-2020), Average of Different Methodologies: CADR



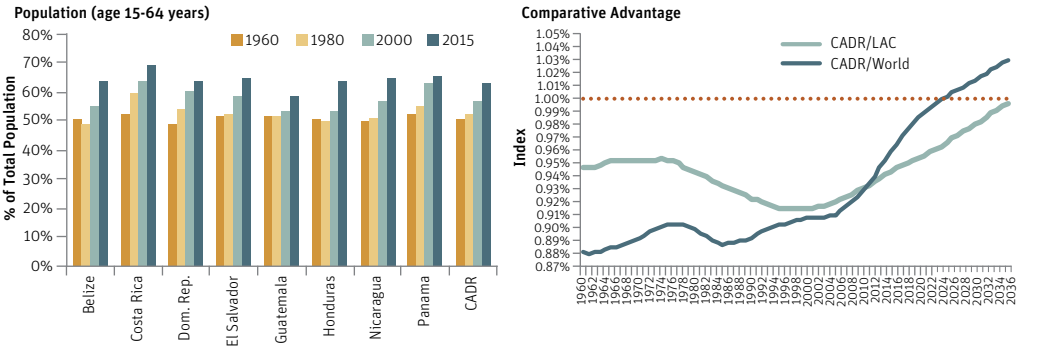

*Source*: CID/IDB Staff estimates using data from UN (2015).

From this viewpoint, potential growth rates would be higher than the projected population increase but at low levels, associated in the best of cases with countries like Panama and the Dominican Republic, which show clear signs of economic slowdown and where potential growth per capita would not rise above 3.8%, and in the worst of cases with Belize, where potential growth per inhabitant could be 0.5% to 0.9% in coming years (very low). If this potential rate situation continues, convergence with the U.S. real per capita production could take CADR between 148 and 159 years, and with that of emerging countries such as Peru, between 46 and 76 years.[20] Hence, it is vital to generate conditions for higher growth.

In particular, given the results of the structural approach (according to the categories analyzed), an examination of the natural evolution of labor force growth in this area is essential. One of the region's advantages is its current demographic situation. Figure 1.12 illustrates the increase in the countries' working age population, especially since the year 2000. It also shows how from the onset of this century, the working age population has been increasing relatively steadily and quickly compared to LAC and the world, without ruling out comparative advantages to be obtained in the future. These topics will be examined in the third chapter of this report.

[20] Assuming that the region's potential growth improves around 0.5 percentage points and the potential growth rates of the United States and Peru remain constant, convergence periods could be reduced to 112 years and 17 years, respectively. Convergence time was calculated as follows: $\left(Ln\left(Y^{i}_{2015}\right) - Ln\left(Y^{CADR}_{2015}\right)\right)/\left(Ln(1+\bar{g}^{\,CADR}) - Ln(1+\bar{g}^{\,i})\right)$, with $i$ being the country toward which convergence is occurring, $Y_{2015}$ being GDP per capita in the initial period and $\bar{g}$ potential growth rates adjusted for population growth.

## Figure 1.12 Working Age Population and Its Comparative Advantages: CADR




*Source*: CID/IDB Staff estimates and data from World Bank..

*Note*: The working age population comparative advantage index is calculated as that population's share in CADR in relation to the respective region divided by the total population's share in CADR in relation to the respective region.

In general, the region must make structural changes based on opportunities as they arise. The world could enter a lasting state of low growth and with it, the potential rate for CADR would be less than those observed in previous years. This situation is simply a new ingredient in the mix of macroeconomic challenges the regional needs to remedy.

The terms of trade are on our side and lower oil prices could continue. Close attention must be paid to the role the energy sector and its market structure have played and could continue to play in our region. In addition, the region as a whole should take into account the conditions for fully exploiting future competitive advantages in the labor force stemming from demographic transitions. This should be framed in policies to strengthen the countries' gamut of institutions (with special attention to the legal and government structure and to consolidating political stability). In this way, CADR could relatively increase its potential growth rate in this new normal.

## Annex 1.1

### Methods Using the Statistical Approach

The process for the three estimations was as follows:

**1) Hodrick-Prescott filter according to constrained minimization, following the methodology with relative variability of trend acceleration.**

The Hodrick-Prescott filter decomposes a time series ($y_t$) into a trend ( $y_t^*$ ) and a cyclical component. For this, the sum of squared deviations from the trend of the series is minimized, penalizing changes in its acceleration (this last through a smoothing parameter ), such that:

$$\min_{\{y_t^*\}_{t=1}^{T}} \left[ \sum_{t=1}^{T} (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} \left( (y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*) \right)^2 \right] \quad con \quad \lambda > 0$$

An usual problem using this indicator is the arbitrariness in the selection of $\overline{\lambda}$. The choice depends on the frequency of the series and is traditionally based on a consideration set out by Hodrick and Prescott (1980) in their analysis for the U.S. economy, from which it became popular to use $\overline{\lambda}$ = 100 for annual data, $\overline{\lambda}$ = 1600 for quarterly data and $\overline{\lambda}$ = 14400 for monthly data. Given that these values come from a particular U.S. study and that the properties of economic cycles can differ among countries, the use of these same values is no assurance of consistent results. For this reason, the alternative proposed by Marcet and Ravn (2003) was used to estimate optimal country $\overline{\lambda}$, making them comparable with the standard values used.

In this regard, the methodology with relative variability of trend acceleration, also called V methodology, was followed. The idea is to minimize the sum of the squares of the difference between $y_t$ and $y_t^*$ under the restriction that the variability between trend acceleration relative to the variability of the cyclical component is limited at the top by a positive constant V. Thus:

$$\left\{ \min_{\{y_t^*\}_{t=1}^{T}} \left[ \sum_{t=1}^{T} (y_t - y_t^*)^2 \right] \;\middle|\; \frac{\sum_{t=2}^{T-1} \left( (y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*) \right)^2}{\sum_{t=1}^{T} (y_t - y_t^*)^2} < V \right\}$$

In this case with annual data, to have a contrasting value V, first the components of the standard Hodrick-Prescott filter were calculated for the United States, and second, the ratio between components was found in order to obtain the V of that country. Then it was optimized. Therefore, given the value of $\overline{\lambda}$ for the U.S., the exercise consisted of finding $\overline{\lambda}$ for each of the CADR countries, approximating the respective values of V to that of the United States. Finally, with those parameters the filter was applied to the natural real GDP logarithm and the potential was approximated given its growth rate. The results of optimal $\overline{\lambda}$ are shown in Table 1.1.A.

**Table 1.1.A** Optimal Smoothing Parameter Based on V

| | Belize | Costa Rica | El Salvador | Guatemala | Honduras | Nicaragua | Panama | Dom. Rep. |
|---|---|---|---|---|---|---|---|---|
| Optimal $\lambda$ | 123 | 138 | 223 | 244 | 58 | 187 | 113 | 107 |

*Source*: CID/IDB Staff estimates.

The database used came from Penn World Table 9.0 (PWT) and the World Economic Outlook (International Monetary Fund, October 2016). The latter was used to extend the final range of the series to 2020 and thereby reduce the bias induced by the sample endpoints, where the cycle effect tends to be underestimated.

**2) Regime-switching.** Se It is assumed that an array of seasonal processes (stable variance-covariance matrix), represented with different probability density functions, generate a time series ($y_t$), allowing variability before a given number of regimes or scenarios.[21]

In this case, and following the Johnson (2013) application, real GDP growth was used as a series (taken from PWT 9.0) and three growth regimes were taken into account (recession or moderate, sustainable, with overheated). The sustainable scenario characterizes potential growth. For its part, it is assumed that neither recession nor economic overheating are absorbing states (in other words, no permanent crisis shocks arise).

Then, an expectation-maximization (EM) algorithm is applied to find the most likely estimators of parameters.[22] Simplifying, the iterative process is carried out on the following three equations ($\forall$ scenario $=j$=1,2,3):

Est. growth = $\hat{\theta}_j = \sum_{t=1}^{T} y_t P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}^{(k-1)}\right) / \sum_{t-1}^{T} P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}^{(k-1)}\right)$

Est. volatility = $\hat{\sigma}_j^2 = \sum_{t=1}^{T} \left(y_t - \hat{\theta}_j\right)^2 P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}^{(k-1)}\right) / \sum_{t-1}^{T} P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}^{(k-1)}\right)$

Uncond. probability = $\hat{\pi}_j = \frac{1}{T} \sum_{t-1}^{T} P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}^{(k-1)}\right)$

where $P\left(s_t = j \middle| \Psi_{t-1}; \hat{\Gamma}\right) = \hat{\pi}_j f\left(y_t \middle| s_t = j; \Psi_{t-1}; \hat{\Gamma}\right) / f\left(y_t \middle| \Psi_{t-1}; \hat{\Gamma}\right)$ with $f$ = normal density function, $\overline{s_t}$ = random variable generated on the basis of the distribution function, $\overline{k}$ = number of iterations, $\overline{\Gamma}$ = parameter vector or set of conditional information.

El Cuadro 1.1.B describe los resultados de convergencia del modelo para el crecimiento promedio, la volatilidad y las probabilidades no condicionadas del escenario sostenible:

**Table 1.1.B Convergence for the Sustainable Scenario**

| Country | Growth | Standard Deviation | Unconditional Probability |
|---|---|---|---|
| Belize | 4.3% | 0.5% | 20.2% |
| Costa Rica | 5.4% | 2.7% | 75.8% |
| Dominican Republic | 5.3% | 3.8% | 95.4% |
| El Salvador | 1.9% | 0.4% | 25.5% |
| Guatemala | 4.0% | 1.0% | 60.2% |
| Honduras | 4.3% | 1.7% | 64.9% |
| Nicaragua | 3.2% | 2.9% | 80.4% |
| Panama | 5.6% | 3.1% | 89.7% |

*Source:* CID/IDB Staff estimates.

[21] To keep this section from being overly lengthy, see the development of regime switching in Johnson (2013), and Kim and Nelson (1999).
[22] See Hamilton (1990, 1991).

**3) Production function.** Following Sosa et al. (2013), for each country a standard Cobb-Douglas production function is assumed, where real output ($Y_t$) is determined by technological progress ($A_t$), the capital factor ($K_t$) and the labor factor ($L_t$) adjusted for skill ($h_t$ = human capital index), such that: $Y_t = A_t K_t^{\alpha}(L_t h_t)^{1-\alpha}$ with $\overline{\alpha}_t$ = capital elasticity (country-specific, averaging the values of PWT 9.0), and constant yields to scale.

The capital factor is calculated in two stages. For its initial value, an economy with balanced growth is assumed: $K_0 = \frac{I_0}{((1+g)(1+n)-(1-\delta_t))}$, where $I_0$ = average weight of investment over GDP multiplied by initial GDP (to minimize the impact of future fluctuations), $g$ = technological progress growth =1.53% (see Ferreira et al., 2011), $n$ = sample population growth average, and $\overline{\delta}_t$ = depreciation (taken from Penn World Tables 9.0). The rest of the values are calculated according to the perpetual inventory method, $K_t = (1-\delta)K_{t-1} + I_t$, in an attempt to approximate capital stock at full capacity.

The labor factor is measured on the basis of the number of workers and the human capital index is obtained following Bils and Klenow (2000): $h_t = e^{\left(\frac{\theta}{1-\psi} s^{1-\psi}\right)}$ with $\overline{\theta}$ = 0.188, $\overline{\psi}$ =0.368 (both values taken from Fernández-Arias, 2014) and $s$ = total years of schooling (using linear interpolation where values are unknown). For its part, $A_t$ is calculated as residual based on solution of the Cobb-Douglas function.

Finally, the potential value arises after linearizing the function with logorithms and estimating respective trends (except that of capital) using the Hodrick-Prescott filter with the new parameter. Avoiding the sample endpoint biases, the series was extended to 2020 with data from the World Economic Outlook (International Monetary Fund, October 2016).

Table 1.1.C shows the sample range according to the methodology employed.

**Table 1.1.C Beginning of the Sample Range, Depending on Methodology**

| Country | Modified Hodrick-Prescott Filter (HP V) | Regime-Switching | Production Function |
|---|---|---|---|
| Belize | 1970 | | 1980 |
| Costa Rica | | | 1950 |
| Dominican Republic | | | 1951 |
| El Salvador | 1950 | | 1975 |
| Guatemala | | | 1950 |
| Honduras | | | 1970 |
| Nicaragua | | | 1980 |
| Panama | 1951 | | 1969 |

*Source*: CID/IDB Staff estimates.

## Annex 1.2

### Summary of Variables Used in Structural Approach Methods

To apply methods using the structural approach, an unbalanced panel was constructed for the countries of the world (with potential sample gaps). In principle and in the best of cases, it runs from 1961 to 2015 with 102 countries (39 high income, 52 medium income and 11 low income). A total of 40 variables were used, including real GDP growth as the variable of interest. Panel construction, as well as classification of the variables in six categories, was based on Lanzafame et al. (2016). Table 1.2.A shows the summary.

**Table 1.2.A Summary of Variables Used**

| Category | Description | Mean | Est. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|
| Dependent | Real GDP growth (%). *World Bank* | 3.9 | 4.8 | -50.2 | 35.2 |
| a) Growth Theory (of theoretical models) | Technological gap with the United States. Constructed as one minus the ratio between the country's labor productivity in relation to that of the U.S., multiplied by 100. Labor productivity represented by real GDP per worker. *Calculated with data from PTW 9.0* | 61.4 | 48.2 | -945.3 | 98.8 |
| | Capital-labor ratio growth (%). *Calculated with data from PTW 9.0* | 2.8 | 4.3 | -20.6 | 45.5 |
| | Human capital growth (%). *PTW 9.0* | 0.9 | 0.7 | -2.4 | 5.8 |
| | Growth trend of the working age population (%). Obtained by applying the Corbae-Ouliaris filter, with parameters for annual data, on the log of the working age population after which the log-difference rate was approximated. *Calculated based on data of the World Bank.* | 1.9 | 1.6 | -2.6 | 20.0 |
| | Patents grants (number). Proxy for investment in research and development. *WIPO* | 7187 | 27018 | 1 | 300678 |
| b) Convergence | GDP per capita at the beginning of each decade (dollars/person). Using real 2010 GDP and the total population. *World Bank.* | 11055.6 | 15613.9 | 171.3 | 115003.2 |

| | | | | | |
|---|---|---|---|---|---|
| c) Educational System | Public spending on education (% GDP). *UNESCO* | 4.5 | 1.9 | 0.8 | 44.3 |
| | Gross enrollment ratio, primary (%). *UNESCO and calculations based on data from INIDE (Nicaragua)* | 99.5 | 17.2 | 15.0 | 165.6 |
| | Gross enrollment ratio, secondary (%). *UNESCO and calculations based on data from INIDE and CNU (Nicaragua)* | 69.2 | 32.5 | 1.4 | 164.8 |
| | Gross enrollment ratio, tertiary (%). *UNESCO and calculations based on data of INIDE and EMNV (Nicaragua)* | 27.0 | 23.2 | 0.1 | 110.3 |
| | Pupil-teacher ratio, primary. *UNESCO* | 27.9 | 12.6 | 8.9 | 87.5 |
| | Pupil-teacher ratio, secondary. *UNESCO* | 18.2 | 7.3 | 6.9 | 70.4 |
| | Average schooling of the population over 15 years, total (years). *Barro and Lee (2013) and calculations from linear interpolation* | 6.7 | 3.1 | 0.2 | 13.6 |
| d) Openness | Overall globalization (index, 1-100=maximum). *KOF Globalization Index* | 52.0 | 18.6 | 11.7 | 92.6 |
| | Economic globalization (index, 1-100=maximum). *KOF Globalization Index* | 52.1 | 19.2 | 9.1 | 97.1 |
| | Political globalization (index, 1-100=maximum). *KOF Globalization Index* | 62.6 | 22.1 | 6.6 | 98.4 |
| | Integration (% GDP). Calculated on the sum of total stocks of external assets and liabilities. *Lane and Milesi-Ferretti (2007) and author's calculations as of 2010 using IMF BOP/IIP and WEO* | 190.2 | 407.7 | 5.3 | 7866.5 |
| | Integration through foreign direct investment (% GDP). Calculated on the sum of total stocks of assets and liabilities in foreign direct investment. *Lane and Milesi-Ferretti (2007) and author's calculations as of 2010 using IMF BOP/IIP and WEO* | 43.3 | 190.4 | -14.6 | 5394.3 |
| | Integration through porfolio equity (% GDP). Calculated based on the sum of stocks of portfolio equity assets and liabilities. *Lane and Milesi-Ferretti (2007) and calculations as of 2010 using IMF BOP/ IIP and WEO* | 17.6 | 84.9 | 0.0 | 2051.2 |
| | Capital Account Openness (normalized index, 0-1=no restrictions). *Chinn and Ito (2006)* | 0.49 | 0.37 | 0.00 | 1.00 |
| | Openness (% GDP). *World Bank* | 67.0 | 37.7 | 5.0 | 251.1 |
| | Real exchange rate (index, 2011=1 for United States). Approximated by price levels in real GDP at current purchasing power parity, in millions of 2011 dollars. Values greater than one indicate that the currency value is higher (appreciation) than indicated due to purchasing power parity. *PTW 9.0* | 0.40 | 0.29 | 0.02 | 3.11 |

| | | | | | |
|---|---|---|---|---|---|
| e) Institutional Quality | Perception of corruption (index, 0-100=low). *Transparency International* | 47.5 | 22.3 | 3.3 | 100.0 |
| | Government effectiveness (index, -2.5-2.5=maximum). *World Bank* | 0.28 | 0.93 | -1.73 | 2.36 |
| | Size of Government (index, -2.5-2.5=maximum). *World Bank* | 6.12 | 1.48 | 0.65 | 9.54 |
| | Labor market rigidity (index, 0-3.5=more rigid worker protection laws). *Campos and Nugent (2012) was used up to 2004; between 2005-2009 data of World Bank-Doing Business was normalized to bring it to the scale of 0-3.5 (with the minimum-maximum methodology); from 2010 on the last available calculated data was used (given little variance in the indicator)* | 1.51 | 0.62 | 0.00 | 3.50 |
| | Legal structure (index, 0-10=greater freedom). Economic Freedom of the World - *Fraser Institute* | 5.8 | 1.7 | 1.2 | 9.6 |
| | Political stability (index, -2.5-2.5=maximum). *World Bank* | -0.02 | 0.89 | -2.81 | 1.66 |
| | Labor market regulations (index, 0-10=greater freedom). *Economic Freedom of the World - Fraser Institute* | 6.0 | 1.5 | 1.8 | 9.3 |
| | Regulatory quality (index, -2.5-2.5=maximum). *World Bank* | 0.29 | 0.89 | -2.21 | 2.08 |
| | Voice of Accountability (index, -2.5-2.5=maximum). *World Bank* | 0.18 | 0.93 | -1.86 | 1.83 |
| f) Economic Structure | Employment in agriculture (% total employment). *ILO - Trends Econometrics Models (Oct. 2013) and World Bank* | 25.8 | 23.3 | 0.1 | 92.2 |
| | Employment in industry (% total employment). *ILO - Trends Econometrics Models (Oct. 2013) and World Bank* | 22.7 | 8.6 | 2.0 | 47.5 |
| | Employment in services (% total employment). *ILO - Trends Econometrics Models (Oct. 2013) and World Bank* | 51.4 | 17.8 | 5.7 | 83.7 |
| | Bulk commodities (% Exports of goods). *Author's calculations based on Comtrade data (using SITC Rev. 1)* | 10.3 | 18.2 | 0.0 | 97.9 |
| | Fuel and mining products (% exports of goods). *Author's calculations based on Comtrade data (using SITC Rev. 1: 27, 28, 3, 68)* | 20.7 | 25.7 | 0.0 | 99.8 |
| | Raw material (% exports of goods). *Author's calculations based on Comtrade data (using SITC Rev. 1: 21, 23-26, 29)* | 5.8 | 8.4 | 0.0 | 61.6 |
| | Raw material plus fuel and mining products (% exports of goods). *Author's calculations based on Comtrade data (using SITC Rev. 1: 21, 23-29, 3, 68)* | 26.4 | 25.8 | 0.0 | 99.8 |
| | Ratio of unemployed youth-adults. *ILO - Trends Econometrics Models (Oct. 2013)* | 3.0 | 1.5 | 0.5 | 13.1 |

*Source*: CID/IDB Staff estimates.

*Note*: Light to darker green highlights the variables considered in the BMA 1 and BMA 2 reductions and both, respectively.

## Annex 1.3

### Structural Approach Methods

Given the panel described in Annex 1.2 (variables with blue tones) and following Lanzafame et al. (2016), the idea is to employ Bayesian model averaging to extract robust determinants for use in a future regression of economic growth and thus estimate its growth potential.

Before applying BMA, each variable is transformed through forward orthogonal deviations (FOD), proposed by Arellano and Bover (1995). With this transformation, the mean of the remaining future observations available in the sample is subtracted from each of the first $(T-1)$ observations.[23] Given a variable $x_{it}$ (country $i$), the transformation results from:

$$x_{it}^{\perp} = \sqrt{(T-t)/(T-t+1)}\left[x_{it} - (x_{it+1} + \cdots + x_{iT})/(T-t)\right]$$

Prior to FOD transformation and with the exception of the convergence variable, the working age population trend component variable, and the variables associated with institutional factors, the first variable lag is taken into account as a tool to address potential problems of endogeneity. Once the transformation is made, BMA is applied.

The general equation to estimate is: $y_{it} = \mu_i + [\gamma_F^T \quad \gamma_A^T]\begin{bmatrix} X_{it}^F \\ X_{it}^A \end{bmatrix} + [\beta_F^T \quad \beta_A^T]\begin{bmatrix} W_{it}^F \\ W_{it}^A \end{bmatrix} + \epsilon_{it}$ ,

where $y_{it}$ is real GDP growth,[24] $\mu_i$ is the fixed effect for the country $i$ [25] $\gamma_F^T$ and $\beta_F^T$ are the coefficient vectors of the focal variables of respective size1 $n_1$ and 1 $n_2$ , $\gamma_A^T$ y $\beta_A^T$ are the coefficient vectors of auxiliary variables of respective size 1x $(N_1 - n_1)$ and 1x $(N_2 - n_2)$, $X_{it}^F$ y $W_{it}^F$ are the vectors of the focal variables of respective size $n_1$ x1 and $n_2$ x1 , $X_{it}^A$ y $W_{it}^A$ are the vectors of auxiliary variables of respective size $(N_1 - n_1)$x1 and $(N_2 - n_2)$x1, and where $\epsilon_{it} \sim i.i.d.(0, \sigma_\epsilon^2)$.[26]

The number of auxiliary variables determines the size of the model space (number of non-null subsets of auxiliary variables). $N_1 + N_2 = N$ variables of which $n_1 + n_2 = n$ are focal, then $2^{N-n}$ = model space, which could exponentially slow the combination of models to be estimated if there are many auxiliary variables.

To simplify, potential growth is defined on the basis of the sum of workforce growth and labor productivity rates (see Harrod, 1939, and Domar, 1946). Under this definition, the working age population trend component would serve as proxy for workforce growth (which could be assumed a focal variable), while the rest of the variables will affect labor productivity growth. If the 38 remaining regressors are taken as auxiliary, the model space would be $2^{38}$=274.9 billion models (which computationally could take more than four continuous years to estimate). It is

[23] The advantage of using this transformation is that it avoids problems of serial correlation, removes unobserved individual effects and is applicable to data with sample spaces (see, for example, Heckman and Learner, 2001).
[24] Lanzafame et al. (2016) use potential growth as the variable of interest, after estimating it using a state-space model. In this case, the dependent variable is observed growth and it is precisely the estimation of this by means of possible determinants of the potential that will bring us to a smoothed result.
[25] The FOD transformation already removes this effect.
[26] Focal variables are those that will always appear in all specifications of the model in the BMA (model space); conversely, auxiliary variables are not fixed so they may not appear in all the possible combinations in the model space.

therefore necessary to reduce that number; selection is facilitated through use of the bivariate correlation matrix and a search for similar representation among the categories employed. With this, auxiliary variables are reduced to 25 (approximately five continuous hours) and the first averaging can be applied (BMA 1). To consider the rest of the variables not included in that first exercise, a second averaging (BMA 2) was also applied with 25 auxiliary variables.

To reduce the possibility of results being highly influenced by multicollinearity between variables, both BMA 1 and BMA 2 are performed in four stages, starting with the 25 variables, then discarding at the end of each result part of the non-robust variables, and thereon successively until the final stage.[27] According to the exercise, apart from the focal variable, robust outcomes involved the variables in Table 1.3.A.

**Table 1.3.A Robust Auxiliary Variables**

| BMA 1 | BMA 2 |
|---|---|
| Technological gap with the United States | Technological gap with the United States |
| Political stability | Openness |
| Legal structure | Real exchange rate |
| Government size | |
| Employment in agriculture | |

*Source*: CID/IDB Staff estimates.

Finally, based on those variables, models with fixed country effects and without effects were estimated to calculate potential growth.

[27] The robustness of the variables is identified through posterior inclusion probability (PIP). If PIP is greater or equal to 0.5, it will be robustly correlated; if PIP is located between 0.25 and 0.5, it is considered marginally robust (see Barbieri and Berger, 2004).

## Annex 1.4

# Potential Growth Results by Country

### Figure 1.4.A Annual Potential Growth Expectations (2016-2020 Average), According to Different Methodologies, By Country


*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).

*Note*: Hodrick-Prescott filter methods according to constrained minimization (HP V), regime switching (SM), production function (PF), and structural methods with reduction using Bayesian model averaging (BMA).

# 2 LOW HYDROCARBON PRICES: OPPORTUNITY AND CHALLENGE

In recent years, falling oil prices have impacted all sectors of the economy, including producers, exporters, governments and consumers. The benefits of this scenario have been greater for net oil importers such as CADR countries, while net exporters have benefitted less. Though this phenomenon has been quantified for many countries, thus far no detailed analysis has come out discussing the impacts of lower prices on CADR.

This chapter summarizes effects on economies from the lower prices of oil derivatives, particularly electricity, liquefied petroleum gas (LPG) and the different types of gasoline. The first question is simple: How much has the region benefited from the decline in hydrocarbon prices? To answer this, we look at the mechanics of how this situation has affected different segments of the economy, whether through electricity generation, LPG use or gasoline demand.

A second goal of this chapter is to determine whether public policies for maximizing the advantages of low international prices exist in the current global context. The discussion primarily centers on how pass-through of lower international prices to end-user prices can benefit the economy. In particular, we quantify the response in macroeconomic aggregates of consumption and investment from improved household income or greater leeway for corporate investment. These estimates can only approximate reality insofar as the electricity matrix and expansion plans are considered, which is what this chapter does. Finally, we analyze implementation scenarios for pass-through mechanisms to end users, taking into account that the results will depend on the time horizon in which benefits materialize in both consumption and investment.

The conclusions of this chapter can be summarized up in four overarching areas. First, pass-through of lower energy prices was greater for LPG and gasoline. Second, the electricity sector saw no substantial rate adjustments for the end user, even though generators' costs fell in many cases. While users' rates remained fairly stable, fiscal costs shrank from the lower costs. Third, improving the pass-through of low international prices to the end user could contribute as much as a 0.5 percentage points in growth by the end of one year. Finally, one lesson drawn from this analysis is the importance of transitioning from current subsidy

regimes to those with better pass-through mechanisms, targeting support where needed. A better balance could be achieved between those who absorb the costs and those who receive the benefits. Benefit and cost reallocation, also known as risk-sharing, will enable the design of automatic protection mechanisms such as a balanced energy matrix, utilization of the regional electricity market (MER, its Spanish acronym), and price-cycle, self-financing subsidies. The risk-sharing strategy should be sustainable and should rein in fiscal cost, making it as efficient as possible.

The chapter is structured as follows: we first describe the evolution of unit costs and end-user price dynamics, after which we use pass-through price estimates to show scenarios where stronger leveraging of lower international prices can lead to positive economic externalities.

## LOWER INTERNATIONAL PRICES, ENERGY COSTS AND BENEFICIARIES

### *Electricity*

This section focuses on the effect of lower oil prices on the electricity sector, describing conditions that enable or constrain pass-through of lower hydrocarbon prices to generation costs and where relevant, rates paid by end users. Content is divided into two parts: the cost structure of electricity, emphasizing generation from domestic sources, and the effect on costs of the interconnection through MER. This separation is important for distinguishing conditions inherent to the behavior of local costs and prices from those influenced by access to energy from the rest of the region.

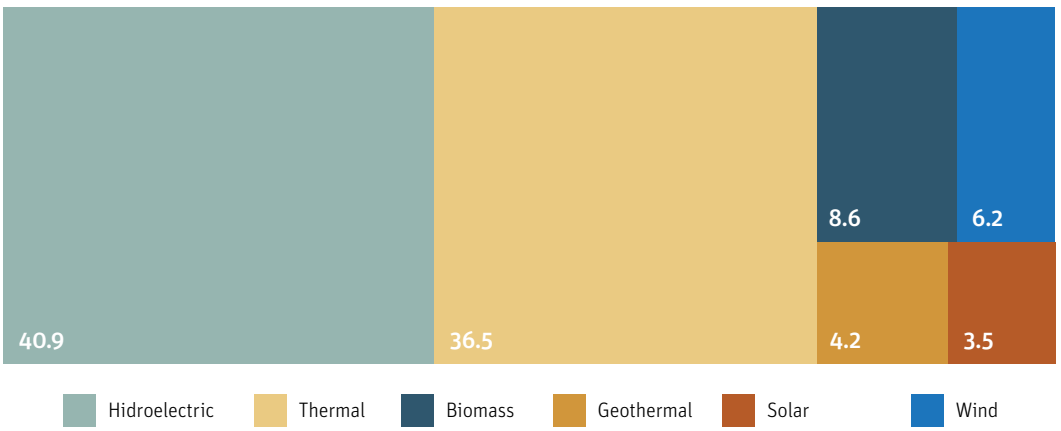
The CADR countries' energy matrix has a strong renewable component, a determining factor in ascertaining the effect of lower hydrocarbon prices. An example of this is documented in EBE (2016),[28] the information from which is given in Figure 2.1. CADR produces just 36.5% of its electricity from fossil fuels. This suggests that in the best of cases, pass-through of lower international prices could contribute somewhat limitedly to lower generation costs, but its negative effect would also be limited to some extent if an increase occurred.

Since the energy matrix varies among countries, lower prices can be expected to affect each country differently. For example, between 2014 and 2015, Guatemala substantially increased its installed capacity (22%), though it did so from non-manageable energy (solar and wind power), thereby reducing its fossil fuel-based domestic production factor. Currently, Guatemala has an intensity factor of 40 for thermal sources versus 60 for renewable sources (see Table 2.1). El Salvador also boosted installed capacity by 6% between 2014 and 2015, but distribution by power source is biased toward thermal at a fixed 46%. Peculiarly, this

[28] "Evaluation of Economic Benefit for Six Countries" is one of the economic studies under the supervision of the IDB's Energy Division. The report will be published in the first half of 2017.

country's other plant facilities often require a thermal engine for generation, exposing the country to international price fluctuations[29] for more than the installed 46%. Like Guatemala, in 2014 and 2015 Honduras increased installed capacity centered on renewable sources, both solar and wind, reducing its exposure to international hydrocarbon price variations. Even so, fixed thermal generation is 40%, one of the highest in CADR. Nicaragua, for its part, still has the most intensive use of thermal technologies. Currently 55% of its generation comes from thermal plants, and although installed capacity rose just 3% from 2013 to 2014, based on wind generation, distribution did not change substantially.[30] By contrast, Costa Rica's installed capacity, based on renewable sources, grew relatively steadily by 6%.[31] This pattern is consistent with its energy policies for maintaining a maximum 20% exposure to changes in international fossil fuel prices. Finally, while also expanding its solar-generation capacity, Panama continued to depend on thermal sources for over a third of its electricity generation. Panama has also opted for increased use of natural gas, which will determine much of the medium-term behavior of generation costs.

Figure 2.1 CADR Electricity Matrix, % of Total Generation




*Source*: CID/IDB Staff using data from EBE (2016).

[29] This in turn explains the propensity to import. Given that renewable-source generation costs have fallen significantly, energy providers turned to importing electricity in years with high thermal generation costs in order to lower costs and maximize profit margins.
[30] Despite having a predominantly thermal matrix, Nicaragua had little demand for cheaper electricity from MER, even during years with high hydrocarbon prices. One reason could be that its demand is 100% contracted, so rates already include thermal costs. Another difference from El Salvador is that Nicaragua lacks a distributing agent, which in the Salvadoran market has played a role in importing and exporting.
[31] Electric companies in Costa Rica use MER to re-balance costs and broaden profit margins without affecting end rates. Since water power technologies figure predominantly in its matrix, Costa Rica tends to import more during the dry seasons. Likewise, during intense rainfall periods the country has surpluses to export to MER.

Table 2.1 Electricity Matrix % Total Generation by Country

| Country | Hidroelectric | Thermal | Biomass | Geothermal | Solar | Wind | Total |
|---|---|---|---|---|---|---|---|
| Guatemala | 33 | 40 | 22 | 1 | 3 | 2 | 100 |
| Costa Rica | 63 | 19 | 1 | 7 | 0 | 9 | 100 |
| El Salvador | 29 | 46 | 14 | 12 | 0 | 0 | 100 |
| Panama | 57 | 35 | 0 | 0 | 1 | 7 | 100 |
| Nicaragua | 9 | 55 | 10 | 12 | 0 | 14 | 100 |
| Honduras | 28 | 40 | 8 | 0 | 17 | 7 | 100 |
| **Total** | **41** | **36** | **9** | **4** | **4** | **6** | **100** |

*Source*: CID/IDB Staff using data from EBE (2016).

## Box 2.1 Prospective Exposure of Energy Matrices

Exposure to changing hydrocarbon prices is closely linked to a country's replacement capacity. Since physical expansion of generating plants usually involves a single type of technology, we need to analyze how energy matrices will look in coming years. Given rigid rate systems and installed capacity limitations, MER can serve to help the region's countries buffer impacts on their revenues. In cases where margins are regulated and the state guarantees the real rate for the distributor or generator, MER can reduce the fiscal burden of subsidies.

**Expected evolution of the CADR energy matrix.** Looking forward, electricity generation studies suggest that most of the countries now focus and will focus in the future on generation from renewable sources. As seen in Figure 2.2, the expansion plans registered with the Regional Operator Agency (EOR, its Spanish acronym) indicate that CADR countries are planning expansions at different times over the next decade. The expansion will be the greatest in Panama, followed by Honduras. Nicaragua and El Salvador will see expansions in 2019 and 2021. Finally, Guatemala, with surplus capacity, has no plans to expand before 2025. This regional expansion comes largely in response to power consumption forecasts.

**Energy matrix at 2020 by country.** At the same time, the characteristics of the planned type of generation will affect the benefits each country will gain from low energy prices. Figure 2.1.B shows what the energy matrix will look like in 2018 and 2020 for each CADR country. For all but Costa Rica, fossil fuels will remain a major energy source. Nicaragua and Guatemala, for instance, expect to maintain over 64% of their generation from nonrenewable sources. By contrast, both El Salvador and Panama will see significant changes in distribution by moving towards greater use of natural gas.

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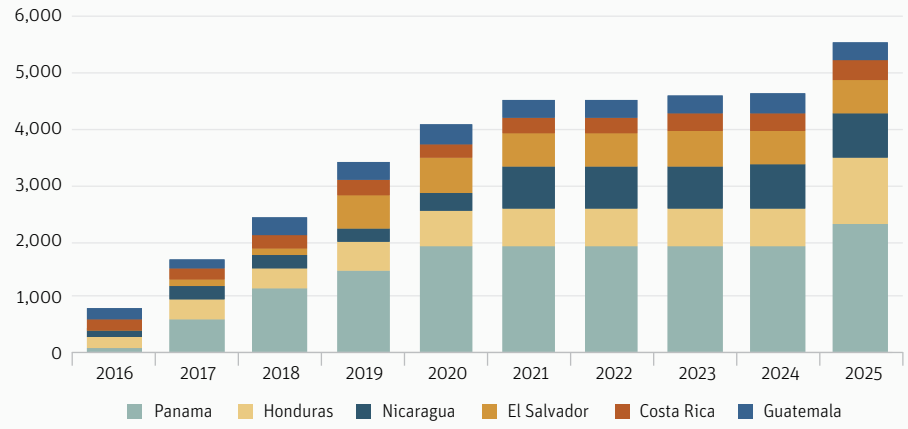
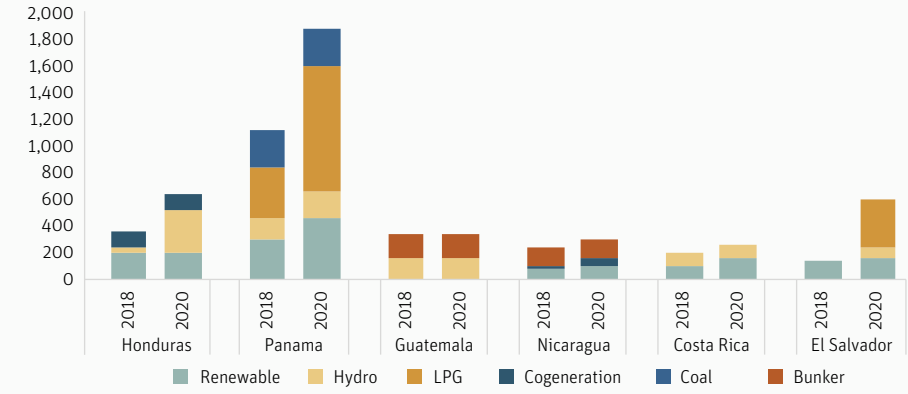
## Figure 2.1.A Expected Expansion in CADR




*Source*: CID/IDB Staff using data from EBE (2016).
*Note*: /1 Data Bank and Regional Operator Agency.

## Figure 2.1.B Expected Expansion by Country




*Source*: CID/IDB Staff using data from EBE (2016).
*Note*: /1 Data Bank and Regional Operator Agency.

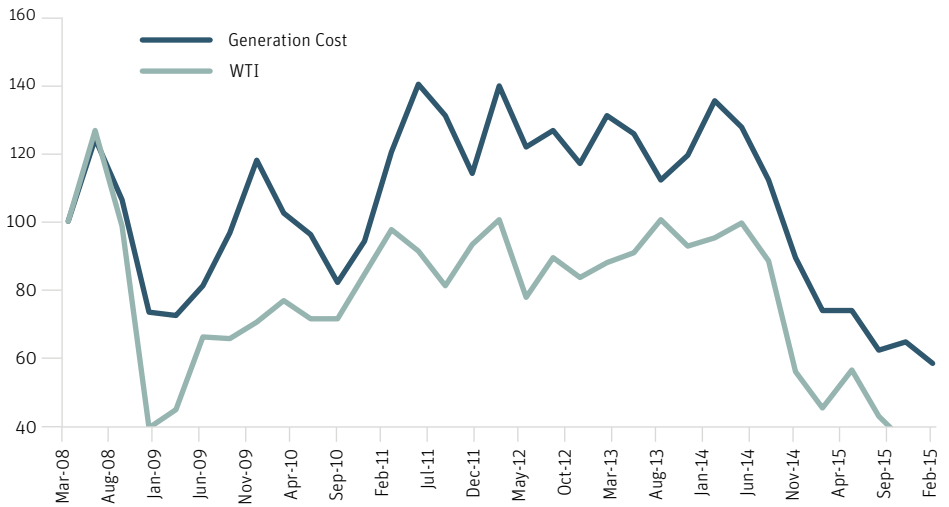
In countries highly dependent on oil derivatives, generation costs are expected to decrease with a fall in international prices. We have estimated elasticity between the West Texas Intermediate (WTI) oil price and each country's average cost of generating electricity.[32] Figure 2.2 shows an historical series of WTI prices and a simple average of variable power generation costs in CADR. The figure illustrates how variable generation costs relate to WTI fluctuations. For example, in El Salvador or Panama, nonrenewable components make up 46% and 35%, respectively. Hence, lacking a replacement mechanism, those percentages at least

[32] Because WTI is a light crude with little refining needed, it is widely used as an international benchmark price.

would be benefited (or affected) by lower (or higher) WTI prices.[33] A country like Costa Rica should feel a much smaller effect, however, with perhaps just 20% of its marketed electricity being impacted.[34]

And what has this relationship been historically? Considering the WTI oil price behavior and the simple average of variable generation costs in CADR since 2008, we see that for every 1% WTI price adjustment, average generation costs in CADR moved 0.46%. Figure 2.3 also reveals a noteworthy fact: WTI-cost price elasticity has been declining over the years. While between 2008 and 2010 this ratio was 0.48% for every 1% of WTI adjustment (both up and down), between 2011 and 2014 it was 0.37% and from 2014 to date has averaged 0.28%. These variations are associated with the speed of WTI price adjustments and the way generating companies have failed to adjust at the same pace,[35] whether due to technological barriers or limited fuel inventories. Note that these numbers include MER, so energy self-sufficiency elasticity may be less.

Figure 2.2 Generation Cost and WTI Prices

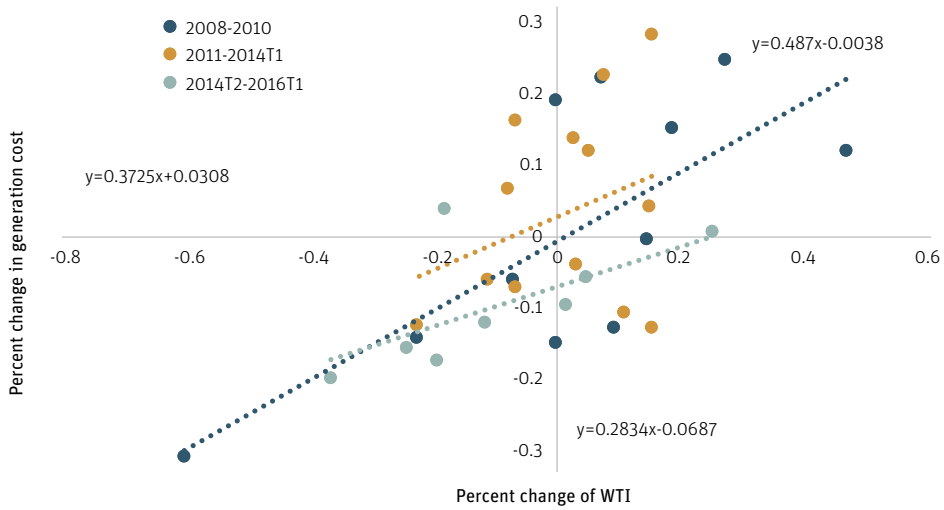



*Source*: CID/IDB Staff using data from Regulatory agencies of each country and Global Economic Monitor.

One of the main factors determining international price pass-through to costs is technology, which leads generation decisions or even decisions along the entire service chain to be based on principles of comparative advantages and opportunity costs. A country with one plant, at the thermal end, might find a high-priced international oil market burdensome and therefore seek an energy matrix with more balanced sources. Since this takes time, only energy trade with a

[33] Obviously, coming into play here is the fact that the government may find it more efficient to increase MER purchases from nonrenewable generators or to tap into any available local renewable energy capacity, thereby increasing the overall benefit within the country.
[34] With the same exception described in the previous footnote.
[35] Other possible explanations also exist, such as those associated with profitability decisions or the current regulatory rigidity.

## Figure 2.3 Percent Variation in Generation Costs




*Source*: CID/IDB Staff using data from Regulatory agencies of each country and Global Economic Monitor.

country whose generation is more renewable (and with surpluses) can mitigate the high costs of the importing country. Naturally, when oil prices are sufficiently low, the opposite occurs. What is still being overlooked here is that rules and regulations are in place to keep these fluctuations from affecting the end user, in which case the government usually absorbs the costs, a situation that is discussed further on in this chapter. In the current context of lower hydrocarbon prices, electrical interconnection can serve as a vehicle for direct benefits applicable to CADR countries. An interconnected market thus creates investment incentives for power plants using new technologies capable of lowering the region's marginal cost; it is also, the integrated market induces of economies of scale by not being limited to the domestic electricity market.[36]

EBE (2016) identifies benefits from remuneration for transmission, importing of required energy, and exporting of surpluses. While calculations of these benefits are important to understanding CADR energy markets, the analysis in this chapter compares lower generation costs with end-user rates, earnings captured by the electricity sector, and fiscal costs incurred by the government. The analysis has to consider that direct calculation of benefits to users with regulated rates, including MER trade, is possible for those countries where demand is not fully contracted, since in those countries rates depend on contract prices.[37]

[36] The region has two types of markets i) single agent and ii) multi-agent. In the first case, private generators contract all of their capacity with the national company through take-or-pay contracts, meaning that this generation falls under the category of mandatory dispatch (Honduras and Costa Rica). In the second case, agents make the power and energy transactions, with or without fully contracted demand (Guatemala, El Salvador, Nicaragua and Panama).

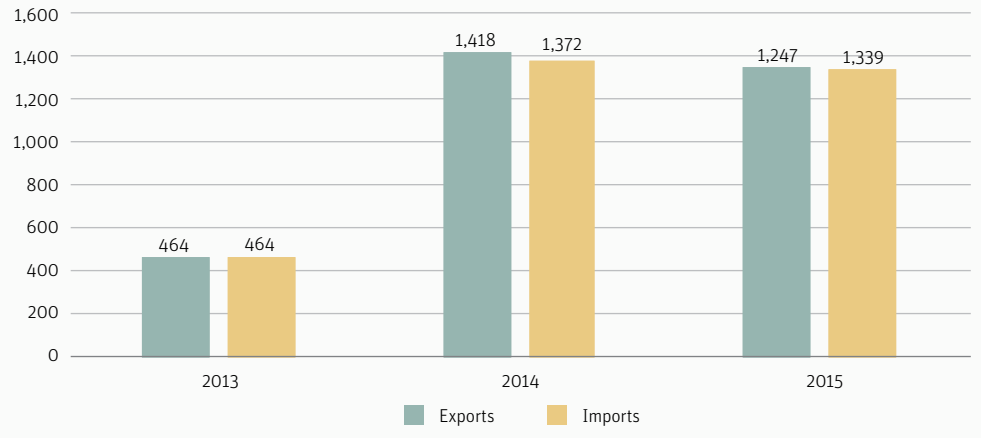
[37] The goal of electricity rates is to ensure financial sufficiency for distributors so they can cover their energy purchase, operating, maintenance and investment needs. The end user rate serves as reimbursement for distributors' purchases from the wholesale market in order to supply their users with energy, plus losses recognized in both medium- and low-voltage distribution.

## Box 2.2 The Regional Electricity Market (MER), a Cost-Balancing Mechanism

MER has served as a means for balancing supply and demand since 2013. Countries with seasonal power generation shortages or high costs of installed capacity can resort to MER to balance costs. The extent to which MER can lead to substantial benefits in the cost chain is associated with both existing technologies and the magnitude of available supply. Since all countries participating in MER have the option to trade electricity and thereby affect the local cost structure, this information box briefly describes MER's evolution between 2013 and 2015.

**Understanding the scope of MER.** In retrospect, MER has increased its flow from around 800 GWh to 2,600 GWh a year (see Figure 2.6) since 2013. The latter figure represents close to one third of the demand in El Salvador or Honduras, or almost half that of Nicaragua. Electrical interconnection has been a determinant of MER's gradual consolidation, and although some technological and regulatory barriers exist between countries, this has not kept MER from being used as a switch to import electricity when generation falls short, or to make it possible to secure less costly electricity. MER has significant potential as a source of power at competitive prices, but it also faces major development challenges. For example, the regional conception of an energy matrix that minimizes costs for the region does not necessarily square with the each country's power generation and expansion plans. Nonetheless, studies evaluating MER (EBE, 2016) indicate that apart from these constraints, MER has provided benefits from the commercial standpoint.

Figure 2.2.A Regional Transactions in GWh




*Source*: CID/IDB Staff using data from EBE (2016).

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**MER Usage Patterns.** Exports from Guatemala were continuous between 2013 and 2015, amounting to 69% of the total, while El Salvador and Nicaragua accounted for 9% and 2%, respectively. In fact, the period in which El Salvador and Nicaragua accompanied Guatemala in exporting coincides with the period when Costa Rica and Panama required energy and made attractive offers to MER in anticipation of the low-rainfall season. Aside from these low-rainfall periods, both Costa Rica and Panama contributed to electricity exports, accounting for 11% and 8%, respectively. El Salvador is the only country exhibiting a rising trend of imports, accumulating, in fact, 58% of the total. In contrast, Costa Rica and Panama only import during the low-rainfall season. These have been the dynamics since 2013, with these two countries together surpassing El Salvador in accumulated volume of imports. The following tables summarize each country's share of imports and exports from June 2013 to December 2015.

Cuadro 2.2.A Imports in MER

| Country | Import GWh | % Share |
|---|---|---|
| Guatemala | 1 | 0% |
| El Salvador | 1,844 | 58% |
| Honduras | 564 | 18% |
| Nicaragua | 103 | 3% |
| Costa Rica | 448 | 14% |
| Panama | 214 | 7% |
| **Total** | **3,174** | **100%** |

*Source*: CID/IDB Staff using data from EBE (2016).

Cuadro 2.2.B Exports in MER

| Country | Export GWh | % Share |
|---|---|---|
| Guatemala | 2,235 | 69% |
| El Salvador | 287 | 9% |
| Honduras | 9 | 0% |
| Nicaragua | 72 | 2% |
| Costa Rica | 366 | 11% |
| Panama | 261 | 8% |
| **Total** | **3,228** | **100%** |

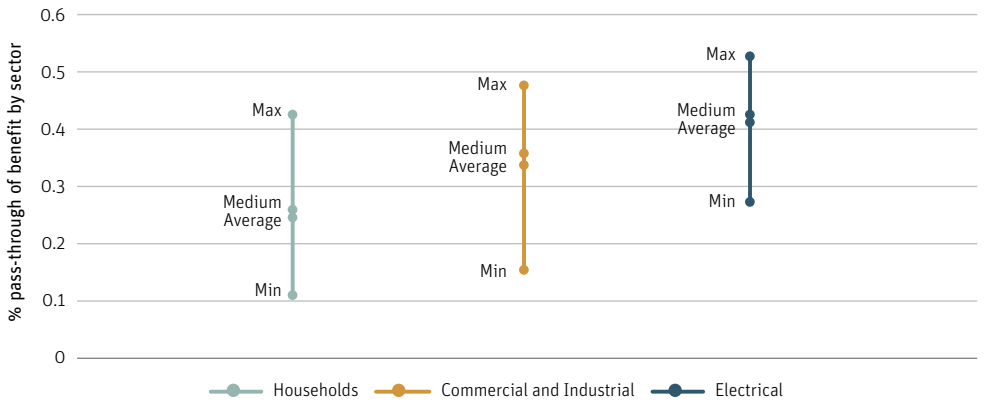
*Source*: CID/IDB Staff using data from EBE (2016).

In the methodology used to measure benefits (see methodological annex), net marginal benefits were broken down by type of end user. The breakdown attempts to account for the way in which hydrocarbon prices led to changes in operating margins with regard to the end user. The results are shown in Figure 2.4, where gross benefits are distributed among households, commerce-industry, and players in the energy supply chain. The greatest percentage was found to come from revenues attributable to a decline in generation costs. Benefits were then drawn from the rate structure levied on the commercial and industrial sector, and finally, from the burden on households. While households shouldered the smallest burden, the benefit from lower rates was very limited.[38] This is due to gradual increases in household rates over recent years, resulting from policies to lower consumption subsidies (or transition to more targeted

[38] In the period analyzed, user rates were adjusted downward only in certain specific cases. In other cases they were adjusted upward, since regulators considered they were already low.

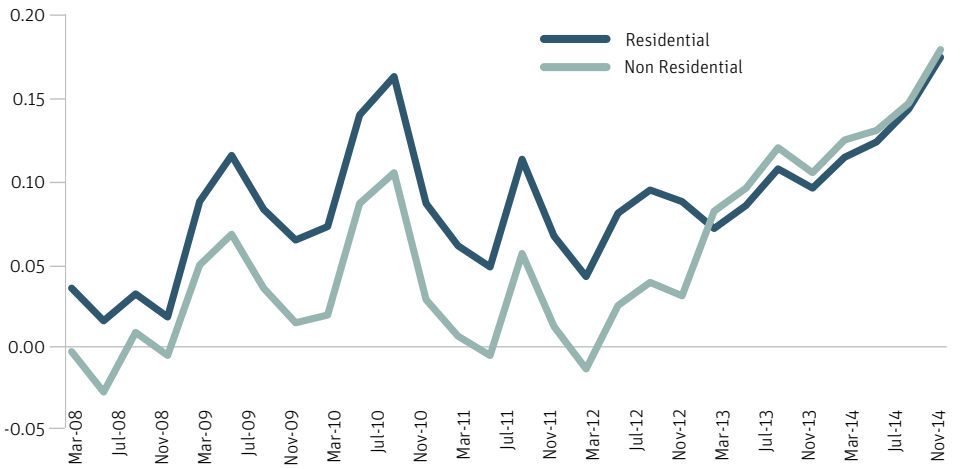
mechanisms). This can also be visualized by looking at the evolution of the differential between end-user rates and costs. Figure 2.5 shows these differentials (averages), in which an upward trend can be seen even from the end of 2013, just before costs began to ease.

**Figure 2.4** Distribution of Benefits to Each Sector (2014-2016 average)




*Source*: CID/IDB Staff estimates.

**Figure 2.5** Differential between End-User Price and Generation Cost (US dollars)



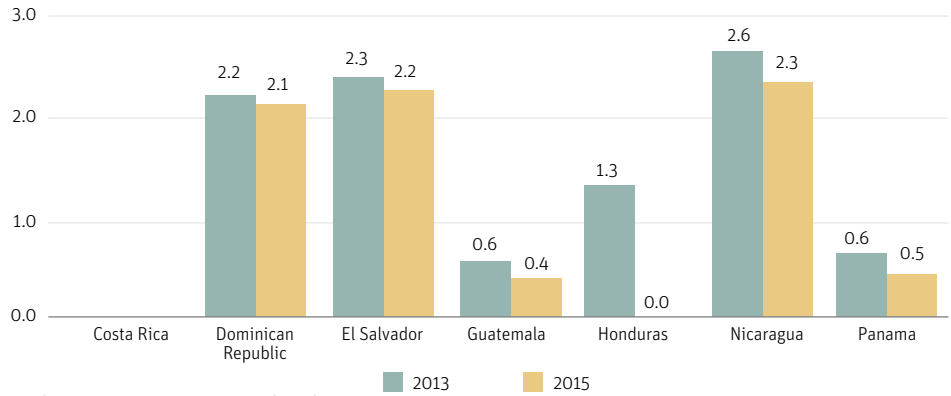

***Source***: CID/IDB Staff using data from regulatory agencies.

In many cases, therefore, the pass-through of lower hydrocarbon prices has not signified lower end-user rates. What, then, induces the low pass-through of benefits to the end user? The most precise answer is: regulation. With the exception of Costa Rica, all of the CADR countries have extended their strategy of long-term demand contracting. This can limit end-user benefits (in both the local market and MER) if the necessary provisions are not included in bid conditions

and the corresponding contracts. Nonetheless, there are also benefits to long-term contracts. They make it possible to stabilize energy prices over time, keeping the prices from being affected by open or spot market volatility. At the same time, these contracts reduce financial uncertainty for power plants.[39]

The rules of CADR electricity markets have redistributive effects on market price fluctuations. When electric companies are certain of their generation costs over time, thanks to contracts, and users must pay fixed rates, the government is the agent absorbing the risks of market price ups and downs. This suggests that the government subsidizes the user sometimes and the electricity sector other times. The drawback is that the fiscal cost may lack limits, putting pressure on public finances in extreme cases. The governments acknowledge this problem, and many have implemented measures to reduce the fiscal burden by having the end user, generator and distributor share the risks of price fluctuations.

**Figure 2.6** Electricity Subsidies (% GDP)




*Source*: CID/IDB Staff using data from IMF (2015)

Table 2.2 summarizes the regimes CADR governments have implemented. These range from systems that are self-financed with market cycles to those that lack any established funding. For example, Costa Rica has cross-subsidization in which subsidies for small consumers are financed through the rates for large ones. Honduras and Panama regulate along the same line, though they usually do not finance the subsidies completely. Users in Guatemala, El Salvador and Nicaragua obtain a discounted rate and the government compensates companies the difference between the rate and a benchmark price. The IMF (2015) tallies each of these amounts, adding any existing fiscal incentives in the distribution chain, and on this basis estimates spending on subsidies for the electricity sector at 2.6% of GDP. The IMF (2015) also indicates the trend over time; indeed, Figure 2.6 illustrates how subsidies have declined, influenced not only by lower energy prices but also by adjustments to social rate rules.[40]

[39] The central idea is that investors, have less uncertainty about cash flows from energy sales compared to power plants based on forecasted prices in the spot market.
[40] See Annex 2.2 for more on the current status of subsidies and recent changes.

Table 2.2. Comparison of Subsidies in Central America

| Characteristic | Guatemala | El Salvador | Honduras | Costa Rica | Nicaragua | Panama |
|---|---|---|---|---|---|---|
| **Application of the subsidy** | Direct contribution as a reduction of the price paid by the end user on the rate set by the regulator | Through an additional rate contribution, separate from the approved charges, appearing on the bill as a discount on the total bill | Direct contribution targeted to what the end user in a given consumption band must pay | Directed at special groups consuming less than 200 kWh a month. They pay a lower price, which does not cover supply costs | For household consumers of electricity within the range of zero to 150 kWh, rates were frozen for a five-year period | Applied as a reduction in the price paid by customers whose monthly consumption is under 500 kWh. This credit is applied to customer billing on the BTS rate in each consumption range, for energy consumption equivalent to 30 days |
| **Party responsible for contributions for paying the subsidy** | Instituto Nacional de Electrificación | FINET | Empresa Nacional de Energía Eléctrica | Costs not covered by the residential rate are covered by users consuming over 200 kWh. | Costs not covered for the rate freeze are absorbed by the government through agreements with distributors. | Amount of the subsidy is obtained through the Rate Stabilization Fund created between the government and ETESA, supervised by ASEP. |
| **Users benefited** | Based on consumption | Depending on monthly energy consumption. Subsidies are for residential users that consume up to 99 kWh/month | According to consumption and targeting by location and type of housing | Based on consumption | Based on consumption | Based on consumption |
| **Legislation** | Social Rate Law, Decree 96- 2000 | Law on the Creation of FINET and its Regulations | - | - | Law 554. Law on Energy Stability | Law 15 of February 7, 2001, Resolution AN 4214-Elec |
| **% of users benefiting from subsidies out of total** | 93 | 63 | 42 | 45 | 84 | 48 |

*Source*: Quijivix (2013)

The aforementioned shows that current electricity market regimes combine the noble intention of supporting lower-income consumers and safeguarding the country's energy security with risk management where the government is always exposed. This is accentuated if we observe how user subsidies through electricity rates are not usually targeted. In awareness of this situation, many countries have responded to this generalized effect by attempting to improve subsidy targeting, as documented in Annex 2.2. While subsidy adjustments are undoubtedly opportune when international prices are low, reduced generation costs could be passed through to the end user to balance out rate adjustments.[41]

In conclusion, our analysis suggests that subsidies should be made more efficient to better distribute benefits and costs among the users, government and electricity sector. This could be achieved by introducing and improving risk-sharing among agents so that automatic financing mechanisms exist, regardless of input price fluctuations for electricity generation.

### *LPG and Gasoline*

Liquefied petroleum gas and gasoline are essential inputs for a great number of economic activities. In terms of personal consumption, gasoline is the most commonly used fuel for private transportation while LPG is frequently used in cooking, furnaces and even public transportation. Given the importance of both goods in consumption and share of available household income, as well as in companies' cost competitiveness and governments' fiscal balances, our analysis of end-user benefit extends to these two markets. Although the usage intensity of these two petroleum derivatives varies from country to country, the data can give us a regional view.

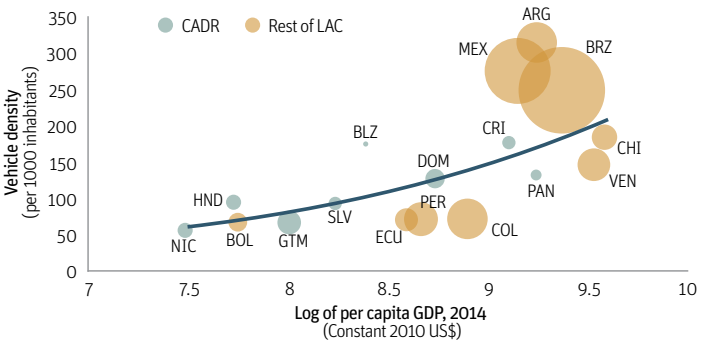
In CADR, the hydrocarbon with the most flexible end-user pricing mechanism is gasoline. Gasoline price volatility causes economic effects regardless of whether prices go up or down. On one hand, lower prices benefit end users as long as the price for consumers moves in tandem with the international price. Their impact on suppliers is also positive when prices are trending upwards and profit margins lack constraints. With price hikes, the ability of end users to cushion the adverse effects on income depends on their ability to make substitutions, such as by using public transportation instead of their own cars.[42] In this case, with a lack of regulation to rein in growing profit margins or taxation on surpluses, the ones to capture the country's above-normal earnings are the gasoline distributors. When gas prices drop, on the other hand, the result is usually less revenue for fuel suppliers. In this scenario, consumers are able to free up income, and the increased available income can be allocated to either consumption or savings, producing benefits to the economy either way.

[41] Rates for end users vary, but usually a simple low-voltage rate is assigned to residential users, while simple medium voltage or time-of-use medium voltage is employed for commercial and industrial users. Very few use high-voltage rates.
[42] Transportation prices also escalate. In a world of price flexibility, economies of scale exist on the cost side making it possible to alleviate rate increases. Also, usually there are subsidies to prevent continuous price hikes.

In recent years, CADR has benefitted from a positive external environment and stable foreign direct investment and macro-fiscal management.[43] As a result, the region has grown at a generally faster-than-average pace for Latin America and is rapidly transitioning to relatively high levels of motorized vehicle use. When we compare the urban and commercial dynamics of CADR with the rest of Latin America and the world, we see rising demand for transportation services and automobile purchases.

CADR currently seems to be divided into two levels of motorization. One group of countries displays a vehicle density comparable to that of countries with similar populations and per capita GDPs, while the second group (Panama and Costa Rica) more closely approaches the five largest Latin American economies despite major population differences, as illustrated in Figure 2.7, which also shows that motorization could evolve to levels similar to countries such as Colombia, Ecuador or Peru. The slope of the trend line indicates the increase in motorization for each 1% rise in country GDP growth. Most of the CADR countries seem to grow at the average Latin American rate (on the trend line), while countries like Honduras and Costa Rica recorded above-average motorization. In contrast, Colombia, Ecuador and Peru are below the line, signifying that their rate of motorization is relatively slower than that of CADR countries. This phenomenon will be important when quantifying the economic benefits or costs of fluctuating hydrocarbon prices.

**Figure 2.7** Motorization in CADR



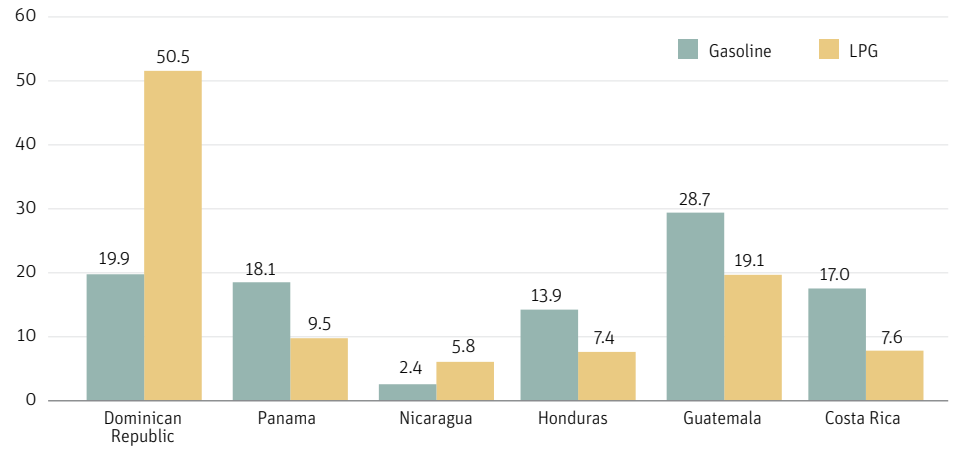

*Source*: CID/IDB Staff using data from World Bank.

As with gasoline, liquefied petroleum gas (LPG) is widely used in homes as input for stoves, furnaces, or heating, or for transportation or commercial and industrial uses. Distribution is typically different for LPG use than for other fuels. For example, while the Dominican Republic and Panama consume approximately the same level of gallons of gasoline per year, the former consumes five times more LPG than the latter (see Figure 2.8). The reason for this is that LPG is

[43] For references to the relatively favorable environment in which CADR economies have been moving during the past two years, see Lagarda et al (2014), Quijada et al (2015) or Maldonado and Manzano (2016).

used in Panama mostly for domestic consumption and commercial establishments, while in the Dominican Republic it is also used for public transportation. In other countries, such as Honduras and Nicaragua, LPG is primarily used in urban households where its consumption is relatively low due to competition from electric stoves. Finally, in Costa Rica the intensity of LPG consumption is relatively low since most needs in urban areas are met by electric energy.

**Figure 2.8** Fuel Consumption Distribution, % of CADR Total




*Source*: CID/IDB Staff using data from energy secretariats or regulatory agencies.

In CADR, one feature differentiating LPG and gasoline markets is the subsidy burden. The LPG subsidy is justified when LPG is used in homes for cooking purposes, since it is used intensively and can soak up a major share of lower-income household earnings. By subsidizing it, authorities are seeking to generate more available income for these homes. However, regional subsidy schemes are not homogeneous:

- Panama discriminates (imperfectly) between household and commercial prices through selective rates based on LPG tank capacity. Specifically, 25-lb tanks are typically used in homes and have a fixed price, while larger tank sizes, used commercially, have open pricing. To compensate for the difference between market price and what is paid by end users, the subsidy amount is paid to the distributor. The market price, comprised by the import parity price plus fixed distribution and profit margins, is regulated.[44]
- In Guatemala's open market, three private companies compete with one another to serve the population. Retail prices reflect import prices, and the Ministry of Energy and Mines monitors prices to make sure they stay within an affordable range for

[44] Price discrimination is based on the distinction between 25-lb and 60-lb containers. The one receiving the subsidy is the 25-lb tank, which is supposedly used for household consumption, although no monitoring mechanism exists to verify this.

consumers, taking domestic and external factors into account, without the existence of a subsidy regime.

- The Dominican Republic has an end-user price (before taxes) comprised by the import parity price and the Bonogas operating fee.[45]
- Nicaragua, a fuel importer, has an autonomous entity (Nicaraguan Energy Institute, or INE its acronym in spanish) that regulates the LPG market. INE does not set LPG prices and consequently does not give out subsidies. The difference between end-user price and parity price thus includes only the operating margins[46] each distributor company applies in an environment of open competition. Though no explicit subsidy exists through the price-gap approach (difference between market price and benchmark price), INE has recently reduced LPG trading margins.
- In Costa Rica, although an automatic price mechanism exists, it is subject to discretional implementation by the regulator. The price formula includes a distribution margin and a single tax on hydrocarbons, but there is no specific subsidy for LPG.
- In Honduras the Petroleum Administration Commission (Comisión Administradora de Petróleo, or CAP) regulates LPG prices. Prices are updated on a weekly basis through a formula based on the CIF price, taxes, and profit margins for distributors and retailers, which are private. The approach to LPG pricing, as for other fuels, suggests the lack of a direct subsidy.
- El Salvador subsidizes LPG consumption through fixed monthly pass-throughs to small consumers. Until April 2011, the price of an LPG tank was fixed and the government subsidized the difference between the market price and the benchmark price.

Some of these mechanisms have inefficiencies. Despite the different constraints arising when subsidies are dismantled, the countries have sought to transition toward more efficient financing and allocation systems. Box 2.3 provides a brief description of selected cases of progress in this area.

[45] In the Dominican Republic, a process was implemented to target the LPG subsidy through a monetary transfer to users selected according to social or production eligibility criteria.
[46] Although there is no subsidy per se, some distributors are exempt from value-added tax, which could be considered a type of subsidy.

## Box 2.3 Progress in LPG Subsidy Efficiency: Selected CADR Cases

LPG is one of the fuels most prone to subsidization, since it is generally used in homes, including lower income households. Decisionmakers might consider a subsidy regime with a limited fiscal cost. Many CADR countries have or have had LPG subsidies and all of them began with a general subsidy. Below is a summary of how three countries have initiated actions to correct this by targeting state aid.

El Salvador went from a universal LPG subsidy to a transfer system for households within a conditional transfer program. Until April 2011, the government set the price of an LPG tank at subsidized rates and subsidized the market gap. The subsidy was high (only 35-40% of the recovery prices were charged), lacked objectiveness, and created contraband problems. Since 2011 authorities have provided the subsidy directly to consumers, either through the electric bill for small consumers or by means of a special subsidy card for companies and households without electricity. ECLAC reports that this reform helped reduce LPG consumption by 15.4% during the 2011-2013 period. In 2013-2014 the government adjusted the subsidy, requiring prior registration and presentation of a special permit at the time of sale (to prevent subsidy leakage). Even so, LPG subsidies represented around 0.6% of GDP in 2013.

From 2005 to 2008, the Dominican Republic undertook a reform to progressively eliminate subsidies for gasoline, diesel and LPG. Part of the savings was slated for subsidies in the form of cash transfers to poor households (to offset the rising monthly cost of LPG consumption and public transportation). The cash transfers were made through a solidarity bank credit card and covered the difference between the market price and the below-market price for targeted consumers.

In Panama the general subsidy for a 25-lb tank does not allow discrimination if the consumer meets household welfare aid requirements. The end user pays a fixed price and the difference is financed by the state and paid to the distributor. Between 2011 and 2013, the average direct subsidy amount was 0.3% of GDP. During 2016, the Ministry of Economy and Finance began studying options for redesigning the subsidy to make it targeted using the eligibility structure of the conditional transfer mechanism. However, the redesign will have to incorporate financing measures to make subsidies less costly for state coffers.

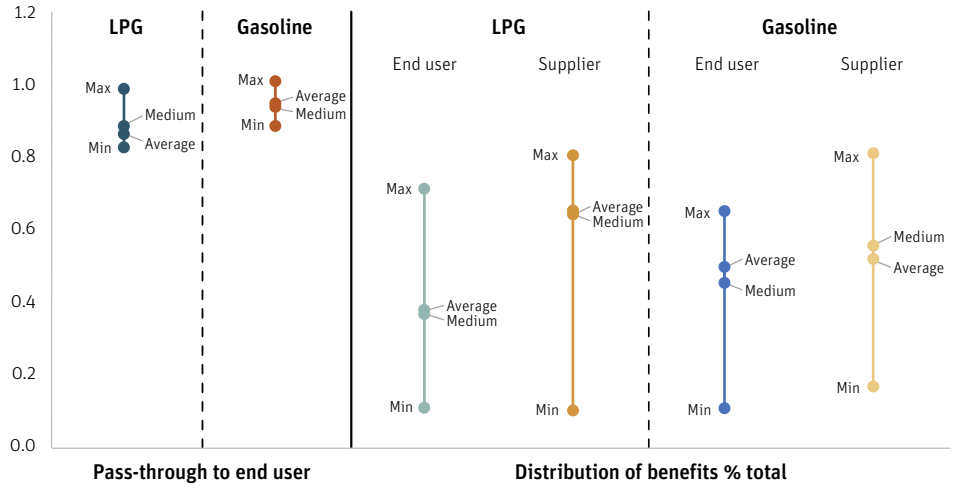
These experiences suggest that, for some countries, existing social protection systems offer a starting point in moving toward cost recovery and protecting those who are most vulnerable. Mechanisms for channeling subsidies to specific groups have improved a great deal with the spread of computerization and inclusive banking, eliminating one of the biggest reservations governments have to changing general subsidies: the administrative complexity of more targeted alternatives. In some environments, capacity might be a limiting factor for targeted subsidies, particularly in low-income countries.

*Source*: CID/IDB Staff and IMF reports and ministries of energy.

Unlike the electricity sector, the LPG and gasoline markets have experienced appreciable pass-throughs to end prices, leading us to analyze the consumer price change magnitude for the two cases.[47] To this end, we use a similar exercise to the one used for the electricity sector in order to measure operating benefit distribution by source. This analysis simplifies the division between fuel supplier and end user.[48] As in the case of electricity, the methodology in Annex 2.1 is used to calculate benefit distribution.[49]

Figure 2.9 shows the results of this exercise and country distribution for each calculation. On the left, the figure shows cumulative pass-through for gasoline and LPG. The panel on the right shows the supplier revenue source distribution. The figures reveal that the magnitude of cumulative pass-through for both LPG and gasoline is close to 90% (average), while variance is relatively low. This is consistent with what we have already mentioned, and the variation is likely influenced by inventory sales lags. When calculating where revenues come from in each of these markets, we find a greater bias toward the fuel supplier with LPG. When end-user prices fall, then, income due to pricing is reduced (this is reflected in the component defined as end user in the figure). However, low international prices also push wholesale prices down, so companies see their margins slightly dampened. Here the demand effect comes into play; because prices are now cheaper, sales go up, driving the component defined as supplier in the figure. The case of gasoline is similar, though the difference is less, primarily due to lower supplier margins for this product.

**Figure 2.9** Cumulative Pass-Through and Distribution of Benefits




*Source*: CID/IDB Staff estimates

[47] A weighted average of the prices of different gasoline in each period is taken into consideration. For LPG a weighted average of household and commercial rates is considered.
[48] As with electricity, users are considered to be households and commerce-industry.
[49] The exercise is also given as a means to evaluate this from the standpoint of cumulative benefits, following Annex 2.1.

Finally, LPG and gasoline are relatively more balanced than electricity rates with regard to benefit source distribution. For both, the main source of earnings comes from demand in response to lower market prices. In contrast, marginal income in the electrical sector was found to be explained mainly by cost reduction (expanding profit margins) and relatively less so by the impact of rates. Likewise, the ratio of pass-through to end user is much greater in LPG and gasoline than in the electricity sector.

The question regarding whether or not there are still spaces for leveraging higher pass-through of international prices to end-users remains open. Thus, the next section sets out econometric simulations providing information on the magnitude of potential benefits and the time horizon in which they would be seen.

## ESTIMATION OF BENEFITS FOR CADR ECONOMIES

A cut in oil prices affects importing countries in three ways. First, real income rises over consumption; second, the production cost of final goods falls, with a consequent effect on earnings and investment; and third, inflation receives a boost. This chapter analyzes how a higher pass-through ratio can generate economic benefits when prices are low. Since lower and higher prices are symmetrical, the analysis leads to an argument for policy mechanisms enabling beneficial risk-sharing if the price trend should reverse.

### *Correlations and Economic Impacts*

Disposable income, investment, energy dependence (net electricity imports) and growth feed into each other. On one hand, an increase in investment will probably raise productivity and GDP. On the other, to the extent that domestic income (GDP) increases, companies might find new business opportunities, thus increasing investment. Likewise, improved GDP performance can beneficially affect household incomes, which would have a positive effect on consumption. These are the correlations the impact analysis seeks to incorporate.

The methodology is based on a VAR that makes use of the previously mentioned variables, some endogenous and others exogenous.[50] The first exercise consists of a (policy) shock that improves pass-through by 10% for each of the previously analyzed energy inputs. This scenario results in a progressively positive effect that peaks around the first year after the policy shift. According to estimates, the response to a 10% increase in electricity pass-through could contribute as much as 0.5 percentage points to growth (see Panel 2.1, upper left-hand figure). The product variation generated by the new policy would be the result of the direct positive effect on consumption in the case of households and on investment in the case of companies. Both consumption and investment have an important growth multiplier, and this in combination

[50] The details of the methodology can be consulted in Annex 2.3.

with pass-through size changes prompts a 13%-15% contribution to total growth change, as documented in the variance decomposition (VD) (Panel 2.1, lower left-hand figure). When electrical input is factored in, the direct influence of electricity rate pass-through was 9% of the additional benefit. The 4% corresponding to electricity dependence could be added to this. Based on this simplified model, the cumulative effect of these two together is just as important as the contribution attributed to private investment (see the VD), which suggests that these policies have valuable potential.[51]

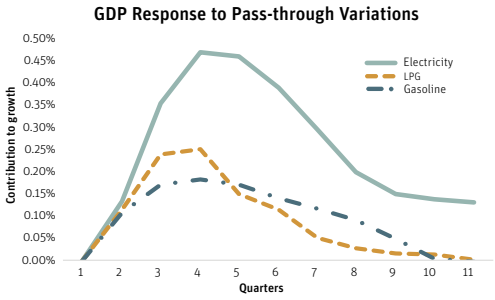
The repercussion on GDP from changes in LPG and gasoline pass-through is shown in the upper left figure in Panel 2.1. The intuition appears to be the same, with the distinction that these two goods already have a pass-through of nearly 100%, so the price effect on income can only activate the economy if the international price drops lower. In any case, the simulated adjustment for CADR contains sufficient synergies for contributing 0.25 and 0.15 percentage points to growth, respectively, deferred to one year after such policies are implemented.

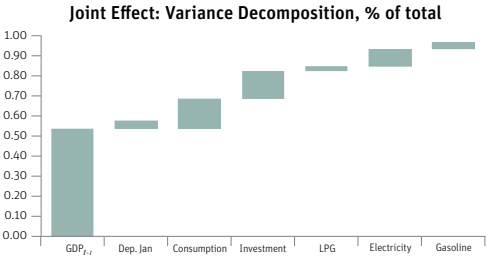
The LPG pass-through effect is greater in Guatemala and the Dominican Republic than in the rest of CADR, largely due to the extensive LPG use in these two countries. Based on the table of scenarios in Panel 2.1, the cumulative four-quarter multiplier indicates that the GDP would rise 0.4 percentage points (p.p.) over the 2015 baseline in the Dominican Republic and 0.14 p.p. over the baseline in Guatemala. Conversely, the rest of the countries, where LPG consumption is less intensive and prices have a high pass-through, have a multiplier of between 0.04 p.p. and 0.07 p.p. compared to the 2015 baseline.

Looking at gasoline, Guatemala has a cumulative GDP contribution of 0.18 p.p., consistent with the fact that it has the largest number of vehicles in the region. At the opposite extreme is Nicaragua, whose contribution after the four quarters of increased pass-through from prices is just 0.1 p.p. Very similar effects show up in the rest of the countries, and benefits to GDP growth range from 0.8 p.p. to 0.12 p.p. above the 2015 baseline.

[51] As in all VD analyses, this involves cumulative effects over time. However, gradualness cannot be visualized. Nonetheless, the shock response pattern in the upper left-hand figure provides a two-year approximation.

## Panel 2.1 Contribution to Growth and Variance Decomposition in CAPDR




**Scenario: LPG pass-through improves by 10% (percentage points)**

| Quarter | CR | GT | HN | NI | PA | DR |
|---|---|---|---|---|---|---|
| 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1 | 0.009 | 0.022 | 0.008 | 0.007 | 0.011 | 0.057 |
| 2 | 0.018 | 0.045 | 0.018 | 0.014 | 0.023 | 0.120 |
| 3 | 0.019 | 0.048 | 0.019 | 0.015 | 0.024 | 0.126 |
| 4 | 0.011 | 0.028 | 0.011 | 0.009 | 0.014 | 0.075 |
| 5 | 0.009 | 0.022 | 0.009 | 0.007 | 0.011 | 0.058 |
| 6 | 0.004 | 0.010 | 0.004 | 0.003 | 0.005 | 0.026 |
| 7 | 0.002 | 0.005 | 0.002 | 0.002 | 0.003 | 0.014 |
| 8 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.008 |
| 9 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.007 |
| 10 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |

**Scenario: Gasoline pass-through improves by 10% (percentage points)**

| Quarter | CR | GT | HN | NI | PA | DR |
|---|---|---|---|---|---|---|
| 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1 | 0.018 | 0.031 | 0.015 | 0.003 | 0.019 | 0.021 |
| 2 | 0.029 | 0.049 | 0.024 | 0.004 | 0.031 | 0.034 |
| 3 | 0.031 | 0.052 | 0.025 | 0.004 | 0.033 | 0.036 |
| 4 | 0.029 | 0.049 | 0.024 | 0.004 | 0.031 | 0.034 |
| 5 | 0.024 | 0.040 | 0.019 | 0.003 | 0.025 | 0.028 |
| 6 | 0.020 | 0.033 | 0.016 | 0.003 | 0.021 | 0.023 |
| 7 | 0.015 | 0.026 | 0.013 | 0.002 | 0.016 | 0.018 |
| 8 | 0.008 | 0.014 | 0.007 | 0.001 | 0.009 | 0.010 |
| 9 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| 10 | -0.001 | -0.001 | -0.001 | 0.000 | -0.001 | -0.001 |

*Source*: CID/IDB Staff estimates.

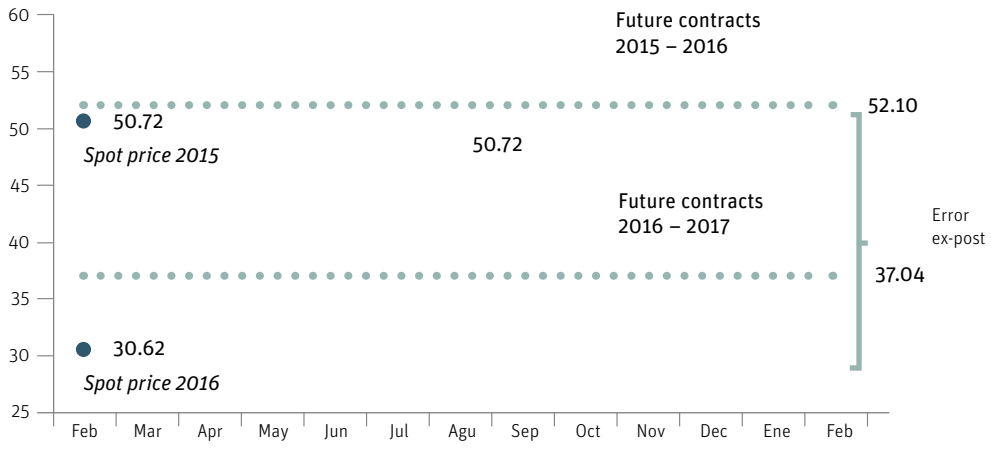
*Note* : To show results at regional level, a weighted average was made of impacts in each case. They are presented in relation to 2015 growth.

There are other relevant effects that our simulations do not consider, however, such as the possibility that oil prices might start to rise during the simulation period or that new subsidies might be imposed that decrease the user price without an automatic adjustment rule. We carried out two additional exercises, one that complements the simulation shown in chapter 4, incorporating oil price increases, and another that shows the option of turning to renewable generation if prices are hiked significantly.

In these simulations, economic benefits dissipate rapidly. For example, a sudden increase of US $30 per barrel (dpb) of WTI would boost high end-user prices if combined with greater pass-through. This would lead to a negative effect on growth of almost 0.3 p.p. Despite the existence of this somewhat extreme possibility, a policy decision encouraging greater pass-through is closely linked to the timing of its implementation and market conditions at that moment. With this in mind, a series of simulations were carried out combining the entry of a higher pass-through policy with an increase in international prices at different moments. In particular, the simulation includes rising oil prices in three stages, together adding up to almost 20 dollars a barrel (dpb) over the 53 dpb at year-end. We used a series of future contracts for light crude quoted in the New York Mercantile Exchange (NYMEX) as a baseline for this and proposed an increase episode of 30% at the end of 2017 and another of 40% in mid-2018.[52] This is a real possibility, given the historical difficulty of predicting prices for this commodity.

[52] The trajectories of these scenarios were selected arbitrarily. The selected levels intend to show drastic changes in a short time. Chapter 4 describes shock scenarios with a greater likelihood of occurring. In any case, the results are in the same direction.

Figure 2.10 Spot Price and Futures Forecasts per Barrel of Oil



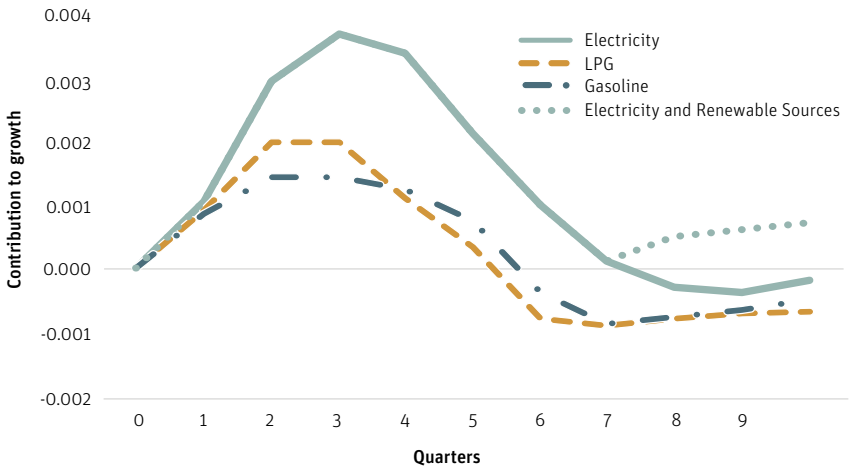

*Source*: CID/IDB Staff using data from IEA and CME Group.

This pattern of increases reveals a significant reduction in the previously calculated benefits. One year after implementation of the pass-through policy, the contribution to growth would be almost 0.6 p.p. at most. The economic advantages would fade away toward the close of the first year, when the oil price increase would reach almost 70 dpb. At that moment the recorded gasoline and LPG benefits could be near zero while the electricity sector would still maintain advantages. At the end of the second year, after the second international price increase brings oil up to almost 95 dpb, the benefits would cancel out and growth might be adversely affected in the absence of cheaper electricity generation options (see Figure 2.11).

Finally, to complement the analysis an additional assumption was included in the CAPDR energy matrix. Just when prices top 90 dpb, we assume that the marginal cost drops by the percentage of renewable sources in the matrix.[53] In the simulation the price is assumed to retreat to 70 dpb. The effect on contribution to growth can be seen in Figure 2.11. According to the estimates, the total effect (GLP, gasoline and electricity) would be practically null, though not negative, and would then be stabilized in subsequent months.[54] Thus, all the above cases show that opportunities exist for achieving benefits, but the potential diminishes as hydrocarbon prices recover.

[53] This is basically a new shock to the oil price, merely re-scaled by the percentage of renewable sources in each country's matrix.
[54] This is a result of subtracting (or adding) the electricity and renewable source estimate from (to) gasoline and LPG. The change in energy resource use intensity in combination with the 10% pass-through shock was also operationalized. In any case this would maintain a positive effect on growth. The difference lies in the magnitude of the impact, which is adjusted according to the relative modifications of intensity.

Figure 2.11 Contribution to Growth, Combined Effect




*Source*: CID/IDB Staff estimates.

## POLICY RECOMMENDATIONS

Improving price pass-through could bring benefits for CADR countries. The benefits include an average additional 0.5 point increase in growth in the first year and, after quantifying subsequent effects, an increase of around 0.9 points at the end of two years. However, the window of opportunity is increasingly narrowing; according to current WTI forecasts, another two to four years of low prices (though no longer quite as low) still remain. If the Organization of Petroleum Exporting Countries (OPEC) decides to speed up supply restrictions or the world economy heats up significantly, prices could rise by up to 10 dpb. Even at this level, benefits could still be obtained. However, if prices were to reach 70 dpb, negative effects would be seen immediately.

The findings of this chapter emphasize the advisability of achieving a better balance of who gets the benefits and who absorbs the costs – an issue that remains pending to address. This risk-sharing can be improved through price pass-through, although that alone would not be enough. The chapter instead of findings points out the importance of creating automatic stabilizers, such as self-financing subsidies with linked to price cycles and more long-term mechanisms such as diversification of the energy and derivatives matrix. All these will result in less burdensome schemes for the commercial entities and households. Moreover, the priority of public policy strategies for improving risk-sharing should be to rein in fiscal costs, increase spending efficiency, and establish adequate energy sector investment incentives.

The countries' decisionmakers could assess current energy sector conditions and consider a comprehensive strategy to maximize overall benefits when international prices fall and cut costs when the prices rise. For this, strategic policies should involve better practices in contracting long-term electricity demand, introducing schemes for sharing and mitigating

risks with end users. Better advantage could then be taken of low spot market prices and the MER interconnection. Also, there is still room in the case of fossil fuels to improve price pass-through by eliminating distortions in maximum prices or generalized subsidies. However, this also means that when prices are on the rise, there should be an automatic mechanism to buffer costs to households and businesses. Various experiences point to schemes that are self-financed with price cycles.

This chapter shows that CADR has taken limited advantage of low international prices. The low prices are still expected to continue for at least two years, enough time to capture the benefits that a price pass-through could offer to both households and the productive sector, with the appropriate safeguards. However, as large oil producers converge toward a restricted supply or the global economy once again heats up, prices will again rise, narrowing possibilities for taking advantage of the current situation. So, is there still time for CADR to profit from low energy prices? The answer is yes.

## Annex 2.1

### Methodological Framework for Calculating Pass-throughs and Benefit Sharing

Using available information, the operating margin for supplying energy to end users is calculated using a simplified rule:

$$\pi_t = \sum_i (p_{t,i} - c_{t,i}) Q_{t,i} + F_{t,i},$$

where $\pi$ is the proxy for gross income, p is the average price per unit received by user i, c is the generation cost per unit, $Q$ is consumption by user $i$, and $F$ corresponds to the fixed costs that are part of the cost structure. According to the above equation, the difference between price and cost is multiplied by energy consumption for the period in order to approximate gross income.[55]

We then calculate a total differential between period-to-period gross incomes. This differential is compared to the variation in rates for residential and non-residential end users. Specifically, the differential is obtained as follows:[56]

$$d\pi_t = \sum_i (p_{t,i} - c_{t,i}) dQ_{t,i} + \sum_i (dp_{t,i} - dc_{t,i}) Q_{t,i}$$

This last is used to approximate the share of gross income variation being paid by households and the share being paid by the productive sector. The first component to the right of the equal sign corresponds to the percent increase in gross income resulting from changes in consumption patterns. The second component corresponds to the portion explained by the relative variation between user prices and generation cost. Another way of reading this is to convert the previous equation into change percentages, making it possible to use the second component to determine how much the user rate was adjusted downwards in relation to sector benefits.

For gasoline and LPG calculations, a pass-through measure was used that reflects the average percentage of international price variation that is effectively reflected in end-user pricing. In particular, pass-through $Tr$ is calculated for each country $j$ as

$$Tr_j = \sum_i w_i \left( \frac{\sum_t dp_{t,i}}{\sum_t dc_{t,i}} \right),$$

where $-\frac{dp_{t,i}}{dc_{t,1}}$ corresponds to the percentage of pass-through to the end price for user $i$ at moment $t$. The element inside the parentheses represents the cumulative pass-through weighted by weight w that each user has in total consumption.

[55] End-user rates vary in the region, but for residential users a simple low-voltage rate is generally assigned. For commercial and industrial users a simple medium-voltage or time-of-use medium-voltage rate is used. The high-voltage rate is usually applied to only very few users.

[56] In reality the differential is calculated in relation to the variation in international WTI prices, but this version makes it possible to describe the calculations in a more simplified manner.

## Annex 2.2

## Electricity Subsidies in CADR: Current Status and Recent Changes

### *Costa Rica*

In Costa Rica the electricity subsidy is implied in the residential rate for end consumption and applied to those consuming less than 200 kWh per month. The subsidy is strictly applied to users in the following sectors: pumping of potable water, education, religion, protection for children and the elderly, welfare and relief institutions, and people on home ventilator support due to temporary or permanent respiratory disability. The subsidy is financed by users consuming more than 200 kWh.

### *El Salvador*

In El Salvador, the National Fund for Investment in Electricity and Telephony (FINET, its Spanish acronym) was created by Legislative Decree N°354 of 1998. As one of its functions, FINET grants subsidies for electricity consumption. In general, there are two main subsidies: one for residential electrical energy consumption by users whose monthly consumption is from 1 kWh to 99kWh, and a temporary subsidy for users consuming 100 to 200 kwh/month.

In May 2015, the government announced a cut in electricity subsidies, except for residential customers consuming 100 kWh to 200 kWh per month. This benefit is applied to households with monthly consumption between 1 kWh and 99 kWh. The measure went into effect as of April 15, 2015. In 2015, US $116.5 million was spent on the residential subsidy for up to 99 KWh a month, US $23 million less than in 2014. In the subsidy for monthly consumption of up to 199 KWh, the government disbursed $7.2 million in 2015, 75% less than in 2014. Together, both subsidies required a total of US $123.7 million in 2015, US $45.5 million less than the US $169.3 million paid in 2014.

### *Guatemala*

Guatemala has a social rate aimed at benefitting users consuming less than 300 KWh. Recently, the Steering Board of the National Electrification Institute (INDE, its Spanish acronym) approved changes in application of the special social rate subsidy, reducing its coverage to a maximum 88 kWh of consumption rather than up to 100 KWh. With this change, the subsidy will gradually be lowered for 175,535 users in the 89-to-100 KWh range, signifying an increase of Q0.05 in each quarter. Scaling will take place in two years for the Guatemala Electric Company (EEGSA, its Spanish acronym) and in four years for Energuate. As of 2019 the subsidy will be indexed to cost of living and minimum wage. Given the above, the total subsidy in 2016 will be an estimated Q936.9 million, and a similar amount could be required in 2017. In general, this stands in contrast to previous magnitudes; as shown in Figure 2.11, the amount has been falling, particularly since the decline in energy prices.

### *Honduras*

Currently electricity subsidies include direct government subsidies to residential users consuming less than 150 kWh per month, who receive the entirety of the billed amount. Attempts have been made for several years now to target this subsidy. According to available data, in 2011 this subsidy was still being applied to 516,170 customers, 67.1% of whom consumed less than 150 kWh/month. Under current regulations, these differences must be partly financed through rates collected from high-use segments, who should all be charged from 100% to 120% of the total supply cost. In the residential sector, rates amounting to 110% of the total cost will be charged for consumption over 500 kWh a month, scaling down to at least 100% for consumption of 301 to 500 kWh, at least 80% for consumption of 101 to 300 kWh, and at least 45% for consumption of between 0 and 100 kWh.[57]

### *Nicaragua*

For more than 10 years the Nicaraguan government maintained a rate freeze for domestic consumers in the 0-to-150 kWh range. The government absorbed costs stemming from the freeze through an agreement with distributors. This scheme ended on August 31, 2015, but the subsidy amount budgeted when the new law came into effect was maintained, so residential rates fell according to the real sale price variation, as established in Law No. 898 and Law No. 911 of 2015. It was also stipulated that these rates could never exceed the prices in effect during the freeze.

In addition, users paying for 0 to 300kWh of consumption are exempt from the value-added tax, and subsidies continue for consumers in squatter settlements and economically vulnerable neighborhoods for four years from the date of the Protocol of Understanding. In the first year, the subsidy will correspond to four percentage points of the average energy purchase price for medium-voltage bars, after which it will decrease one percentage point every subsequent year.

### *Panamá*

In Panama some laws dating prior to privatization of the electricity sector have established electricity rate discounts. The laws do not make any specific entity responsible for contributing these funds, so customers in the electricity sector in general continue subsidizing the groups benefited by these special laws. These subsidies are reflected on the customer's bill as follows: (i) the Red Cross, based on Law 11, (ii) the agricultural sector, as established in Law 2, (iii) retirees, pensioners, and the elderly, in accordance with Laws 15, 37 and 14; (iv) political parties, pursuant to Law 9, and (v) basic consumption and individuals with disabilities, in accordance with Laws 15 and 134.

[57] The regulation stipulates that in no case will they be transferred to the end consumer through rates or operational or administrative inefficiencies of public, private or mixed enterprises in the subsector, regardless of whether they are engaged in generation, transmission or distribution.

Panama has a rate stabilization fund (FET, its Spanish acronym) and an energy compensation fund (FACE, its Spanish acronym). The goal of the former is to cushion the effect of rate increases on end customers. FET initially targeted customers that consume up to 500 kWh/month; a plan for gradual reduction was established so that from 2017 on, only those consuming no more than 300 kWh are eligible. The second fund (FACE) is designed to maintain the rate prices and compensate electrical energy distributors for loss of earnings from the updating of electricity rates. In periods when the rates requested by distributors and verified by ASEP are higher than the baseline, FACE would be used to offset those increases, and when the requested rates are lower than the baseline rate, the difference would be returned to the fund to offset disbursements made during earlier rate periods. The following figure shows the evolution of state contributions to the two funds.

## Annex 2.3

### Theoretical and Methodological Framework for Estimating Economic Impacts

EOil price cuts affect importing countries through three main channels. The first is increased real income over consumption, the second is reduced production costs of final goods with a consequent effect on revenues and investment, and the third is the effect on inflation. As can be expected, the magnitude of the three effects varies among countries. The effect on real income, for instance, is less in the United States, which now produces more than half of the oil it consumes, than in the Euro Zone or Japan. The effect on real income and profits also depends on country energy use intensiveness; China and India continue to use energy substantially more intensively than advanced economies and therefore benefit more from lower energy prices. On average, the share of oil consumption in GDP is 3.8% in the U.S., compared to 5.4% in China and 7.5% in India and Indonesia. This type of correlation is relevant to CADR countries since they all have small, open economies. However, modeling an oil price shock would be relatively simplistic, especially when different channels are activated with a potential for generating multiple economic benefits.

In order to characterize factors that might affect CADR economic activity or that fall outside domestic policy control, analyses of the performance of CADR economies usually assume external shocks such as growth in the United States, economic activity in China, higher Federal Reserve interest rates, or supply-side variations such as changing oil prices or episodes of financial volatility. A natural extension of these quantifications is to include endogenous variables responding to the drives from these external factors.

The literature documents vector autoregression (VAR) exercises for analyzing these dynamics. One example is the method used by Chinn (2013) to determine the relationship between expansionary policies in the U.S. and the performance of various emerging economies. Lim et al (2014) perform a similar exercise seeking evidence of economic spillovers. The International Monetary Fund's Regional Economic Outlook (2016) sets out public infrastructure spending shock scenarios that enable it to come up with approximated multipliers and assemble an economic history of the simulated events. With proper attention to statistics, VAR can be a useful extrapolation tool for the issues explored in this chapter. Bearing in mind the virtues of these methodologies, this section seeks to complement previous findings and analyze the macroeconomic impact in greater depth. The approach used looks as existing correlations between price pass-through to end users and the performance of macroeconomic variables such as private consumption, investment, inflation and GDP for estimating the magnitude of economic benefits, measured as GDP growth, from implementing policies to improve that pass-through. In addition, since the system is a dynamic one, we can look at whether the expected evolution of international hydrocarbon prices might open up opportunities for CADR countries to implement policies for strengthening economic growth.

To assess these reciprocal relationships, a structural VAR is estimated for each country. Our endogenous variables are private consumption ($C$), investment ($inv$), energy dependence ($d$) [58]and GDP growth ($GDP$), and we use pass-through ($Tr$) and a measure of electrical, LPG and gasoline use intensity ($w$) as our endogenous control instruments. To make the exercise more robust, we have incorporated a variable to approximate energy subsidy spending ($S$) as an exogenous policy instrument. We expect simulations with these variables to reflect, inasmuch as possible, differences in energy use intensity and energy regulation limitations. The analysis makes use of quarterly time series from 2005 when available.[59] It is worth emphasizing that the effect of the pass-through on inflation should not be overlooked. Our analysis depends on both the direct effect of oil prices on overall inflation and the pass-through of oil prices to wages and other prices, but our estimates do not directly incorporate inflation. Instead, the pass-through variable calculated in equation 2.3 is used.[60] By using this variable, we implicitly assume that there is no more exogenous way of altering the price index, which would be to isolate the impact of fuels on households and the productive sector.[61]

Formally, this involves an estimation based on a system such as the following[62]

$$AY_t = BX_t + CY_{t-1} + D\epsilon_t,$$

$$Y_t = \begin{bmatrix} PIB_{t,i} \\ i_{t,i} \\ C_{t,i} \\ d_{t,i} \end{bmatrix}, \quad X_t = \begin{bmatrix} 1 \\ S^e_{t,i} \\ w^e_{t,i} \\ Tr_{t,i} \end{bmatrix},$$

where $e$ includes only LPG and gasoline. Of the variables contained in $Y_t$, investment and consumption are entered in percent of GDP. The pass-through was entered in log form for easier interpretation of the simulations. In the same way, the energy subsidy metric is subsidy spending as percentage of GDP.[63]

Finally, to cover the possibility of oil price increases, possible WTI price variations are incorporated in the exogenous variable vector.

$$X_t = \begin{bmatrix} 1 \\ S^e_{t,i} \\ w^e_{t,i} \\ Tr_{t,i} \\ Oil_{t,i} \end{bmatrix}.$$

[58] Electricity import and export information is used as reported by the authorities of each country.

[59] Here country VARs are done and then averages are presented. The alternative is to use a model of equations on differences estimated using the generalized method of moments, which control for characteristics that do not vary over time, based on the VAR panel data strategy as proposed in Góes (2016).

[60] Although pass-through is conceived as a mechanism independent of the dynamics of exogenous variables, since it is the only incorporated price instrument, we attempted a scenario using it as an endogenous variable.

[61] In general the magnitude of the pass-through depends on real wage rigidities (the way in which nominal wages react to inflation in the CPI) and the anchoring of inflation expectations. In this simplified exercise the implicit assumption is that there are no systematic mechanisms for anchoring inflation expectations. In normal times, monetary policy would respond to a lower basic inflation rate with a proportionately larger nominal interest rate reduction and therefore with a lower real interest rate.

[62] For simplicity of analysis, we assume that no contemporaneous effects exist for the endogenous variables and that the D matrix is strictly diagonal.

[63] The subsidies are calculated on the basis of two elements: first, regulation, and second, when the regulation refers to the existence of the subsidy its base is quantified as the difference between the market price and price actually received by the end user. This metric ignores the existence of operating margins, although they were used for those countries for which information was available.

# 3 OPPORTUNITIES AND CHALLENGES OF DEMOGRAPHIC TRANSITION IN CENTRAL AMERICA AND THE DOMINICAN REPUBLIC

As mentioned in Chapter 1, the population of the CADR countries is changing; the labor force comprises an increasingly important percentage of the total population and will continue to expand in upcoming years. What opportunities and challenges does this transformation pose for the region's growth? Is there time to take advantage of this favorable population composition?

A first brief review of the relationship between demographic changes and economic growth, the subject of extensive analysis in academic and public policy circles, is helpful. For many years discussion has centered on the connection between *population size* and economic growth.[64] The predominant view, in line with Malthus' theory (1798),[65] was that an increase in birth rates would adversely affect economic growth[66] by deviating resources from savings and investment to consumption in order to handle an expanding child population. It was thus concluded that measures were needed to moderate the pace of population growth (World Bank, 1984).

In recent years, discussion has migrated toward analyzing the effects on country development of changes in the population's *age structure*.[67] According to Bloom et al. (2001), these effects can be significant given that the savings and consumption decisions of economic agents are quite different at each stage of the life cycle. Societies with a high proportion of child population tend to dedicate more resources to their care and consumption – resources that in other circumstances could be allocated to fostering capital accumulation and accelerating growth. All else being equal, countries with a greater proportion of working age population not only have higher per capita productive capacity, but also can potentially invest more in physical capital and improve workforce productivity, thanks to the favorable savings conditions produced by the population composition. In the first place, there is a lower proportion of dependents in relation to the total population, and second, working-age individuals save at a greater rate than in other stages of the life cycle. On the other hand, a country having a higher proportion of elderly is similar to that having a young population, in that an important part of the "less productive" population demands more resources than the rest of society.

[64] This was especially relevant in the mid-1950s and 1960s when unprecedented rates of world population growth were recorded, at nearly 2% a year.
[65] Malthus (1798) postulated that a population growth rate higher than the increase in agricultural production capacity would inevitably lead to lower per capita consumption in the long run, triggering disease and famine. Nonetheless, humanity – whose population has multiplied seven-fold since then – seems to have escaped this tragic prediction thanks to technological innovations that significantly improved agricultural productivity and disease control.
[66] Some studies suggest that population growth is neutral for development. See Birdsall et al. 2001.
[67] This shift occurred in a context where population growth decelerated significantly due to a reduction in fertility rates worldwide, plunging from five births per woman in the 1950s to around 2.5 in 2015.

Population dynamics observed in different regions of the world suggest that nations do not permanently belong to either one of these categories, but transition through them. This process is known as *demographic transition* (see Box 1). For this reason, the transition stage with a rising working age population constitutes a *demographic window* of opportunity to boost economic growth. The materialization of that potential results in a production increase known as *demographic dividend* or bonus and depends, however, on whether these population dynamics are accompanied by policies for increasing labor force quality and generating sufficient quality jobs to absorb it.[68]

## BOX 3.1: Demographic Transition

*Demographic transition* is the process by which societies move from a regime with high rates of fertility and mortality to one with lower, stable rates. Each transition stage is characterized by specific dynamics in these variables, with different implications for both the growth rate and age structure of the population.

At the first stage, or that of pre-transition, fertility and mortality rates are both high. As a result, population growth is stable and low. In the second stage, mortality rates begin to decline due to such factors as medical advances, better access to water and sanitation services, and lifestyle changes (Costa, 2005). This phenomenon produces an increase in the number of children, or a baby boom, at the onset of the transition, increasing the pace of population growth.

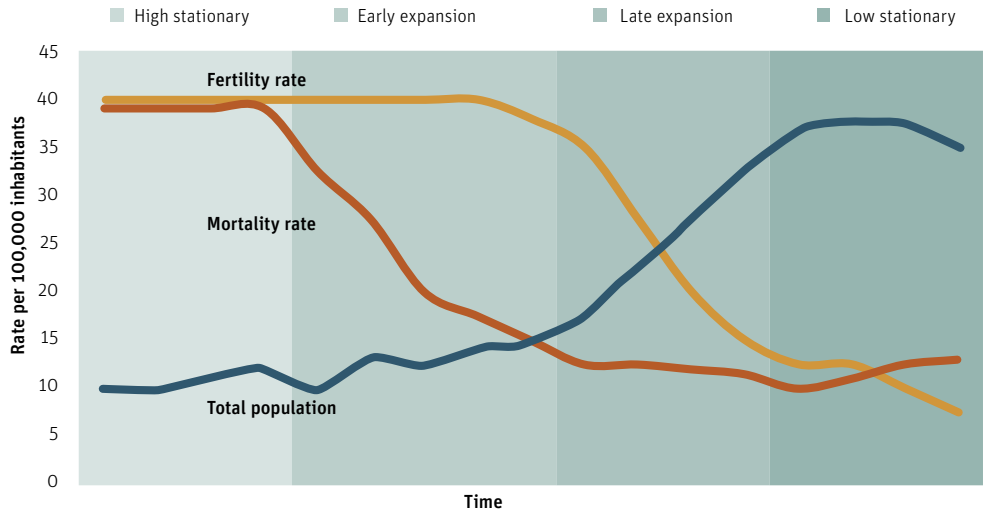
In a third stage, fertility and population growth rates start to gradually fall as parents recognize that fewer births are required to achieve their child survival goals. This induces changes in the population's age composition. On one hand, lower fertility tends to reduce the relative population size of early age groups. With the passage of time, cohorts born during the baby boom swell the upper sections of the population pyramid. Most developing countries, including those in CADR, are moving through this phase.

Finally, in the post-transition stage, where most developed countries now find themselves, both fertility and mortality rates are low, stabilizing population growth.

*Continue...*

[68] See Bloom and Canning (2008), Bloom et al. (2010), Drummond et al. (2014) and Mahmood (2011), among others.

**Figure 3.1.A** Stages of Demographic Transition

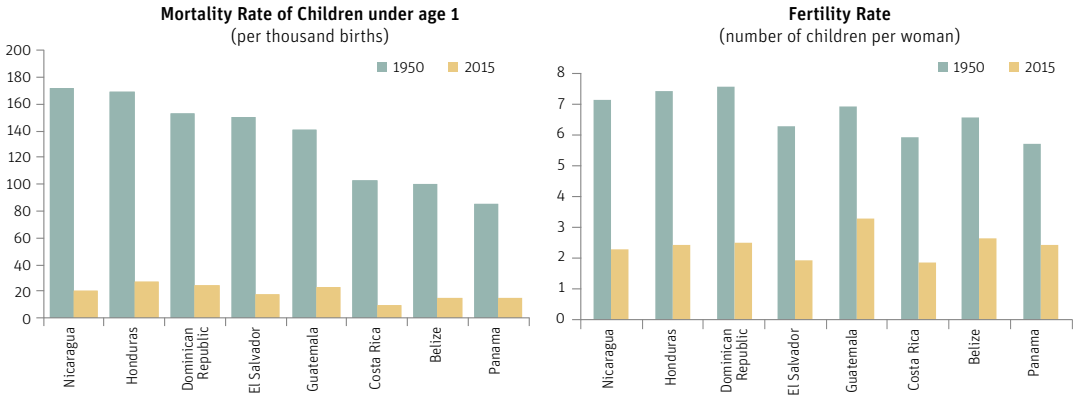



*Source*: CID/IDB Staff

## DEMOGRAPHIC TRANSITION IN CADR

Similar to other regions of the world, CADR countries have recorded significantly reduced rates of child mortality and fertility. In recent decades there has been a drastic and sustained decline in mortality for children under one year of age, from 134.4 deaths per thousand births in 1950 to 18.9 in 2015. As is characteristic in these transitions, the fertility rate has also fallen, albeit years later. Between 1950 and 1965 the number of children per woman remained stable at around 6.7, then dropped to 2.4 in 2015.

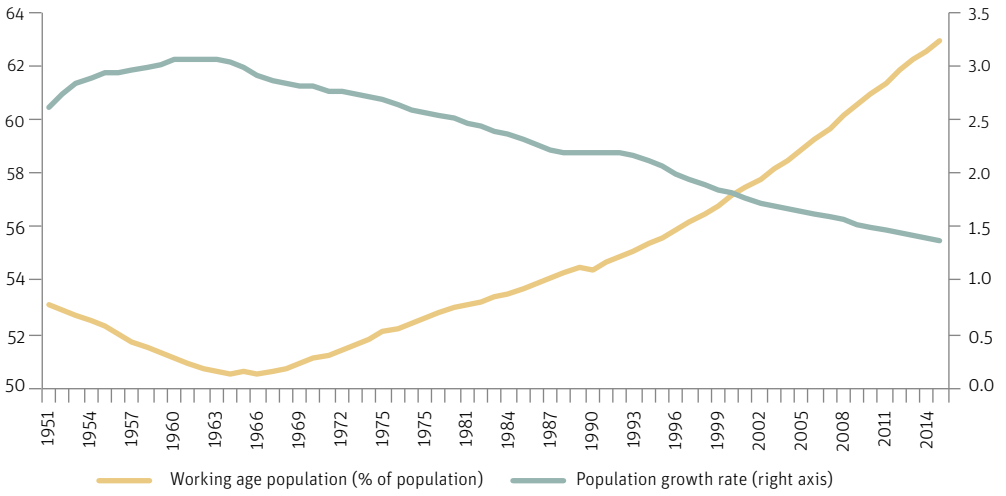
**Figure 3.1** Child Mortality and Fertility in CADR




*Source*: CID/IDB Staff using data from UN (2015) and World Bank (World Development Indicators, 2016) data.

These dynamics produced an increased child population that temporarily broadened the base of the region's population pyramid and has been transitioning to working age. As a consequence, the size of the working age population in relation to total population has incremented steadily since the sixties, weighing in at 50.6% in 1964 and 63.9% in 2015 (see Figure 3.2).[69] According to United Nations population forecasts, this upward trend is expected to last until 2040, when the share of the workforce will reach its peak of 66.1%.

**Figure 3.2** Evolution of the Population Pyramid in CADR




*Source*: CID/IDB Staff using data from United Nations (2015).

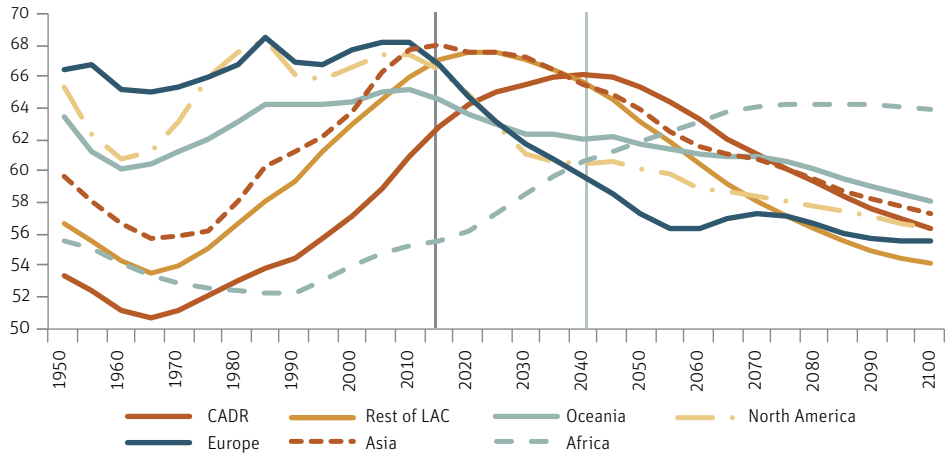
It is worth emphasizing that compared to other regions of the world, CADR is at the earliest stage of demographic transition, second only to Africa, where lagging adoption of medical technology advances and family planning techniques has limited the pace of reductions in child mortality and fertility rates (Drummond et al., 2014). In other developing regions such as Asia and the rest of Latin America and the Caribbean, the percentage of people at working age has already begun to fall, or will do so soon.[70] According to these trends, CADR would be the region with the largest share of working age population in the world between 2040 and 2060.

An analysis of the population dynamics at the country level in CADR reveals important intraregional differences in terms of the duration and magnitude of demographic transition. Figure 3.4 shows that Belize, Guatemala and Honduras are at the earliest stage, with the rise in labor force percentage expected to be longer (to the mid-2040s) and greater (5.5 percentage points on average). These are followed by El Salvador, the Dominican Republic and Nicaragua, where the working age population will continue to rise for the next 20 to 22 years, though to

[69] For the purposes of the rest of this chapter, the working age population is defined as persons between 15 and 65 years of age.
[70] The transition in CADR has been slower than in Asia and the rest of Latin America. Despite a similar descending fertility rate trend, in CADR this indicator has averaged 25% higher than in those regions.

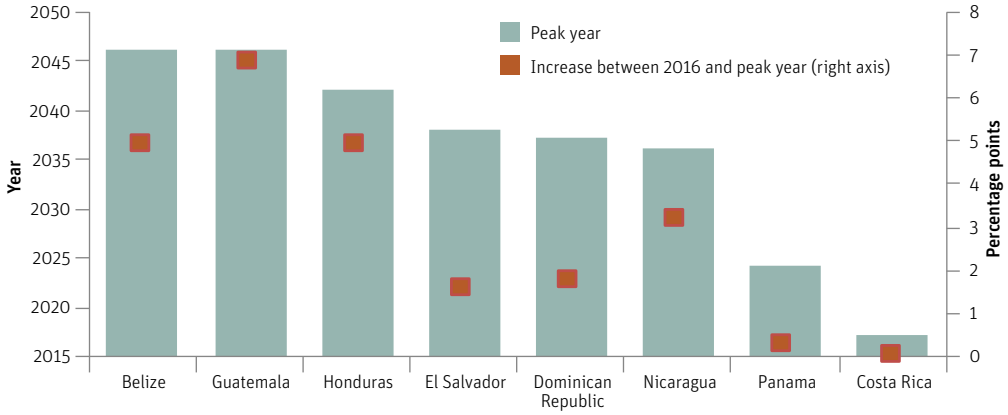
a lesser degree. Panama and Costa Rica exhibit more advanced demographic transitions, with working age populations already close to maximum values.[71]

**Figure 3.3** Working Age Population in Different Regions of the World




*Source*: CID/IDB Staff using data from United Nations (2015).

**Figure 3.4** Working Age Population in CADR Countries (% total population)



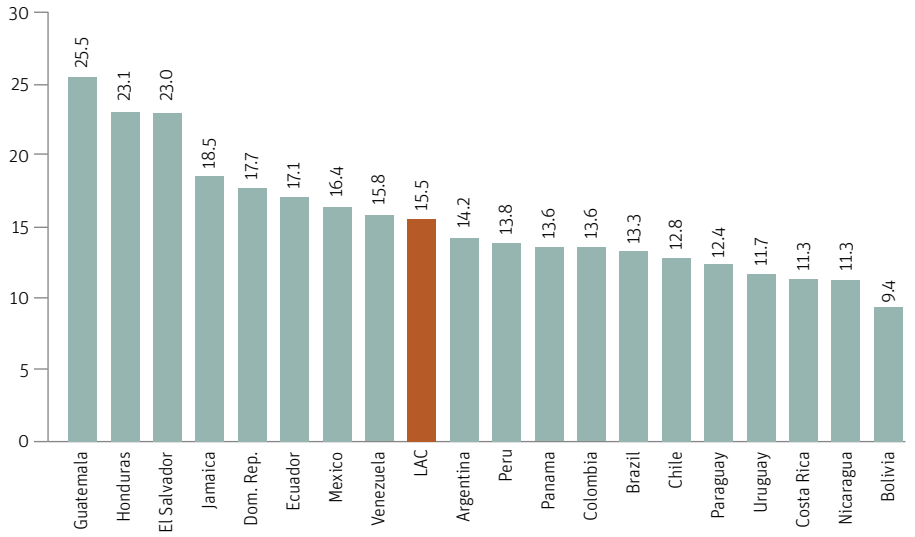

*Source*: CID/IDB Staff using data from United Nations (2015).

An additional challenge facing CADR is unemployment in the economically active population, particularly among young people. Figure 3.5 shows the 2015 percentage of 15-to-24 year-olds who neither study nor work. In general terms, the percentage of people in this group was 18%, three percentage points higher than the LAC average. The context in CADR is less than

[71] The indicators shown incorporate the effect of international migration. In the absence of migration, transitions in the Dominican Republic and El Salvador would take 10 and 5 years longer, respectively, and the percentage of working age population would be around one percentage point higher at its peak. No significant change is observed in the other countries.

encouraging; four of the countries rank within the five top positions for highest presence of this group in Latin America. The region's economies must be capable of increasing the human capital (skills) of the working age population, while simultaneously generating ideal conditions to create jobs for absorbing the growing labor force. Otherwise, the youth unemployment problem will deepen. As indicated earlier, international experience indicates that demographic transition should go hand in hand with timely, crosscutting measures and policies ranging from prudent macroeconomic management to changes in the economic development model in order to take full advantage of the demographic bonus.

**Figure 3.5** 15-24 Year-Olds Who Neither Study Nor Work, 2014/[1]
(% of population between 15 and 24)




*Source*: CID/IDB Staff using data from Duryea and Robles (2016).
*Note*: /[1] Bolivia, Chile and Venezuela data correspond to 2013, and that of Jamaica and Nicaragua to 2012.

## HOW TO MAXIMIZE THE DEMOGRAPHIC DIVIDEND: LESSONS FROM INTERNATIONAL EXPERIENCE

Different authors[72] have indicated that the main factor in the economic miracle achieved by the Asian Tigers[73] in recent decades was that they took advantage of the demographic transition. Between 1965 and 2015 these countries experienced an average annual per capita GDP growth of 5.17% (in contrast, the CADR countries grew barely 1.77% in the same period). Asia's strong economic performance has also been attributed to the high priority given to human and physical capital accumulation, higher labor participation rates, and their initial labor-intensive

[72] Bloom et al. (2000) and Mason (2001).
[73] Hong Kong, Singapore, Taiwan and South Korea

export sector development policy. These factors made it possible to maximize the benefits of a swelling labor force and transition to more highly productive sectors. Notwithstanding the contribution of the demographic transition, however, this economic growth was boosted by an array of economic, trade, policy and even cultural measures.

The Asian Tigers' economic and social policies could be labeled "*fundamental*" or "*market-friendly*". For Lee, (2002), successful implementation of these policies required suitable institutional mechanisms to encourage private investment, a competent bureaucracy capable of executing policies, and institutions able to facilitate communication between the state and the private sector. There is a significant difference, for example, between the CADR countries and the Asian Tigers with respect to regulatory quality (the government's ability to formulate and implement policies and regulations for fomenting private sector development). According to World Bank governance indicators for 2015, the regulatory quality indicator for CADR was 50.6 versus 93.2 for the Asian Tigers (zero being the minimum and one hundred the maximum).

Page (1994) identified four areas, along with population growth, as contributing to the Asian Tigers' surging economic development: i) prudent macroeconomic management, ii) educational strengthening, iii) an export-driven development model, plus changes in productivity, and iv) the creation of an ideal environment for private investment.

Macroeconomic stability was another key element in the Asian success. According to Page (1994), the Asian Tigers kept fiscal deficit at a manageable level with low initial debt. This made it easier to control inflation, which in turn permitted stable real interest rates. External debt was practically nonexistent (or very low) in three of the four countries. The exchange rate policy focused on mobilizing fixed exchange rate systems toward flexible ones. Their low levels of inflation and active exchange rate policies helped them avoid the exchange rate crisis that buffeted Africa and Latin America.

Changes were also implemented to raise the quality of the educational system. Spending on education was not only higher, but better. One indicator of educational quality (albeit an imperfect one) is spending per student, and in South Korea, the real growth in spending per student between 1970 and 1989 was 355%. Nonetheless, more spending on education does not entirely explain the accumulation of human capital, the broad base of which was fundamental for rapid growth. Universal primary education was reached early on, while basic education was geared to acquiring general academic skills and post-secondary education to vocational skills, all of which made it easy for businesses to enhance workers' skills in using new technologies.

The push for exports and change in productivity was crucial for growth. Export policy was based on greater trade opening and exchange rate devaluation. According to Stiglitz (1996), the new export-driven model also benefited from the provision, development and maintenance of infrastructure, mainly for electrical and telecommunications services. There was also some restricted access to capital, since certain government-preferred industries benefitted from

subsidies (lower interest rates). By way of comparison, the infrastructure gap between the Asian Tigers and Latin America is quite wide. According to Calderón and Servén (2010), there is a 48% difference in fixed phone lines per worker, up to a 91% difference in electricity generation capacity, and a 53% difference in the length of the highway system. According to the Inter-American Development Bank (2014), the region needs to invest 5% of GDP annually for the next 10 years to close the infrastructure gap.

The government also played an important role. As Hermes (1997) explains, government intervention was aimed at creating subsidies for certain investments, initially cheap and/or selective credit programs. In other cases, the government assigned the minimum that banks could loan to certain sectors it considered strategic. Other mechanisms were preferential tax treatments, selective foreign currency distribution, and encouragement for the creation of cartels. In very specific cases, the state absorbed the losses of certain industries (such as in the case of South Korea and the shipping industry). Subsidies were granted on the basis of performance criteria, since the governments were diametrically opposed to speculative activities. Another aspect to consider was cooperation between the state and the banking and private sectors, which afforded the opportunity to expose the economy's bottlenecks, as well as strengths and weaknesses, generating huge gains with the exchange of information.

Cultural and autochthonous aspects may have contributed to the growth of these countries. Easterly (1995) indicates that avoidance of wars during the 1960-1989 period, the Confucian work ethic, the high population density and the virtual incorruptibility of public employees have had a great impact on attracting and establishing investment for the Asian Tigers.

The population's improved health was another important aspect in the strong Asian economic performance. Bloom (2011) identifies four channels by which health affects economic growth. First of all, a healthy workforce is a productive workforce. Secondly, healthy children tend to perform better in school and stay longer in the academic cycle, resulting in a more educated workforce. Children with better health also have better cognitive functions. Thirdly, healthy populations tend to have higher rates of saving, since people save more in anticipation of a longer life after retirement. Finally, healthy populations have better capacity to attract foreign direct investment.

Good health is also vital in alleviating poverty. For Bloom (2011) the greatest asset poor people have is their work, and the value of this asset is determined by their state of health; the better it is, the more possibilities they have to improve their income. Under this argument, public health is an instrument, not a cause, of good economic performance.

## THE EDUCATIONAL PANORAMA IN CADR

A key factor for taking advantage of the demographic bonus is to provide the population with the necessary capacities and abilities. Despite achievements in educational quality and coverage, CADR still lags behind more advanced regions of the world. As reference, in 2013, average years of schooling of the over-25 population was 10.7 in the Asian Tigers versus 7.3 years in CADR (almost the same the Asian Tigers had in 1990). The situation was similar for educational coverage; in 2013 the gross secondary enrollment rate was virtually 100% for Asian Tigers compared to 80% in CADR countries. According to the Fifth State of the Region Report (2016), these lags pose a strategic educational dilemma for the region.

Broad access to quality education is a necessary but not sufficient condition for CADR to raise output, improve social equity and strengthen democracy. As explained in the State of Region (2016), between 2000 and 2014 the region improved on most educational indicators. While the pace of progress and country situations vary, some common elements can be observed.

i. Education has greater presence in public discourse, which leads to more funding and a certain improvement on performance indicators.
ii. Educational policy documents lack clear and explicit goals, deadlines for achieving them, resources, and monitoring and evaluation mechanisms to ensure that the goals are achieved.
iii. Results of the TERCE tests warn of poor quality primary education. Most of the third- and sixth-grade students of CADR (except Belize and El Salvador) placed at the lowest performance levels.
iv. More than 50% of young people aged 15 to 24 are outside the educational system, most working in poor-quality, low-paying jobs.

According to that same report, countries of the region can be grouped according to three strategic situations. The first is characterized as being a mature educational system, with ample funding and achievements in terms of access; however, this type of system has not managed to solve problems such as providing high quality service and universal secondary education and raising the educational profile of the labor force. Maneuvering room is limited, timewise, to achieve these goals, since the demographic bonus period will run out in this decade. The country coming the closest to this situation is Costa Rica.

The second strategic situation is characterized as “mixed” since it has characteristics of the first situation but with fewer achievements and less institutional capacity, and with low levels of investment, coverage and quality. In part, this is because a major proportion of the teaching Staff lacks the skilled human resources of mature systems. Unlike the preceding system, however, room for maneuvering is greater since the end of the demographic bonus is not as immediate. The countries closest to this description are Panama, El Salvador and Belize.

Finally, the third strategic situation is characterized as having incipient educational systems, lagging in all arenas, at both Central American and Latin American levels. These systems demonstrate weak institutionality, meager public spending, highly deficient educational quality, and low levels of coverage, especially in middle and secondary education. Authorities have a great deal of maneuvering room to make adjustments since the countries are at a relatively early stage of demographic transition. Here, Nicaragua, Guatemala and Honduras best fit the description

## IMPACT OF THE DEMOGRAPHIC DIVIDEND ON CADR GROWTH

An empirical model is estimated in order to quantify the impact of the projected workforce increase on per capita growth in the region. This model, based on Bloom *et al*. (2001) and Drummond *et al*. (2014), aims to explain per capita income growth as a function of a set of variables that includes indicators describing the demographic transition, as well as factors commonly identified in the literature as growth determinants[74], such as initial per capita GDP,[75] the economy's degree of trade opening, and change in agricultural share in GDP (intended to measure output variances with productive structure changes)[76]. The demographic variables included are the percentage of the working age population in total population at the start of each period and its growth. Following the usual growth regression practice, the model is estimated at five-year frequencies for a data panel that includes 165 countries during the 1960-2015 period.

The results of the model estimation (see Table 3.1, Column (1)) are consistent with those found in the literature.[77] The initial GDP per capita has a negative and significant coefficient, in line with the conditional convergence effect. On the other hand, both greater trade openness and a shift-away from agriculture to other economic sectors tend to be associated with higher growth. The demographic variables, the initial working age population size and its change over time, show significant positive signs, indicating that a larger workforce at the beginning of each period raises the productive capacity of the economy and that its increase accelerates the pace of economic growth. In particular, for each additional percentage point in the proportion of working age individuals, per capita GDP growth increases by 0.3 percentage points.

The experience of the Asian region during its demographic transition suggests that countries with a more skilled labor force can take better advantage of the increased working age population. To analyze this effect, and following Drummond et al. (2014), the interaction between working age population growth and its productivity, proxied by the years of schooling

[74] See Annex 3.1 for the derivation of the model.
[75] To capture possible convergence effects by which less developed countries record higher growth to reduce the income gap with more developed countries.
[76] These explanatory variables are found to be highly correlated with per capita income growth. For this reason and to avoid problems of endogeneity, the explanatory variables are lagged one five-year period.
[77] For model specification an approximation from general to particular was employed, through which non-significant variables are sequentially eliminated. In this process, the 'spending as percentage of GDP' variable was eliminated.

of the labor force, is added to the base model.[78] The estimation of this specification (column 2 of Table 1) indicates that, while overall results remain unchanged, the coefficient of the interaction between working age population growth and years of education is positive and significant, indicating that the quality of human capital can magnify the effect of the demographic transition.

**Table 3.1** Growth Regressions for CADR

| | (1) | (2) |
|---|---|---|
| Ln (GDP per capita)$_{t-5}$ | -3.734*** | -3.307*** |
| | (0.820) | (0.775) |
| Trade opening $_{t-5}$ | 0.031*** | 0.019*** |
| | (0.011) | (0.007) |
| $\Delta$ (Agriculture/GDP)$_{t-5, t}$ | -0.128*** | -0.117*** |
| | (0.043) | (0.033) |
| WAP $_{t-5}$ | 8.638*** | 11.657*** |
| | (3.090) | (2.738) |
| $\Delta$ WAP $_{t-5, t}$ | 0.313*** | 0.167* |
| | (0.088) | (0.100) |
| ($\Delta$ WAP$_{t-5, t}$) x G(years of education$_{t-5}$) | | 0.823** |
| | | (0.453) |
| Constant | -4.641 | -19.244 |
| | (12.289) | (12.356) |
| Number of observations | 1.196 | 1.003 |
| Number of countries | 165 | 132 |
| Adjusted R-squared | 0.245 | 0.27 |

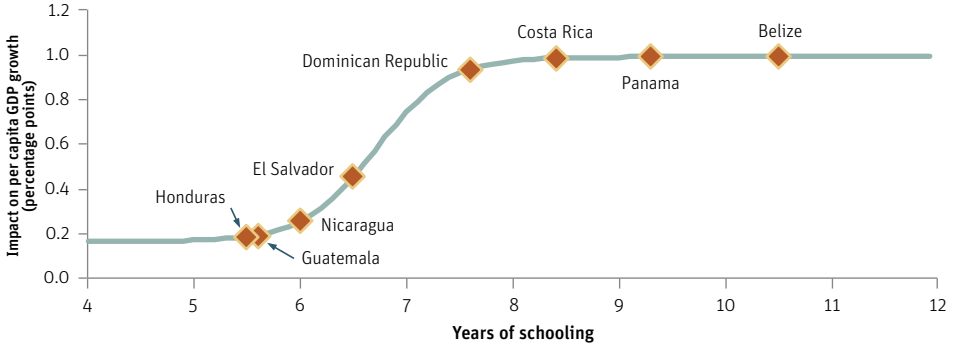
*Notes*: All regressions include fixed effects by country and time. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 3.5 shows the estimated multiplier effect more explicitly. The graph shows that growth elasticity to changes in working age population increases as the workforce educational levels rise. For each additional percentage point of working age population, per capita GDP growth increases around 0.2 percentage points for those countries having five or fewer years of schooling. At the other end of the spectrum, in countries with a high educational level this effect can be five times greater, reaching almost 1 percentage point of additional growth.[79]

[78] This indicator has an important limitation in that it does not capture differences in educational quality. It was selected based on available information for a wide group of countries.
[79] This estimated range is comparable to the one that was found.

**Figure 3.6 Impact of Demographic Change on Growth and Educational Level**

(Impact on growth rate of a 1 percentage point increase in the ratio of working age population to total population)



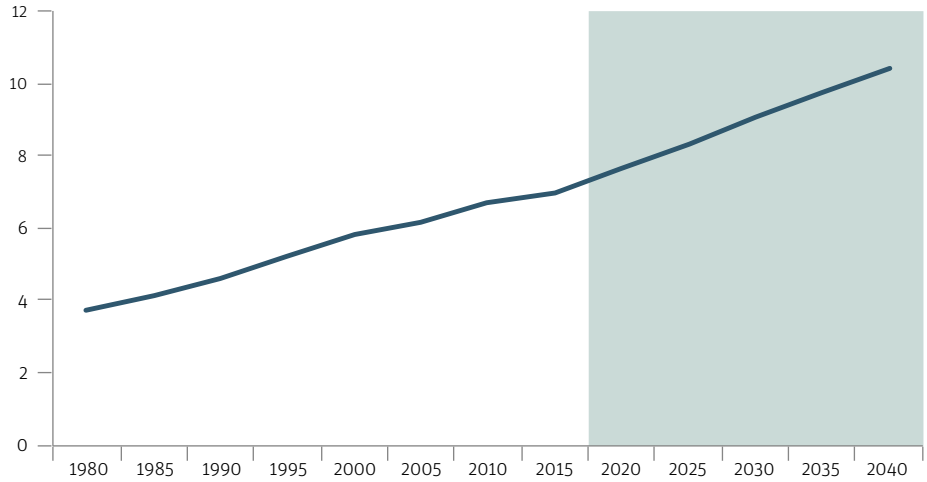

*Fuente*: CID/IDB Staff estimates.

For CADR, given the levels of schooling recorded in 2014, two groups can be identified. The first, with the Dominican Republic, Panama, Costa Rica and Belize, appears to be better prepared to take advantage of the demographic dividend, as these countries' levels of schooling enable them to obtain an elasticity close to the possible maximum, implying that the impact of more schooling on elasticity is low. The opposite occurs in the second group comprised of Honduras, Guatemala, Nicaragua and El Salvador, which have a less skilled labor force. For this group, the effect of a one percentage point increase in the proportion of working age population would have less effect on growth, which varies from 0.2 for Honduras to 0.5 in the case of El Salvador. Unlike the first group, the educational level of the workforce in these countries is situated in an interval that still allows an increase in elasticity, signifying still greater benefits for growth if human capital is increased.

Based on these outcomes, what are the implications of the demographic transition for future growth in the region, in quantitative terms? To measure the impact of labor force increases, per capita GDP growth trajectories were simulated using equation (2) in Table 1 under three different scenarios: (i) a base scenario in which both the percentage of working age population and its educational level remain constant at 2015 levels, (ii) another in which the working age population grows according to UN population forecasts, and finally, (iii) a third scenario in which an increase in the workforce's years of schooling is incorporated along with the projected variation in the working age population in scenario (ii). In this last case, it is assumed that the region gradually increases years of schooling for its labor force at a rate of 0.7 years per five-

year period, a rate equivalent to the 75th percentile in the distribution of variations observed in the world during the past 25 years. This effort would signify raising the region's average level of schooling from seven years in 2015 to 10.5 years in 2040, a value similar to that of South Korea in 2000.

**Figure 3.7** Impact of Growth on the CADR Demographic Transition

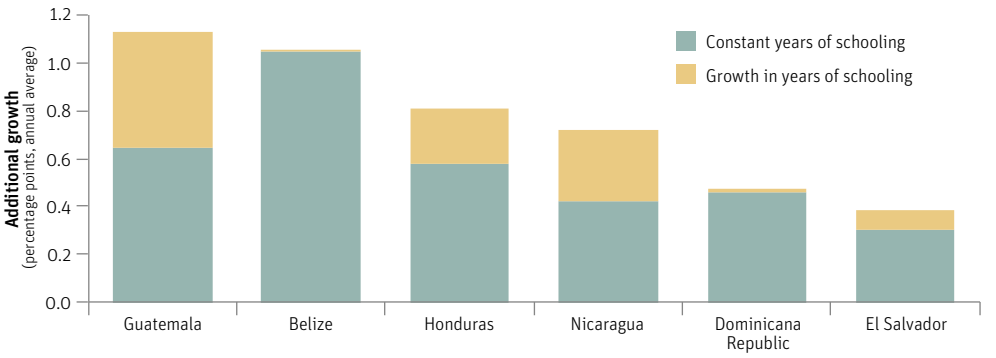



*Fuente*: CID/IDB Staff estimates using data from Barro y Lee (2016), y cálculos propios.

Figure 3.8 shows additional per capita GDP growth that each country would register on average during its respective demographic window, due to projected increases in the labor force and improvements in its educational level with respect to the base scenario. Costa Rica and Panama are excluded from these exercises due to their advanced stage of demographic transition.

In the absence of increased years of schooling, CADR would experience an average boost in annual per capita GDP growth of around 0.6 percentage points (p.p.). In this scenario, the impact would be greater for Belize, where this phenomenon would contribute 1 p.p. of additional growth per year over the duration of the demographic window. This effect is greater than in Guatemala (0.6 p.p.), even though both are experiencing similar demographic transitions. The difference is explained by the higher educational level of labor in Belize. On the other hand, El Salvador would register the lowest impact (0.3 p.p.); even though it has an ample demographic window (22 years), its proportion of working age population would only increase modestly by 1.5 percentage points.

Figure 3.8 Impact of Growth on the CADR Demographic Transition




*Source*: CID/IDB Staff estimates.

We find that improvements in human capital could expand the effect of the increased labor force by 33% on average, adding an 0.2 percentage points of per capita growth in each year of the transition. However, significant differences exist between the region's countries. Guatemala, Honduras and Nicaragua would get better returns from this type of policy given that they are starting out with a less skilled working age population. In contrast, in Belize and the Dominican Republic the effort to raise the educational level of the working age population would have a marginal effect on amplifying the demographic dividend. It is important to note that that this outcome does not imply that investment in human capital should be disregarded, since the analysis is limited to analyzing the role this has on the effect of changes in the population's age structure. Rather, it indicates that in these countries the emphasis should be on other complementary policies, such as expanding the trade opening and promoting sectors with higher productivity.

Altogether, the finding is that the effect of workforce transformation could produce an additional 0.8 percentage points of growth during the demographic transition. This is significant, considering that on average it represents around 40% of the per capita GDP growth registered in the last 20 years.

## POLICY RECOMMENDATIONS

The increase in the labor force in upcoming years provides a window of opportunity for CADR. The boost this population transformation will give to regional growth is significant when compared to the pace of income growth during the past 20 years. The results also indicate that this impact could be heightened with suitable investment in the accumulation of human capital, particularly in those countries averaging a less skilled labor force.

The task is not easy, considering that some of the region's countries are experiencing setbacks in primary school coverage and a major percentage of young people are neither working nor studying. The characteristics of the labor force make it necessary to invest not only in expanding educational coverage, but also in job placement and training programs to help young people outside the educational system increase their productivity. This would allow the economy as a whole to shift to sectors with greater value-added.

While the demographic transition represents an opportunity, it also poses potential social risks if not managed appropriately. In particular, if the region's economies are not able to generate enough jobs to absorb a growing labor force, unemployment could rise significantly. Further, the demographic transition will eventually signify an aging of the region's population. In the following stage, the proportion of older adults will begin to rise, which could put pressure on savings and investment.

Taking advantage of the demographic dividend is even more important given the potential materialization of the risks to global economic activity described in Chapter 1, that can dampen economic growth in the region.

## Annex 3.1

## Data and Methodology

### *Estimation of Demographic Bonus*

The methodological proposal followed is that of Drummond et al. (2014), in turn based on Bloom et al. (2010). Per capita output is first disaggregated into output per worker and the share of the economically active population (EAP) as percentage of the total population:

$$\frac{Y}{N} = \frac{Y}{W} \cdot \frac{W}{N} \qquad (1)$$

where

- $Y$ is gross domestic product
- $N$ is total population size
- $W$ is the economically active population

In the same way, it can be determined that $y = log\frac{Y}{N}$ $z = log\frac{Y}{W}$ $w = log\frac{W}{N}$ Differentiating equation (1) we obtain:

$$\dot{y} = \dot{z} + \dot{w} \qquad (2)$$

The per capita income growth rate is thus decomposed into income growth per worker and EAP growth.[80] The income per worker growth rate $(\dot{z})$ in turn depends on the initial income per worker (denoted as $z_0$ ) and its deviation with respect to steady-state income per worker (denoted as $z^*$). With $\overline{\rho}$ being the speed of convergence, the income per worker growth rate can be expressed as:

$$\dot{z} = \rho(z^* - z_0) \qquad (3)$$

Given that the initial income per capita is $y_0 = w_0 + z_0$ , then

$$\dot{y} = \rho(z^* + w_0 - y_0) + \dot{w} \qquad (4)$$

Since $z^*$is determined by a set of variables at its initial level $(X_0)$, equation (4) can be rewritten as

$$\dot{y} = \rho(\beta' X_0 + w_0 - y_0) + \dot{w} \qquad (5)$$

Equation (5) motivates the empirical model. To explain real per capita GDP growth we include the initial level of EAP ( $w_0 \equiv PEA$ ), growth during the period ( $\dot{w} \equiv \Delta PEA$ ), the initial level of GDP per capita ( $z_0$ ) and a set of growth determinants in its initial period ( $X_0$ ). The initial empirical specification of the model to be used is expressed as:

$$y_{i,t} = \alpha + \beta_0 log(PEA)_{i,t-1} + \beta_1 \Delta PEA_{i,t} + \beta' X_{i,t} + c_i + \theta_t + \varepsilon_{i,t} \qquad (6)$$

where $i$ is the country indicator, for the period $t$. $c_i$ is the country-specific effect, while $\overline{\theta}_t$ is a dichotomous variable for the time fixed effect.

[80] Based on the assumption of a constant participation rate

As mentioned in the document, the specification equation (6) is expanded to include a nonlinear term:

$$y_{i,t} = \alpha + \beta_0 log(PEA)_{i,t-1} + \beta_1 \Delta PEA_{i,t} + \beta_2 \Delta PEA_{i,t} G\left(AE_{i,t}\right) + \beta' X_{i,t} + c_i + \theta_t + \varepsilon_{i,t}$$

where $\bar{AE}_{i,t}$ denotes years of schooling of the EAP and G(.) is a logistic function of the form:

$$G(x) = 1 - exp(-\zeta(x - \bar{c})^2), \quad \zeta > 0 \qquad (8))$$

where $\bar{c}$ y $\bar{\zeta}$ are parameters to be estimated. It is important to note that this smooth transition regression model, developed by González, Teräsvirta and Dijk (2005), is a generalization of the standard model of dummy variables since it corresponds to a particular case in which $\bar{\zeta}$ tends to infinity.

In line with different empirical growth studies, five-year data are used to estimate equations (6) and (7) in a panel context. To avoid problems of endogeneity, Drummond et al. (2014) suggest using the observation found one year before each five-year period for the variable $log(PEA)_{i,t}$. In the case of $\Delta PEA_{i,t}$ the change in EAP percentage points is calculated between the beginning and end of each five-year period. The initial per capita GDP is included (in order to capture potential conditional convergence effects), along with the trade opening (international trade as a % of GDP) and sector transformation (change in agriculture sector as % of GDP). With the exception of sector transformation, the control variables are taken before each five-year period to ensure they are predetermined.

The table below presents the statistical summary of the variables used in the estimation, as well as their sources.

**Table 3.1.A** Statistical Summary of the Variables

| Variable | Obs. | Mean | Standard Dev. | Min. | Max. | Source |
|---|---|---|---|---|---|---|
| Real five-year per capita GDP growth | 1,581 | 1.49 | 3.3 | -22.56 | 27.8 | World Bank (2016) |
| Log of initial per capita GDP | 1,584 | 8.15 | 1.5 | 4.75 | 11.65 | World Bank (2016) |
| Trade opening | 1,522 | 76.86 | 51.56 | 0.02 | 432.95 | World Bank (2016) |
| Sector change (agriculture) | 1,337 | -1.2 | 4.28 | -43.13 | 26.22 | World Bank (2016) |
| Years of schooling | 1,540 | 6.09 | 3.27 | 0.04 | 13.24 | Barro & Lee (2013) |
| EAP | 2,035 | 57.19 | 7.46 | 43.17 | 85.06 | United Nations (2015) |
| Change in EAP | 2,035 | 0.56 | 1.46 | -7.89 | 7.73 | United Nations (2015) |

*Source*: CID/IDB Staff estimates using data from from the World Bank (2016), United Nations (2015) and Barro & Lee (2013).

# 4 SCENARIOS GOING FORWARD: EVALUATION OF THE REGION'S POLICY SPACE

## A REGION EXPOSED TO GLOBAL ECONOMIC CONDITIONS

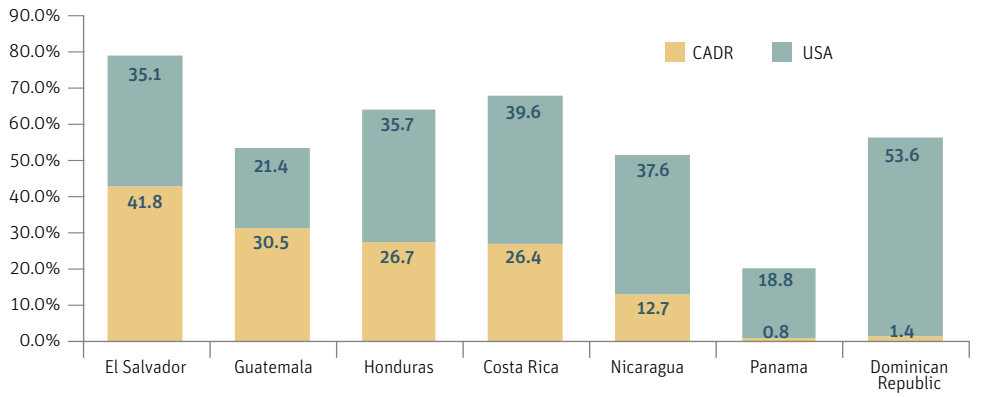
The openness of the CADR countries exposes the region to global economic and financial conditions, making it necessary to estimate the magnitude of the effects of external shocks on the region's growth. At the same time, it is necessary to assess the countries' fiscal and monetary policy response capacities to mitigate the effects of the shocks. To this end, the first part of this chapter describes relevant regional economic characteristics that represent transmission channels for external shocks, while the second part estimates the potential effects of those shocks on economic activity examines various economic policy measures.

We find that trade and remittances are stronger transmission channels, while the financial channel appears to be somewhat weaker.[81] The trade channel is extensive and highly concentrated on the United States. On average, 35% of all 2015 CADR exports went to the United States, the region's main trading partner. While the US. market represented more than a third of their total 2015 exports for the Dominican Republic, Costa Rica, Nicaragua, Honduras and Salvador, it was 20% for Panama and Guatemala. There is also an indirect effect through intraregional trade, since exports within the region account for 20% of the total, on average. The regional market is especially important for El Salvador, Honduras, Guatemala and Costa Rica, where it appears to have gained ground, helped by the secondary effects of growth in the United States and the deepening of free trade treaties such as CAFTA-DR.[82] The regional market is less significant for Panama and the Dominican Republic, whose exports are mainly destined for China and Europe, respectively.

[81] See Roache (2008).

[82] Along with external demand stemming from higher U.S. growth, CAFTA-DR has also contributed to the rise. This free trade treaty went into effect between 2006 and 2009 and includes Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua, the Dominican Republic and the United States. Panama and the U.S. also signed a free trade agreement that became effective in October 2012.

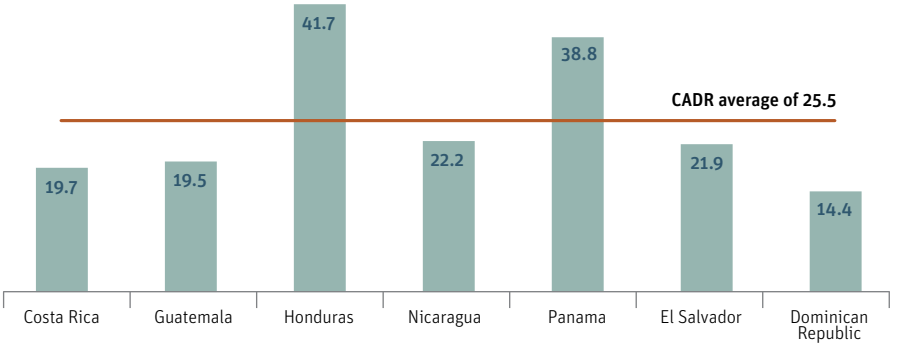
## Figure 4.1 % Share of Total Exports in US$ by Destination Market (2015)




*Source:* CID/IDB Staff using data from Central American Integration System and the National Statistics Office of the Dominican Republic.

It should be noted that CADR exports of goods and services averaged 26% of their GDP in the 2010-2015 period, although with differences among the countries.

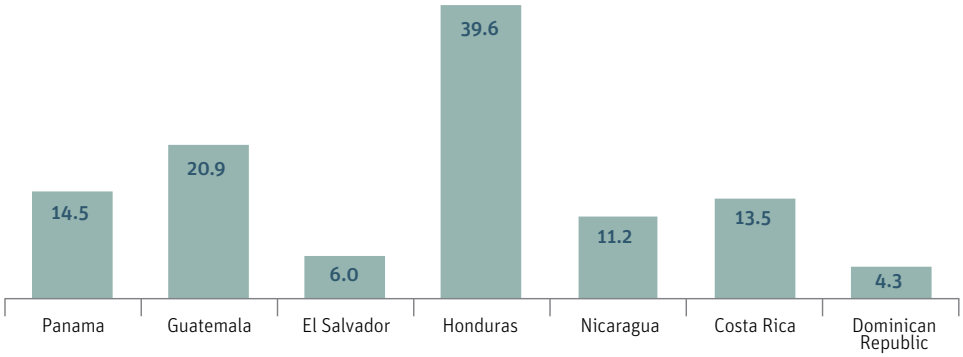
## Figure 4.2 Exports as % of GDP (2010-2015 Average)




*Source:* CID/IDB Staff using data from FOCUSECONOMICS.

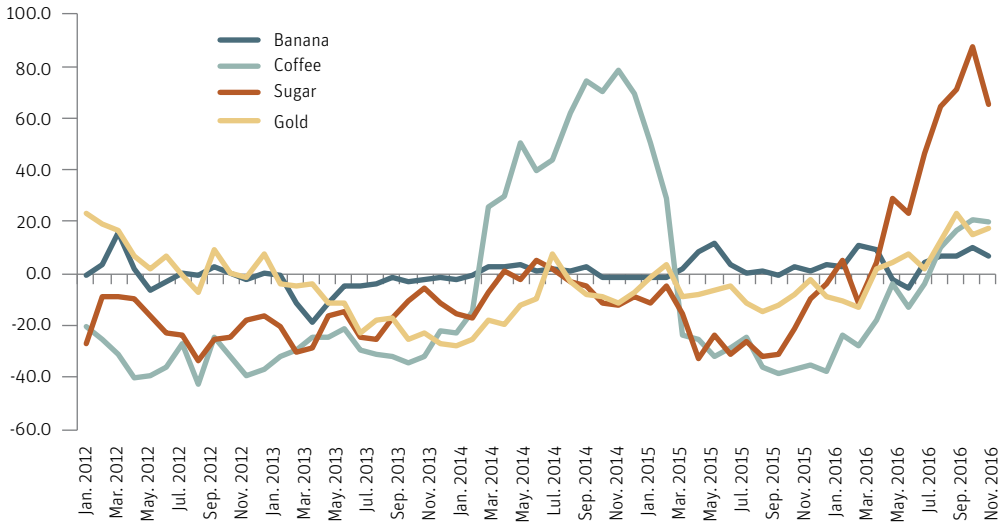
In general, however, exports are concentrated in a few primary products whose prices are set internationally, with little differentiation and low value-added. In 2015 the top ten CADR exports sold abroad were agricultural goods such as coffee, banana, and sugar (averaging 17.6% of the total); fruits, palm oil and shrimp (9.7%); medium-technology products (7.3%); and gold (4.4%) – a structure that has not changed significantly over time. In general, the prices of these goods are set in international markets, which represents a vulnerable point. Fortunately, in the first nine months of 2016 the prices of products like coffee, banana and sugar have gone up.

## Figure 4.3 % Share of Coffee, Banana and Sugar in Total CADR Exports (2015)




*Source:* CID/IDB Staff using data from the Central American Integration System.

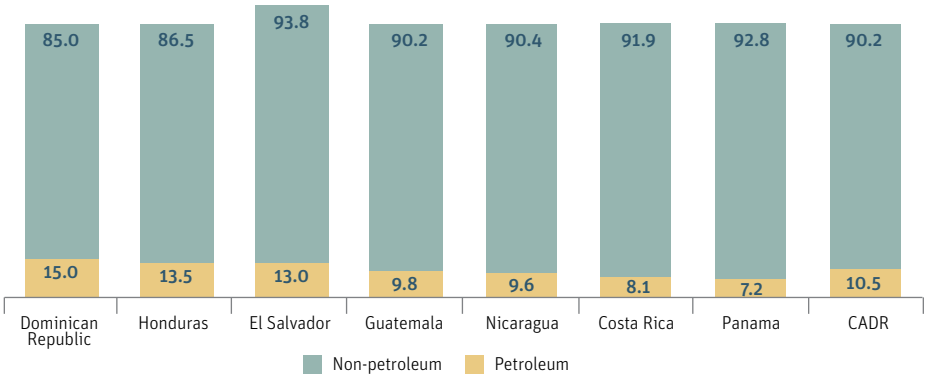
## Figure 4.4 International Prices of Raw Materials (Annual Variation)




*Source:* CID/IDB Staff using data from World Bank.

The region is a net importer of oil, so it has benefited from the current economic juncture. Petroleum and derivative imports represent 10% of imports of the region. Along with significantly reducing inflationary pressures, lower international prices of oil and derivatives since 2015 improved the current account, allowing the region to redirect part of the gain in disposable income toward increased consumption, which in turn, pushed economic growth. In 2016 there were moderate upward corrections observed in the price of oil and derivatives. No significantly greater increase is foreseen in the short term, but any major declines like those witnessed previously are unlikely. International raw material price fluctuations thus have serious implications for available household and company income. CADR's current account deficit at the end of 2015 was 2.6% of regional GDP, the lowest since 2009.

Figure 4.5 % Share of Hydrocarbons in Total Imports (2015)



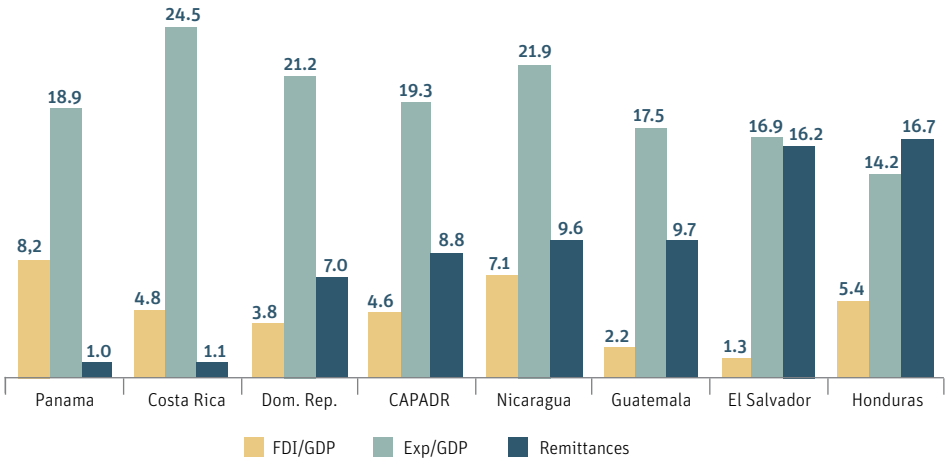

*Source:* CID/IDB Staff using data from Central American Integration System.

Remittances have continued to rise in recent years, supported by higher employment rates in the United States. Remittances in the region averaged 9% of GDP between 2011 and 2015, although with important differences among the countries: remittances amount to almost 17% of Honduras's GDP, but only 1% of Panama's GDP.

Foreign direct investment (FDI) averaged 4.6% of GDP for the region during the 2011-2015 period. While accounting for much less than remittances, it covers a significant part of the current account deficit. FDI is usually linked to national and international economic expectations, though in the region it is often aimed at expanding companies' capacities for exporting to the United States and so would be linked to the U.S. economic cycle.

External financing is CADR's most direct financial link to global conditions. This has two main sources: international financial markets through issuance of financial instruments (bonds, for example), and international loans, usually from the foreign financial institutions. The amount of external market financing, which can be susceptible to greater volatility, is small in the government sector, representing less than half the foreign debt (9% of GDP), and marginal in the banking and non-banking private sectors.

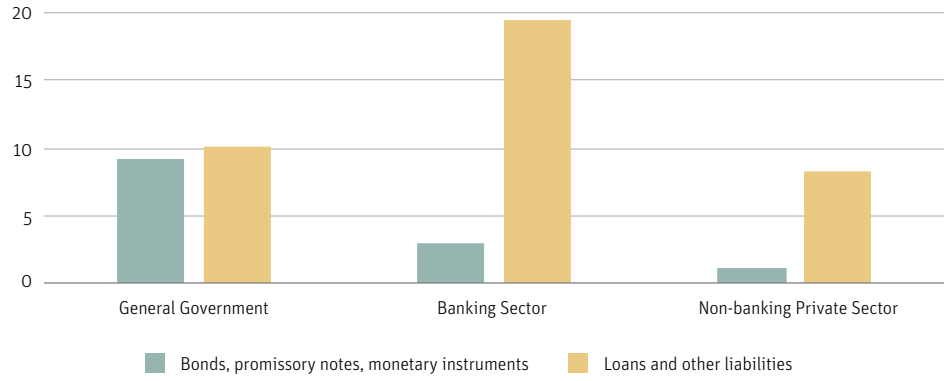
## Figure 4.6 Remittances, Exports and FDI (2011-2015 Average as % of GDP)




*Source:* CID/IDB Staff using data from Central Banks of Central America and the Dominican Republic.

Most of the foreign borrowing is in the banking sector (19% of GDP); nonetheless, in an environment where very small, gradual rate hikes are expected in the U.S., the conditions of these loans are not expected to be significantly affected. The banking sector finances its activity primarily through deposits, which represent more than 80% of the system's total liabilities. Moreover, in previous episodes of U.S. rate increases, no synchronization has been observed in CADR interest rates, even in dollarized economies (see Roache, 2008).

## Figure 4.7 External Sources of Debt (% GDP)




*Source:* CID/IDB Staff using data from the Executive Secretariat of the Central American Monetary Council.

## SENSITIVITY ANALYSIS AND POLICY ACTIONS IN RESPONSE TO A POTENTIAL DETERIORATION IN EXTERNAL CONDITIONS

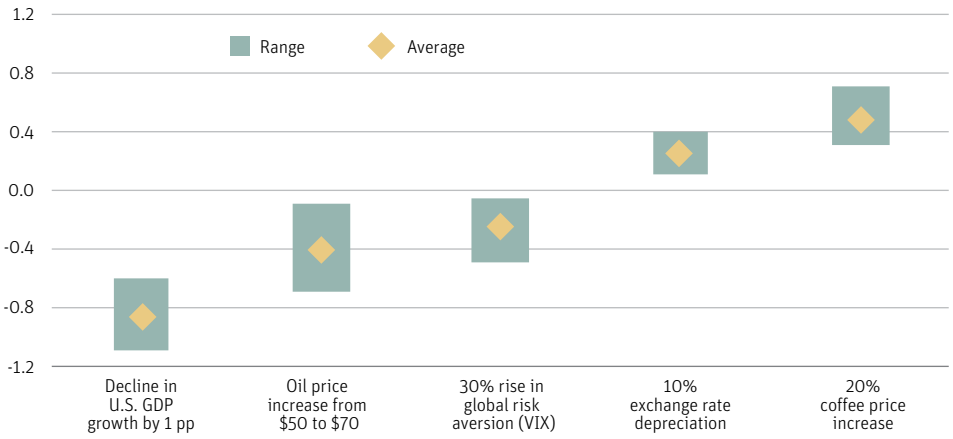
At a first stage, we estimate shock scenarios for the U.S. GDP, international oil prices, global risk aversion, exchange rate depreciation, and rising international coffee prices. For these variables, the estimates and intervals presented are the result of a group of statistical models described in annexes 4.1 and 4.2.[83] The effect on CADR GDP of an increase in U.S. tariffs that would lead to a reduction in U.S. imports from the region is also estimated.

The macroeconomic variable that seems to have the greatest impact on the region's growth is the performance of the Unites States. It is worth mentioning that U.S. GDP was used as a measure to summarize the economies' exposure to demand, investment and remittances from that country. An important effect also results on increase in international oil prices. Concretely, it is estimated that an increase from US$50 to US$70 per barrel would slow CADR growth by -0.4 percentage points (p.p.). On the other hand, global risk aversion, measured through the Global Volatility Index[84] (VIX),[85] seems to have a more limited effect. It is estimated that an increase of 30% on the VIX would bring it to a level similar to that reached during the European crisis in the third quarter of 2015, affecting growth by -0.25 percentage points.

It is worthwhile emphasizing that just as downturn risks are perceived, there is also the possibility of positive shocks. Such is the case of a moderate exchange rate depreciation and an international coffee price uptick, which has observed in recent months. The effect of a 10% exchange rate depreciation, assumed to be an orderly, one-time event of moderate magnitude, was estimated to have marginal implications for prices and other financial variables, thus avoiding economic imbalances. According to estimates, a 10% exchange rate depreciation could contribute to a rise in GDP of 0.2 p.p. In relation to the other variable, a 20% increase in the international coffee price could lead to a 0.5 p.p. higher GDP growth in the region.[86] This 20% increase is similar to what has been recently observed (see Figure 4.8 for the summary of effects).

[83] Panel estimated as FLGS, 2SLS and a structural VAR of the area as a whole (exogenous variables: U.S. GDP, oil price and VIX).
[84] VIX is an index of volatility in the price of S&P500 options.
[85] A 30% increase in the VIX would be similar to reaching 75% of the level reached by the VIX in the Euro crisis period, in December 2011.
[86] The coffee price is used as a proxy variable for the prices of raw materials produced in the region due to its relative weight in exports and because its price behaves similarly to that of other agricultural products produced in the region.

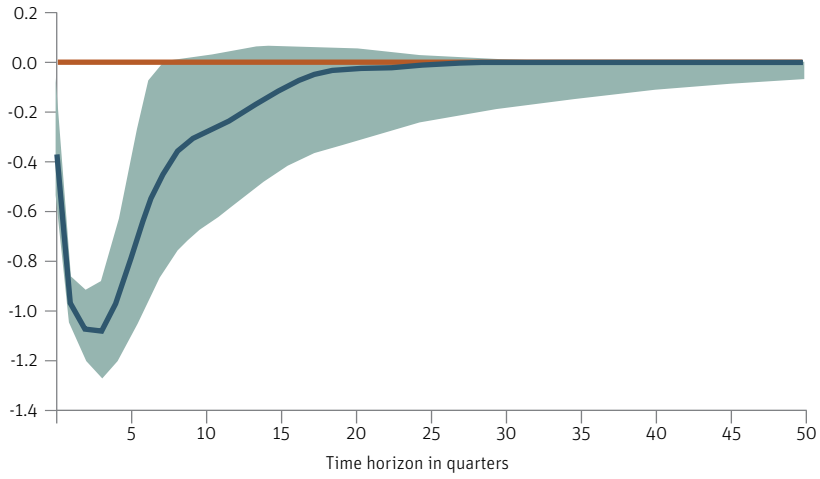
## Figure 4.8 Effects of Selected External Shocks on GDP Growth Rate (percentage points)




*Source*: CID/IDB Staff estimates.

On the other hand, the estimates show that the effects of the U.S. GDP shock on the CADR GDP are almost immediate and take almost two years to dissipate (see Figure 4.9).

## Figure 4.9 Impulse Response of Central American GDP Given a Negative 1% U.S. GDP Shock, on the Basis of the Structural VAR Model

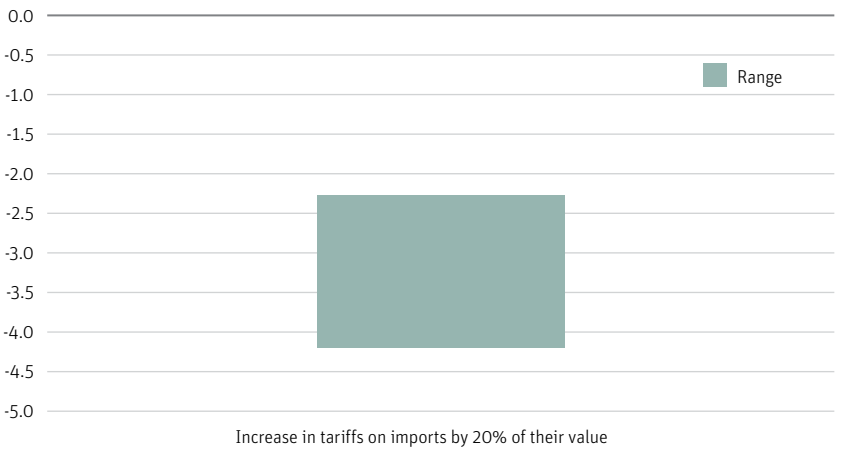



*Source*: CID/IDB Staff estimates.

If U.S. growth were to decline permanently (not temporarily), the estimates suggest that the effect would be transferred almost completely and directly to the region. In a scenario of this type, the region's growth does not depend on fiscal and monetary policies for buffering the economic cycle, but rather on policies that enhance productivity by improving efficiency and/or transition the countries' economic structures toward sectors with greater value-added.

Recently there has been an increase in uncertainty toward international trade policy of developed countries. Considering that the United States is the region's main trading partner, we estimate the effects a policy of this type could have if applied to the region. We estimate the effect on CADR GDP of a hike in the average tariff for regional imports to the United States to an additional 20% on their value. This is a significant increase given that according to the World Trade Organization the weighted average tariff for U.S. trade in 2014 was only 2.2%. The estimate considers a U.S. import price elasticity of 1.1, estimated by Looi *et al.* (2008), and a 20% share of exported goods in the CADR GDP at constant 2014 prices. This would give, as a direct effect, a decline in the region's GDP of 4.4 p.p. The price elasticity could be much less, though, since imports from the region might be difficult to substitute with local products and the tax increase would also apply to producers of similar goods in other countries. For example, if elasticity were halved, the effect would be reduced by up to -2.2 p.p. (see Figure 4.10). This estimate is abstracted from indirect effects through other components of the GDP or dynamic company effects (such as lowered margins).

Figure 4.10 Effect on GDP Growth Rate of an Increase in U.S. Import Tariffs (percentage points)

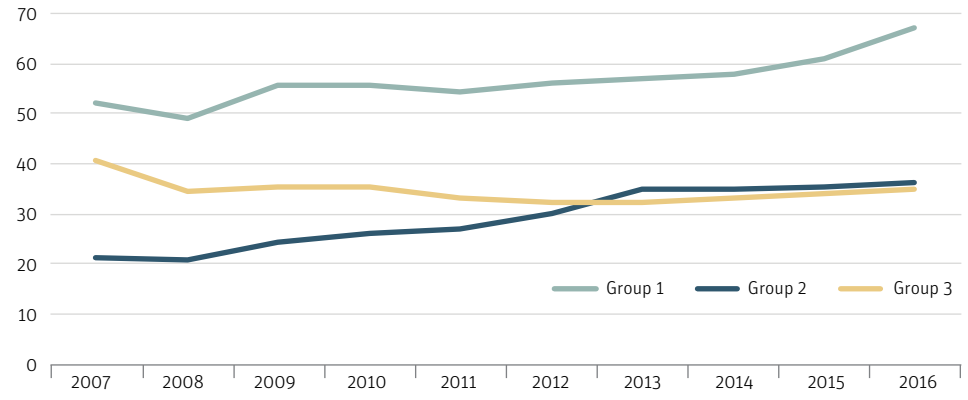



*Fuente*: CID/IDB Staff estimates.

In these exercises we generally estimate that shocks external to macroeconomic, financial, and international raw material price variables are temporary in nature, so once the shock dissipates the region's GDP returns to its original level. If there were a tariff hike the shock would be permanent in the sense that tariffs would reach a new level such that, due to a higher price, exports would fall. The repercussion of this would be a reduced GDP (real) from the one that existed when tariffs were lower.

To cushion the effects of a temporary external shock, the countries could use a mix of monetary and fiscal policy.[87] In the case of fiscal policy, despite the heterogeneity among countries[88] (see Figure 4.11), their room for maneuvering seems limited, given the region's significantly expanded public spending after the 2008-2009 crisis, which in some cases increased public debt as percentage of GDP. An example of this appears to be the fiscal consolidation taking place in some economies of the region. The 2008-2009 expansion in government expenditure concentrated on current expenditure in response to the immediate need to implement a counter-cyclical policy. In this sense, it is important to consider that usually an expansion of current expenditure is more difficult to retract once the event that motivated it has passed, which translates into medium-term pressures on spending and public debt.

**Figure 4.11** General Gross Government Debt (% of GDP)*




*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).

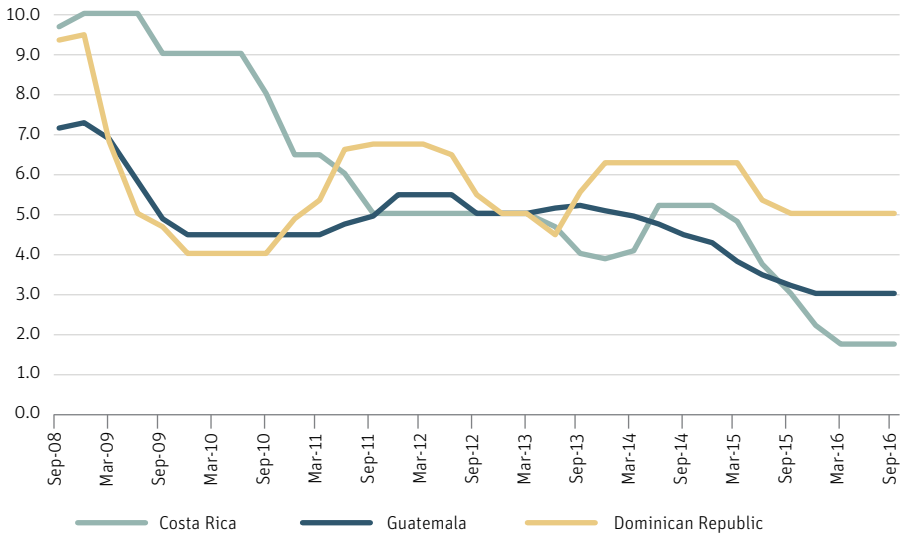
*Simple average. Group 1: Belize, Costa Rica, and El Salvador. Group 2: Guatemala, Honduras and Dominican Republic. Group 3: Nicaragua, Panama.

According to estimates, in the context of a real shock of, for example, a 1.1 p.p. decline in U.S. GDP leading to a decrease of around 0.9 p.p. in the region's activity, a 5% expansion of public expenditure would increase GDP growth by around 0.1 p.p. The effect is estimated to be small, so to have a greater effect government spending could focus more on infrastructure, which would also allow this expansion to be temporary and counter-cyclical, given the similarly transitory nature of the shock. Given that investment projects require preparation time, it would be worth studying the creation of a list of medium-range infrastructure projects for the country prepared ahead of time (such as design, impact assessments and pre-investment studies) so they can be geared up in the event of a negative external shock or if extraordinary financial resources were obtained.

[87] The effects of temporary shocks on the economic cycle can be buffered by applying policies with a transitory scope and effect, as monetary and spending policies tend to be, while addressing shocks of a permanent character entails changes in the economic structure.
[88] With countries where debt is high and growing, others where it is moderate but steadily rising, and others where it has stabilized.

In some cases there is space to buffer the effects of external shock through monetary policy. Countries with an inflation-targeting monetary policy, such as Costa Rica, Guatemala and the Dominican Republic, offer an example. These countries have even already cut monetary rates, considering that inflation is under control or even below target.

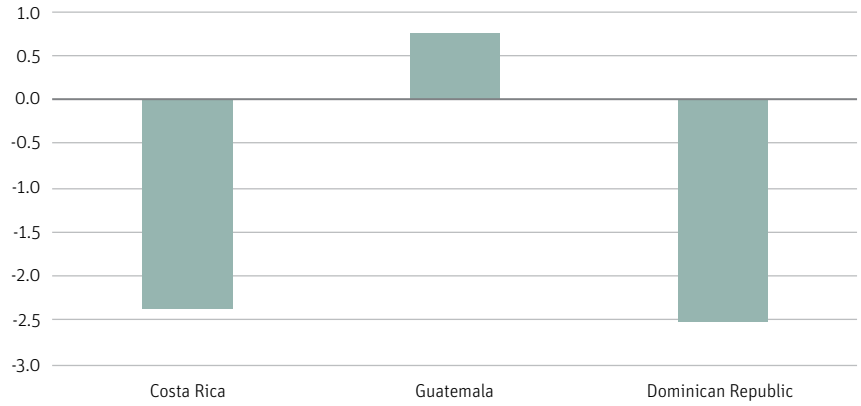
Figure 4.12 Monetary Rate (%)




*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016)..

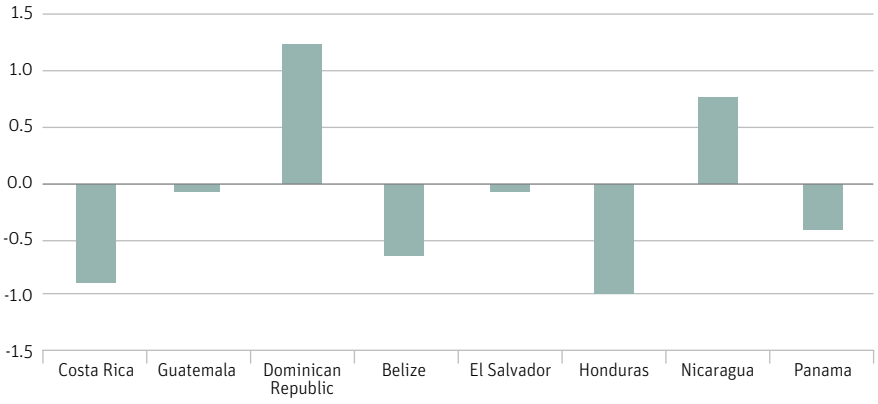
Inflation is generally low in the region, aided by falling oil derivative prices. In the case of Costa Rica and the Dominican Republic, inflation is below target (3%+/-1% and 4%+/-1%, respectively), while in Guatemala the central bank forecasts annual inflation in December above the 4% target. As for the product gap, the average for Costa Rica, Guatemala and the Dominican Republic is slightly over zero since the gap is positive in this last country. Even so, if an external shock materializes with implications for economic activity, the product gap would tend to widen, providing space for monetary easing.

## Figure 4.13 Inflation Gap (difference from target)




*Source*: CID/IDB Staff using data from Central Banks.

## Figure 4.14 Output Gap (% of potential GDP)




*Source*: CID/IDB Staff using data from IMF, WEO (October, 2016).

It is estimated that a reduction of 50 base points in the monetary rate of these countries, on average, could raise the GDP growth rate 0.1 – 0.2 percentage points.

On the other hand, El Salvador and Panama use the dollar as their legal currency, while Belize, Honduras and Nicaragua have a fixed exchange rate or one of mobile parity. In each of these countries, the product gap with respect to its potential is negative or close to zero, except for Nicaragua, where it is estimated to be positive. These countries could take other relaxation measures for the economy, such as lower legal reserve requirements or an accelerated depreciation pattern, among others, although that will depend on the economic and political

conditions of each country. As commented previously, it is estimated that the effect of an orderly and moderate average regional exchange rate depreciation of about 10% could help raise GDP by around 0.2 percentage points.

In summary, the region's economy is exposed to diverse external risks that have been skewing upwards. While some countries have certain room to temporarily mitigate them through economic policies, where such room has shrunk in recent years the policies should be strengthened whenever the opportunity arises. The goal is to be in position to respond more comprehensively at the moment one of the aforementioned negative events materializes.

## Annex 4.1.

### Estimation with BSVAR (Bayesian Structural Vector Autoregression) with Block Exogeneity

Estimation with a structured VAR model, used to explain the potential impact in the Central American region[89] of different variables, such as the U.S. GDP, international raw material prices, global risk, and others, is a special case developed by Zha (1999), in which additional restrictions are placed on the estimation, by means of which the exogenous block variables are not affected by the endogenous block variables, either contemporaneously (in time *t*) or in the lags (for example, *t-1*). In other words, a zero value is imposed on the coefficients of the exogenous block variables (both contemporaneously and in the lags) in the equations whose dependent variable is included in the exogenous block at the moment the estimation is made.

In this case, the endogenous block is made up of the variables of CADR GDP, nominal exchange rate, accumulated government expenditure, and coffee price while the exogenous block is comprised of the U.S. GDP, the VIX and the international Brent oil price. Restrictions are also placed on the contemporaneous coefficients (time *t*) with scaling (upper triangular), as is typical in estimating a structured VAR (SVAR), in the following order: nominal exchange rate, coffee price, accumulated government expenditure and GDP for the Central American block. For the exogenous cluster, the following order is used: Brent prices, U.S. GDP, and the VIX. In addition, estimates were made changing the order of the variables, emphasizing endogenous variables, and no substantial changes were found in the results. The data employed were expressed in annual percent changes except for VIX, given its high level of heterogeneity compared to the other series, and the sample period includes the first quarter of 2004 to the third quarter of 2005.[90]

On the other hand, since this is a Bayesian estimation, it is customary to report percentiles at 90% of the estimated values (equivalent to the confidence intervals of classic econometrics). However, to give more homogeneity to the estimators in relation to those obtained through other estimation methods (linear regression, panel) the values of the estimators found in the joint distribution mode are used, based on the maximum likelihood method.

Using model fit criteria, comparing second moments (variances and correlations) of the observations (simulations) generated by the estimated model and the sample moments obtained from the data, the two lag selection in the SVAR estimation was found to best describe the dynamics of the data.

The impulse-response figures presented in the text are calculated with the estimated parameter mode indicated by the blue line, and the gray area denotes the bands at 68% of the posterior distribution.[91]

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[89] The countries considered are: Costa Rica, Guatemala, Honduras, Nicaragua, Panama, the Dominican Republic and El Salvador.

[90] To obtain data for the Central American region, the average rate of variation in the nominal exchange rate was taken. For accumulated government expenditure and GDP, these were brought to the same currency (dollars) through the exchange rate for each period and added together for the seven countries to then obtain percent change.

[91] Percentiles were obtained with 120,000 simulations of the Bayesian SVAR estimations, disCADRing the first 20,000.

## Annex 4.2.

### Panel Analysis

Complementarily, panel estimations were made for the determinants of GDP growth in CADR economies. The explanatory variables of country GDP are the same ones indicated previously: the nominal exchange rate, the international coffee price, accumulated government expenditure, U.S. GDP, the international Brent oil price and the VIX. The data employed were expressed in annual percent changes. The panel is not balanced since the sample periods are different in the countries depending on data availability, and most of them begin as of 1991 (in 2004 for one case). The estimations included ordinary least square (OLS) estimates, feasible generalized least squares (FGLS) to correct a slight autocorrelation, and 2SLS with instrumental variables, using the same variable lag, as instruments for a dynamic panel analysis that included the lagged variable of country GDP growth as explanatory variable. The model adjustment was generally good, with R2 statistics for the estimates situated between 0.7 and 0.8.

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