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SELECTED ISSUES

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Approved By
The Western Hemisphere Department

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CONTENTS

ASSESSING RISKS IN THE PANAMANIAN BANKING SECTOR: STRESS TESTING AND CONTAGION ANALYSIS[1]

A. Executive Summary

Risks Covered

1. ***This paper takes a close look at the recent evolution of the banking sector, and reports results from bank-level stress testing and contagion analysis.*** *Tapping on publicly available balance-sheet data, we assess the resilience of individual banks to adverse shocks interest-rate and growth shocks. Using data on interbank deposits, the paper then assesses the potential for propagation of shocks through these exposures by tracking the effect of simulated defaults.*

Key Results

2. ***The analysis suggests that Panama's banking system seems able to withstand reasonably severe shocks, while contagion risks stem primarily from foreign banks.*** *Ample starting capital buffers and bank profitability prevent translation of higher loan defaults under stress into materially impair capital adequacy ratios. If we reverse engineer the exercise to gauge what it would take to erase one-fourth of system capital, we find that the shock would need to be not only unprecedented, but also extremely large. In terms of contagion, while failures of both domestic and foreign banks would result in significant capital losses for Panamanian banks, the risk of contagion propagation is much higher in the case of the latter.*

B. Introduction

3. **Panama has a deep and well-integrated banking sector, and its adequate monitoring is key to macroeconomic stability.** Panama's financial depth, as measured by credit-to-GDP, is relatively high (Chart 1)[2]. With its role as regional trade and financial hub, and in the absence of a lender of last resort, periodic monitoring of the banking sector risks is essential to ensure the country continues to enjoy macroeconomic stability and maintains its sustainable growth path.

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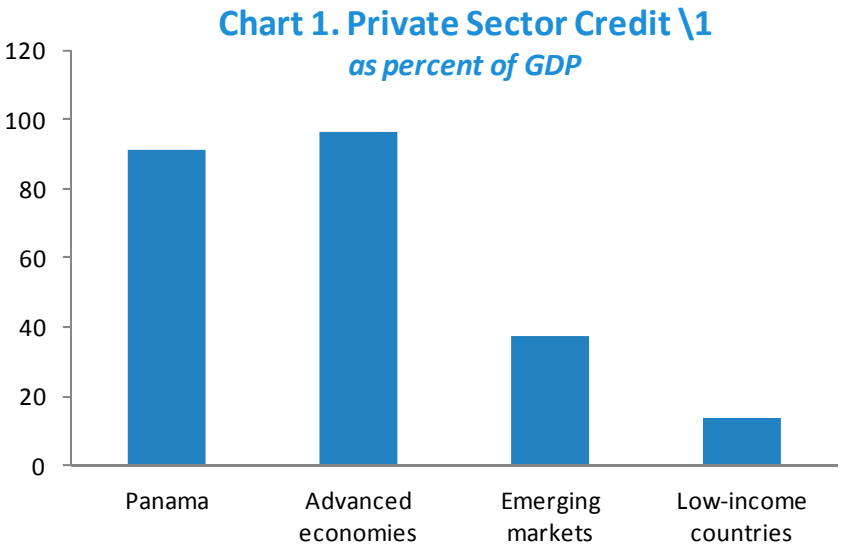
[1] Prepared by D. Cerdeiro, M. Hadzi-Vaskov and T. Wezel. We would like to thank Paola Ganum, Etibar Jafarov, Camelia Minoiu, and Wei Shi for their contributions. We are also very grateful to the Panamanian authorities (Superintendencia de Bancos de Panama) for excellent cooperation and sharing the data.

[2] In addition, and consistent with its role as a financial center, total assets of the banking sector represent about 250% of GDP at end-2014.



\1 For country groups, the chart shows the median.
Source: WEO and Staff calculations.

4. This paper takes a close look at the recent evolution of the banking sector, and reports results from bank-level stress testing. Panama's economy has grown rapidly in recent years, and the banking system has accompanied this process. As growth slows down towards its medium-term potential, it is important to monitor how banks are adjusting to this new scenario. We therefore start our analysis by discussing recent trends in banking sector performance, highlighting potential sources of vulnerabilities. Tapping on publicly available balance-sheet data, we assess the resilience of individual banks to adverse shocks. The focus is on two key factors that may put pressure on banks' balance sheets. First, and ahead of the expected U.S. monetary policy normalization, an increase in interest rates that may compress banks' earnings, while raising loan defaults. Second, adverse growth shocks that also affects the quality of banks' portfolios.

5. After assessing banks' resilience at the individual level, the paper evaluates potential contagion risks stemming from the network of domestic as well as international interbank exposures. An important lesson from the financial crisis is that focusing the analysis only on individual financial institutions may lead to overlooking the buildup of significant risks arising from the system's interconnectedness. To this end, Section D assesses the potential for propagation of shocks through interbank deposit exposures, by tracking the effect of simulated defaults.

6. The analysis suggests that Panama's banking system seems able to withstand reasonably severe shocks. Ample starting capital buffers and bank profitability prevent translation of higher loan defaults under stress into materially impairing capital adequacy ratios. Only a number of smaller banks would fail the stress test featuring a slowdown and moderately higher interest rates, while only extreme conditions (recession in combination with sharply rising interest rates) would lead to widespread undercapitalization. If we reverse engineer the exercise to gauge what it would take to erase one-fourth of system capital, we find that the shock would need to be not only

unprecedented, but also extremely large. Under less extreme assumptions the projected decline in system capitalization would appear manageable.

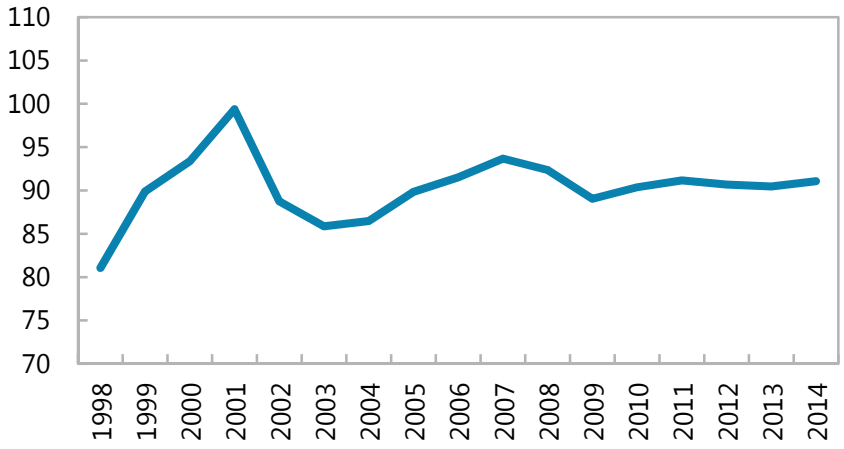
7. Contagion risks stem primarily from foreign banks. While failures of both domestic and foreign banks would result in significant capital losses for Panamanian banks, the risk of contagion propagation is much higher in the case of the latter. In fact, the systemic importance of foreign banks would be further magnified when funding risk through foreign banks' exposure to Panama is taken into account.

C. Banking Sector Performance and Vulnerabilities

8. The banking sector is generally healthy. Most banks pursue a traditional business model with limited wholesale funding, are well-capitalized, profitable, and liquid. Offshore banks' exposure to the domestic economy is limited to interbank exposures to onshore banks, and more recently purchases of certain domestic debt. Liquidity holdings are ample, since banks need to self-insure against funding risks in the absence of a lender of last resort.

9. Panama's financial depth, as measured by credit-to-GDP, is relatively high. This partly reflects Panama's role of a regional trade and financial hub. For example, domestic credit includes exposures to firms in the Colon Free Zone trading mainly internationally. After overshooting in the mid-2000s, bank credit has recently grown more in line with domestic activity, reflected in a broadly flat credit-to-GDP ratio since 2010 (Chart 2).

Chart 2. Panama: Credit-to-GDP Ratio

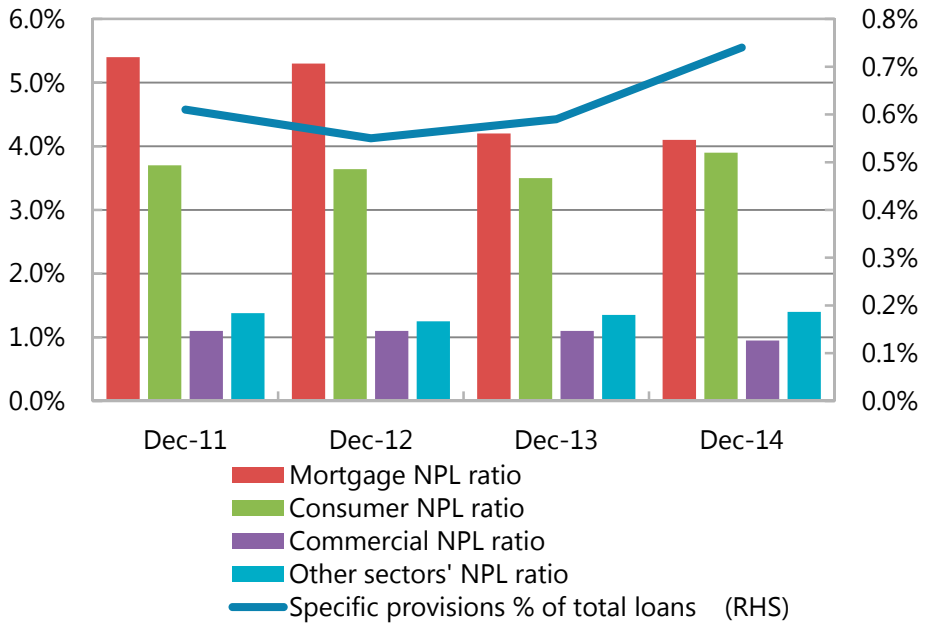


Source: Country authorities.

10. Non-performing loans (NPLs) are low and provisions coverage appears adequate in general, though there is heterogeneity across lending segments. Loan delinquencies hardly increased during the global financial crisis given Panama's robust growth in those years. The overall NPL ratio currently stands at 1½ percent but the household sector displays greater loan defaults,

which may be partly due to a shrinking payment capacity on the back of increasing household indebtedness (up by 15 percent y-o-y). The buffer of specific loan loss provisions has grown in recent years as the SBP ordered additional provisions for doubtful exposures to the Colon Free Trade Zone. Provisions coverage is also aided by the phasing-in of countercyclical provisions from 2014 (Chart 3).

Chart 3. Portfolio Quality by Recipient Sector of Bank Credit



Source: Superintendency of Banks Panama (SBP).

11. However, some recent trends in key bank performance indicators need to be monitored closely (Figure 1). In particular, the system's capital adequacy ratio (CAR) and leverage ratio, albeit high, have worsened slightly over the past years. Foreign banks operate with somewhat less capital than their domestic competitors. After falling in the aftermath of the global financial crisis, the average liquidity ratio has recovered since 2013 on account of a rebound in foreign banks, while the negative trend persists at domestic banks. Meanwhile, profitability has improved markedly in the last few years, after slumping since the financial crisis. The difference between the performance of domestic/foreign banks and the system on average is explained by a lower profitability of public institutions.

12. Panama's financial soundness indicators point to overall higher buffers and performance in comparison to other financial hubs (Figure 2). While Panama's average capital adequacy ratio is lower, its capital-to-total asset ratio is higher compared to Hong Kong, Luxembourg and Singapore. Panamanian banks' return-on-assets (ROA) is also higher, implying a higher earnings buffer for absorption of shocks. While the NPL ratio is only marginally higher than in the other financial hubs, the coverage of nonperforming assets by provisions in Panama is better than in Luxembourg and Singapore, although the value of collateral is deducted from the loan value

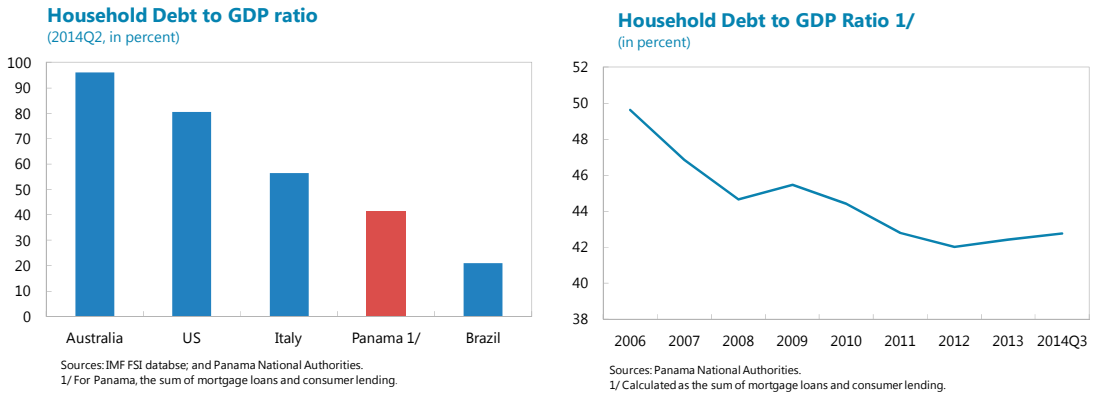
before provisioning. Finally, at about 100 percent, the loan-to-deposit ratio (not shown below) is quite high, but not excessively so in comparison with some other emerging market economies.

13. Rising interest rates may reduce banks' earnings, while raising loan defaults. The prospect of an end to quantitative easing in the U.S. is a risk to profitability, as banks may not be able to pass on rising funding costs to borrowers, at least in the short run. The findings in the Selected Issues Paper *Interest Rates in Panama: U.S. Pass-through and its Effects on Local Economic Activity* suggest that the pass-through from U.S. interest rates has been lower for lending rates relative to deposit rates, implying a negative relationship between U.S. interest rates and Panamanian banks' lending-deposit spreads. However, major banks hope to avoid a strong spread compression, as prevailing variable-rate loans should allow re-setting interest rates in due course. While margins may be preserved to some extent, rising loan rates would affect borrowers' payment capacity and could lead to defaults. The estimated credit risk models (reported in Section C) provide evidence that, historically, the NPL ratio indeed tended to move in lockstep with domestic loan rates.

14. Real estate prices have been growing rapidly, but there is still little evidence of price growth being out of line with fundamentals. Index data for residential real estate prices, to which the SBP recently gained access, confirm a rapid increase over the last 10 years. Even so, house price developments do not seem to be out of line with the strong economic growth over the same period. Going forward, a continued pick-up in house prices is to be expected, as medium-to-low income earners increasingly gain access to mortgages, in large part at preferential rates. While there are no data on commercial real estate prices, there is anecdotal evidence of excess capacity in some segments (lower occupancy rates at hotels and office buildings). Banks claim that their exposures to these segments are limited.

15. At over 40 percent of GDP, household debt is lower than in advanced countries but relatively high in regional comparison. After declining in line with buoyant economic growth, the household debt-to-GDP ratio has only slightly outpaced nominal GDP recently (Chart 4). The debt-service-to-income ratio cannot be calculated yet, but the SBP plans to obtain the necessary income data directly from banks.

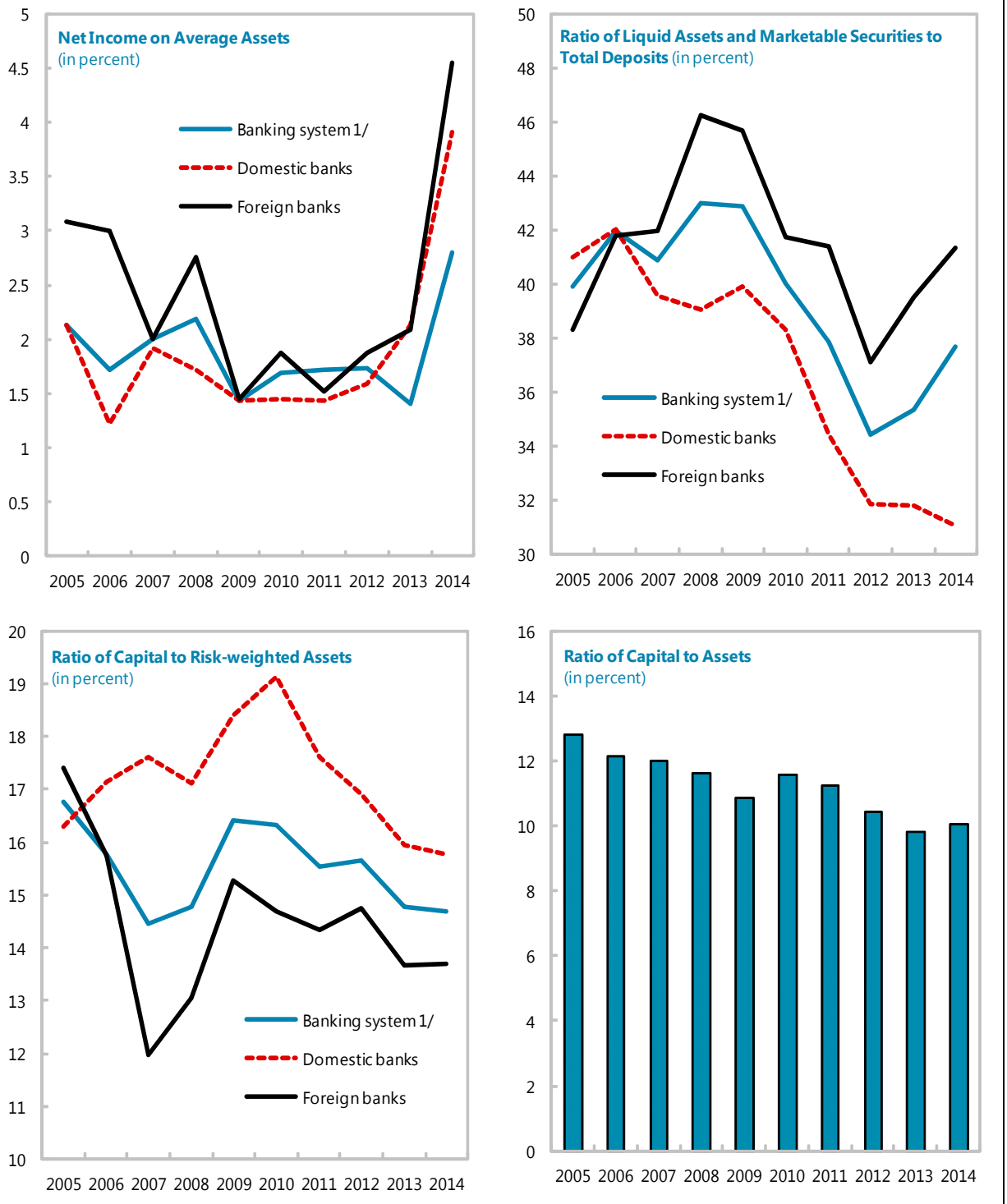
Chart 4. Household Indebtedness



Sources: IMF FSI databse; and Panama National Authorities.
1/ For Panama, the sum of mortgage loans and consumer lending.

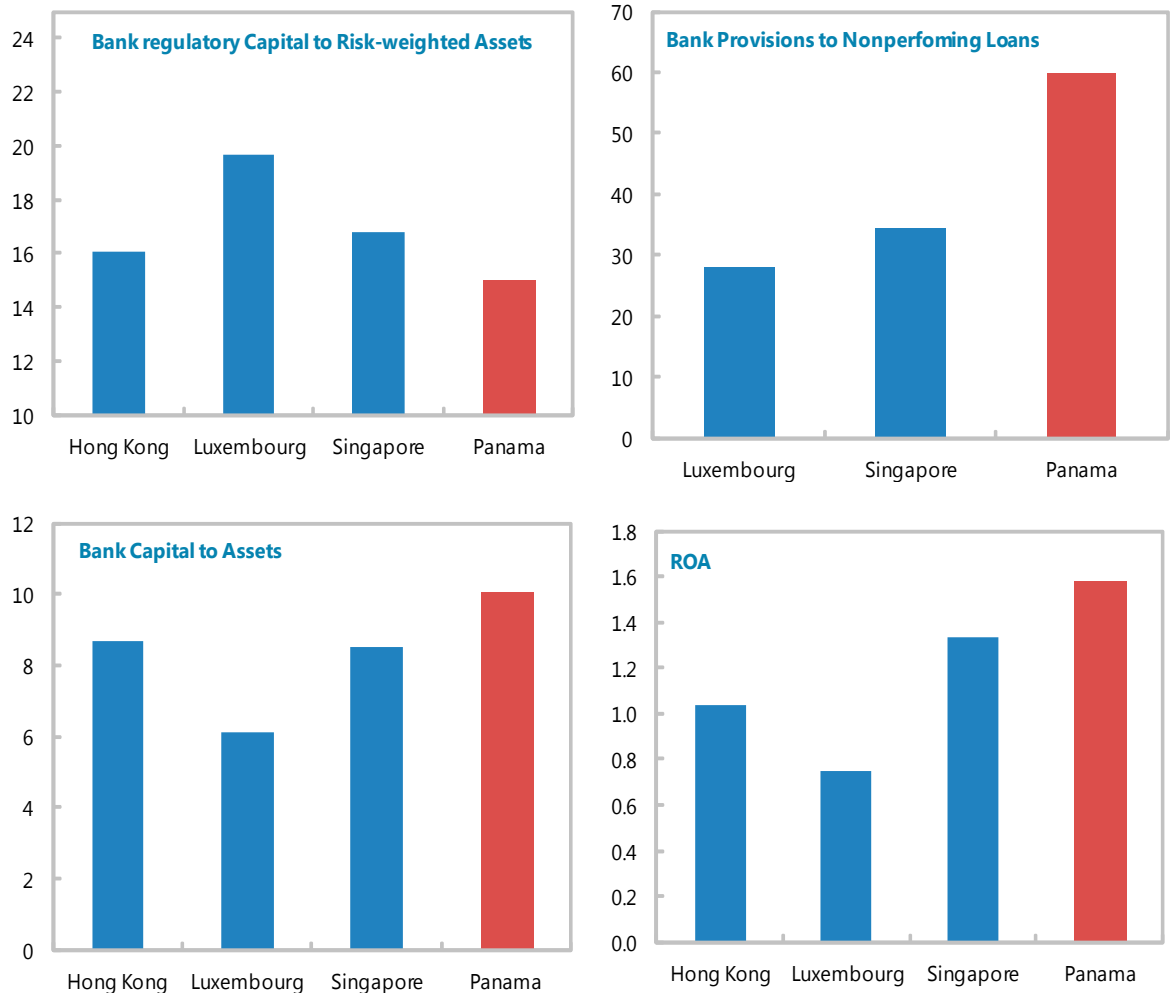
Sources: Panama National Authorities.
1/ Calculated as the sum of mortgage loans and consumer lending.

Figure 1. Panama: Selected Financial Soundness Indicators, 2005–14



Source: IMF Staff calculations based on SBP data.

Figure 2. Panama: Financial Soundness Indicators in Peer Comparison



Source: IMF Staff calculations based on SBP data.

D. Solvency and Liquidity Risk

Solvency Risk

16. A solvency stress test for onshore banks was performed by the mission team. This section describes the properties of the credit risk model that was implemented at the SBP with the help of IMF Technical Assistance in 2011 and updated in early 2015. The following paragraphs explain the model structure, the variable selection procedure, stress test scenarios as well as the method of projecting NPLs, provisions and capital adequacy ratios. For confidentiality reasons, stress test results are reported at the system level.

17. The type of credit risk model used in this exercise takes a balance sheet approach to projecting loan defaults. This approach aims at explaining variations in impaired loans by way of changes in key macroeconomic and financial variables. Specifically, it uses a dynamic panel data model with bank-specific fixed effects. In this panel model, NPL ratios for up to 51 Panamanian onshore banks during 2003Q1–2014Q4 were regressed on the lagged dependent NPL ratios, an array of explanatory variables at the economy and/or sector level and bank fixed effects depicting time-invariant bank-specific factors. A total of seven sectoral panel models were estimated for the primary sector, construction, manufacturing, commerce, services as well as for consumer and mortgage loans. Bank-specific data (loan interest rates) were tested but resulted significant only in the panel for the construction sector. The model uses a wide definition of NPLs that includes also "special mention" loans that in Panama require provisioning as well.[3]

18. In view of Panama's openness, both domestic and external explanatory variables were tested, but in the end only domestic factors resulted significant. Specifically, the sectoral models include as explanatory variables real Panamanian GDP growth and/or the average interest rate on loans charged to the respective economic sector. Other variables such as U.S. or Chinese economic growth, exports, oil prices and inflation did not result significant in any of the newly-run regressions.[4] This finding may be viewed as suggesting that it is mainly domestic factors, perhaps influenced by external factors, that explain variations in NPLs. As some of these additional variables entered in the 2011 version of the model, it stands to reason that there is an increasing decoupling of loan quality from external factors. In some sectoral models the level of significance was lower than in others, particularly in the services panel.

19. Text Table 1 provides an overview of the explanatory variables used in each panel. Real GDP growth entered in all panels but mortgage lending, while the average loan interest rate for a given sector turned out significant for the primary sector, manufacturing, commerce and for mortgage loans. Explanatory variables entered mainly with their contemporaneous levels, although some were lagged by one or two quarters. The lagged dependent variable always resulted highly significant, with coefficients ranging from 0.68 to 0.75, indicating moderate inertia in the evolution of NPL ratios. The regression fit can be considered good, with values of R-squared ranging between 0.74 and 0.80.

20. Two stress test scenarios were considered. The baseline scenario applies the mission team's projections for real GDP and the evolution of interest rates as well as credit growth during 2015-16, which does not necessarily imply stress but rather aims to project loan quality and

[3] The NPL variable underwent a logistic transformation, as is standard in regression-based credit risk models. Since by construction the dependent variable is bounded between zero and one, in the regression the logit-transformed value was used to create an unrestricted variable and thus avoid non-normality of the error term.

[4] External factors nonetheless may have significant impact on the quality of Panamanian banks' credit exposures. Based on BIS data, Appendix B suggests that high bilateral downstream exposures through lending to foreign clients imply significant potential credit losses.

capitalization under expected conditions (real GDP to rise slightly to 6.4 percent in 2016, and lending rates to increase by 60 basis points (bp) until the end of the projection horizon, Text Table 2). The adverse scenario contemplates a gradual slowdown of real GDP to 2 percent y-o-y by end-2016 and a likewise gradual increase in domestic loan rates by 113 basis points. Regarding lending rates, the shock originates from a rise in funding costs of 150 bp with an assumed 75 percent pass-through to loan rates (full pass-through in the baseline scenario). A direct determinant of risk-weighted assets under Basel I, credit growth is assumed to recede by -0.4 pp and -1.0 pp quarter-on-quarter in the baseline and adverse scenario, respectively.[5]

Text Table 1. Explanatory Variables used in Sector-Specific Credit Risk Models

Sector/Variable	Lagged NPL ratio	Real GDP growth	Lending rate
Primary Sector	0.746 (22.47)***	-0.022 (2.57)**	0.129 (1.90)*
Manufacturing	0.750 (19.71)***	-0.018 (1.89)*	0.155 (2.47)**
Construction	0.694 (25.36)***	-0.022 (2.63)**	0.064 (3.17)***
Services	0.713 (18.39)***	-0.014 (1.74)*	
Commerce	0.745 (22.21)***	-0.021 (2.73)***	0.112 (1.85)**
Consumer loans	0.685 (16.84)***	-0.019 (2.37)**	0.050 (1.71)*
Mortgage loans	0.726 (9.44)***		0.194 (2.59)**

Note: ***, **. * denote significance at the 1, 5 and 10 percent level, respectively.

[5] Other necessary assumptions comprise a tax rate on bank profits of 28 percent; a dividend payout rate of 25 percent; and quarterly growth rates of investment and other income as well as operating costs of 2, 1¾ and 1½ percent in the baseline, adverse and extreme scenario, respectively (the decline of operating costs assumes cost-saving measures by banks under adverse conditions). The drop in income is assumed to be more moderate than may be called for under stressful conditions since rising interest rates, particularly on the large holdings of liquid assets, would have a mitigating effect.

Text Table 2. Stress Test Scenarios

	Actual	Baseline		Adverse		Extreme	
Variable/end-year	2014	2015	2016	2015	2016	2015	2016
GDP growth y-o-y	5.7	6.1	6.4	4.0	2.0	2.5	-1.5
Δ Avg. lending rate	-	+0.2	+0.6	+0.4	+1.1	+0.5	+1.5
Δ Credit growth q-o-q	-	-0.2	-0.4	-0.5	-1.0	-1.0	-2.0
Δ Avg. deposit rate	-	+0.2	+0.6	+0.5	+1.5	+1.0	+3.0

21. In addition, a reverse stress test[6] was run to evaluate what kind of shock would be necessary to deliver a loss of 25 percent of system capital ("extreme scenario"). By backward induction it was ascertained that doubling the severity of the GDP shock and further increasing lending rates by 37 bp would erase one-fourth of capital. The additional rate shock is predicated on a deposit rate increase by 300 bp, half of which the bank is assumed to pass on to borrowers, implying both higher credit risk and lower net interest income.

22. NPL ratios were then projected on the basis of the seven sectoral credit risk models and using the aforementioned three scenarios. The NPL ratio is projected to rise from currently 1.3 percent to 2.4 and 3.9 percent under the adverse and extreme scenario, respectively (Text Table 3), while increasing only slightly under the baseline. Using the wider definition of NPLs that includes "special mention" loans, which also underlies the credit risk models, the delinquency ratio increases by 1.3 and 3.4 percentage points in the stress scenarios, reaching 6.7 percent in the extreme one.

Text Table 3. Current and Projected NPL ratios

	Current (end-2014)	Baseline (end-2016)	Adverse (end-2016)	Extreme (end-2016)
NPL ratio (narrow def.)	1.3	1.8	2.4	3.9
NPL ratio (wide def.)[7]	3.3	3.5	4.6	6.7

23. To obtain the impact of the loan quality shock on banks' income, the projected variation in the NPL ratio was then translated into credit losses. Projecting the increase in loan loss provisions required a forecast of the provisions-to-total-loans ratio that predicted both

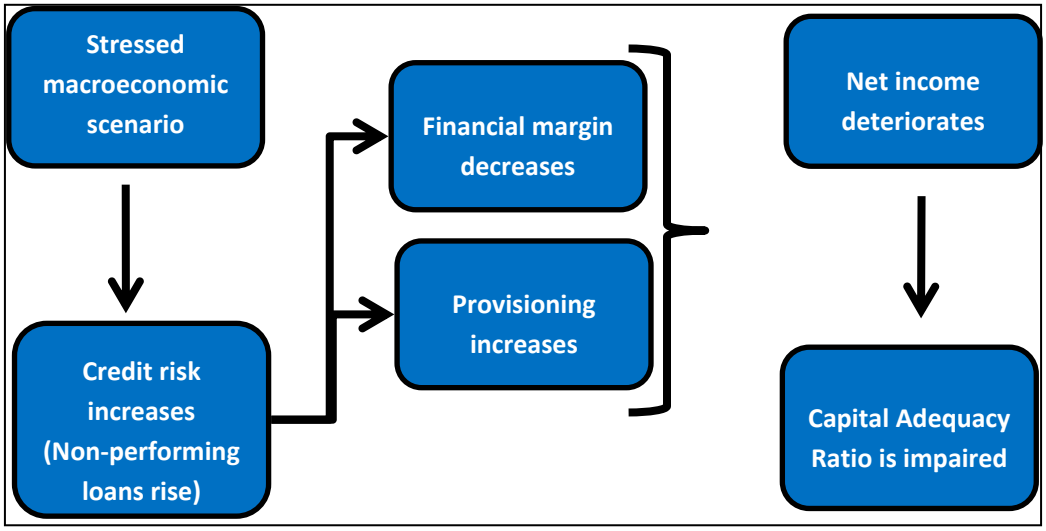
[6] Details on the properties of a reverse stress test can be found in Henry and Kok (2013).

[7] Including loans classified as in the special mention category.

components separately. The effective provisioning rates for each bank and risk category were used to forecast the increase in the provisioning flow under each scenario.[8] In order to project the share of impaired loans in each of the loan classification categories, a similar satellite model was estimated.[9]

24. The post-provision income was joined with a forecast of risk-weighted assets (RWAs) to obtain projected capital adequacy ratios. The final step of the exercise consisted in forecasting banks' CARs by setting the projected change in capital on account of adjusted provisioning costs and other net income in relation to projected risk-weighted assets. In accordance with the Basel I accord applied in Panama, the projected change in commercial and consumer loans carries a risk weight of 100 percent and that in mortgage loans a weight of 50 percent. Note that higher provisioning does not necessarily imply falling capital, if banks' pre-provision income is sufficiently high to absorb the additional cost. Chart 5 summarizes schematically the impact of stress conditions via higher loan impairment and lower financial margins onto net income and capital adequacy.

Chart 5. Transmission Channel from Macroeconomic Shocks to Capital Adequacy Ratio



25. The stress test results illustrate that the banking system appears resilient to adverse conditions. In both the baseline and the adverse scenario, the system's capital adequacy ratio remains above 15 percent of RWA, whereas in the extreme scenario it drops to 12 percent (Text Table 4). While in the adverse scenario three small banks representing less than 1 percent of system

[8] The effective provisioning rates rather than the statutory ones were taken because loans in the system were amply collateralized. To arrive at effective rates, the statutory rates of 20, 50, 80 and 100 percent for special mention, substandard, doubtful and loss loans, respectively, were adjusted by considering the average degree of collateralization in each of the seven sectors.

[9] To obtain the share of each of the categories of impaired loans for the projection, a fixed effects panel data model was estimated with non-performing loans (as previously estimated for each bank and economic sector) as explanatory variable.

capital would fall below the hurdle rate of 8 percent (in large part due to continued fast credit growth, which by assumption is not accommodated by capital injections), in the extreme scenario more than one-third of the banks accounting for 20 percent of overall capital would experience a decline in the CAR to below the 8 percent threshold.

Text Table 4. Current and Projected Capital Adequacy Ratios, and Banks Failing Tests

	Current (end-2014)	Baseline (end-2016)	Adverse (end-2016)	Extreme (end-2016)
Capital Adequacy Ratio in %	17.7	15.8	15.2	11.9
Number of banks below 8%	-	2	3	18
Initial share of those banks in system capital		0.4	0.8	19.6

26. In interpreting the stress test results, a number of factors have to be taken into account. First, the drop in banks' CAR in the baseline scenario despite still positive profits is somewhat fictitious, as it is explained by a softer but still reasonably strong credit growth, thus automatically raising RWAs virtually one-to-one, and also flat capital positions by assumption. The reason why such a drop in capital adequacy is seldom observed in tranquil times is that banks are periodically recapitalized by owners to retain the capacity to expand operations. As this possibility is not foreseen in the stress test, the results under the baseline clearly represent a worst-case outcome. Second, the relatively small drop in CAR under the adverse scenario relative to the baseline is owed to a partial offset of diminishing capital buffers due to rising loan impairment and lower pre-provision income by slower credit expansion and, hence, RWA growth in the denominator of the ratio. Finally, the assumptions underlying the reverse stress tests are to be qualified extreme but plausible even though Panama has never experienced the combination of such a GDP plus funding rate shock. The purpose of the reserve stress test is to show that it would take an unprecedented event combining most severe domestic and external shocks to cause a systemic event.

Liquidity Risk

27. Notwithstanding ample liquidity holdings of Pananamian banks, a liquidity stress test by way of approximating the Liquidity Coverage Ratio (LCR) was run. Required by regulation and also due to the lack of a lender of last resort, banks have historically held a relatively large share of assets in cash and highly liquid instruments. The SBP requires banks to maintain a ratio of liquid assets, as defined by regulation, to total short-term liabilities of 30 percent. The liquidity index is calculated at the 6-month horizon, and includes repayments of principal and interest on interbank and customer loans at that horizon. In the first months of 2015, the index has fluctuated in a range of 59 to 62 percent. This liquidity concept does not correspond well to the liquidity standards established as part of the Basel III framework (BCBS, 2013), which require banks to maintain adequate coverage of liabilities at the 30-day horizon (the LCR) and ensure sufficiently stable

funding at the 12-month horizon (the Net Stable Funding Ratio, NSFR). Given data limitations, the mission team decided to calculate only the LCR at this point.

28. The LCR resembles a traditional deposit run-off stress test measuring the degree to which outflows can be met by liquid assets, yet it reinforces the importance of maintaining high-quality liquid assets (HQLA). The quality of liquidity assets is reflected in haircuts to the balance sheet value of liquidity positions, with the highest quality assets (cash, central bank reserves, and certain domestic debt) not requiring value adjustments and those of lesser quality ("Level 2 assets") commanding haircuts of between 15 and 50 percent according to Basel III. The total adjusted value of HQLA is required to exceed the net cash outflows in the denominator of the ratio, comprising outflows of deposits and other liabilities weighted by run-off factors net of similarly-weighted cash inflows from asset positions, including customer loans. Two important restrictions apply under the Basel III LCR framework: the share of level 2 assets may not exceed 40 percent of total HQLA, and cash inflows to be subtracted are the lower of calculated inflows and 75 percent of gross outflows, thus preventing the denominator from becoming very small or even negative.

29. A number of assumptions needed to be made to approximate the LCR for Panama. Available data for the cash outflows on maturing wholesale liabilities and repo agreements is reported only at a residual maturity of 12 months. Based on evidence shared by the SBP, it was assumed that 1/12th of wholesale liabilities and all of the repos mature within the next month. Additionally, deposits at *Banco Nacional de Panamá*, a state-owned bank entrusted with certain functions typically carried out by the central bank, were given the HQLA-haircut of 0 percent foreseen for reserves at central banks. Text Table 5 summarizes the components of the LCR taken into account in the present case.

30. The results of the LCR approximation confirm that the Panamanian banking system is highly liquid on average, yet some banks would not meet the new standard. Keeping in mind the margin of error introduced by the aforementioned assumptions, the median LCR is calculated to be 284 percent as at December 2014, well above the Basel III requirement of 100 percent. However, the tails of the distribution are thick, with some banks around 1000 percent and some clearly below the 100 percent mark – the lower quartile lies at 125 percent. Specifically, nine banks are assessed not to hold a sufficient amount of high-quality assets given their liability structures, although they are compliant according to the Panamanian liquidity requirement (Text Table 6). Upon closer inspection, the limiting factor is generally the volume of cash or cash-like positions that is often too low to allow inclusion of the entire volume of available Level 2 assets.

Text Table 5. Approximation of LCR for Panamanian Banking Sector

Numerator of LCR: High-Quality Liquid Assets	Weighting Factor
Level 1 Assets (cash, deposits in *Banco Nacional de Panamá,* debt securities with risk weighting of 0%)	100%
Level 2 Assets (Sovereign exposures with risk weighting of 20% and corporate debt securities rated AA- or higher)	85%
Denominator of LCR: Net Cash Outflows	**Weighting Factor**
Customer deposits outflows (all assumed in "unstable" category)	10%
Wholesale funding/repurchase transactions (the volume assumed to mature within 30 days)	100%
Minus: Amounts to be received from retail and non-financial wholesale counterparties within 30 days	50%
Minus: Amounts to be received from financial institutions within 30 days	100%

31. The outcome of the liquidity test also illustrates that upgrading the liquidity regulation and data compilation would be needed to become compliant with Basel III. The current liquidity requirement ought to be brought in line with the LCR standard, while computation of the NSFR would bolster the quality of longer-term funding. In this context, efforts to compile data at the required 30-day horizon would be necessary to move from an approximation to the calculation of a Basel III-compliant LCR.

Text Table 6. Aggregate Results of LCR Approximation

LCR Measure, Banks Below the Norm	Ratio
Median LCR	284%
Lowest Quartile	125%
Number of banks below 100%	9
Share of banks below 100% in percent of system capital	6.6%

E. Interbank Contagion Risk

A Simple Model of Interbank Contagion

32. This section studies the resilience of the Panamanian banking system by tracking the effect of simulated defaults. We apply the balance sheet-based analysis proposed by Espinosa-Vega and Sole (2010) to identify banks' contagiousness and vulnerability. A single bank is assumed to fail, spreading contagion to other banks (both creditors and borrowers) through two different channels. First, institutions which are creditors to a failing bank are affected through the *credit channel*, losing a fraction λ of their deposits. Second, borrowers from the failing bank are affected through the *funding channel*. In particular, these borrowers can only replace a fraction 1-ρ of the funding they were getting from the failed bank and need to restore their balance-sheet identity. They achieve this by selling assets at a (fire-sale) price of \$1/(1+δ) on the dollar. We adopt the baseline calibration in Espinosa-Vega and Sole (2010) and assume λ=1, ρ=0.35, and δ=1. While it may be considered an extreme case, the 100-percent loss given default assumption (λ=1) reflects our conservative approach to account for potentially high uncertainty related to bankruptcy resolutions.

33. We consider three scenarios for the threshold of capital under which banks would become insolvent. As contagion travels through the network, a key question is how low a bank's capital adequacy ratio needs to be before the bank files for bankruptcy. We take an agnostic stance on this issue, and run the simulations with three different thresholds. A *high-sensitivity scenario* assumes that banks default when their CAR falls below 8 percent. In a *medium-sensitivity scenario*, banks are assumed to default when their CAR is below 4 percent. Finally, a *low-sensitivity scenario* is the most benign, assuming that banks default on their obligations (and remove their liquidity from the system) only when their capital is fully depleted. In practice, the relevant threshold will depend on country- and market-specific factors such as regulation and the ex-ante stability of the system.

34. To understand the magnitude of necessary interventions upon an exogenous default, capital losses are classified in three categories: buffer losses, injection required to restore CAR, and excess losses. After each simulation, capital losses (excluding those of the original defaulting bank) are classified as follows. *Buffer losses* are those over and above 8 percent of each bank's risk-weighted assets, whereas the *injection required to restore CAR* represents the difference between 8 percent of risk-weighted assets and actual capital after contagion brought capital below the 8 percent threshold. For defaulting banks in scenarios 1 and 2 (i.e. those banks whose capital is below 8 and 4 percent of CAR, respectively), any remaining is classified as *excess loss*.

Data

35. The data include December 2014 interbank deposits among 77 Panamanian banks, and the deposits these banks have in 151 foreign banks. Of the Panamanian banks, 27 have international license (offshore), while general-license (onshore) banks include 20 owned by residents and the remaining 30 owned by foreigners. The dataset is constructed by SBP based on banks' weekly liquidity report. Each bank reports on a weekly basis its deposits in other depository

institutions, both in Panama and abroad. Since banks report the deposits they make, and not the ones they receive, the data do not include information on foreign banks' deposits in Panama.

36. Interbank deposit data were matched with bank-level data on capital and risk-weighted assets. SBP is the supervisor of origin for 52 of the 77 Panamanian banks included in the dataset. While balance-sheet data are available for all 77 banks, only those supervised by SBP are required to report regulatory capital and risk-weighted assets data to SBP.[10] Risk-weighted assets of the remaining 25 banks were estimated by multiplying their unweighted assets by the average ratio of risk-weighted assets to unweighted assets of the banks under SBP's supervision. A similar approach was taken with regulatory capital. However, this left 11 banks below the required capital adequacy ratio (CAR) of 8 percent. For those banks we set the capital so that the CAR is equal to the median CAR of the other banks.

Text Table 7. Interbank Deposits by License Type 1/

			Destination			
			GL	GF	IL	Foreign
Origin	GL	U$S million	1,194	580	27	6,021
		as % of GL equity	31	15	1	156
		as % of GL assets	3	1	0	13
	GF	U$S million	573	940	5	7,529
		as % of GF equity	9	15	0	124
		as % of GF assets	1	2	0	16
	IL	U$S million	53	107	10	3,174
		as % of IL equity	2	5	0	138
		as % of IL assets	0	1	0	17
	Foreign		n.a.	n.a.	n.a.	n.a.

1\ GL stands for "General license, local", GF for "General license, foreign", IL for "International license".

Results

37. Capital losses following an exogenous default are only weakly related to the number of contagious defaults. Following the default of an institution, both the capital loss of the entire banking system as well as the number of contagious defaults are important indicators of the system's resilience to shocks for several reasons. For example, to assess capital needs and potential fiscal impact, information on capital losses is crucial. For monitoring the risks of a banking crisis, the number of defaults is also relevant. Figure 3 shows, for each scenario, the link between total capital losses and number of contagious defaults. While there is a natural positive relationship (to the extent that capital losses are necessary for contagion), similar levels of capital impairment can be

[10] For some banks, the regulatory capital is significantly larger than the capital that shows up in the balance sheet, as regulatory capital corresponds to a larger holding.

associated with widely different outcomes in terms of defaults. For example, in Scenario 1, seven simulations generate losses greater than U$S 1.5bn (or 1.4 percent of total assets, 13.2 percent of equity, and 3.2 percent of GDP). While up to 9 contagious defaults take place in the worst of these simulations, some feature only one or zero contagious defaults. On the one hand, the failure of a bank that receives many but small deposits (relative to depositors' capital) in the interbank market is likely to generate substantial capital losses but few instances of contagion. On the other hand, the failure of banks that receive large deposits from comparatively fewer banks is likely to be highly contagious.

38. Contagion risks stem mainly from foreign banks, while exposures to domestic general-license banks, albeit substantial, are much less contagious. Figure 4 shows, for each scenario, total capital losses and number of defaults caused by the 30 banks that inflict the largest losses on the system. The license type of the original defaulting bank is displayed in lieu of its name. The largest capital loss is generated by the simulated default of a foreign institution, and amounts to U$S 2.8bn, or 24 percent of the system's capital and 6 percent of GDP. The largest capital injection required amounts to U$S 1.4bn, or 12 percent of capital and 3 percent of GDP. While both foreign and general-license banks feature prominently in all three scenarios, the losses generated by the latter are mostly absorbed by the system's buffers. Furthermore, even in cases where defaults take place, the injection required to restore adequacy ratios is typically much smaller following the default of a Panamanian bank than that of a foreign bank. For instance, in Scenario 1, the largest injection required by the default of a general-license bank amounts to U$S180mn (Figure 4, top panel, seventh bank starting from the right). In comparison, the *average* injection required by the default of one of the foreign banks displayed in Figure 4 under this scenario is U$S330mn.

39. The systemic importance of foreign banks would be even larger if the data included foreign exposures to Panama. The dataset used here does not include foreign banks' deposits in Panama and is therefore insufficient to assess foreign funding risks. Appendix C provides an assessment of this source of risk based on cross-border exposures reported to the Bank for International Settlements (BIS). The results suggest that Panama could face a significant contraction in foreign credit availability if a bank deleveraging cycle were triggered in Europe or North America.

40. Capital losses are fairly similar across scenarios, partly reflecting the fact that vulnerable banks tend to be less contagious (Figure 3). Total capital losses across all simulations amount to $39.6bn in Scenario 1, $37.6bn in Scenario 2, and $36.4bn under Scenario 3. Differences in capital losses across scenarios will only arise if they feature different sets of failing banks, and this only happens to a limited extent in our results. The reasons are that exposures to banks that are prone to contagious defaults are small, and exposure chains are in general short. In this regard, it is worth noting for example that, out of the 50 contagious simulations in Scenario 1, 41 do not cause defaults beyond the first contagion round, 6 take two rounds, and the remaining ones take three rounds.

41. In fact, banks' contagiousness is negatively correlated with their vulnerability, implying that banks whose failures would have knock-on effects are typically more resilient to other banks' failures. We define a bank's *contagiousness* as the number of other institutions that

would fail as a result of the latter's failure. Conversely, a bank's *vulnerability* is defined as the number of simulations in which the bank failed as a result of another bank's failure.[11] Text Table 8 presents estimates from regressing Panamanian banks' contagiousness on their vulnerability, excluding from the sample those banks that are neither contagious nor vulnerable.[12]

Text Table 8. Contagiousness Vulnerability Regressions 1/

	k = 8	k = 4	k = 0
Vulnerability	-0.118	-0.196	-0.650*
	(-0.55)	(-0.72)	(-2.30)
Constant	2.187***	1.593***	1.510***
	(8.34)	(8.98)	(10.28)
No. observations	50	33	26
R2	0.006	0.016	0.180

1\ For banks that can both originate and be affected by cascades, the estimates correspond to regressions of "contagiousness" on "vulnerability".
t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

42. Offshore banks have little systemic importance in terms of deposit exposures, and spillovers to the onshore system are negligible. Text Table 9 aggregates the results of all the simulations distinguishing by the license type of the originating bank and of the banks affected by the cascade.[13] It is evident that the relationship between the offshore banking system and onshore banks is weak and asymmetric. While the failure of some onshore banks may cause problems in parts of the offshore center, the reverse does not hold. Furthermore, only two banks would have their CAR brought down below 8 percent by failures of offshore banks. No offshore bank's failure would impair another bank's capital to the extent of bringing it below 4 percent.

[11] Espinosa-Vega and Sole (2010) refer to this measure as the bank's *hazard*.
[12] Several banks are neither contagious nor vulnerable. If these were included in the regression, the estimated slope would be positive. The regressions in Table 2 are thus conditional on the bank having meaningful exposures in the interbank deposit network.
[13] Contrary to Figure 4, Text Table 9 is based on the results of *all* simulations, and not just the ones corresponding to the 30 most important institutions.

Figure 3. Panama: Total Capital Losses and Number of Defaults 1/
(Based on three scenarios related to sensitivity of bank failures to CAR)

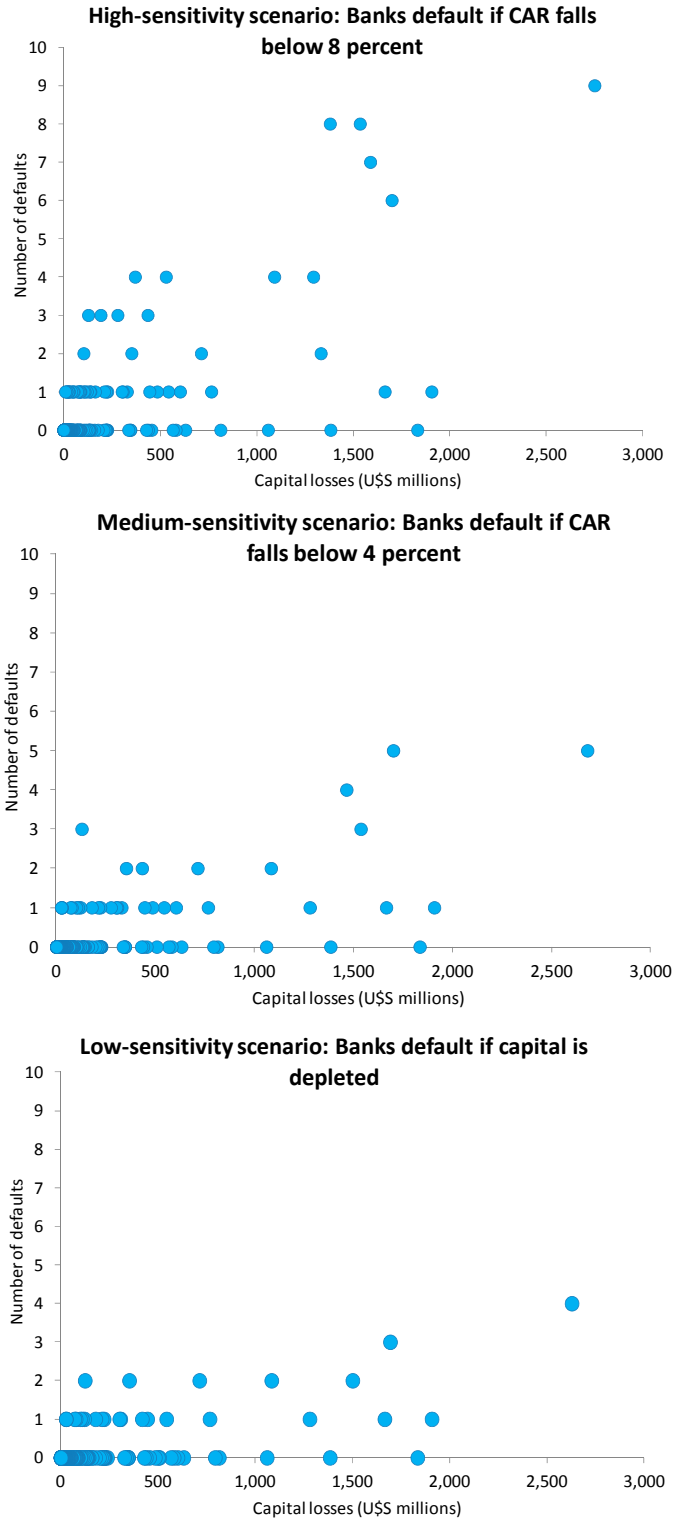
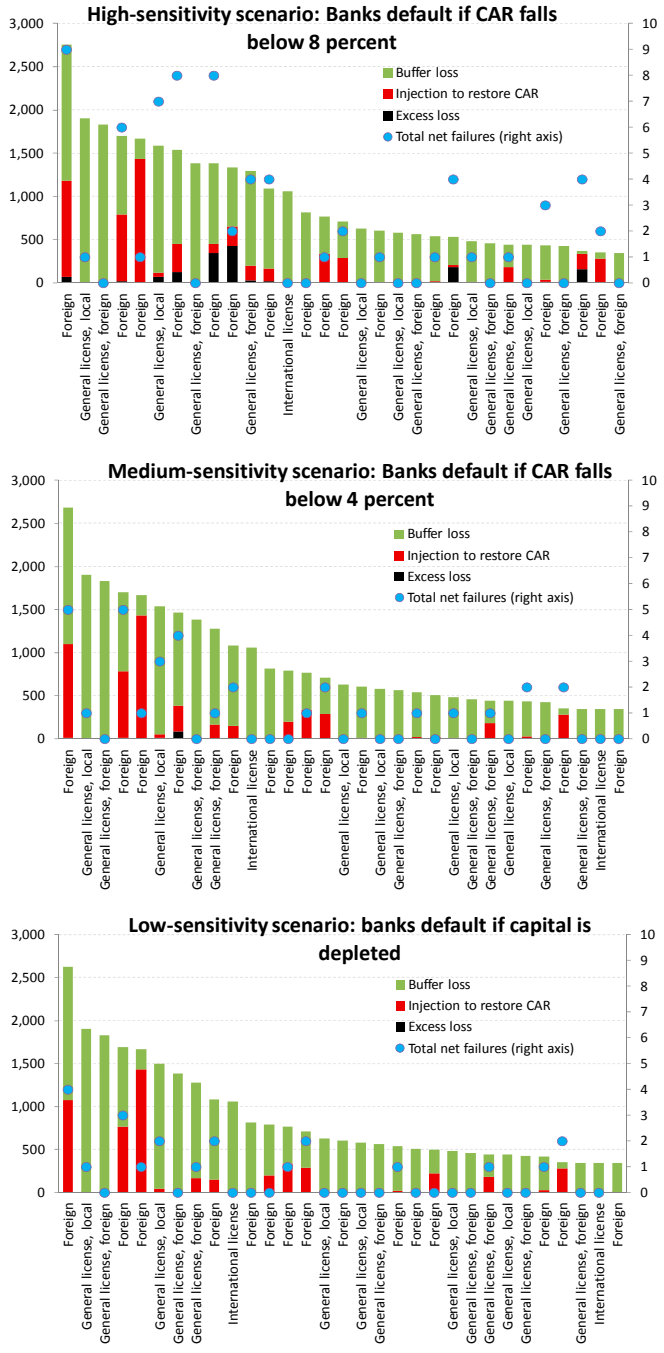


Figure 4. Panama: Capital Losses as Function of Original Defaulting Bank 1/2/

(US$ millions, 30 most systemically important institutions)



1\ Each column displays total capital losses in the banking system (excluding those of the original defaulting bank) following the exogenous default of one bank (the license type of the original defaulting bank is shown in lieu of its name). *Buffer losses* are those over and above 8 percent of RWA, whereas *injection to restore CAR* represents the difference between 8 percent of RWA and actual capital after contagion. For defaulting banks (i.e. those whose capital is below 8, 4, and 0 percent of CAR in scenarios 1,2, and 3, respectively), if remaining capital is positive then that amount is classified as *excess loss*.
2\ Total number of failures excludes original defaulting institution.

Text Table 9. Number of Failures and Capital Losses by License Type 1/

Number of failures by license type

Affected institution			Originating shock: GL	GF	IL	Foreign
High-sensit. Scenario		GL	4	0	0	18
		GF	3	6	0	37
		IL	3	2	2	32
Med.-sensit. Scenario		GL	2	0	0	7
		GF	2	3	0	16
		IL	1	0	0	20
Low-sensit. Scenario		GL	1	0	0	2
		GF	2	2	0	12
		IL	0	0	0	17

Capital losses by license type

Affected institution			Originating shock: GL	GF	IL	Foreign
High-sensit. Scenario		GL	6,369	843	46	8,508
		GF	802	7,162	43	9,640
		IL	67	117	2,775	3,269
Med.-sensit. Scenario		GL	6,337	838	46	7,453
		GF	785	7,155	43	8,770
		IL	63	109	2,772	3,213
Low-sensit. Scenario		GL	6,310	836	46	6,822
		GF	776	7,155	43	8,337
		IL	63	109	2,772	3,197

1\ GL stands for "General license, local", GF for "General license, foreign", IL for "International license". Each cell aggregates the effects of simulations by the type of license of the affected institutions. The results are colored according to deciles (e.g. the darkest red corresponds to highest contagion levels):

Color code (deciles)

1	2	3	4	5
6	7	8	9	10

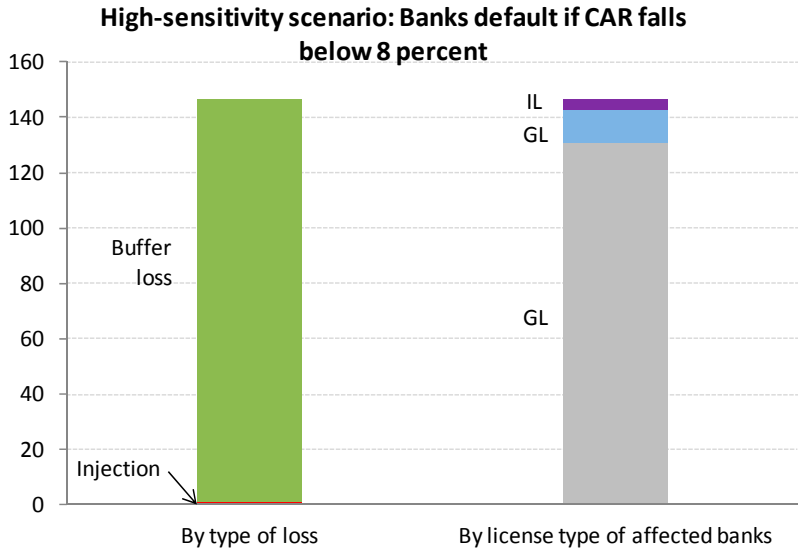
F. A Combined Shock Scenario Based on Stress Testing Results

43. This section considers the systemic implications of a scenario where banks that do not perform well in the individual stress tests simultaneously fail, thereby affecting the rest of the banking system. In other words, we put together the results of the individual stress-testing exercise (Section C) with the interbank contagion analysis (Section D). We do so by tracking the potential effects of the simultaneous failure of those banks that fall below the regulatory CAR in the *severe* stress-testing scenario.

44. The simultaneous shock would have modest implications for the rest of the banking system. In all contagion scenarios (high-, medium-, and low-sensitivity), total capital losses (excluding those of the originally defaulting institutions) would amount to $147mn.[14] Even though almost all of these losses (97 percent) are concentrated in the onshore system, the shock would not cause the default of any onshore bank in any of the scenarios (Chart 7). In terms of the offshore system, one bank would require a capital injection of less than $1mn in order to restore its CAR to 8 percent. Moreover, this offshore bank would only fail in the high-sensitivity scenario, as the post-shock capital would remain above 4 percent of risk-weighted assets.

Chart 7. Capital Losses with Combined Shock Scenario

(US$ millions)



45. Further assessments of systemic-risk should consider the response to common shocks, and incorporate additional channels for contagion. The methodology employed in this section is

[14] For conciseness, here we show the results for the high-sensitivity scenario. However, total capital losses differ by less than U$S 0.1 million across scenarios. In the medium- and low-sensitivity scenarios no contagious default takes place, and thus no capital injection is required.

well-suited for studying the systemic implications of idiosyncratic bank failures. Such failures are not necessarily related to underlying developments in the real economy, as is the case, for example, when bankruptcy is filed upon fraud or corruption cases. However, from a regulatory standpoint, it is also important to evaluate how the system would cope should a shock affect several institutions simultaneously. In this sense, it is particularly important to take into account and understand the potential implications of common exposures in the real economy. These common exposures may also open additional avenues for propagation that are not taken into account in the analysis of this section. More specifically, institutions under stress may be forced to deleverage through fire sales, thereby indirectly affecting the balance sheet of all institutions holding similar asset classes.

G. Concluding Remarks

46. Panama's banking system has performed well in recent years and appears resilient to a variety of shocks. Key financial soundness indicators remain at levels indicating low risk, although some of them have lately worsened somewhat. Pockets of vulnerabilities exist in the dependence of local interest rates on U.S. monetary policy action and in excess capacity in commercial real estate. Another weakness is the relatively high debt of households that, going forward, may impair their payment capacity in times of distress.

47. The banking system seems able to withstand reasonably severe shocks. Ample initial capital buffers and bank profitability prevent translation of higher loan defaults under stress into materially impair capital adequacy ratios. Only a number of smaller banks would fail the stress test featuring a slowdown and a moderate increase in rates interest rates, while only extreme conditions (recession in combination with sharply rising interest rates) would lead to widespread undercapitalization. However, it would take an unprecedented degree of shocks to cause a systemic event erasing one-fourth of system capital, whereas under less extreme assumptions the projected decline in system capitalization would appear manageable.

48. On average liquidity holdings are more than adequate, although pockets of vulnerability exist. As was to be expected from the large share of highly liquid instruments that Panamanian banks maintain, the median LCR is about three times the minimum required by Basel III. At the same time, a number of banks would not meet the LCR requirement at this point, owing to insufficient cash positions limiting the inclusion of lesser-quality liquid assets in the overall stock of high-quality liquid assets. Updating the liquidity regulation and corresponding data collection to ensure compliance with Basel III liquidity norms should therefore be a policy priority.

49. Contagion risks stem mainly from foreign banks, while exposures to domestic general-license banks, albeit substantial, are much less contagious. While failures of both domestic and foreign banks would result in significant capital losses for Panamanian banks, the risk of contagion propagation is much higher in the case of the latter. In fact, the systemic importance of foreign banks would be further magnified when funding risk through foreign banks' exposure to Panama is taken into account. As a final cautionary note, and as noted in the previous section, a more

comprehensive systemic-risk analysis should consider the response to common shocks, and incorporate additional channels for contagion.

References

Cerutti, E. (2013), *Banks' Foreign Credit Exposures and Borrowers' Rollover Risks: Measurement, Evolution and Determinants,* IMF Working Paper WP/13/09.

Espinosa-Vega, M. and J. Sole (2010), *Cross-Border Financial Surveillance: A Network Perspective*, IMF Working Paper WP/10/105.

Basel Committee on Banking Supervision (2013), *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, January 2013.

Beck, N. and J.N. Katz (2009), *Modeling Dynamics in Time-Series-Cross-Section Political Economy Data*, California Institute of Technology Social Science Working Paper 1304.

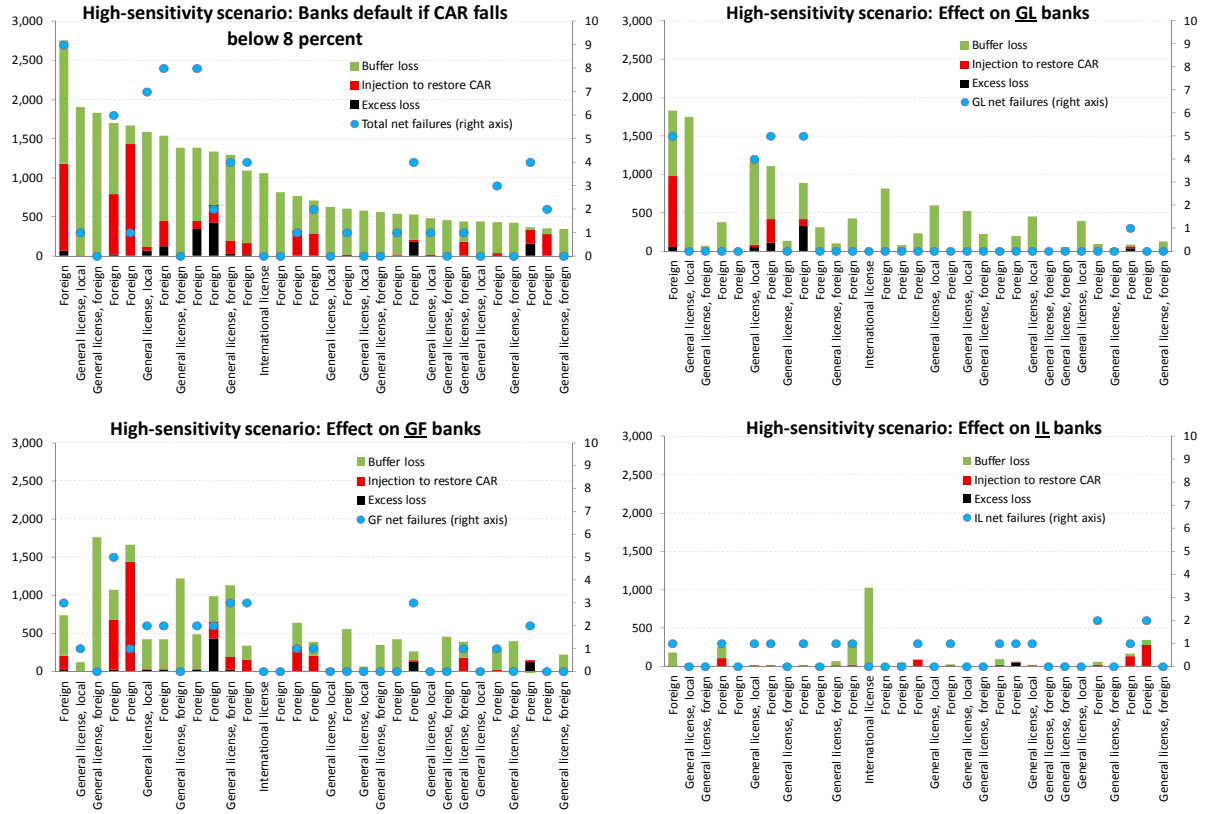
Henry, J. and C. Kok (2013), *A Macro Stress Testing Framework for Assessing Systemic Risks in the Banking Sector*, ECB Occasional Paper No. 152.

Wawro, G.J., C. Samii, and I.P. Kristensen (2011), *On the Use of Fixed Effects Estimators for Time-Series Cross-Section Data*, mimeo. Available at: https://files.nyu.edu/cds2083/public/docs/kristensen_etal.pdf.

Appendix I. Contagion Analysis - Capital Losses by License Type

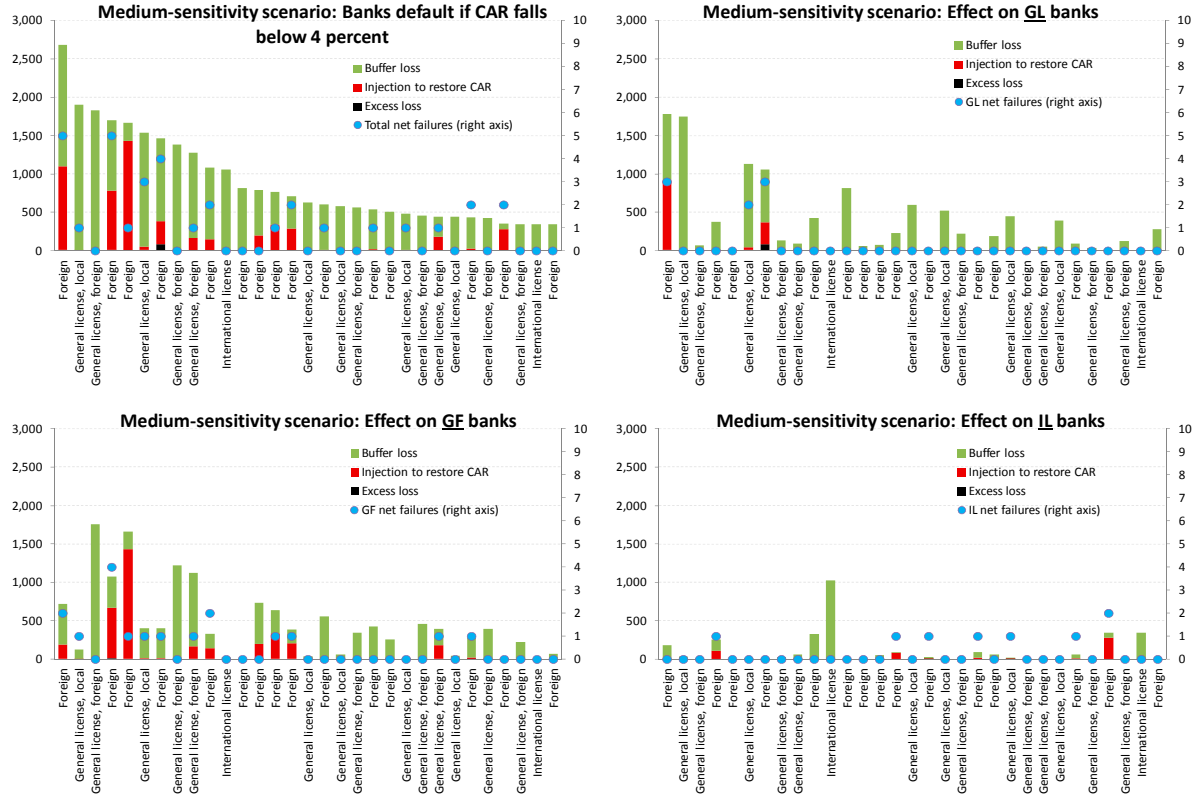
The top-left panel in Appendix I Figures 1–3 correspond to the results shown in Figure 3 in the main text, whereas the remaining panels present the breakdown by the license type of the affected institution.

Appendix I Figure 1. Capital Losses as Function of Bank Originating Cascade 1/ 2/
High-sensitivity scenario
Breakdown by Type of Bank Being Affected
(US$ millions, 30 most systemically important institutions)



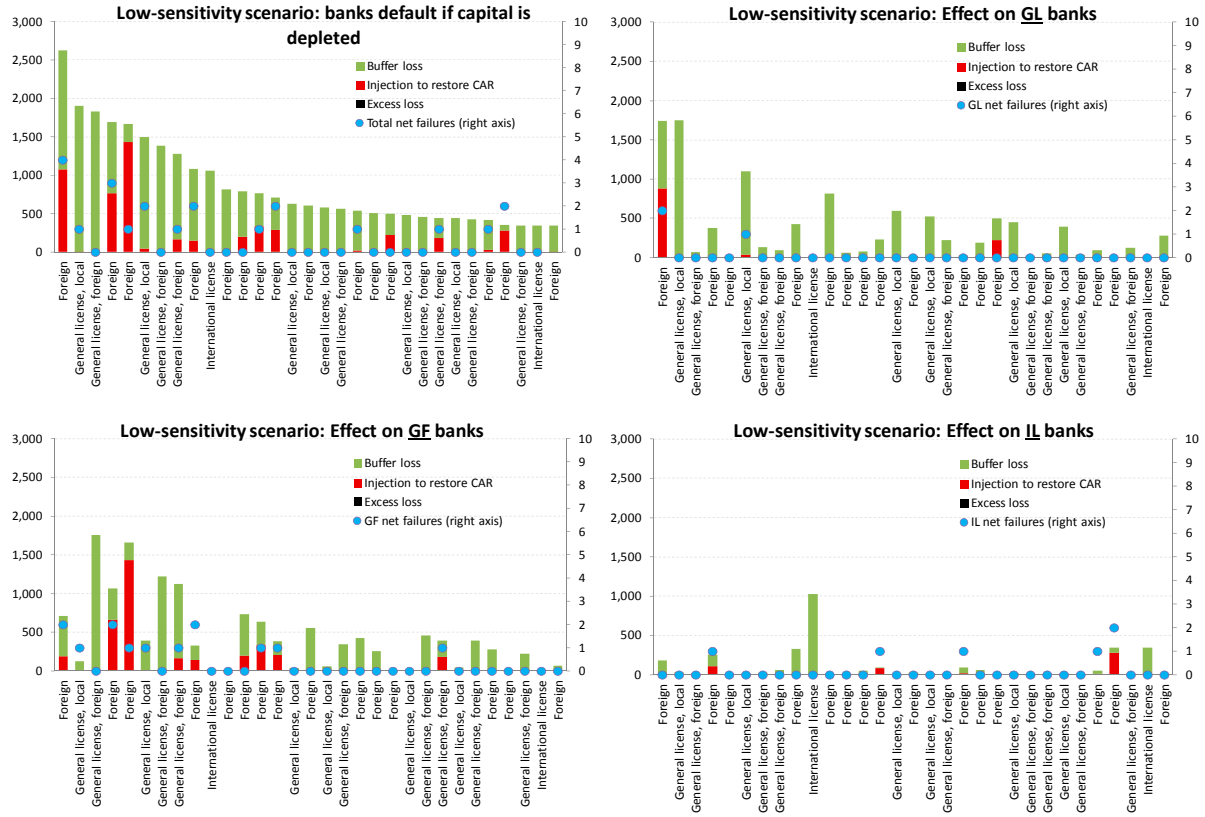
1\ Each column displays total capital losses in the banking system (excluding those of the original defaulting bank) following the exogenous default of one bank (the license type of the original defaulting bank is shown in lieu of its name). *Buffer losses* are those over and above 8 percent of RWA, whereas *injection to restore CAR* represents the difference between 8 percent of RWA and actual capital. For defaulting banks (i.e. those whose capital is below 8, 4, and 0 percent of CAR in scenarios 1,2, and 3, respectively), if remaining capital is positive then that amount is classified as *excess loss*.
2\ Total number of failures excludes original defaulting institution.

Appendix I Figure 2. Capital Losses as Function of Bank Originating Cascade 1/ 2/
Medium-sensitivity scenario
Breakdown by Type of Bank Being Affected
(US$ millions, 30 most systemically important institutions)



1\ Each column displays total capital losses in the banking system (excluding those of the original defaulting bank) following the exogenous default of one bank (the license type of the original defaulting bank is shown in lieu of its name). *Buffer losses* are those over and above 8 percent of RWA, whereas *injection to restore CAR* represents the difference between 8 percent of RWA and actual capital. For defaulting banks (i.e. those whose capital is below 8, 4, and 0 percent of CAR in scenarios 1,2, and 3, respectively), if remaining capital is positive then that amount is classified as *excess loss*.
2\ Total number of failures excludes original defaulting institution.

Appendix I Figure 3. Capital Losses as Function of Bank Originating Cascade 1/ 2/
Low-sensitivity scenario
Breakdown by Type of Bank Being Affected
(US$ millions, 30 most systemically important institutions)



1\ Each column displays total capital losses in the banking system (excluding those of the original defaulting bank) following the exogenous default of one bank (the license type of the original defaulting bank is shown in lieu of its name). *Buffer losses* are those over and above 8 percent of RWA, whereas *injection to restore CAR* represents the difference between 8 percent of RWA and actual capital. For defaulting banks (i.e. those whose capital is below 8, 4, and 0 percent of CAR in scenarios 1,2, and 3, respectively), if remaining capital is positive then that amount is classified as *excess loss*.
2\ Total number of failures excludes original defaulting institution.

Appendix II. Foreign Downstream Exposures

Panama's claims on foreigners—its "downstream exposures"—are broadly distributed internationally, with a significant share corresponding to LA5 economies. The data reported to the BIS can also be used to study Panama's exposure by borrower country. The Panamanian banking system's global downstream exposure amounts to almost 40 percent of GDP as of 2014Q3, significantly higher than the corresponding figures for other BIS-reporting LA5 economies.

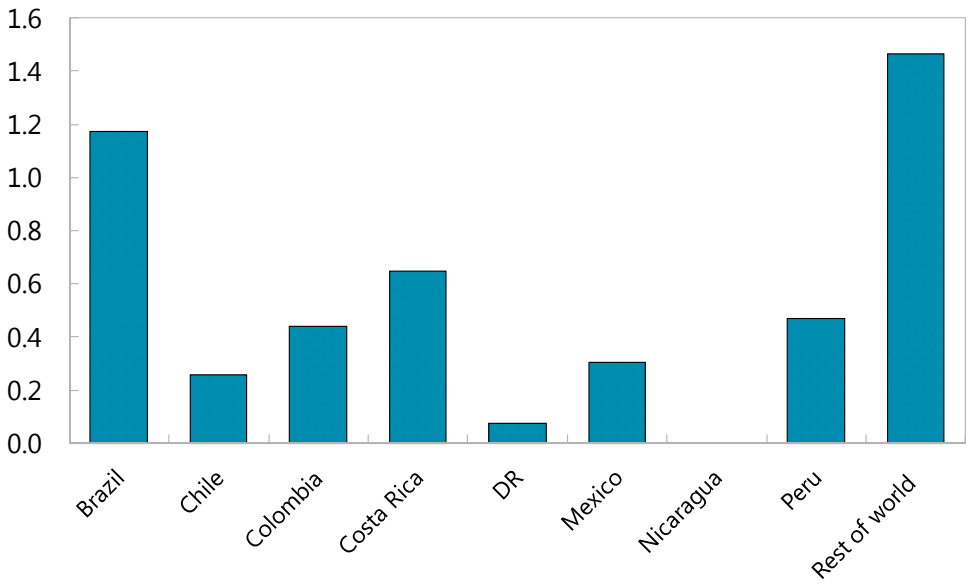
The high bilateral downstream exposures through lending to foreign clients imply significant potential credit losses. Estimated using inputs from the IMF's Vulnerability Exercises for Advanced and Emerging Economies and employing standard loss-given-default ratios (75 percent for the sovereign and 60 percent for the private sector), potential downstream losses amount to almost 5 percent of GDP, with Brazil accounting for about a quarter of this total. Compared to other BIS-reporting LA5 countries, potential losses of Panamanian banks are several times larger. Overall, the results confirm the findings of the main text in terms of the potential credit risks stemming from foreign exposures of Panamanian internationally-active banks.

Downstream exposure of Panama's banking system

	Total	Brazil	Chile	Colombia	Costa Rica	DR	Mexico	Nicaragua	Peru	Rest of world
Exposure (% of GDP) [1/]	38.9	3.6	0.8	2.1	2.1	0.4	2.9	0.0	2.0	25.0

Source: IMF staff calculations based on BIS, Bankscope, ECB, and IFS data.
[1/] Total refers to the downstream exposure (cross-border claims plus foreign claims) of the Panamanian banking system vis-à-vis all borrowers in the rest of the world. For the other countries indicated as column heading, these are the bilateral claims of the Panamaian banking system vis-a-vis borrowers in each country.

Panama: downstream exposure potential losses (% of GDP)



Source: IMF staff calculations based on BIS, Bankscope, ECB, and IFS data, using the IMF's Research Department Bank Contagion Module.

Appendix III. Assessing Foreign Funding Risk

This Appendix assesses the funding risk from a foreign systemic event based on BIS bilateral banking statistics. To complement the analysis of the main text, here we examine the risks posed by the exposures of foreign banks to Panamanian residents (that is, the "upstream exposures" of Panama). BIS-reporting banks' claims on Panama amount to about 73 percent of GDP. This is significantly higher than the upstream exposures of other LA countries and gives rise to considerable funding risk.

Upstream exposure of Panama to foreign credit availability

	Total	Brazil	Chile	Colombia	Costa Rica	DR	Mexico	Nicaragua	Peru
Exposure (% of GDP)	73.0	11.5	21.2	6.1	0.1	4.0	6.4	2.2	6.5

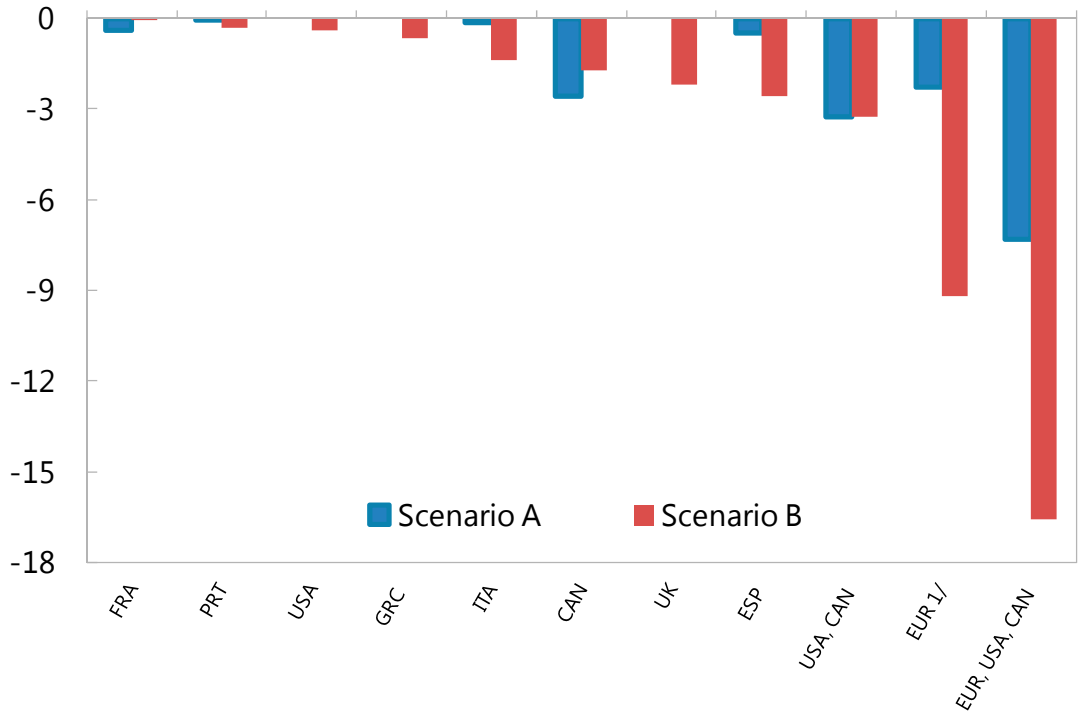
Source: IMF staff calculations based on BIS, Bankscope, ECB, and IFS data.

Foreign credit availability in Panama may be significantly affected in case of adverse shocks to foreign banks' balance sheets. This approach measures the potential impact of a shock to the banking system in a foreign country on the availability of foreign credit in Panama (see Cerutti (2013) for details on the methodology). It is assumed that the shock leads to defaults on a given percentage of bank assets, which forces the banks to deleverage in order to restore capital at the prescribed adequacy level. The exercise covers two shocks: a uniform 3 percent default rate for banking systems in each creditor country considered (scenario A), and a country-specific default rate based on the change in their NPL indicators in recent years (scenario B).[1] Intuitively, higher exposure and weaker capital position translate into stronger impact from deleveraging. The results in Appendix III Figure 1 indicate that shocks in Europe and North America lead to significant declines in credit availability to Panama, with a joint shock (to bank balance sheets in European countries, the U.S., and Canada) exerting credit contractions in Panama of 7.3 percent of GDP and 16.6 percent of GDP in scenarios A and B, respectively.[2]

[1] Scenario A: default rate equals 3 percent on all on-balance sheet claims (all borrowing sectors/all countries). Scenario B: losses amounting to 2.5 percent, 5 percent, and 10 percent, respectively, of bank balance sheet claims in countries whose change in non-performing loans (NPLs) from 2007 to 2012 was between 0 and 2.5 percent (Canada, Germany, France, and The Netherlands); between 2.5 and 5 percent (US and UK); and above 5 percent (Greece, Ireland, Italy, Portugal, and Spain).

[2] The reduction in foreign banks' credit due to the impact of the shock to their balance sheet assumes a uniform deleveraging across domestic and external claims. All simulations are based on BIS bilateral banking statistics as of 2014Q3.

Appendix III Figure 1. Impact on Credit Availability from shocks to BIS-reporting Banks of Selected Countries (% of GDP)



Source: IMF staff calculations based on BIS, Bankscope, ECB, and IFS data, using the IMF's Research Department Bank Contagion Module.
1/ Country group "EUR" includes Greece, Ireland, Portugal, Italy, Spain, France, Germany, The Netherlands, and UK.

INTEREST RATES IN PANAMA: U.S. PASS-THROUGH AND ITS EFFECTS ON LOCAL ECONOMIC ACTIVITY[1]

A. Executive Summary

1. ***Interest rates in Panama track closely U.S. interest rates, but with a pass-through lower than expected for a dollarized economy.*** *Furthermore, lending rates exhibit lower sensitivity than deposit rates, making intermediation margins respond negatively to movements in U.S. rates.*

2. ***The effect of U.S. interest-rate normalization is likely to be cushioned through lower intermediation margins, without significantly affecting banks' overall profitability or economic growth.*** *The expected increase in U.S. interest rates is likely to compress intermediation margins in Panama. However, this would not affect banks' profitability, as the returns on liquid assets would increase. The limited real effects of U.S. interest-rate shocks are consistent with the results from an econometric exercise that incorporates real economic activity.*

B. U.S. Interest-Rate Pass-Through

3. Short-term deposits represent the bulk of the deposit base, while lending is mainly concentrated in the commercial sector. Almost three-quarters of the deposit base of Panamanian banks correspond to deposits of up to one month maturity (Chart 1). In terms of retail credit exposures, about half of recently issued loans correspond to the commercial sector. The analysis in this Annex therefore focuses on the one-month deposit rate, and the one-year commercial lending rate[2].

4. While Panamanian rates track closely U.S. interest rates, the pass-through is lower than expected for a dollarized economy. Regression analyses between Panamanian interest rates and U.S. rates of the same maturity show that the pass-through from U.S. rates is substantially lower than 1, typically in the range 0.5–0.8 for deposit rates and between 0.1–0.3 for lending rates (Text Table 1; see also Chart 2).[3] A possible explanation for the low pass-through is that Panamanian

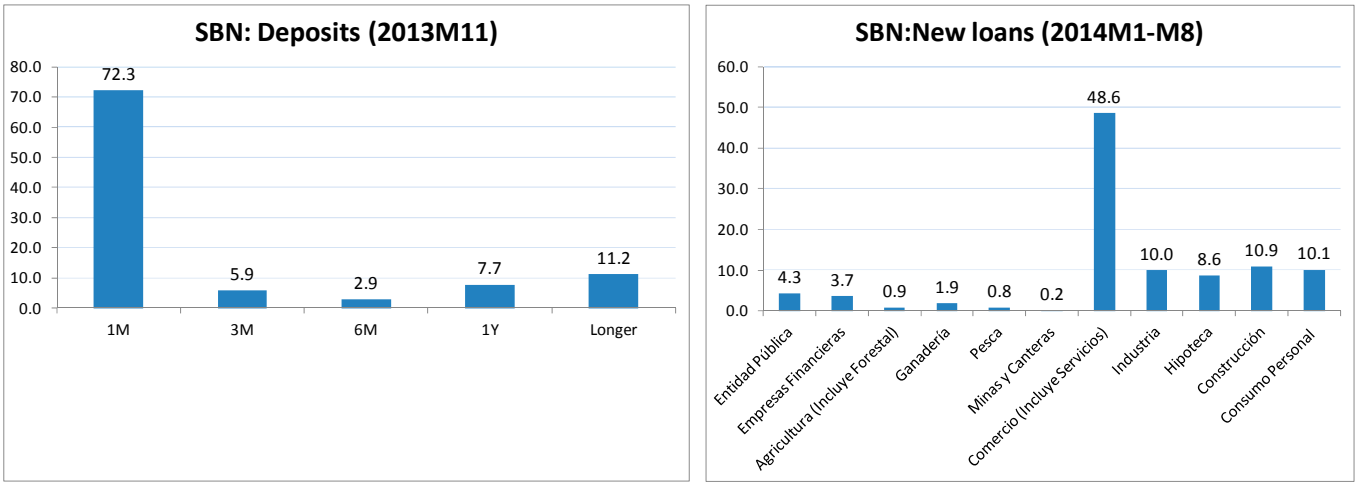
[1] Prepared by D. Cerdeiro and W. Shi.

[2] There are no data available on the maturity profile of loans by sector. The interest rates reported by the Superintendency of Banks (SBP) correspond to new deposits and loans (i.e. they are *marginal* rates), and are the simple (i.e. unweighted) average across banks and customers.

[3] The relatively low pass-through from U.S. rates has already been pointed out by Swiston (2011), who also presents estimates for other dollarized economies in the region (Ecuador and El Salvador). Table 3 in the Appendix presents regression results that allow for different responses to U.S. interest rate increases and decreases. The pass-through is typically higher for U.S. rate increases, but the largest pass-through (at 0.85) is only slightly larger than the largest one found the regressions of Table 1.

banks need to compete for deposits in a context of high credit growth, and therefore reductions in U.S. rates are not fully reflected in domestic deposit rates.[4] Furthermore, while banks may be able to get cheaper financing from foreign wholesale sources in the short run, they have traditionally leaned towards domestic deposits as a more stable way of financing. Table 1 also shows that both deposit and lending rates present a higher pass-through from the U.S. 5-year government bond yield, which may suggest that investors arbitrage Panamanian assets with U.S. assets of longer (and thus riskier) maturity.

Chart 1: Panama SBN:[5] Deposit and Lending Structure
(As percent of GDP)



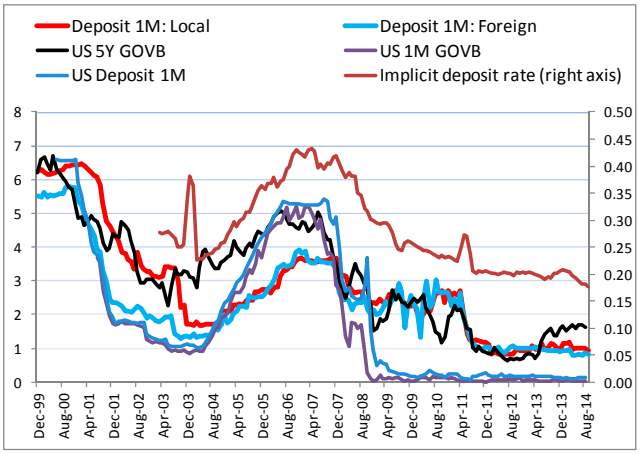
Source: Superintendencia de Bancos de Panama and staff calculations.

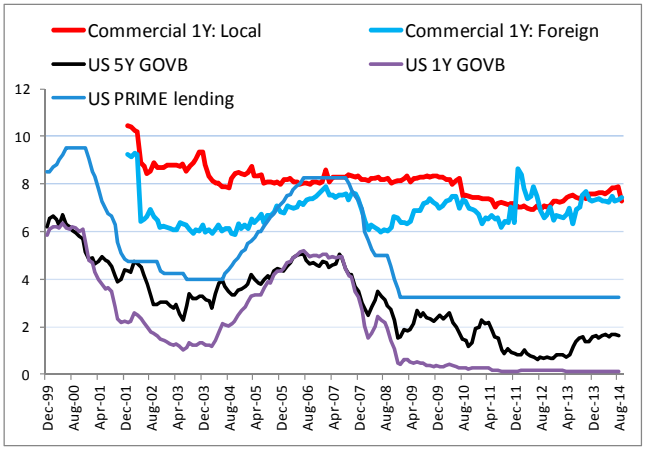
5. The decline in deposit rates in the face of more steady lending rates has opened a relatively large intermediation spread. As U.S. interest rates declined from their pre-financial crisis levels, the lower pass-through to Panamanian banks' lending rates vis-à-vis deposit rates has opened up a large bank spread of about 6 percent.

[4] A closer inspection of Figure 2 also reveals that the relation between Panamanian and U.S. rates used to be stronger in the past. Since the handover of the Canal in 1999 the Panamanian economy has become generally less dependent (and thus also less synchronized) with the U.S. cycle. The pairwise correlation in quarter-on-quarter real GDP growth rates fell from 0.4 during 1996–2001, to 0.2 during 2002–2013.

[5] SBN stands for the national bank system of Panama which excludes the offshore banks, i.e. banks that hold an international license and are prohibited by law to involve in domestic business. In terms of total deposits, the size of the offshore banks is approximately one-fifth of the onshore banks.

Chart 2: Panama Rates versus U.S. Rates





Sources: SBP and Bloomberg.
Note: Implicit deposit rate calculated as the ratio of deposit interest income in month t to total deposits in month t-1.

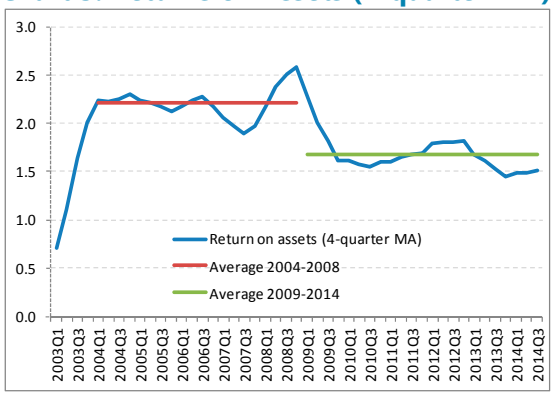
Text Table 1: Panama Interest Rate Regression

	Deposit 1M						Implicit deposit rate 1\	Commercial lending 1Y				
	Local			Foreign				Local			Foreign	
U.S. 1M deposit	0.5379***			0.5110***			0.0726***					
	(0.0000)			(0.0000)			(0.0000)					
U.S. prime lending								0.1576***			0.0642**	
								(0.0000)			(0.0164)	
U.S. 1M gov. yield		0.4908***			0.4665***							
		(0.0000)			(0.0000)							
U.S. 1Y gov. yield									0.1732***			0.0482
									(0.0000)			(0.1003)
U.S. 5Y gov. yield			0.8168***			0.7544***				0.3003***		0.0418
			(0.0000)			(0.0000)				(0.0000)		(0.4003)
VIX	0.0426***	0.0472***	0.0426***	0.0189**	0.0244***	0.0188**	0.0020***	0.0228***	0.0233***	0.0204***	-0.0162***	-0.0165***	-0.0176***
	(0.0000)	(0.0000)	(0.0000)	(0.0140)	(0.0000)	(0.0198)	(0.0056)	(0.0000)	(0.0000)	(0.0000)	(0.0008)	(0.0005)	(0.0002)
Observations	170	157	174	170	157	174	133	151	151	151	151	151	151
Adjusted R-squared	0.7723	0.6634	0.7656	0.7758	0.6714	0.7048	0.9162	0.5145	0.5331	0.6554	0.0381	0.0268	0.0197

1\ Constructed from income statement and balance sheet of banking system. Interests paid in month t divided be deposits in month t-1.
Regressions control for domestic inflation and economic activity
Robust pval in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6. However, banks' returns have actually been compressing, as larger returns on intermediation only partially offset lower returns on liquid assets. Indeed, net income on average assets of the banking sector has fallen from 2.3 percent in 2004–08 to 1.5 percent in 2009–14 (see also Chart 3). In the absence of a lender of last resort, Panamanian banks maintain ample levels of liquidity. This implies that since the onset of the financial crisis banks' interest income has been significantly affected by the low returns on its liquid positions. Hence, the widened intermediation spreads partially compensate for the negative impact of low U.S. rates on banks' profitability (Chart 4). Note that, despite the large interest-rate spreads, there are no clear signs of lack of competition in the banking sector.

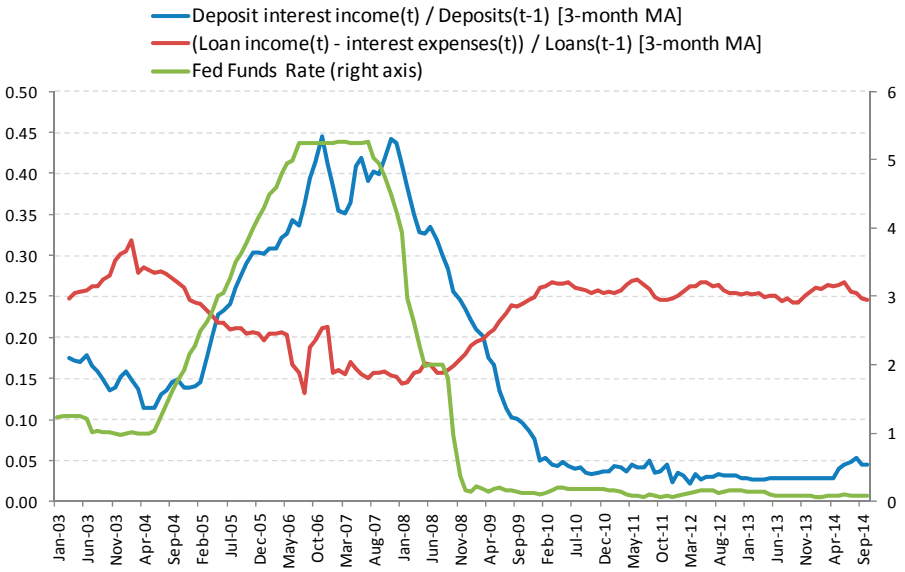
Chart 3: Returns on Assets (4-quarter MA)



Sources: SBP and staff calculations.

7. The effect of U.S. interest-rate normalization is likely to be cushioned through lower spreads, without affecting banks' overall profitability. In light of the previous results, it is not surprising that the bank lending-deposit spreads in Panama are negatively related to U.S. interest rates. Estimates indicate that a 100 basis points increase in U.S. interest rates causes a compression of spreads of about 25–40 basis points (see Text Table 2). Hence, as interest rates in the U.S. normalize, the response of lending rates is expected to be more subdued than the one for deposit rates. The effect on economic activity would be softened by a compression in spreads. The lower spreads would not be at the expense of banks' profits, as the returns on liquid assets should increase at the same time.

Chart 4: Returns on Deposits and on Intermediation



Sources: SBP and staff calculations.

Text Table 2: Panama Intermediation Spreads

	Spread: 1Y commercial lending rate - 1M deposit rate									
	Local					Foreign				
U.S. 1M deposit	-0.2515***					-0.3549***				
	(0.0000)					(0.0000)				
U.S. prime lending		-0.2779***					-0.3665***			
		(0.0000)					(0.0000)			
U.S. 1M gov. yield			-0.2959***					-0.3873***		
			(0.0000)					(0.0000)		
U.S. 1Y gov. yield				-0.2632***					-0.3853***	
				(0.0000)					(0.0000)	
U.S. 5Y gov. yield					-0.3087***					-0.5099***
					(0.0000)					(0.0000)
VIX	-0.0084	-0.0121**	-0.0146***	-0.0120*	-0.0068	-0.0297***	-0.0344***	-0.0376***	-0.0352***	-0.0279***
	(0.1877)	(0.0352)	(0.0095)	(0.0505)	(0.2608)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Observations	151	151	151	151	151	151	151	151	151	151
Adjusted R-squared	0.4145	0.4536	0.4519	0.3779	0.2960	0.4201	0.4022	0.3949	0.4125	0.4119

Regressions control for domestic inflation and economic activity

Robust pval in parentheses. *** p<0.01, ** p<0.05, * p<0.1

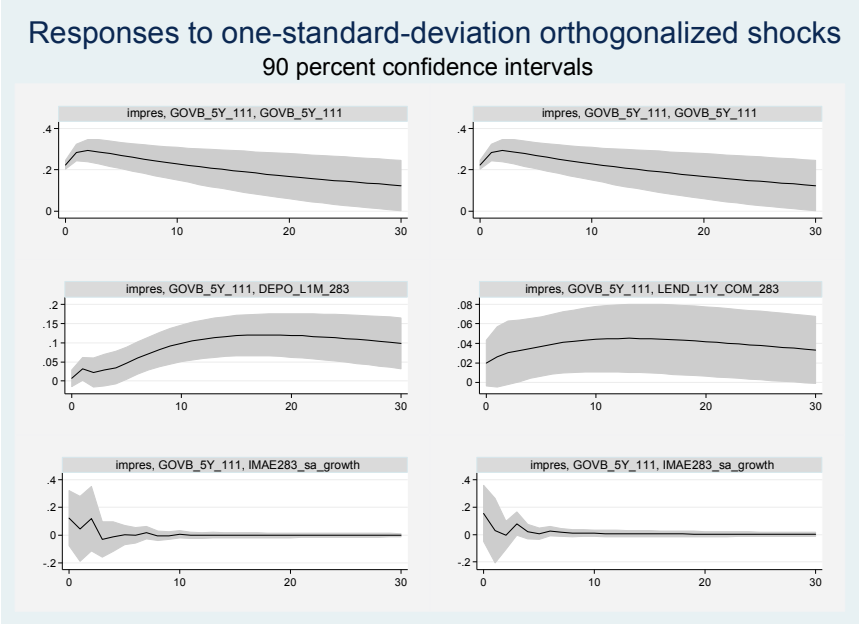
C. Effects on the Real Economy

8. The limited real effects of U.S. interest-rate shocks are consistent with the results from an econometric exercise. To investigate the spillovers from U.S. interest rates, we estimate a VAR including U.S. industrial production growth, the U.S. 5-year government bond yield, a Panamanian interest rate (local 1-month deposit or 1-year commercial lending), growth of credit to the private sector in Panama, and growth of the monthly economic activity indicator of the Panamanian economy (IMAE).[6] The data are monthly, and identification through the above (Cholesky) ordering, with U.S. variables being an exogenous block.[7] U.S. interest rate shocks have a significant and persistent effect on Panamanian interest rates, which peaks between one and two years after the shock (Chart 5). Despite this increase in rates, domestic economic activity is not affected. Furthermore, note that while the U.S. 5Y rate peaks at about 0.26 percentage points, the response of Panamanian rates is of at most 0.12 percent for deposits and 0.04 for lending, which is broadly consistent with the results in Text Table 1.

[6] The U.S. 5-year yield is used since it showed the highest explanatory power for Panama's deposit and lending rates in our previous regression analyses. Refer to Table 1.

[7] The Cholesky ordering within the Panamanian block is justified under the following identifying assumptions. Bank officials decide on a rate without taking into account total credit being given and economic activity within the month, but responding to foreign variables. Credit is affected by interest rates but not by economic activity in that same month, as firms need to plan at least one month ahead when they want to take a loan.

Chart 5: Response to U.S. Interest Rate Shocks



Notes: Model on the left column includes 1-month deposit; model on right column includes 1-year commercial lending. Each row displays the response of U.S. 5-year yield, Panamanian interest rate, and IMAE, respectively, to one-standard deviation shocks in the U.S. 5-year yield.

D. Concluding Remarks

9. Interest rates in Panama track closely U.S. interest rates, but with a pass-through lower than expected for a dollarized economy. Furthermore, lending rates exhibit lower sensitivity than deposit rates, making intermediation margins respond negatively to movements in U.S. rates.

10. The effect of U.S. interest-rate normalization is likely to be cushioned through lower intermediation margins, without affecting banks' overall profitability. The expected increase in U.S. interest rates is likely to compress intermediation margins in Panama. However, this would not affect banks' profitability, as the returns on liquid assets would increase. A VAR analysis that incorporates real economic activity suggests that movements in U.S. rates do not have large effects on the Panamanian economy.

Reference

Swiston, A. (2011), Official Dollarization as a Monetary Regime: Its Effects on El Salvador, IMF Working Paper 11/129.

Appendix I. Asymmetric Response to U.S. Rates

Table 1: Separating Positive and Negative U.S. Rate Changes

	Deposit 1M						Implicit deposit rate 1\	Commercial lending 1Y					
	Local			Foreign				Local			Foreign		
U.S. 1M deposit (+)	0.4482***			0.4681***			0.0675***						
	(0.0375)			(0.0345)			(0.0025)						
U.S. 1M deposit (-)	0.6343***			0.5570***			0.0813***						
	(0.0343)			(0.0244)			(0.0030)						
U.S. prime lending (+)								0.1301***			0.0652**		
								(0.0192)			(0.0285)		
U.S. prime lending (-)								0.2061***			0.0625		
								(0.0235)			(0.0392)		
U.S. 1M gov. yield (+)		0.4222***			0.4464***								
		(0.0332)			(0.0255)								
U.S. 1M gov. yield (-)		0.6044***			0.4999***								
		(0.0439)			(0.0286)								
U.S. 1Y gov. yield (+)									0.1580***			0.0189	
									(0.0217)			(0.0327)	
U.S. 1Y gov. yield (-)									0.1980***			0.0960**	
									(0.0322)			(0.0408)	
U.S. 5Y gov. yield (+)			0.7551***			0.7058***				0.2857***			0.0131
			(0.0467)			(0.0430)				(0.0292)			(0.0528)
U.S. 5Y gov. yield (-)			0.8477***			0.7788***				0.3125***			0.0657
			(0.0379)			(0.0413)				(0.0321)			(0.0551)
VIX	0.0375***	0.0429***	0.0385***	0.0165**	0.0231***	0.0156*	0.0018***	0.0180***	0.0219***	0.0193***	-0.0160***	-0.0194***	-0.0198***
	(0.0081)	(0.0069)	(0.0100)	(0.0072)	(0.0054)	(0.0082)	(0.0006)	(0.0033)	(0.0035)	(0.0032)	(0.0053)	(0.0050)	(0.0049)
Observations	170	157	174	170	157	174	133	151	151	151	151	151	151
Adjusted R-squared	0.8046	0.6929	0.7745	0.7858	0.6734	0.7123	0.9305	0.5455	0.5347	0.6569	0.0315	0.0367	0.0266

1\ Constructed from income statement and balance sheet of banking system. Interests paid in month t divided be deposits in month t-1.

Regressions control for domestic inflation and economic activity

Robust pval in parentheses. *** p<0.01, ** p<0.05, * p<0.1

PANAMA: INVESTMENT AND GROWTH[8]

A. Executive Summary

1. ***Panama's growth has been strong over the last decade, supported by productivity enhancement and public investment.***

2. ***There is evidence that public investment has had a positive impact not only on growth but also on private investment (crowding-in).***

3. ***Going forward, sustaining a strong growth performance will depend more on productivity and human capital accumulation, hence the quality of macroeconomic policies and structural reforms will remain crucial.***

B. Brief Review of Economic Growth

4. **Panama's growth performance has been strong compared to other countries in the region.** Between 1990 and 2014, growth averaged 6.5 percent in Panama, compared with 3.1 percent for the region and 3.6 percent for global output. Between 2007 and 2014, average growth rate accelerated to 8.7 percent, placing Panama as one of the fastest growing economies in the world. This note attempts to highlight the main drivers behind Panama's strong growth performance. In particular, it investigates the contribution of public investment to growth and shows the implications for future economic performance.

Chart 1. Panama: Average Output Growth
(1990–2014)

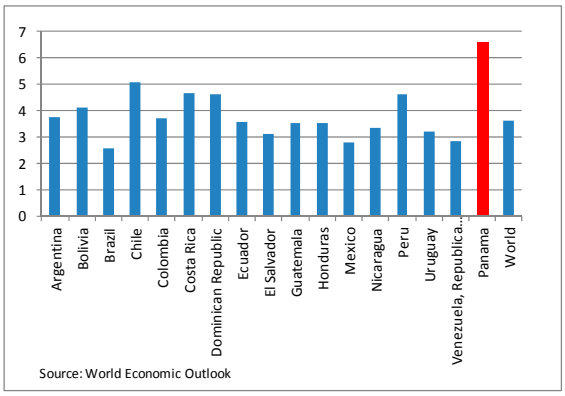
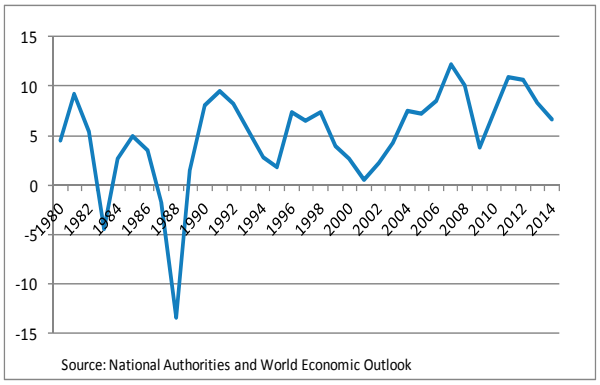


Chart 2. Panama: GDP Growth
(1980–2014)



[8] Prepared by F. Yang and D. Cerdeiro. We are grateful to A. Buzaushina to valuable contributions.

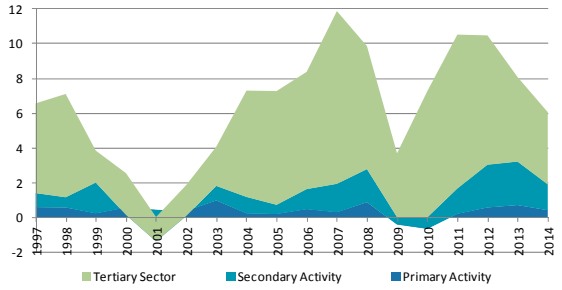
5. Reflecting its comparative advantage, Panama's economic development has focused on services. The service sector benefited significantly from the rapid expansion of global trade since the 1990s, the economic boom of the region, and the strong demand from emerging Asia. Accounting for about ¾ of total GDP and about ²/₃ of employment, the services industry is the most important contributor to the economy. The shares of agriculture, fishing and manufacturing have been decreasing in GDP over the years, but they still account for about ¹/₃ of employment.

Text Table 1 Panama: Sector Shares of GDP
(1997–2014)

	1997-2014	1997-2006	2007-2014
Agriculture, and fishing	6.0	7.1	4.5
Manufacturing	7.4	9.0	5.4
Mining & quarrying	1.2	0.8	1.6
Construction	5.2	3.9	6.8
Transport and communications	18.4	15.1	22.5
Commerce, restaurants, and hotels	18.8	17.1	20.8
Financial Intermediation	8.4	8.5	8.3

Source: Panama National Authorities and staff estimates.

Chart 3: Panama: Sector Contribution to GDP



6. Panama has experienced a number of negative external shocks since 1980s and the economy became more resilient since the 1990s. Panama's economy suffered substantially during the Latin American debt crisis in the early 1980s and the U.S. invasion in the late 1980s. In contrast, during the Tequila crisis in 1994–95, the global economic slowdown in 2000–01, and the global financial crisis in 2008–09, Panama's economy demonstrated impressive resilience. It maintained positive growth during these periods, and recovered relatively quickly from them. Sector performance during the shocks showed that the manufacturing industry is more volatile and susceptible to shocks than the primary and service industries.

C. Growth Accounting

7. To assess the drivers of economic growth in Panama, we first calculated the contribution to growth from factor inputs, namely, labor, capital and total factor productivity (TFP). Capital input is generated using the usual perpetual inventory model[9]. Assuming a Cobb-Douglas production function, we obtain the following:

$$Y_t = A_t K_t^{\alpha} L_t^{(1-\alpha)} \qquad (1)$$

where Y_t is the level output, K_t is capital input; L_t is labor input, (the number of employees in the economy adjusted by education attainment represented by average years of schooling obtained from Barro and Lee (2013)), while A_t is the technology or total factor productivity (TFP) and α is assumed at 0.5. TFP is then computed via:

[9] $K_t = (1-\delta)K_{t-1} + I_t$ where depreciation rate δ is assumed at 0.05, a quite common assumption in non-OECD countries.

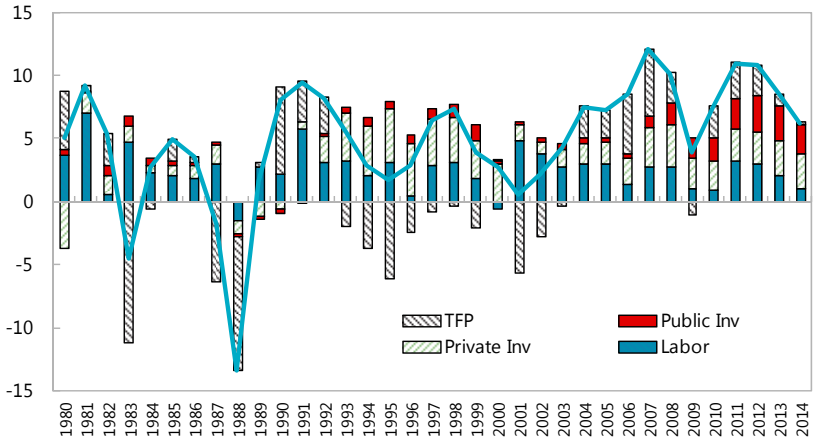
$$A_t = \frac{\mathrm{Y_t}}{K_t^{\alpha} L_t^{1-\alpha}}$$

The resulting GDP growth decomposition is presented in the following table.

Text Table 2. Panama: Real Growth and Input Contributions (%)

	1980-2014	1980-1990	1991-2003	2004-2014
GDP	5.0	2.3	4.5	8.4
Capital	2.7	0.7	3.3	4.0
Public	0.8	0.2	0.5	1.6
Private	1.8	0.2	2.7	2.5
Labor	2.5	2.6	2.8	2.2
TFP	-0.2	-1.1	-1.6	2.3
Memorandum item				
Investment/GDP (%)	19.3	11.2	21.9	25.0

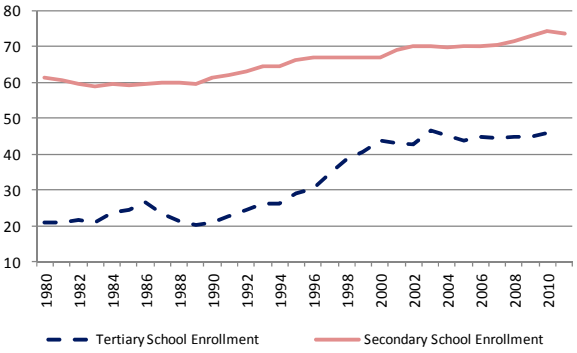
Chart 4. Panama: Growth and Input Contribution



8. The decomposition suggests that labor contribution to output growth has been relatively stable. Employment increased as the economy grew, while education indicators improved over the years. Enrollment rates compare favorably with peers in the region. In particular, tertiary education enrollment accelerated since the 1990s, and doubled from 22.7 percent in 1991 to 45.7 percent in 2010. Average years of schooling of the population of 15 years and older increased from 7.7 years in 1990 to 9.6 years in 2010. However, the quality of education could be a constraint to human capital accumulation. In 2009, Panama participated for the first time in the Program of International Student Assessment (PISA) administered by the OECD. The result indicated that

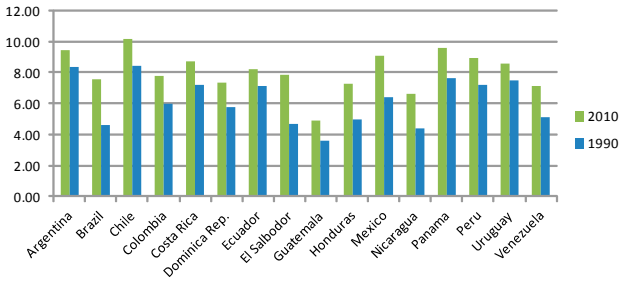
Panama performed below what its income and investment in education would predict, as did a large number of Latin American countries[10].

Chart 5. Panama: School Enrollment (%, 1970–2012)



Source: World Bank

Chart 6. Panama: Years of Average Schooling of +15 Year Olds



Source: Education attainment dataset.

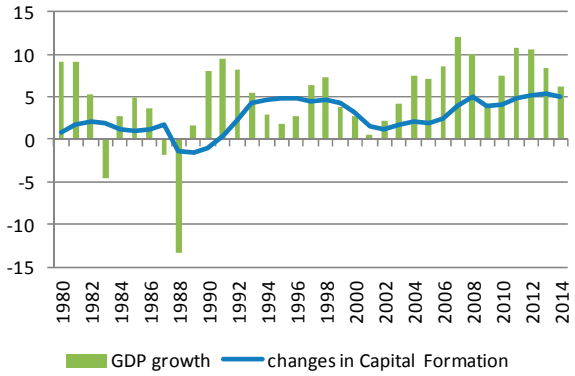
9. The quality of education and the mismatch between demand for skilled labor and supply could potentially be an impediment to medium term growth. The current unemployment rate, at about 4.8 percent, indicates tight labor market conditions. As output grows fasters in sectors that are skill intensive, human capital may become a constraint. To address this issue, it is important to increase the efficiency of investment in education and further reform the labor market to alleviate skill mismatches and ensure better job opportunities.

10. Capital input contribution to output increased over time. While the 1980s were marked by a lack of investor confidence, private investment surged with remarkable strength in the 1990s. Since the turn of the century, both private and public investment have boosted growth. In the period between 2007 and 2014, output growth averaged 8.7 percent, above the potential output

[10] Alejandro J. Ganimian and Alexandra Solano Rocha (2011): "Measuring Up? How did Latin America and the Caribbean Perform on the 2009 Program for International Student Assessment (PISA)?" Partners for Educational Revitalization in the Americas.

growth, with fixed asset investment by both public and private sectors contributing to almost half of output growth.

Chart 7. Panama: Output Growth and Capital Formation



Sources: National Authorities and staff estimate.

11. TFP did not contribute to output growth until 2004. TFP registered negative contribution to growth in the 1980s and 1990s, indicating weaknesses in improving economic efficiency during the period. In the last decade, however, TFP's contribution accounted for about ¼ of output growth. The results regarding TFP's contribution are robust to alternative assumptions about the capital share. In particular, TFP growth remained consistently negative for the 1980s and 1990s, and consistently significant and positive for the last decade when intensive reforms took place in Panama.

Text Table 3. Panama: Sensitivity Test: TFP Growth with Alternative Factor Shares

Assumption of capital share	TFP contribution to growth (%)			
	1980-2014	1980-1990	1991-2003	2004-2014
0.33	-0.13	-1.68	-1.40	2.90
0.40	-0.16	-1.42	-1.47	2.65
0.50	**-0.20**	**-1.06**	**-1.57**	**2.28**
0.60	-0.24	-0.69	-1.67	1.91

Source: Staff estimate.

12. Structural reforms over the years helped to improve the competitiveness of the economy. Beginning in the 1990s, the authorities adopted an economic strategy aiming at a permanent reduction of public sector indebtedness and an economy-wide increase in productivity. Structural reforms were implemented in the 2000s to remove impediments to productivity growth and private sector investment, and to enhance the public sector capacity. They include significant efforts in privatization, trade and market liberalization, strengthening financial supervision and promotion of the private sector investment. As part of the institutional improvements to attract foreign investment, an agency for the Attraction of Investments and Promotion of Exports (Proinvex

Panama) was established as a one-stop-shop that allows the potential investors to easily identify all the investment instruments and relevant information for foreign direct investment. Measures have also been taken to increase labor mobility.

13. Private sector confidence improved. The improvements in the efficiency of the economy as well as in public finances, the better climate for private sector activities, the investment opportunities opened up by privatizations, and the reverting of the Panama Canal and the neighboring land contributed to enhancing investor confidence. Private sector investment averaged about 22 percent of GDP in 1990–2012, a substantial increase over the 9 percent average for 1980–1990. As of today, Panama ranks among the top Latin American countries in the major competitive indicators. For instance, it is the second most competitive economy in Latin America (after Chile) in the 2014 World Economic Forum Global Competitive Index. It also improved its ranking in the ease of doing business index from 65 in 2008 to 52 in 2014.

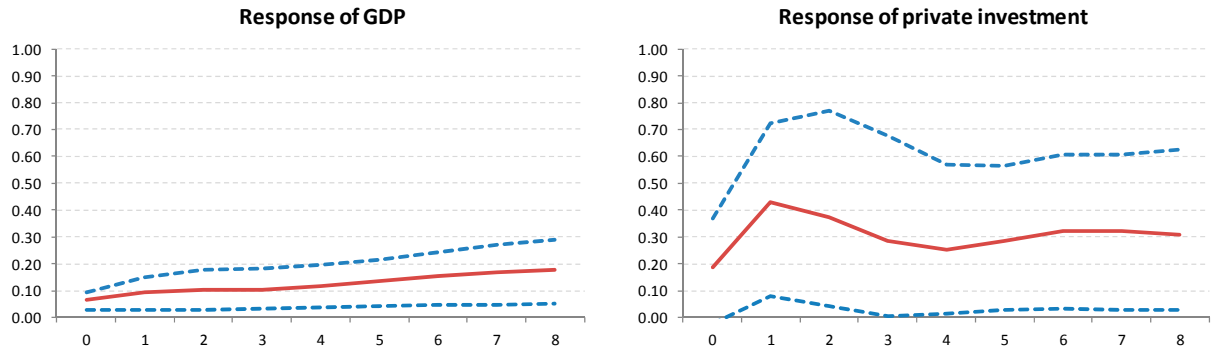
D. Impact of Public Investment on Real GDP and Private Investment

14. Results from an econometric exercise indicate that public sector investment has had a positive impact on output growth as well as on private investment. To gauge the impact of public investment on the economy, we estimated a vector error correction (VEC) model including real GDP, as well as real public and private investment (all in logs), using annual data for the period 1969–2014 (46 observations).[11] The Figure below presents the responses of GDP and private investment to a one-percent permanent shock in the level of public investment. Real GDP increases initially by about one-tenth of the increase in public investment, with a somewhat larger increase after four years.[12] Importantly, private investment also rises in response, by about one-third of the increase in public investment, with most of the effect already taking place during the first year. This confirms the "crowding-in" effect of public investment on private investment.

[11] We first ran a battery of unit root tests, and could not reject the null hypothesis of unit root for any of the three variables. Since the series were then found to be cointegrated, we chose to model the dynamics through a VEC (rather than a VAR in first differences). Shocks were identified through the following Cholesky ordering: public investment, GDP, and private investment. The model was estimated with two lags.

[12] Our results are consistent with those of Bom and Lighart (2013), who found that the average output elasticity of public capital amount to about 0.1 based on 578 estimates collected from 68 studies: *What Have We Learned from Three Decades of Research on the Productivity of Public Capital?* Journal of Economic Surveys 12037.

Chart 8. Panama: The Response to a One-Percent Public Investment Shock 1/
VEC model based on annual data for 1969–2014



1/ Point estimates and confidence intervals of the impulse-response functions were obtained through a bootstrap procedure.

E. Public Investment Since 2007

15. The economy has been in an investment boom since 2007. A number of sectors have been identified as the growth engines of the economy, including logistics, tourism, agriculture, and financial services. The vision was for Panama to become a hub for logistics services, financial services, and tourism. Consistent with the growth strategy, the authorities identified areas in which public investment and government action would yield better returns in terms of sustained economic growth and job creation. As an important component, a third set of locks on the Canal are being built to enable the transit of post-Panamax containerships through the Canal. Total investments in the Canal expansion project are estimated at US$5.3 billion. Once operational—expected in early-2016—the expanded Canal would double the transit capacity, boost growth, and facilitate other trade-related activities. The latest Strategic Plan of the government released in January 2015 announced the plan to invest US$19.5 billion over the years 2015–19, most of which would be invested in long-term infrastructural projects, including new highways, airports, roads, ports, urban infrastructure, new subways, sewage systems, and healthcare facilities.

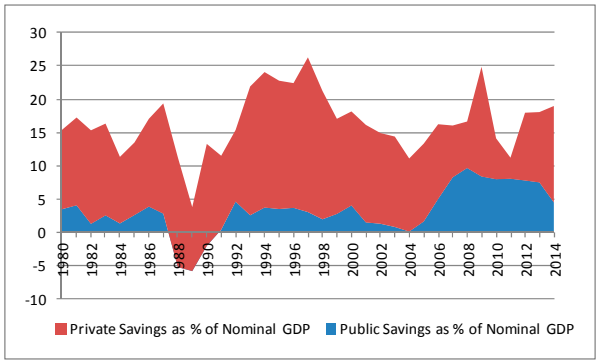
Text Table 4. Panama: Indicative Public Investment Plans, 2015–2019

(In millions of US$)

	2015	2016	2017	2018	2019	Total 2015-2019	% of Total
Logistics	821,475.1	833,846.6	504,115.2	550,072.0	568,075.0	3,277,583.9	16.8
Agriculture	211,570.6	166,340.6	164,480.9	163,061.0	163,908.9	869,362.0	4.5
Tourism	42,517.2	37,965.0	58,615.0	38,615.0	44,315.0	222,027.2	1.1
Water and sanitation	649,978.7	663,386.1	770,376.7	758,344.9	844,681.7	3,686,768.1	18.9
Urban sanitation	21,019.9	16,817.8	14,217.8	12,017.8	10,200.0	74,273.3	0.4
Housing	247,299.4	217,144.7	331,903.7	332,701.8	327,447.5	1,456,497.1	7.5
Urban transportation	448,535.0	651,880.7	775,523.8	666,681.3	667,765.4	3,210,386.2	16.5
Health	454,893.4	361,244.2	246,984.3	249,215.0	322,815.0	1,635,151.9	8.4
Social transfers	193,432.9	246,463.3	297,501.5	331,624.7	331,358.4	1,400,380.8	7.2
Basic education	374,337.6	364,774.3	347,603.8	365,446.7	397,021.8	1,849,184.2	9.5
Technical training	124,779.2	121,591.4	115,867.9	121,815.5	132,340.6	616,394.6	3.2
Zoning Improvements	1,734.9	4,460.8	4,461.2	5,421.8	5,485.0	21,563.7	0.1
Environmental management	15,614.2	40,148.0	40,152.2	48,796.5	49,365.3	194,076.2	1.0
Institutional reforms	58,912.2	47,859.2	41,658.4	43,762.5	35,852.5	228,044.8	1.2
Justice and securities	125,898.9	142,016.7	147,482.7	162,375.0	167,350.0	745,123.3	3.8
Total	**3,791,999**	**3,915,939**	**3,860,945**	**3,849,952**	**4,067,982**	**19,486,817.3**	100.0
Memorandum : as % of GDP	7.2	6.8	6.0	5.5	5.3		

16. Public finances improved significantly in the last two decades. The transition of the Panama Canal and the land around the canal area to the Panamanians in 1999, the efficient management of the canal as a commercial entity, and successful tax reforms increased tax revenue, significantly improved tax buoyancy in the last decade, and improved the public sector financial position. Public sector debt declined from over 70 percent of GDP in the 1990s to about 40 percent now. A Sovereign Wealth Fund was established to help institutionalize the positive loop of public savings. All major rating agencies have granted Panama above investment-grade ratings. Going forward, the medium-term fiscal framework needs to be strengthened to enhance its efficiency, credibility, and—in the absence of monetary policy—to build buffers to guard against shocks.

Chart 9. Panama: Savings as % of Nominal GDP



F. Going Forward

17. Growth projections for the next five years using the production function approach coincide with the authorities' projection of 6–7 percent. Taking into account the public sector investment plans for 2015–19, assuming other factor contributions and TFP follow past trend, it can be projected that growth in the next five years is likely to fall in the range between of 6–7 percent.

18. The quality of public investment and accompanying macroeconomic policies will remain crucial. In particular, investment should be sustainably financed to avoid buildup of public debt. In addition, structural reforms to improve the business climate would encourage complementary private sector investment. And finally, procedures need to be in place to ensure the quality of public investment, including project selection, implementation and monitoring.

19. As large public investment is expected to slow down in the medium term, growth will depend more on productivity and human capital accumulation. Private investment is assumed to continue its growth momentum. Nonetheless, with the increase of public capital stock and the normalization of public investment, the challenge is to develop the strategy to maintain a more sustainable and inclusive growth. It is imperative to increase the efficiency of education investment and further reform the labor market to alleviate skill mismatches and ensure better job opportunities.

G. Conclusions

20. Panama's growth has been strong over the last decade, supported by productivity enhancement and public investment. Until the 2000s, Panama's growth performance was mainly due to factor accumulation. It was in the last decade that TPF contributed significantly to growth. This coincided with the surge in public investment and more importantly, the structural reforms aimed at improving the efficiency and competitiveness of the economy.

21. There is evidence of complementarities between public investment and private investment. Since the public investment provide much needed resources in areas where the private sector is unable or unwilling to, these public investment are largely complementary to private investment and make them more efficient. The Canal expansion has fostered the developments of ports, the building of roads has improved connectivity between logistics centers, and the expansion of airports in the provinces has fostered private investment in tourism as well as higher value-added agricultural exports. Public investment was also aimed at developing new industries around the logistic hubs, such as light manufacturing and value-added warehousing. Investment in education and hospitals should help improve social condition and human capital over the medium term.

22. Going forward, sustaining a strong growth performance will depend more on productivity and human capital accumulation, hence the quality of macroeconomic policies

and structural reforms will remain crucial. Public finances improved significantly in the last two decades, and all major rating agencies have granted Panama above investment-grade ratings. Going forward, investment should be sustainably financed to avoid buildup of public debt, and—in the absence of monetary policy—to build buffers to guard against shocks. As large public investment is expected to slow down in the medium term, growth will depend more on productivity and human capital accumulation. Given the inevitable lags in influencing productivity, it is crucial to intensify efforts in areas that still need progress, for example by improving the quality of public education and healthcare, addressing skill mismatches through internship and training programs, promoting greater female labor force participation (e.g. by increasing the flexibility of working arrangements), and strengthening institutions. Doing so will enhance human capital, reduce skills shortages and youth unemployment, improve the business environment, as well as raise productivity and living standards.

References

Aschauer, D. A. (1989A) Is Public Expenditure Productive? Journal of Monetary Economics 23 (1989) 177-200.

Aschauer, D. A. (1989B) Does Public Capital Crowd out Private Capital? Journal of Monetary Economics 24 (1989) 171-188.

Barro, Robert J. and J. W. Lee (2013) A New Data Set of Educational Attainment in the World, 1950-2010, Journal of Development Economics 104 (2013) 184-198.

Blanchard, O. and R. Perotti (2002) An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output, The Quarterly Journal of Economics, November 2002.

Commission on Growth and Development (2008), The Growth Report: Strategies for Sustained Growth and Inclusive Development.

Dabla-Norris et al. (2013) Anchoring Medium-Term Growth in the Emerging Market and Developing Economies: The Importance of Productivity-Enhancing Reforms, IMF Staff Discussion Note.

Johnson, C. (2013) Potential Output and Output Gap in Central America, Panama and Dominican Republic IMF Working Paper WP/13/145.

National Government of the Republic of Panama Strategic Government Plan 2010-2014.

Romp, W. and J. Hann (2005) Public Capital and Economic Growth: A Critical Survey EIB Papers.

World Bank (1994) World Bank Development Report.

World Bank (2007) Fiscal Policy for Growth and Development: Further Analysis and Lessons from Country Studies.

PANAMA: ENERGY AND GROWTH[1]

A. Executive Summary

1. ***Panama would benefit from more efficient energy production through increased fiscal space and lower electricity prices****. Recent problems experienced by the energy sector in Panama (high oil prices, a drought, and an explosion in a power plant) uncovered some vulnerabilities and weaknesses in the energy sector, with energy subsidies increasing markedly in 2014. More efficient thermal generation and better transmission would allow reducing energy subsidies and/or the domestic cost of electricity consumption. Lower electricity prices would in turn translate into lower inflation. By reducing the amount of subsidies, this would also help reduce the vulnerability of the fiscal accounts in the face of exogenous shocks such as higher oil prices and adverse climatic conditions.*

2. ***The pressure on the fiscal accounts can also be eased by better targeting energy subsidies.*** *Non-targeted subsidies currently represent about three quarters of total energy subsidies in Panama. Better-targeted subsidies would generate substantial fiscal savings without compromising the social safety net for the most vulnerable households.*

3. ***The positive effect of lower oil prices on Panama may be dampened by weaker global demand.*** *Our econometric exercise confirms the prior that Panama benefits at the margin from a surge in global crude oil production, but it is also very sensitive to world aggregate demand. Hence an appropriate assessment of the effect of the recent oil price decline on Panama's growth performance requires a careful consideration of the underlying forces driving the price slump.*

B. Energy Production and Consumption in Panama

4. **A mix of private and state-owned enterprises operates in the electricity sector**. While energy transmission is provided by the state-owned enterprise ETESA, both generation and distribution are mainly private with minority participation by the state.[2] There are over twenty generation companies; the two firms fully state-owned represent about 10 percent of total generation.[3] The four largest generation companies provide more than half of the total supply of energy in the country. In terms of energy mix, about 60 percent of energy is generated through hydropower, with thermal energy representing the remaining 40 percent. For thermal generation, Panama is fully dependent on imported oil. Electricity distribution is provided by three companies

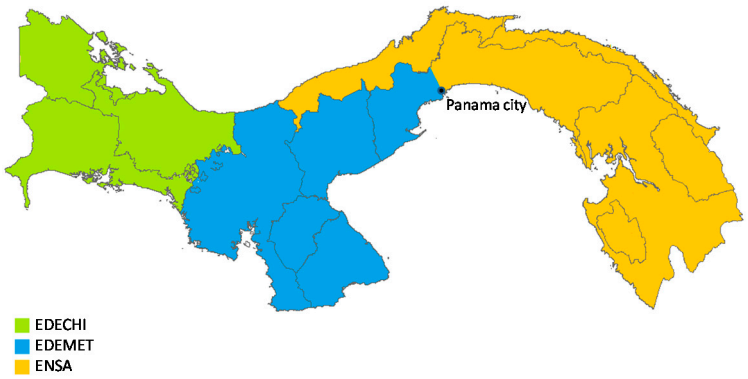
[1] Prepared by D. Cerdeiro.

[2] The energy sector in Panama underwent substantial reforms in the late 1990s, including extensive privatization efforts. See IADB (2013).

[3] The two state-owned generation companies are Autoridad del Canal de Panama and EGESA. The state also retained minority participation in ENEL Fortuna and AES Panama.

(EDECHI, EDEMET and ENSA), which operate regional monopolies (see Chart 1), with the state owning about 49 percent of shares in each company.[4]

Chart 1. Electricity Distribution Companies—Geographic Coverage

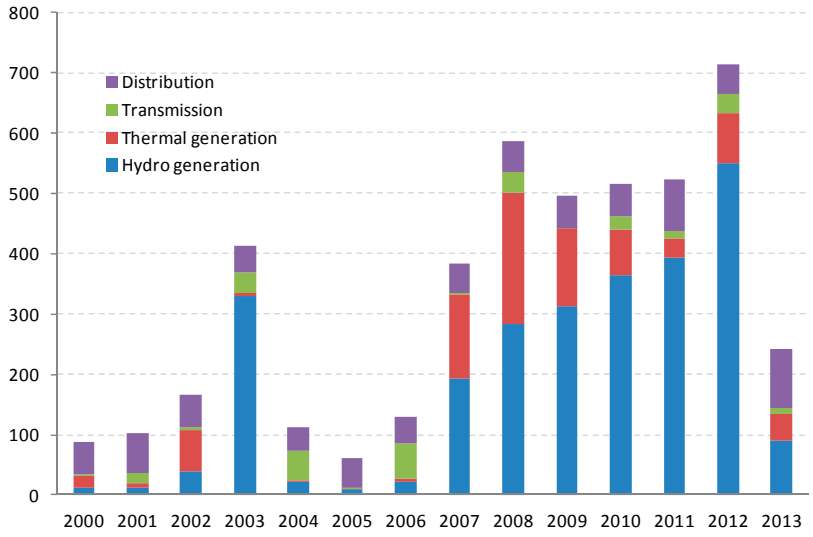


Source: Autoridad Nacional de los Servicios Publicos

5. The government plans to increase energy supply through investments. With the economy growing rapidly, energy consumption has been on a steady increase. Despite the soaring demand, investment in generation and transmission has been subdued in the last years (Chart 2). As a result, transmission capacity is below generation capacity, and authorities are of the opinion that thermal generation is inefficient (see also Chart 3). The government announced plans for US$5bn investments in the energy sector during 2015-2019, with 24 percent expected to come from public sources. Investments plans in generation are expected to total US$3.2bn (US$1.3bn in hydro, US$0.9bn in coal, and US$1bn in gas). Investments in transmission, estimated at US$1.2bn, include US$0.5bn for the interconnection with Colombia, and US$0.2 and US$0.5bn for the third and fourth transmission lines, respectively. The construction of the third transmission line started in November 2014, and is expected to be completed in 2016.

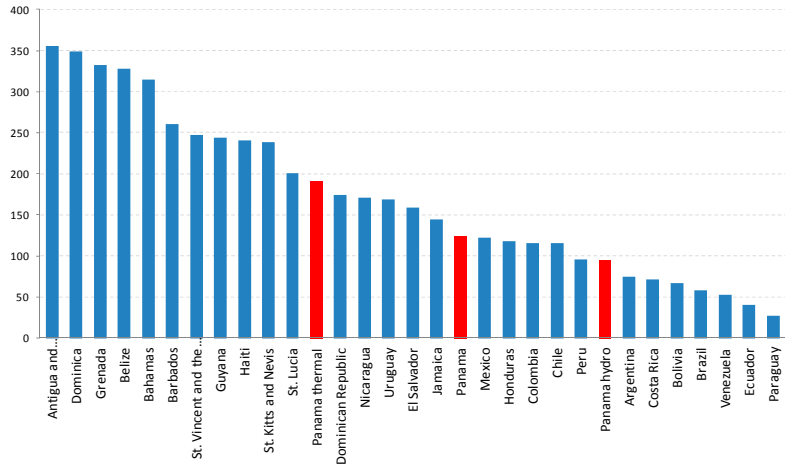
[4] The majority shareholder of EDECHI and EDEMET is the Spanish holding Union FENOSA, whereas the majority shareholder of ENSA is Colombian holding Empresas Publicas de Medellin.

Chart 2. Investments in the Energy Sector
(In millions of USD)



Source: Autoridad Nacional de los Servicios Publicos.

Chart 3. Generation costs in LAC
(In USD per MWh)



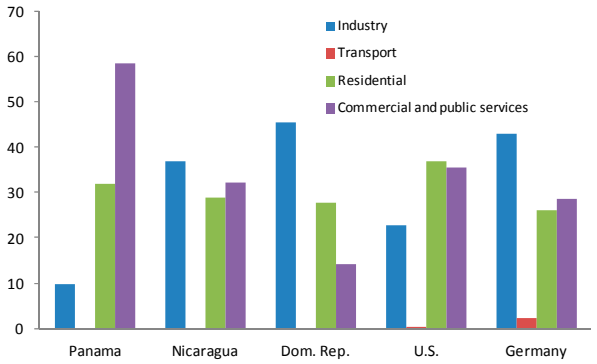
Sources: Di Bella, et al. (2015), Autoridad Nacional de los Servicios Publicos, and Staff calculations. For Panama, generation costs are average April 2013-September 2014.

6. The services sector and households make up most of the demand for electricity in Panama. Being a service-based economy, more than half of the demand for electricity in Panama comes from the services sector (Chart 4). Thus, the services sector represents a much larger fraction of electricity demand than in other countries in the region and in advanced economies such as the U.S. and Germany. In 2012, households' demand for electricity represented about 31 percent of total demand, whereas industrial demand amounted to about 10 percent. Oil, on the other hand, is consumed mainly by the transportation and industrial sectors (Chart 5).

7. Demand for electricity will keep raising fast. Staff projections indicate expected annual growth rates of real GDP in the range of 6–7 percent over the next five years, with the services sector remaining central to Panama's growth model.

Chart 4. Electricity Consumption

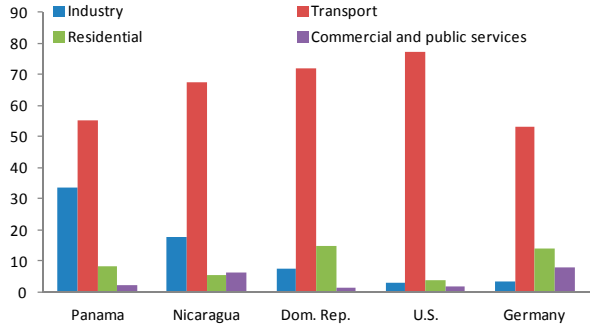
Sectoral Consumption as Percent of Total Consumption



Source: International Energy Agency

Chart 5. Oil Consumption

Sectoral Consumption as Percent of Total Consumption



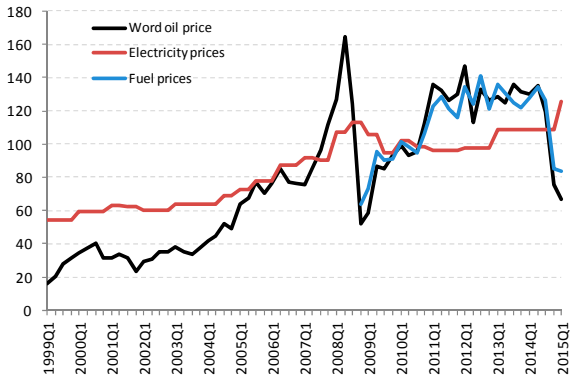
Source: International Energy Agency

C. Energy Prices and Subsidies

8. While domestic gasoline prices follow closely world oil prices, electricity prices are less responsive (Chart 6). The estimated elasticity of electricity prices to international oil prices is of 0.37, whereas for fuel prices it is 0.74. Electricity subsidies, Panama's energy matrix (60 percent hydro), and regulation (bi-annual revisions for electricity as opposed to bi-weekly revisions for fuel prices) explain the lower elasticity of electricity prices.[5] Due to the high pass-through to fuel prices, the recent drop in world oil prices has brought about a substantial decline in inflation, despite an increase in electricity prices driven mainly by a significant reduction in subsidies (Chart 7).

[5] While electricity tariffs are set following a specific formula that reflects generation, transmission, and distribution costs, the Cabinet Council can override this automatic procedure by using funds from FACE to compensate the difference between costs and end-user prices.

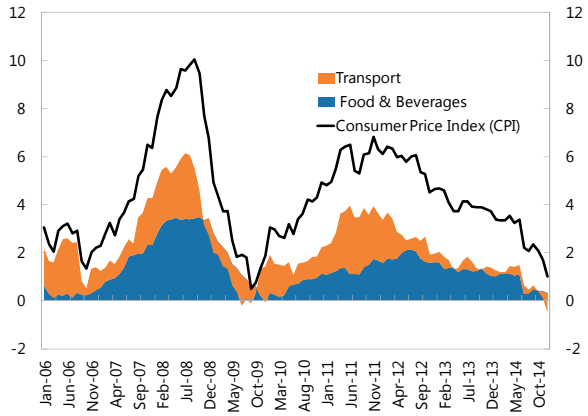
Chart 6. World Oil Prices and Energy Prices in Panama 1/
2010 = 100



Sources: WEO, Autoridad Nacional de los Servicios Publicos, and Staff calculations.

1/ The world oil price is a simple average of Dated Brent, West Texas Intermediate and Dubai Fateh. The price of fuel corresponds to the maximum price at the pump set by ASEP for 95-octane gasoline. The domestic electricity price is a weighted average of prices for different categories and distribution companies published by ASEP. The weights are given by the level of demand (in GWh) in each segment and for each distribution company during January-June 2014.

Chart 7. Inflation in Panama



Source: Panama National Authorities, and IMF staff estimates.

9. Electricity tariffs in Panama are subsidized, and about three quarters of the subsidies are not targeted. Panama has two main electricity subsidies.[6] The Tariff Stabilization Fund (FET), established in 2004, is targeted at small users, and is intended to cushion tariffs against movements in international oil prices.[7] The Energy Compensation Fund (FACE), established in 2011 amid rising international oil prices, aims to stabilize tariffs to all users. In addition, FACE also compensates three generation companies for forgone earnings due to lack of investments (and the resulting insufficient transmission capacity) by the state-owned ETESA (see Table 1). In 2014, FACE represented about 75 percent of total electricity subsidies.

[6] In addition to the subsidies, energy in Panama is largely tax exempt. While domestic consumption of fuel is taxed, oil and fuel imports are tax free. Furthermore, electricity generation, transmission and distribution are exempt from the ITBMS tax.

[7] The FET subsidy is currently received by users of up to 400Kwh/month, with the threshold expected to reach 300Kwh/month by end-2016.

Text Table 1. Main Electricity Subsidies in Panama 1/

	Fondo de Estabilizacion Tarifaria (FET)	Fondo de Compensacion Energetica (FACE)
Established	2004 (Cabinet Resolution No. 6)	2011 (Cabinet Resolution No. 174)
Beneficiaries	Users with consumption < 400Kwh	All users
Purpose	Prevent oil price changes from affecting small users	Prevent oil price changes from affecting users, and compensate generation companies for lack of investment in transmission
Financing	Through budget and contribution by large consumers	Through budget, loan from Banco Nacional, and contributions to FET 2\

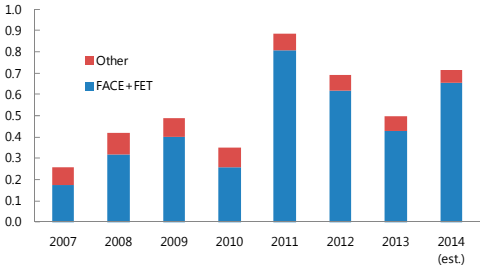
1\ Remaining electricity subsidies are those to the agricultural sector, pensioners, political parties, and subsistence consumption (under 100 Kwh/month)

2\ As the threshold (in Kwh) for users to receive FET subsidy is progressively reduced, excess funds accumulated by FET will be used for FACE

10. Subsidies increased in 2014 due to a combination of external and internal factors, uncovering vulnerabilities in the energy sector (Chart 8). Pre-tax subsidies experienced a marked increase in 2014 on the back of high oil prices, a drought, and an explosion in a large thermal plant (the last two prompted the government to purchase energy from less efficient plants). Total pre-tax subsidies are estimated to have reached US$320mn in 2014,[8] or about 0.7 percent of GDP (and 3.2 percent of public sector revenues), while post-tax subsidies are estimated to be about US$60mn higher on account of foregone tax revenues. The bulk of the 2014 subsidies was disbursed during January-August, before the oil price slump.

[8] FACE and FET amounted to $295mn in 2014. The 2014 figures for the remaining electricity subsidies (for the agricultural sector, pensioners, political parties, and subsistence consumption) are not yet available. These other subsidies averaged about $25mn/year over the past three years.

Chart 8. Electricity Subsidies in Panama
(As percent of GDP)



Source: ASEP and Staff calculations.

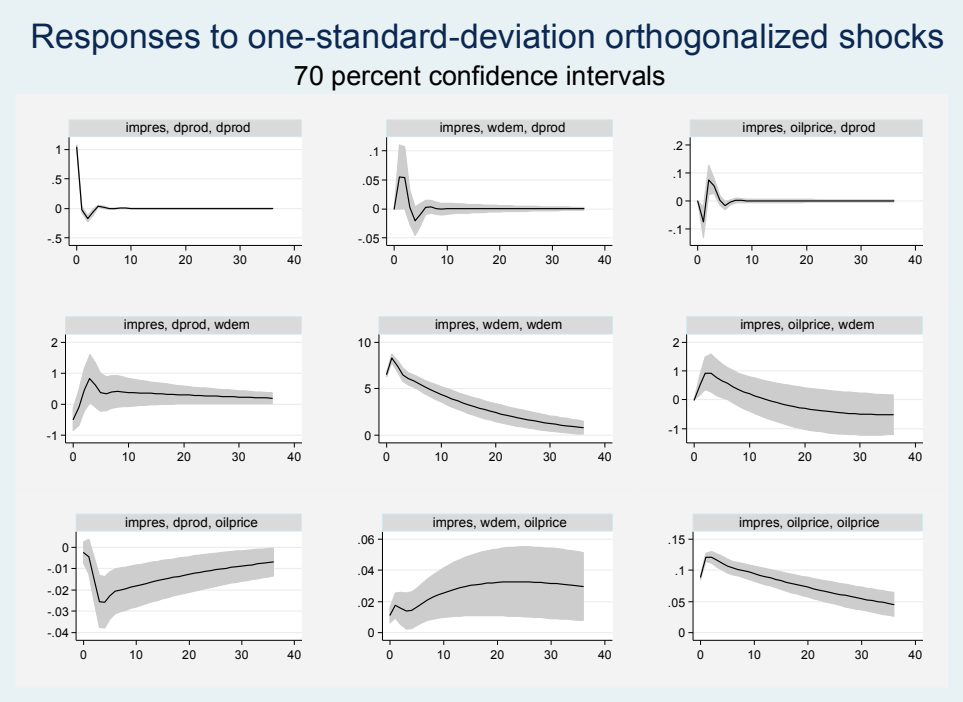
11. Energy subsidies should decline in 2015, thanks to lower oil prices and an increase in tariffs. Tariffs have been increased in January 2015 by between 6 and 25 percent, for about one-fourth of consumers. Coupled with lower oil prices, this is expected to cause a significant reduction in subsidies in the short term. The 2015 budget—prepared in September 2014—projects electricity subsidies at about US$350mn. Going forward, the planned investments should help raise the productivity and reliability of the energy sector, thus progressively reducing the need for subsidies.

D. Energy Prices and Growth Estimates for Panama and the Region

12. A simple model of the world oil market is estimated to assess the potential effects of oil-price movements on growth. Both supply and demand considerations are behind the recent drop in world oil prices (see e.g. Arezki and Blanchard, 2004). This section estimates the model proposed by Kilian (2009) to gauge the effect of three different shocks on growth: oil supply shocks, global demand shocks, and demand shocks that are specific to the oil market (e.g. precautionary demand due to concerns on future availability of oil). The first step consists in estimating a structural VAR of the world oil market, including the (log difference) of world crude oil production, Kilian's (2009) index of real economic activity, and the (log) real price of oil (deflated with the U.S. CPI). The identification strategy is recursive, with the variables set in the aforementioned order[9]. The model is estimated using monthly data from May 1984 through October 2014 (366 observations). Chart 9 shows the impulse-response functions. A one-standard deviation shock to oil supply will have a persistent (negative) effect on oil prices that will only die out after three years. The effect of world demand shocks is quantitatively similar (with the opposite sign), but takes more time to set in. Finally, an oil-specific demand shock has a large and persistent effect on the oil price.

[9] See Kilian (2009, p. 1059) for a justification.

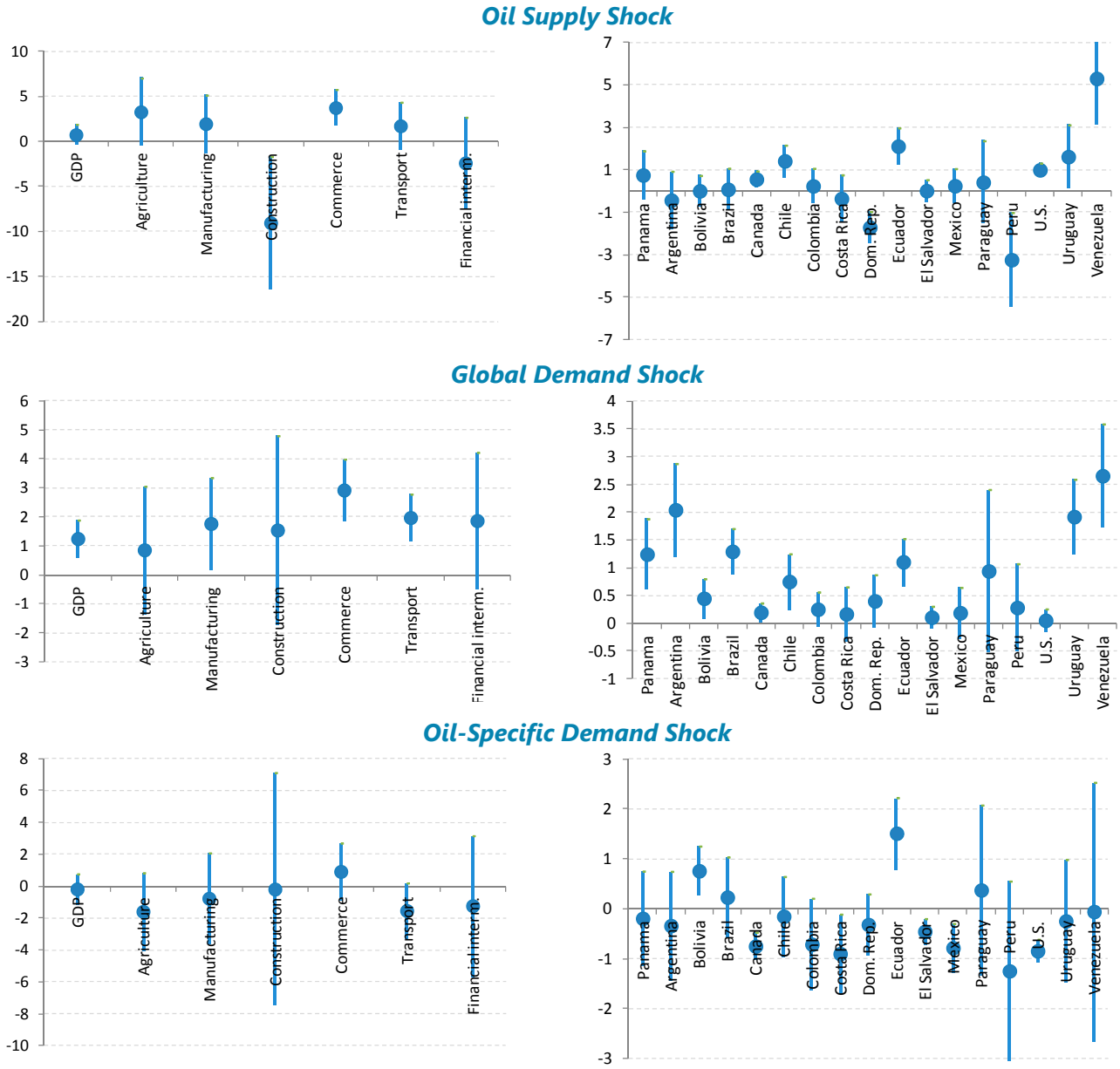
Chart 9. Model for the World Crude Oil Market



13. The estimated structural unexpected shifts in oil supply, world demand, and oil-specific demand are then used in country-specific growth regressions. Following Kilian (2009), we estimate, for each structural shock separately and for each country in our sample, a linear regression model where GDP growth is the dependent variable and contemporary and lagged values of the shock are the explanatory variables. The estimates below should be interpreted as the overall effect of oil-supply, demand, and oil-demand shocks on the economy, acting either directly or indirectly through variables that are not included in the regression but are systematically affected by the shocks (e.g. terms of trade, or systematic changes in subsidies). For regional comparison, we estimate the effects on growth for 16 countries in the region. The regressions are also estimated for some key sectors in Panama. The samples used in each case are detailed in the Appendix.

Chart 10. Growth Responses to Structural Shocks

Sectoral responses in Panama (left) and responses in the region (right). Effect after 1 year, one-s.e. bands.



14. A decrease in oil prices due to a surge in the global oil supply has a positive effect on Panama, although error bands are not tight. Chart 10 reports the cumulative effect on growth after one year of each shock. One-standard-error bands are plotted alongside the point estimates.[10] A positive shock to oil supply boosts growth in Panama, mainly driven by agriculture and commerce.

[10] Standard errors for the cumulative response are calculated using the (robustly-estimated) covariance matrix of coefficient estimates.

The estimate, however, is within one standard error of zero, indicating that the effect may not be significant.[11] The only counterintuitive result relates to the response of construction growth, a series that exhibits ample volatility. In regional comparison, the response of Panama lies in between that of the U.S. and Canada, and stands to benefit more from these shocks than its neighbors Colombia and Costa Rica. The responses of Peru and Dominican Republic are also counterintuitive, and can be due to omitted variables whose effect is picked up by the included regressors.

15. A fall in oil prices due to a slowdown in world demand is, on net, associated with a significant negative effect on Panama. The estimates show that Panama benefits across the board from surges in world demand, with significant boosts to manufacturing, commerce and transportation. In regional comparison, it is the 5th country (out of the 17 included) most exposed to changes in world demand. As a result, drops in oil prices that are associated with lower global demand would have a positive effect that is more than offset by the negative effect of weak global demand. The result is consistent with Panama's role as a hub for world trade, 5 percent of which passes through the Canal, and a globalized financial system.

16. Oil price changes due to demand shocks specific to the oil market seem to have small and not-significant effects on Panama. While, as expected, some sectors (e.g. transport) tend to be negatively affected by oil-price increases related to precautionary demand for oil, the overall effect on GDP growth is not significant. This is similar to several other countries in the region, such as Argentina, Chile, and Uruguay. However, Canada, Costa Rica, El Salvador, Mexico and the U.S. are negatively affected by these shocks, while some exporters of hydrocarbons such as Ecuador and Bolivia appear to gain from speculative demand shocks.

17. The relative importance of global demand factors for Panama is confirmed by model simulations. Chart 11 displays simulation results performed by the IMF's modeling division (see Andrle et al., 2015). The simulations, carried out in mid-December 2014, assume that the oil price decline between August and December 2014 is 80 percent driven by increased oil supply and 20 percent due to weaker global demand. With those supply and demand relative contributions, Panama would actually not benefit from the recent oil price decline (see red line in Figure 10).

18. Assessing the effect of oil price changes on Panama's growth performance requires closely monitoring the supply-demand mix in the crude oil market. The results above highlight the importance of understanding the underlying forces driving the recent drop in oil prices to assess its effects on growth. The April 2015 World Economic Outlook (IMF, 2015) provides an insight into the relative importance of supply and demand factors, suggesting that supply considerations have gained in importance since mid-October 2014, even though global demand still remains weak (Chart 12).

[11] The effect of oil supply shocks have been estimated in several papers over the past 20 years. Table A.2 in the Appendix summarizes the findings, showing that recent research for advanced economies points to a substantial decline in the growth effect of oil supply shocks. These papers, however, simply ascribe oil-price changes to oil supply shocks without recognizing other possible driving forces.

Chart 11. December 2014 Simulations for Panama

Oil Price Decline Due to Weaker Demand (20%) and Higher Production (80%)

Decline in Demand (blue), Plus Increase in Oil Production (red)

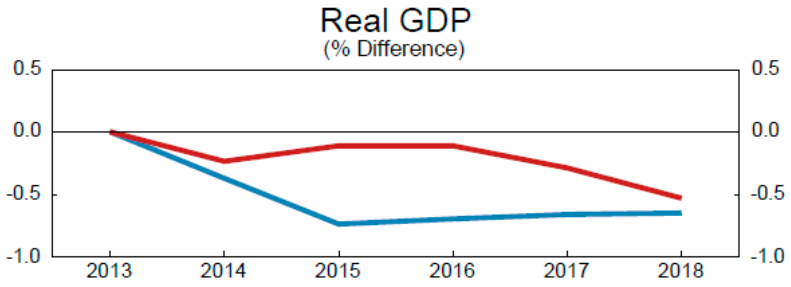
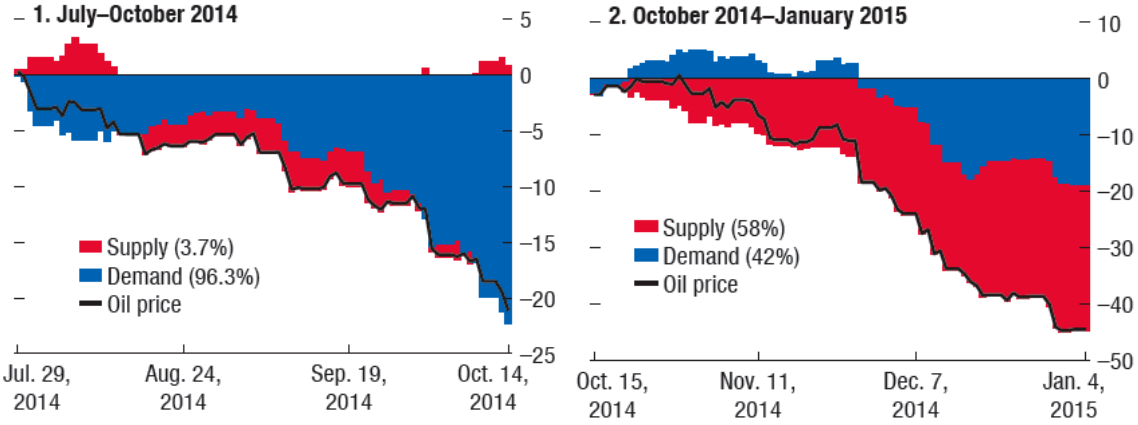


Chart 12. Drivers of Oil Prices

World Economic Outlook, April 2015 (Box 1.1)



E. Concluding Remarks

19. More efficient energy production would create fiscal space and may reduce inflationary pressures. The recent problems faced by the energy sector in Panama (high oil prices, a drought, and an explosion in a power plant) uncovered some vulnerabilities and weaknesses in the energy sector. More efficient thermal generation and better transmission would allow reducing energy subsidies and/or the domestic cost of electricity consumption. Lower electricity prices would in turn translate into lower inflation. By reducing the amount of subsidies, this would also help reduce the vulnerability of the fiscal accounts in the face of exogenous shocks such as higher oil prices and adverse climatic conditions. These improvements require additional investment in the energy sector.

20. The pressure on the fiscal accounts can also be eased by better targeting energy subsidies. Non-targeted subsidies currently represent three quarters of total energy subsidies in

Panama. Better-targeted subsidies would generate substantial fiscal savings without compromising the social safety net for the most vulnerable households.

21. The positive effect of lower oil prices on Panama may be dampened by weaker global demand. While Panama benefits at the margin from a surge in global crude oil production, it is also very sensitive to world aggregate demand. Hence an appropriate assessment of the effect of oil price changes on Panama's growth performance requires closely monitoring the supply-demand mix in the crude oil market.

References

Alvarez, J. and F. Valencia (2014), *Made in Mexico: Energy Reform and Manufacturing Growth,* IMF Working Paper 15/45.

Andrle, M., P. Blagrave, P. Espaillat, K. Honjo, B. Hunt, M. Kortelainen, R. Lalonde, D. Laxton, E. Mavroeidi, D. Muir, S. Mursula, and S. Snudden (2014), *The Flexible System of Global Models – FSGM*, IMF Working Paper 15/64.

Arezki, R. and O. Blanchard (2014), *Seven Questions About the Recent Oil Price Slump*, iMFdirect blog.

Bernanke, B. and M.L. Gertler and M.W. Watson (1997), *Systematic Monetary Policy and the Effect of Oil Price Shocks*, Brookings Papers on Economic Activity, 1997, vol. 28, issue 1, pages 91-157

Blanchard, O. and J. Gali (2007), *The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so different from the 1970s?*, NBER Chapters, in: International Dimensions of Monetary Policy, pages 373-421 National Bureau of Economic Research.

Di Bella, G., L. Norton, J. Ntamatungiro, S. Ogawa, I. Samake and M. Santoro (2015), *Energy Subsidies in Latin America and the Caribbean: Stocktaking and Policy Challenges*, IMF Working Paper 15/30.

Gault, N. (2011), *Oil Prices and the U.S. Economy: Some Rules of Thumb*, HIS Global Insight Bulletins.

Hooker, M.A. (1996), *What Happened to the Oil Price-Macroeconomic Relationship?*, Journal of Monetary Economics 38, pp. 195-213.

Kilian, L. (2009), *Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market*, American Economic Review 2009, 99:3, 1053-1069.

IADB (2013), *Energy Dossier Panama,* March 2013.

IMF (2011), *World Economic Outlook*, April 2011.

IMF (2014), *Quarterly Review of Commodity Prices*, International Monetary Fund, Research Department - Commodities Team.

IMF (2015), World Economic Outlook, April 2015.

Hamilton (2003), *What Is an Oil Shock?,* Journal of Econometrics, Volume 113, Issue 2, April 2003, p. 363-398.

Mork, K.A. and O. Olsen and H.T. Mysen (1994), *Macroeconomic Responses to Oil Price Increases and Decreases in Seven OECD Countries*, The Energy Journal, Vol. 15, No. 4 (1994), pp. 19-35.

Appendix I. Country Samples

Appendix I Table 1: Samples Used in Growth Regressions

	Sample	No. of observations
Panama	1996Q1 - 2013Q3	71
Argentina	1980Q2 - 2014Q3	138
Bolivia	1990Q1 - 2014Q2	98
Brazil	1990Q1 - 2014Q3	99
Canada	1986Q1 - 2014Q3	115
Chile	1986Q1 - 2014Q3	115
Colombia	2001Q1 - 2014Q3	55
Costa Rica	1991Q1 - 2014Q3	95
Dom. Rep.	1992Q1 - 2014Q1	89
Ecuador	1990Q1 - 2014Q4	100
El Salvador	1990Q1 - 2014Q3	99
Mexico	1980Q1 - 2014Q3	139
Paraguay	1994Q1 - 2014Q3	83
Peru	1980Q1 - 2014Q3	139
U.S.	1980Q1 - 2014Q3	139
Uruguay	1997Q1 - 2014Q3	71
Venezuela	1997Q1 - 2014Q3	71

Appendix II. Oil Price Effect on Output – Evidence for Advanced Economies

Recent research for advanced economies finds that the effect of energy prices on growth has decreased substantially. Table A.2 summarizes the findings of the literature regarding the effects of oil prices on growth. For comparability across studies, the table shows the response of GDP in one year to a 10 percent increase in oil prices. For the U.S., the study using the most recent sample finds no effect of oil prices on GDP (IMF, 2014). Other recent studies find small negative effects for the U.S. (e.g. IMF (2011), Gault (2011), Blanchard and Gali (2007) for the U.S.), while some other countries feature non-significant or even positive responses to oil price increases (see e.g. effect for France, Germany, Italy and Japan in Blanchard and Gali (2007)).[1]

Appendix II Table 1: Output Effect of a 10 Percent Increase in Oil Prices

Evidence for Advanced Economies

Study	Country	Sample	Effect after 1 year (in percent)
Quart. Rev. Commodity Prices (IMF, 2014)	U.S.	1983-2013	0.0
WEO (IMF, 2011)	U.S.	Model	-0.1
Gault (2011)	U.S.	Model	-0.2
Blanchard and Gali (2007)	U.S.	1984-2007	-0.1
	France	1984-2007	0.0
	UK	1984-2007	-0.1
	Germany	1984-2005	0.2
	Italy	1984-2005	0.0
	Japan	1984-2007	0.2
Hamilton (2003)	U.S.	1949-2005	-0.7
		1949-1980	-2.9
Bernanke, Gertler and Watson (1997)	U.S.	1966-1995	-0.2
		1986-1995	-2.2
		1976-1985	-3.9
		1966-1975	-0.5
Hooker (1996) /1	U.S.	1973-1994	>0
Mork, Olsen and Mysen (1994) /2			
	U.S.	1967-1992	-0.5
	Japan	1967-1992	-0.2
	Germany	1967-1992	not signif.
	France	1967-1992	not signif.
	Canada	1967-1992	-0.6
	UK	1967-1992	-0.4
	Norway	1967-1992	0.5

/1 Size of shock not reported.
/2 Effects for price decrease are estimated separately, and are only significant for the U.S. (+0.8) and Canada (+0.6).

[1] A recent paper by Alvarez and Valencia (2014) uses a panel data set to estimate the effect of electricity prices in Mexico on manufacturing output. Estimated elasticities range between -0.11 and -0.28 depending on the specification.