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PANAMA

Selected Issues

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Approved by the Western Hemisphere Department

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A. Introduction

1.   **Achieving investment grade status is an aim shared by many emerging market economies.** Among the benefits often associated with having investment grade status are lower financing costs for both the sovereign and the private sector; increased financing options in international capital markets, including from institutional investors; higher private capital inflows; and rapid financial development. Panama's sovereign credit rating was raised to investment grade by the three major rating agencies in the first half of 2010. There is the expectation that the upgrade will bring benefits to the Panamanian economy and ultimately help increase economic growth.

2.   **This paper presents empirical evidence on the effects of achieving investment grade on borrowing costs for the sovereign and the private sector.** Evidence consists of statistical analysis and model-based estimates. The latter build on a modeling framework developed by Jaramillo (2010). The paper uses a panel data framework for a sample of emerging market economies for 1995-2010. Econometric results indicate that reaching investment grade lowers sovereign debt spreads by over 140 basis points. At the same time, a five-notch upgrade of the sovereign to investment grade is found to reduce borrowing costs for the private sector by about 180 basis points.

3.   **The rest of the paper is organized as follows**. Section B presents background information on sovereign credit ratings and compares Panama's key macroeconomic and institutional characteristics with those of other emerging markets. Sections C and D present statistical evidence on (a) the reduction in sovereign spreads associated with obtaining investment grade status, and (b) the impact of the sovereign's upgrade on corporate financing costs. Section E concludes.

B. Background

4.   **Sovereign credit ratings provide summary measures of a government's ability and willingness to repay its debts on time.** As such, sovereign ratings are forward-looking indicators of the probability of default as perceived by the rating agencies. Sovereign ratings condensate a vast amount of information and provide important signals to market participants. A move from speculative grade to investment grade can have important implications for borrowing costs to the extent that investment grade is assigned to high-quality credit risks ("safer" investments).

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[1] Prepared by Mario Dehesa, Laura Jaramillo, and Michelle Tejada.

5.   **Empirical studies have shown that country ratings depend on a relatively small set of economic and institutional variables**. The three major credit agencies (Fitch Ratings (Fitch), Moody's Services (Moody's), and Standard and Poor's (S&P)) provide credit ratings summarizing those variables, without being explicit about the specific weights attached to them. Building on the existing literature, Jaramillo (2010) identifies a parsimonious set of economic and institutional variables as determinants of investment grade status. The set includes domestic macroeconomic variables (GDP per capita, real GDP growth, potential GDP growth, inflation, unemployment), external sector variables (exports to GDP, current account balance to GDP, private external debt to GDP, international reserves to GDP), fiscal variables (primary balance, external and domestic public debt to GDP), financial depth variables, and a political risk index.

6.   **Panama's key indicators were comparable to those of emerging markets with investment grade status a couple of years ago.** Table 1 groups emerging markets into those with investment grade status and those with a speculative grade rating. The table shows that investment grade countries tend to outperform speculative grade countries on most economic and institutional variables. Panama's indicators were generally aligned with those of investment-grade countries, while surpassing the mean and median of that group in a few areas, including economic growth, financial depth, and political risk. This helps explain why Panama's upgrade to investment grade by the three main credit rating agencies in March-June 2010 had been widely expected by market participants.[2] The upgrade was also consistent with the behavior of EMBI spreads, which placed Panama alongside other investment grade countries in the region, such as Peru and Brazil (Figure 1).

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[2] The agencies indicated that the upgrade reflected the strengthening of the public finances in recent years, prospects for further declines in public debt, and a very favorable growth outlook.

Table 1. Country Characteristics by Investment Grade Rating

| Variable	Panama 2008	Mean Investment grade	Mean Speculative grade	Median Investment grade	Median Speculative grade
Macroeconomic Variables					
GDP per capita (US$ dollars)	6,819	8,083	3,766	4,950	2,800
Real GDP growth	10.7	4.8	3.8	5.1	4.4
Potential GDP growth	6.0	4.4	3.7	3.9	3.8
Inflation	8.8	5.7	25.9	4.4	7.7
Unemployment	5.6	8.3	10.5	7.5	9.8
External Sector					
Exports to GDP	32.6	45.7	30.4	40.9	29.1
Current account balance to GDP	(11.6)	(3.0)	(2.4)	(2.9)	(2.4)
Private external debt to GDP	-	42.4	19.6	32.3	14.3
NIR to GDP	11.7	18.7	14.5	17.1	11.2
Government Sector					
Primary balance to GDP	3.5	0.4	0.8	(0.1)	0.8
External public debt to GDP	32.7	12.8	30.6	9.9	25.3
Domestic public debt to GDP	6.1	21.7	27.3	15.2	19.6
Financial Depth					
Broad money to GDP	87.4	64.3	54.6	50.4	42.6
Other					
Political risk index ICRG (+ is better)	74.0	73.0	64.6	74.0	65.5

Sources: Authors' calculations based on data from IMF, World Bank, and International Country Risk Guide.

C. Investment Grade Status and Sovereign Borrowing Costs

7.   **Countries benefit when the sovereign receives a higher credit rating.** Kim and Wu (2008) argue that improvements in sovereign credit ratings encourage *inter alia* financial development and capital inflows. Three main specific reasons are frequently stated for why sovereign credit ratings are important. First, they are identified as a key determinant of a country's borrowing costs in international capital markets. Second, the sovereign rating sets a key benchmark for the ratings assigned to domestic firms and therefore affects private financing costs. And third, some institutional investors have lower bounds for the risk they can assume in their investments and will choose their portfolio composition taking into account the country risk signaled by the rating notations.

8.   **Sovereigns with better credit ratings have tended to enjoy lower spreads.** Figure 2 depicts the (non linear) relationship between sovereign ratings and spreads in selected years since 1999. The figure shows that sovereign credit ratings are a key determinant of a country's borrowing costs in international capital markets. The slope of the curves in Figure 2 suggests that a rating upgrade (a movement to the left on the horizontal axis) may result in a substantial reduction in borrowing costs for the sovereign. Figure 3 provides an alternative graphical representation of the differences in spreads between investment grade and speculative rating countries.[3]

Figure 2. Sovereign Spreads and Ratings
(Selected years, basis points)

Source: Bloomberg; and authors' calculations.

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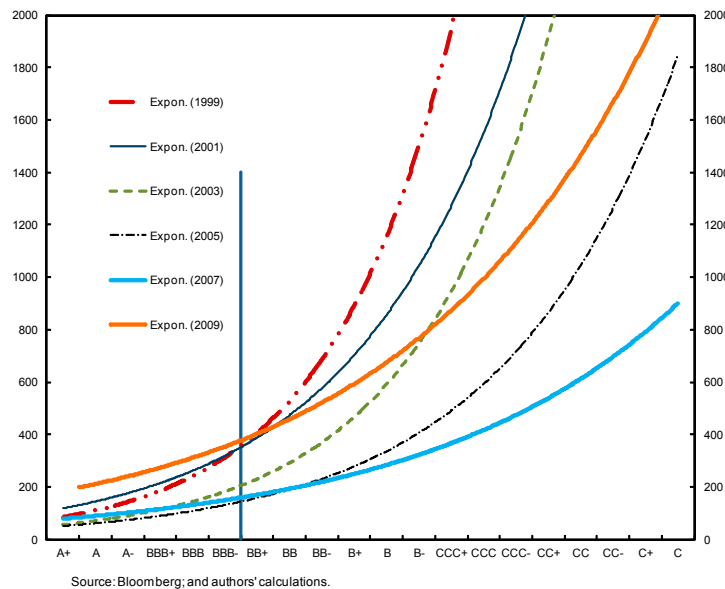
[3] A Wilcoxon test indicates a significant difference between the average spreads for investment grade countries (189 basis points) and speculative grade countries (505 basis points). A Welch test of medians also finds significant differences between the spreads of investment grade and speculative grade countries (with medians of 159 and 409 basis points respectively).

Figure 3. Sovereign Spreads, Median
(Basis points)

Source: Bloomberg.
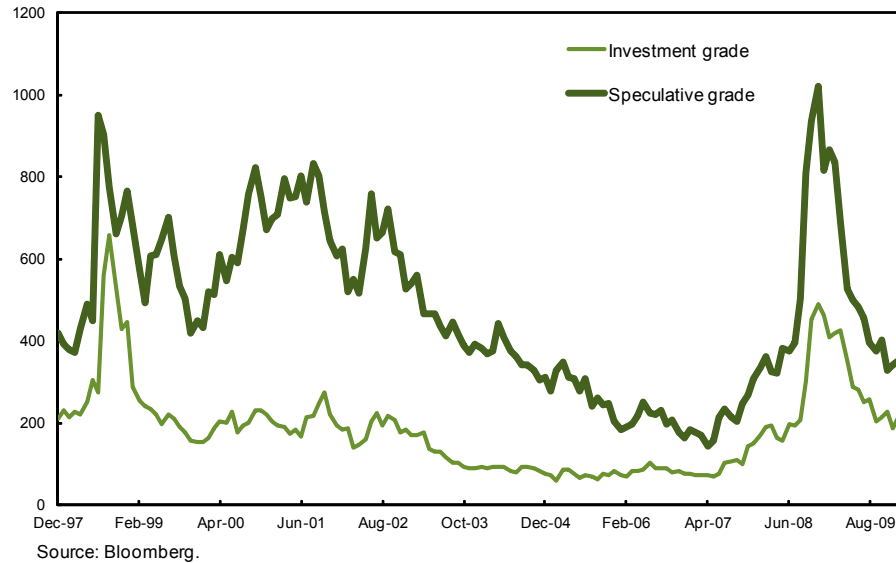
9.   **However, the economic fundamentals summarized in sovereign credit ratings
are not the only factors determining borrowing costs**. In particular, factors linked to
global liquidity also affect the behavior of sovereign spreads (Gonzalez Rosada and Yeyati
(2006), Hartelius *et al*. (2008)). Two variables that have been found to summarize well these
conditions are the Federal Funds futures rate and the Chicago Board Options Exchange
Volatility Index (VIX) (a proxy for risk appetite).

10.   **The two questions addressed in this section to analyze the benefits of attaining
investment grade are:**

- Do investment grade countries have lower borrowing costs relative to speculative
grade countries after controlling for the global environment?

- Does investment grade reduce sovereign spreads by more than justified by the
macroeconomic determinants?

11.   **The model used to investigate these questions is the following:[4]**

$$Spd\_embi_{it} = \alpha + \beta IG_t + \gamma vix_t + \delta fff_t + \eta epd_{y_{it}} + \theta dpd_{y_{it}} + \lambda y_{it} + \phi res\_y_{it} + \mu_t$$
(1)

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[4] The specification builds on Jaramillo (2010).

Where Spd_embi_{it} denotes sovereign spreads; α is a constant, IG_t is a binary variable that takes the value of 1 for countries with investment status, and zero otherwise; vix is the Chicago Board Options exchange volatility index; fff is the U.S. Fed Funds futures rate; epd_y is the external debt-to-GDP ratio; dpd_y is the domestic debt-to-GDP ratio; y is the growth rate of real GDP; res_y is the ratio of international reserves to GDP; and μ represents disturbances that are assumed to be independent across countries.

12.   **The model is estimated using a variety of panel regression techniques.[5]** These include fixed-effects (FE) two-stage least squares (2SLS), which is the preferred technique. This approach helps overcome the problem of heterogeneity bias, and also the possible endogeneity of credit ratings. The instruments used in the estimation are the exports-to-GDP ratio, the ratio of broad money to GDP, and a political risk index. The choice of FE is based on Haussmann tests that reject random effects (RE). Tests for panel-based co-integration (as some variables are non-stationary) find that the variables are co-integrated.[6]

13.   **All the estimated coefficients obtained with the preferred technique are significant and have the expected sign (Table 2, column 3).** The results suggest that attaining investment grade status decreases sovereign spreads by 143 basis points, after controlling for other macro variables. The reduction in spreads using the FE OLS model is only 55 basis points, but this estimate may be subject to a downward bias due to the possible endogeneity of the ratings. The average spread for speculative-rated countries was 505 basis points during the sample period, which suggests that moving to investment grade tends to make a substantial difference for debt spreads.

14.   **External factors seem to be more important than domestic macroeconomic variables to explain changes in spreads.** Only between 10-20 percent of the changes in spreads is explained by domestic macroeconomic variables. At the same time, the estimates suggest that a one standard deviation increase in: (i) vix raises spreads by 116 bps; (ii) fff increases spreads by 50 bps; (iii) epd_y the external debt-to-GDP ratio raises spreads by 30 bps. Changes in international reserves to GDP do not appear to have a large effect on sovereign spreads.

15.   **Fiscal consolidation in non investment grade countries explains the narrowing of spreads between investment grade and speculative credits in recent years.** Since 2004, the difference in spreads between investment grade and speculative grade sovereigns has declined by about 70 basis points. The regression results suggest that some 31 basis points of

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[5] The sample period is January 1995- March 2010; and the data is monthly. The list of countries included in the sample is provided in the Appendix.

[6] The Kao and Johansen Fisher panel co-integration tests were used.

this decline is accounted for by a reduction in debt levels (mostly external debt) in non investment grade countries.

Table 2. Regression Results on the Benefits of an Investment Grade Status

|	FE OLS	RE OLS	FE 2SLS	RE 2SLS
	(1)	(2)	(3)	(4)
Variables	Spd_embi	Spd_embi	Spd_embi	Spd_embi
ig	-54.63***	-62.98***	-142.8*	-319.6***
	(13.33)	(13.19)	(82.13)	(80.49)
vix	13.02***	12.99***	13.04***	13.06***
	(0.466)	(0.471)	(0.470)	(0.495)
fff	23.85***	24.43***	25.00***	27.87***
	(4.551)	(4.599)	(4.738)	(4.965)
epd_y	9.430***	9.317***	8.398***	6.173***
	(0.430)	(0.421)	(1.093)	(1.091)
dpd_y	5.391***	3.691***	5.225***	3.459***
	(0.550)	(0.472)	(0.583)	(0.550)
y	-11.49***	-11.76***	-12.31***	-14.19***
	(0.953)	(0.958)	(1.236)	(1.271)
res_y	-2.143***	-2.697***	-1.764**	-1.215*
	(0.571)	(0.556)	(0.708)	(0.733)
Constant	-2555***	-2538***	-2615***	-2731***
	(448.1)	(453.6)	(456.5)	(480.9)
Observations	3641	3641	3622	3622

Standard errors in parentheses. Fixed effect coefficients are not shown.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

D. Sovereign Ratings and Corporate Financing Costs

16.   **Corporates based in emerging market economies issued a growing amount of bonds in international financial markets in the last decade.** Sovereign risk plays a critical role in allowing corporates of developing countries to borrow from international capital markets at favorable terms (Reinhart and Rogoff, 2004**).** In particular, lower sovereign risk improves access to the deep and liquid financial resources of the major financial centers and offers opportunities to emerging market corporations to reduce their cost of capital by diversifying their funding and lengthening maturities.

Figure 4. Corporate Bond Issuance from Emerging Markets
(Number)

Source: Dealogic Analytics.
Note: Data until March 2010.
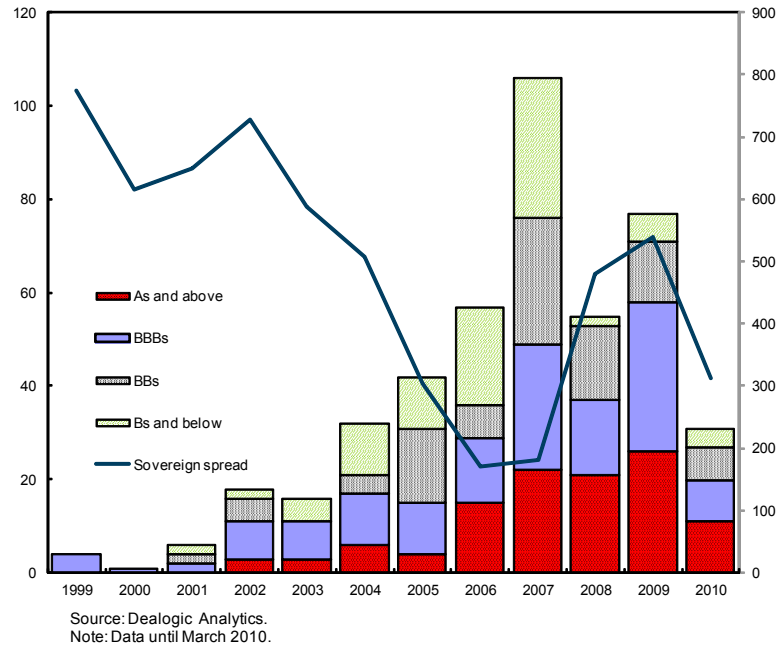
17.   **Sound macroeconomic policies tend to reduce the cost of capital for corporations.** International investors care about the macroeconomic conditions and the institutional setting in which corporations seeking to issue international bonds operate (World Bank, 2007). In this context, the improvements in country performance reflected in sovereign credit ratings are interpreted as proxies of an improved business environment (Das *et. al*, 2010). At the same time, domestic growth performance affects corporate profitability and cash flows.

18.   **Sovereign creditworthiness interacts with corporate creditworthiness through several channels**.[7] The first channel is the common macroeconomic environment shaped by country economic policies and country-specific macroeconomic vulnerabilities, such as exposure to large term-of-trade shocks. Major events such as large currency depreciation could often imply difficulties for both companies and the sovereign to meet foreign currency liabilities. A second channel is the "spillover"/externality effect from the solvency of the sovereign to private debtors. A sovereign default may be followed by policies that have an adverse impact on the corporates' ability to service their debts, such as inflationary financing or tax increases. The third channel is the potential closure of the capital account or foreign exchange markets in times of sovereign default, a possibility that underpinned the pre-1997 credit rating agencies' policy of "sovereign ceiling", whereby no private company was rated above the sovereign.

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[7] See Borensztein, Cowan and Valenzuela (2007).

19. **Corporate spreads in investment grade countries tend to be lower than those in speculative grade countries (Figure 5).** This suggests that improvements in sovereign creditworthiness may benefit domestic companies. Corporate bond spreads are higher than sovereign spreads in investment grade rated countries, suggesting the existence of an implicit sovereign ceiling. However, the evidence suggests that the difference between sovereign spreads and corporate spreads in non investment grade countries is much smaller.

20. **Corporate characteristics will also affect the benefits from an improvement in a country's rating.** Studies reporting corporate bonds trading at a lower risk premium than sovereign debt suggest that the sovereign ceiling may be inappropriate, for example, for firms generating foreign exchange through exports, affiliates of foreign companies, or firms with strong ties to the government (Durbin and Ng, 2005). Thus, the sovereign rating appears to have become a benchmark rather than an effective limit.[8]

21. **The following model is estimated to assess the benefit to domestic corporates from an upgrade in the sovereign credit rating status :**

$$Corp\_spd_{it} = \alpha + \beta rating\_corp_{it} + \gamma vix_t + \delta fff_t + \_Icountry\_26_t + \theta duration_{it} + \lambda deal\_val_{it} + \mu_t$$

(2)

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[8] The country ceiling concept replaced sovereign ceilings in Fitch Ratings and other credit risk assessments (Fitch Ratings, 2008).

Where $Corp\_spd$ is the corporate spread; a is a constant, $rating\_corp$ is the corporate rating; vix is the Chicago Board Options exchange volatility index, fff is the U.S. Fed Funds futures rate; $\_Icountry\_26$ is a dummy to adjust for the observations corresponding to Russia (which is an outlier); $duration$ corresponds to the length of time before the bond matures; $deal\_val$ is the amount of the corporate issuance; and μ represents disturbances that are independent across countries.

Table 3. Regression Results on the Determinants of Corporate Spreads

Corp spd	Coefficient	Std. error	t
rating_sov	35.77	10.32	3.46
vix	6.48	2.26	2.87
fff	32.35	5.64	5.73
_I country_26	88.48	23.56	3.76
duration	0.82	0.94	0.88
deal_val	-3.13E-08	2.05E-08	-1.52
_cons	-3388.156	536.63	-6.31
Obs	110		
F(6,103)	14.03		
R-squared	0.628		
Adj R-squared	0.607		

22. **Results suggest that upgrades to investment grade status reduce corporate debt spreads substantially**. The estimated size of the contribution from a rating change of one notch (36 bps) is similar to that obtained in World Bank (2007). Moving from the average in the speculative grade rating to the lowest investment grade category (BBB-)—a five-notch upgrade—tends to reduce corporate spreads by about 180 basis points**.**

E. Final Remarks and Implications for Panama

23. **Panama's sound macroeconomic policies in recent years were key to attaining investment grade status in early 2010**. The improved rating had been validated by the spreads on sovereign bonds observed prior to the upgrade. These placed Panama alongside other investment grade countries, such as Brazil, Peru, and South Africa, and well below the Latin American average dominated by the speculative grade countries.

24. **Empirical evidence suggests that the recent rating upgrade may lead to a substantial reduction in borrowing costs**. The econometric estimates reported in the paper indicate a reduction of 55 to 210 basis points, with the preferred estimate suggesting a reduction of 140 basis points. This is a sizeable decline compared to the average spread for speculative grade countries during the sample period, which was 505 basis points.

25.　**Improved creditworthiness of the sovereign tends to lower financing costs for domestic corporations.** Estimates suggest that a five-notch upgrade (to the lowest investment grade category) lowered domestic corporate spreads by about 180 basis points over the sample period**.** As the sovereign rating improves, corporate spreads will tend to experience a substantial decline.

26.　**Panama's sovereign credit upgrade to investment grade should lower borrowing costs in the country and help boost economic growth.** The upgrade also provides strong incentive to maintain prudent fiscal management, a strong fiscal framework, and sound financial sector policies.

APPENDIX

Data Sources and Country Sample

Data Sources

The source for the data on corporate bonds is Dealogic Analytics (Emerging Market – Corporate External Issuance), which provides information on the date of issuance, industry, issuer type, and spreads. The EMBI spread (from Bloomberg) and the other variables are matched with the day the corporate bond was issued. The sample period covers January 1995-March 2010; monthly data is used.

Sample of Emerging Market Countries

Argentina	Indonesia	Poland
Brazil	Jamaica	Russia
Bulgaria	Kazakhstan	Serbia
Chile	Korea	South Africa
China	Lebanon	Sri Lanka
Colombia	Lithuania	Thailand
Croatia	Malaysia	Tunisia
Dominican Republic	Mexico	Turkey
Ecuador	Morocco	Ukraine
Egypt	Pakistan	Uruguay
El Salvador	Panama	Venezuela
Hungary	Peru	

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II. MACRO-FINANCIAL LINKAGES IN PANAMA [1]

A. Introduction

1.   **The recent global crisis has given rise to a renewed interest in macro-financial linkages.** The economic literature (e.g., Kiyotaki and Moore, 1997) has shown that shocks to economic activity can have quantitatively large adverse effects on the financial system, which then give rise to second-round effects on the real economy through reduced credit availability. Recent empirical support for this hypothesis using U.S. data is provided in Bayoumi and Melander (2008). While this type of credit cycles have not been extensively studied for emerging markets, they are highly relevant for Panama, given its high level of financial intermediation and the key role played by credit during the recent high-growth period.[2]

2.   **Feedback loops from credit to activity reflect both demand and supply effects.** The linkages from credit to the real economy are commonly thought to be supply-driven, i.e. that reduced credit availability constrains spending by households and firms. However, changes in credit can also be demand-driven. While real demand is usually proxied by GDP growth, credit supply is often measured through surveys on lending standards—whenever available—and some measure of loanable funds, such as bank deposits. The effects of lending rates on credit are typically thought to represent a mix of supply and demand effects.

3.   **A Bayesian VAR (BVAR) model is used to study macro-financial linkages in Panama during 1999–2009.** A central question of the paper is the importance of domestic feedback loops between the real and financial sectors, and the transmission of international financial and real shocks. The model is estimated using a methodology developed by Villani (2008), which allows for the specification of informative steady-state priors for the variables used. An important advantage of this methodology is that it substantially reduces the problem of degrees of freedom often associated with conventional VARs.

4.   **The paper finds clear evidence of domestic macro-financial linkages and confirms previous findings of strong external spillovers to real activity in Panama.** The results show that GDP growth responds to domestic credit, and that the response is stronger than to other domestic macroeconomic variables. At the same time, credit growth is found to be mainly demand-driven. Finally, the paper confirms previous findings of important spillovers from U.S. GDP growth to economic activity in Panama (Swiston, 2010), with a positive one standard deviation shock to U.S. growth increasing the growth rate of real GDP in Panama by about 1½ percentage points.

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[1] Prepared by Juliana Araujo and Kristin Magnusson.

[2] Panama has no national currency or central bank and has the U.S. dollar as its only legal tender. This means that neither money supply nor credit are buffered or amplified by domestic monetary policy considerations.

5.   **The rest of the paper is organized as follows.** Section B briefly describes the financial sector and the evolution of growth and lending during the crisis. Section C introduces the model. Section D presents the main results, and section E concludes.

B. Background

6.   **Panama showed an impressive growth record prior to the crisis, and avoided a recession following the global shock.** Real GDP growth averaged 6 percent during 1999-2008, driven by rapid growth in private investment and exports. Growth slowed to 2.4 percent in 2009, but remained above the average for the region.

7.   **Panama experienced a healthy expansion of credit prior to the crisis.** Panama has a very high level of financial intermediation compared to the region, with bank credit amounting to about 90 percent of GDP. Growth of domestic credit to the private sector averaged about 14 percent during 2004-08, against a backdrop of strong economic growth. It declined to about 1 percent in 2008 in the context of the global crisis and the domestic slowdown.
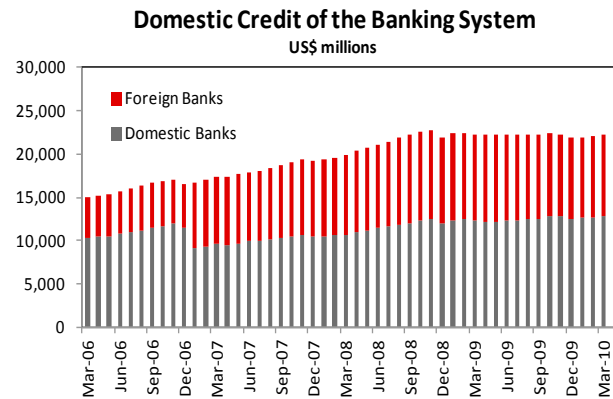
8.   **The financial system held up well during the global crisis.** Bank financial soundness indicators remained strong, while private deposits continued to grow at a solid pace, aided by inflows from the region. Given that retail funding is the dominant source of bank financing in Panama, funding to banks was affected relatively little by the international drought in interbank markets. This may be regarded as *a priori* evidence that lack of liquidity, or supply effects, was not the main contributor to the slowdown of domestic credit growth.

9.   **Domestic lending rates fell, but much less than U. S. rates.** While the increases in lending rates before the global crisis were of similar magnitudes in Panama and the U. S., the decline in rates following the crises was more modest in Panama. One possible explanation for the asymmetry is that Panamanian banks adopted relatively more conservative lending standards following the financial crisis partly owing to the absence of lender of last
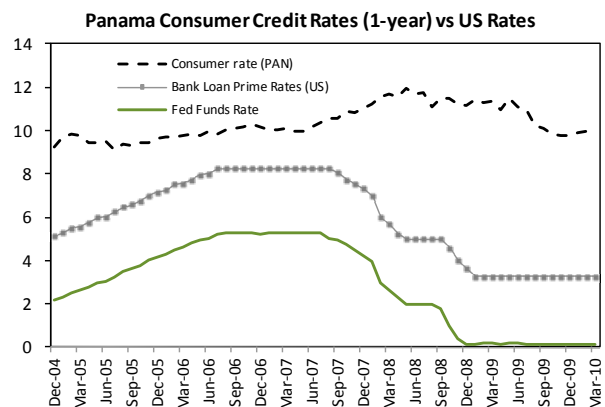
resort. Sustained high deposit rates also likely limited the scope for decreasing lending rates.

C. Model and Empirical Implementation

10.   **VAR models are useful for estimating and forecasting the dynamic responses of economic systems, but the short samples available are a challenge.** VAR models have been widely used since they impose little restrictions on the system and perform well in forecasting, provided sufficiently long time series are available. The fact that samples are often small places an important constraint on the number of variables that can be included in the model due to the associated relatively few degrees of freedom.

11.   **Bayesian VAR modeling helps overcome small-sample shortcomings and forecasting.** By including relevant prior information regarding the steady-state values of some variables, the degrees-of-freedom problem can be mitigated. As suggested by Villani (2008), using informative priors on the steady-state level of a variable makes the forecasts converge to a reasonable level. If the priors are appropriate, forecasting performance will be improved, as has been shown empirically (Adolfson et al, 2007, Österholm, 2008, Österholm and Zettelmeyer, 2008).

12.   **The model is given by**

$$G(L)(x_t - \psi) = \eta_t \qquad\qquad\qquad (1)$$

where $G(L) = I - G_t L - \ldots - G_p L^p$ is a lag polynomial of order p, x_t is an n x 1 vector of stationary macroeconomic variables and η_t is a n x 1 vector of iid terms with properties $E(\eta_t) = 0$ and $E(\eta_t \eta_t') = \Sigma$. In this model, ψ represents the steady state, over which the researcher is assumed to have informative prior information.

The prior on Σ is given by $p(\Sigma) \propto |\Sigma|^{-(n+1)/2}$, the prior on $vec(G)$, where $G = (G_1 \ldots G_p)'$, is given by $vec(G) \sim N_{pn^2} (\theta_G, \Omega_G)$ and the prior on ψ is given by $\psi \sim N_n (\theta_\psi, \Omega_\psi)$. In practice, this implies that only the priors of the vector of dynamic coefficients $vec(G)$ and the steady state parameters ψ will typically be informative.

13.   **Both domestic and external variables were included in the empirical specification.** Following Österholm and Zettelmeyer (2008), we separate the vector of variables x_t into a domestic and a foreign block:[3]

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[3] Previous work (Swiston, 2010) has found trade in goods and services to be an important transmission channel of shocks from the United States to Panama, but we chose not to include it given the presence of U.S. GDP growth in the model and the paper's focus on financial and domestic factors. Panama's large off-shore financial center is also excluded from the model because the segment is largely de-linked from the rest of the economy.

$$\mathbf{x_t} = [\Delta y_t^{US}, i_t^{US}, LOS_t^{US}, HY_t, \Delta FDI_t^{PAN}] \ [\Delta y_t^{PAN}, i_t^{PAN}, \Delta g_t^{PAN}, credit_t^{PAN}, dep_t^{PAN}] \ (2)$$

where the external block comprises:

- Δy_t^{US}, growth rate of U.S. real GDP,

- i_t^{US}, the nominal U.S. Federal Funds rate,

- LOS_t^{US}, the U.S. Federal Reserve's Senior Loan Officer Survey, a non-price measure of credit availability (Swiston, 2008, Bayoumi and Melander, 2008),

- HY_t, the U.S. high-yield corporate bond spread, included as a proxy for global risk aversion,

- ΔFDI_t^{PAN}, the ratio of Panama's foreign direct investment to GDP.

The domestic block is given by:

- Δy_t^{PAN}, Panama's growth rate of real GDP,

- i_t^{PAN}, Panama's nominal 3-month consumer lending rate in the onshore banking system,

- $credit_t^{PAN}$, Panama's growth rate of real credit to the private sector by the onshore banking system,

- dep_t^{PAN}, Panama's growth rate of real credit supply,

- Δg_t^{PAN}, Panama's ratio of government spending to GDP.

14. **The identification strategy for ordering the variables of the system was based on previous research.** As in Villani (2008), it is assumed that the U.S. Federal Funds rate is the most exogenous variable, followed by the other variables in the external block. In the domestic block, the lending rate was assumed to be the least endogenous variable, followed by government spending and GDP growth; private sector credit and deposits were assumed to be the most endogenous. We assumed that no variables in the domestic block affect the external block, in line with the small size of the Panamanian economy compared to the U.S.

15. **To better ascertain the role of financial factors in economic activity, the model specification separates demand and supply of credit.** Following the literature, credit demand is proxied by real GDP growth. When available, survey-based lending standards have been found to be a useful measure of credit supply (Bayoumi and Melander, 2008, Calani et al, 2010, Lown and Morgan, 2000). However, in the absence of such surveys for

Panama, we follow Daseking *et al.* (2003) and use total deposits in the onshore banking system as a proxy for credit availability.

16.   **The model is estimated with data for the last decade and allows for a structural break in growth rates in Panama.** A sample at the quarterly frequency starting in the last quarter of 1999 was used. Evidence points to potential GDP growth increasing markedly in Panama starting in 2003. Data suggest a structural break also in other model variables around this time. Given that this could have potentially shifted the underlying relationships between the variables in the model, we included a dummy that takes on the value of one from that year onwards. This also means that separate priors were defined for the two subperiods. Finally, we set the lag length at 4.

17.   **In view of the lack of conclusive evidence in previous research, numerical values for priors were mainly taken from the data.** Priors for the U.S. interest rate was based on combing an inflation target of around two percent with a real interest rate of two percent as spelled out by the Fisher hypothesis for the earlier part of the period, while the dramatic interest rate changes during the latter part of the sample period led us to choose a wider distribution. Priors on growth rates for U.S. and Panamanian output were taken from desk estimates in the IMF's Western Hemisphere department for both subperiods.[4] For the rest of the variables, neither previous research nor theory could provide estimates, which is why relatively wide distributions were chosen.[5]

D. Results

Impulse Responses

18.   **The main variables of interest are GDP and private sector credit growth.** Figure 1 (left and right panels) presents impulse responses for these two variables. The full set of impulse responses are found in Figures A1 in the Appendix. Impulse responses are generated

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[4] For the first subperiod the prior on US GDP growth was between 1 and 3 percent and for the latter subperiod was -1 and 2 percent. The prior on Panama's GDP growth rate was between 2 and 8 percent and 6 and 10 percent, respectively.

[5] For the priors governing the dynamics of the model, we follow Litterman, 1986, in using a modified version of the Minnesota prior. If a variable is modified in levels, the prior mean on its first own lag is set to 0.9; if in growth rates, it is set to 0. The reason for modifying the traditional Minnesota prior in this fashion is that a prior mean on the first own lag equal to 1 is theoretically inconsistent with a mean-adjusted model, since a random walk does not have a well-specified mean.

in a standard fashion, i.e. reflect one-standard deviation shocks.[6] Coefficients are often significant and generally of the expected sign, both for the external and domestic block.

19.   **Among the domestic variables, credit is more important than government spending for GDP growth.** The results suggest that a one standard deviation increase in bank credit growth in Panama results in an increase of ½ percentage points in real GDP growth. The impact of fiscal policy is about a fifth that of credit, i.e. a one standard deviation increase in the ratio of government spending to GDP leads to 0.1 percentage points increase in real GDP growth. Credit supply (proxied by deposits) is found not to affect GDP growth in a significant fashion.

20.   **Spillovers to the real economy from U.S. growth shocks are large, but other external variables do not seem to have significant effects.** Changes in U.S. real GDP growth have a strong and persistent impact on the Panamanian economy. A one standard deviation increase in U.S. growth leads to an increase of about 1½ percentage points in the rate of GDP growth in Panama. A one standard deviation increase in the FDI-to-GDP ratio increases economic growth by ¼ percentage point. Coefficients for the high-yield bond spread and U.S. interest rates have the expected negative sign, but the effects are not statistically significant.

21.   **Estimated spillovers from U.S. growth are broadly similar to those found in previous studies.** Using a structural VAR (SVAR) framework, Swiston (2010) finds that a positive one standard deviation shock to U.S. GDP growth raises the growth rate of activity by about 1¼ percentage points in Panama. The impact of shocks from other advanced economies, as well as from the rest of Central America, on Panama's GDP growth is found to be nil.

22.   **Credit supply and lending standards in the U.S. are not found to have significant effects on Panama's credit growth.** The impulse responses in Figure 1 (right panel) show that growth in total deposits in Panama has a positive effect on credit growth, but the coefficient is small and insignificant. U.S. lending standards affect credit in Panama within one year and in the expected direction: an easing in standards translates into higher willingness to lend and hence increases credit, but the results are also not significant. It is, however, possible that our measure of credit supply fails to take into account changes in credit standards (unrelated to the availability of loanable funds), which were tightened in Panama during the recent crisis.

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[6] One standard deviations shocks correspond to the following magnitudes for the included variables: 6.6 percent for PAN credit growth, 1.5 percent for PAN government spending, 4 percent for PAN FDI, 4 percent for PAN GDP, and 2 percent for U.S. growth.

Figure 1. Impulse Responses for Panama GDP Growth and Credit

Left panel: PAN GDP. Right panel: PAN credit
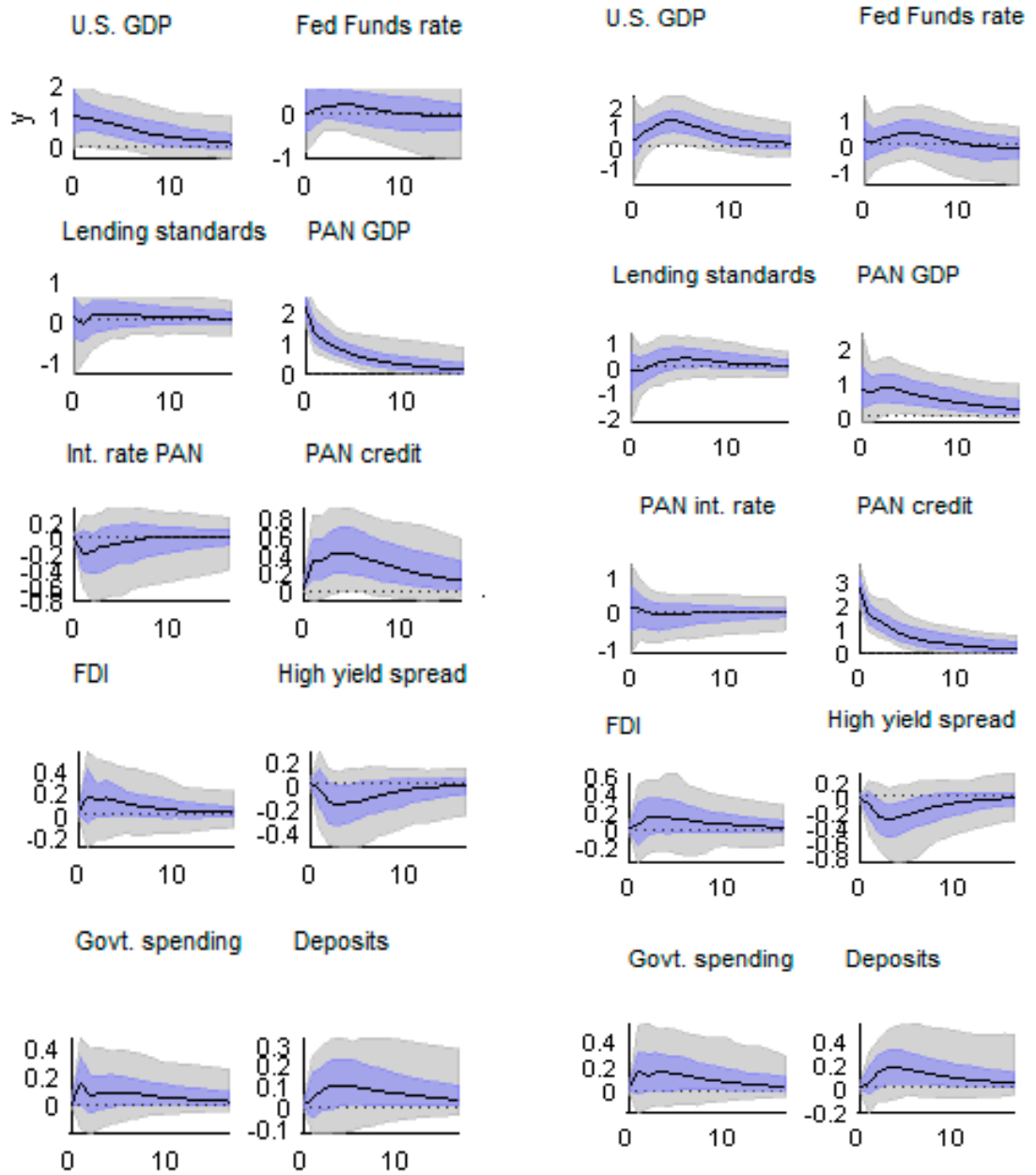
Note: The shaded areas correspond to 95 and 68 percent confidence intervals.

23.   **Credit growth is to a large extent driven by developments in the domestic economy.** A one standard deviation increase in domestic economic growth leads to an increase of about 0.9 percentage points in domestic credit growth. This suggests that the response of credit to changes in activity is about twice as large as the response of activity to changes in credit. No other domestic or external variables (including interest rates and risk aversion) are found to have significant effects on credit in Panama. Taken together, this provides support to the hypothesis that credit follows developments in the real economy.

Variance Decomposition

24.   **The estimated model can explain about half of the shocks to GDP growth in Panama over the last 10 years.** As shown in Figure 2, own shocks to Panama's GDP explain around 50 percent of the variance of output growth, which is a reasonable proportion for a VAR. Shocks to U.S. GDP explain around 25 percent at the ten-quarter horizon. Shocks to U.S. interest rates, lending standards and domestic credit explain the remaining 25 percent.

25.   **Credit developments are sensitive to several variables.** Own shocks to credit also explain about 50 percent of the variance (Figure 2). Shocks to U.S. and Panama's output explain about 15 percent each, while the remaining 20 percent can be attributed to shocks to real interest rates in the U.S. and Panama.

E.   Concluding Remarks

26.   **Our estimated model finds important two-way linkages between the real economy and the financial sector in Panama.** Real GDP in Panama is found to be strongly affected by credit to the private sector, FDI and government spending. However, the effect from all domestic variables is found to be less important than that from U.S. GDP growth. A one standard deviation shock to U.S. growth is found to increase the growth rate of Panama's real GDP by about 1½ percentage points. We also find large effects of real activity on credit growth in Panama (twice the size of the effect of credit on real growth), suggesting that credit is mostly demand-driven. Measures of credit supply are not found to have significant effects on credit growth.

27.   **The results suggest that credit growth in Panama will increase as the recovery firms up.** The increase in GDP growth starting in the last quarter of 2009 was likely aided by an improved external environment. With GDP growth expected to recover fast, the model predicts a significant rebound of bank credit to the private sector.
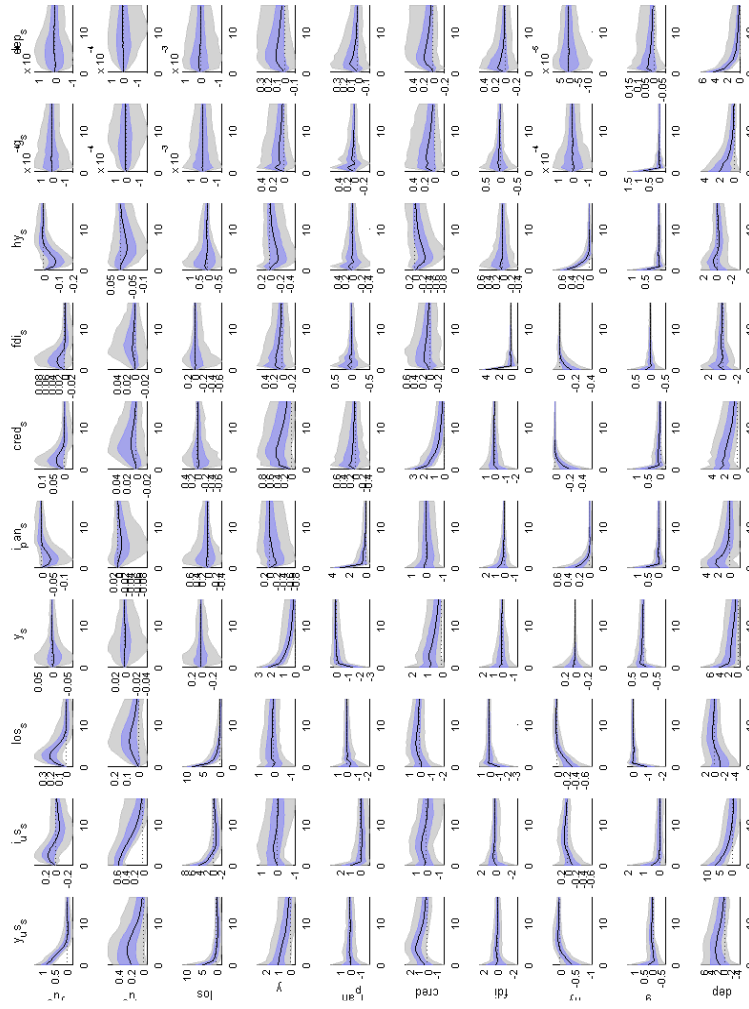
Figure 2. Variance Decompositions
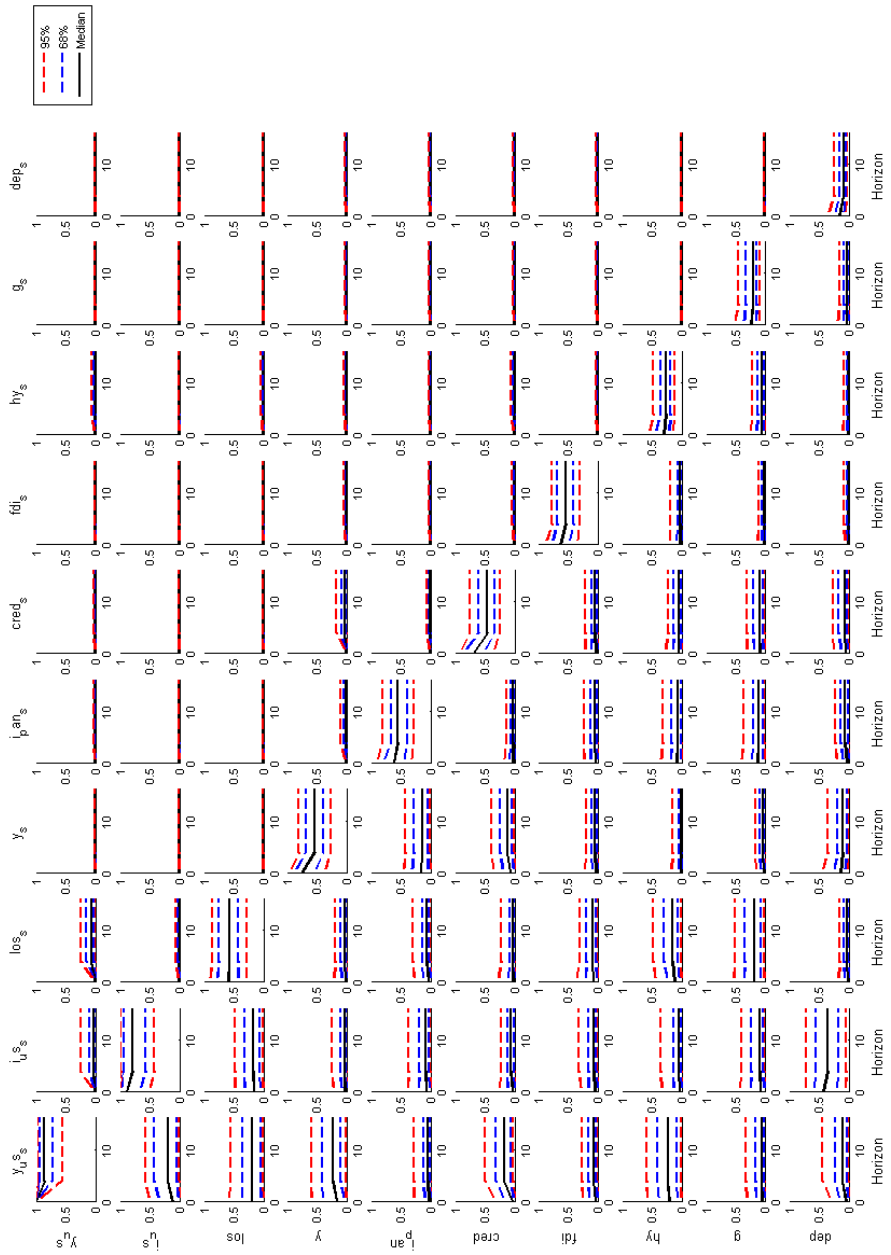
Left panel: PAN GDP. Right panel: PAN credit
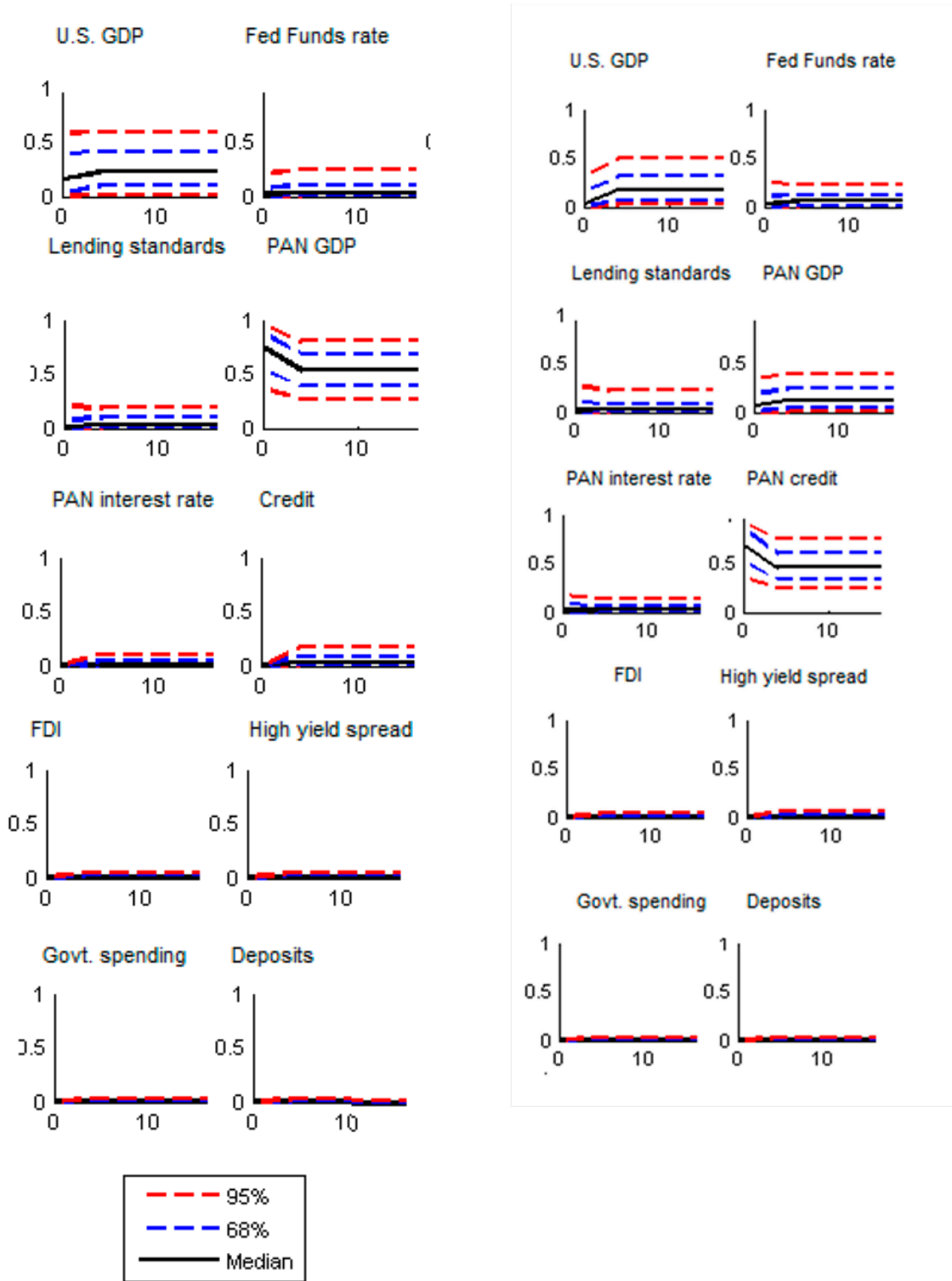
APPENDIX

Figure A1. Impulse Responses

Note: The shaded areas correspond to 95 and 68 percent confidence intervals.

Figure A2. Variance Decompositions

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