The Relationship between Illicit Coca Production and Formal Economic Activity in Peru

BANCO CENTRAL DE RESERVA DEL PERU

October 13, 2011

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Focus of the Presentation

How can we empirically study the following:

"The Relationship between Illicit Coca Production and Formal Economic Activity in Peru"

Motivation

Background

What does the literature tell us?

Hypothesis

Methodological Solutions

Limitations

Results

Findings

Conclusions

Motivation

Illicit informal sector activity may affect economic growth in Peru.

➢ Peru requested IMF's assistance to develop a ML/FT risk-based strategy focused on **threats, vulnerabilities, and consequences**.

➢ Fund staff collected and analyzed data on different possible threats, such as **the illicit drug sector**, smuggling, tax evasion, and counterfeiting.
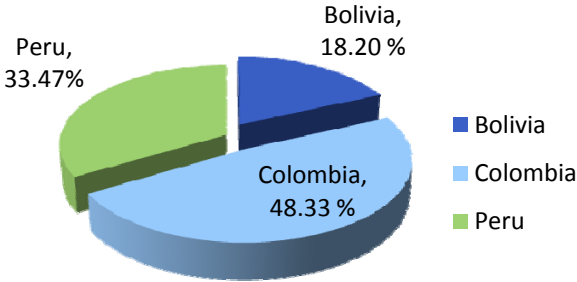
Background

Peru is one of the world's **largest** producers of coca and coca derivatives.

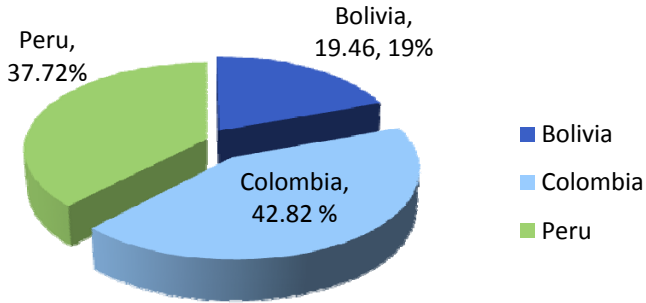The Illicit coca sector accounts for a **sizeable** portion of the informal sector.

The relationship between the illicit coca sector and the formal economic activity needs **further analysis**.

Coca Bush Cultivation percentage variation in the Andean Region

2008

Bolivia, 18.20 %
Peru, 33.47%
Colombia, 48.33 %

- Bolivia
- Colombia
- Peru

2009

Bolivia, 19.46, 19%
Peru, 37.72%
Colombia, 42.82 %

- Bolivia
- Colombia
- Peru

Source: Peru Monitoreo de Cultivos de Coca 2009, UNODC (2010)

Coca Sector Production Ratio (As a percent of the formal GDP)

Bolivia: **1/8-1¼** percent of total GDP (2000-2009)

Colombia: **¾-3¾** percent of total GDP (2000-2009)

Peru: **0.9*** percent of total GDP in 2009

Sources: UDAPE (2010), DANE (2010), authors calculations*

What does the literature tell us?

Estimates of any illegal activity are **highly speculative**.

The economic effects of the drug sector have been widely debated and **sharp differences exist**.

➢ The drug industry **has depressed** the growth of the formal sector of the economy, and that the economy would do better without drugs. **Thoumi (2003).**

➢ Cocaine production confers **unambiguous benefits** to the country. **De Franco And Godoy (1992).**

Table 1. Coca Leaf Cultivated Hectares According to CNC, UNODC, and CADA-CORAH (2001-2009)

Sources	2001	2002	2003	2004	2005	2006	2007	2008	2009
CNC	32,100	34,700	29,250	27,500	34,000	42,000	36,000	41,000	40,000
UNODC-DEVIDA	46,200	46,700	44,200	50,300	48,200	51,400	53,700	56,100	59,900
CADA-CORAH	-	-	-	-	49,481	54,856	64,716	64,218	61,629

Sources: Narcotic Affairs Section, Embassy of the United States in Peru, 2010.

Hypothesis

Illicit drug sector is expected to have two possible opposing effects on the formal sector:

- A **decrease in** formal sector economic activity due to crowding out

- An increase in formal sector economic activity due to **spillover effects**.

Hypothesis (cont'd)

We are interested in the **NET** effect of these two opposing forces, possibilities include:

- The net effect is **positive** (spillovers dominate).

- The net effect is **negative** and lies **between 0 and -1** (crowding out dominates, but is less than one for one).
  - Implication: **total** illicit plus formal economic activity **increases.**

- The net effect is **negative** and **less than -1** (crowding out dominates, and is greater than one for one).
  - Implication: **total** illicit plus formal economic activity **decreases.**

Methodological Solutions

To estimate the **GDP equivalent of illicit coca production** at the national level annually from 2001-2009 using:

- ➤   **INEI's** methodology

- ➤   **IDEI's** estimates on cultivated hectares and tons of illegal and legal coca by region.

To employ a **mix of panel VAR and panel cointegration methods**

Table 2. Estimated Illicit coca Cultivation in Hectares by Region (2001-2009)

Regions	2001	2002	2003	2004	2005	2006	2007	2008	2009
UCAYALI	1,037	1,051	496	486	903	1,556	1,596	1,663	2,899
HUÁNUCO	11,463	12,871	11,714	15,371	14,545	15,586	16,946	17,644	17,586
SAN MARTIN	2,892	2,289	1,771	1,383	1,313	1,398	412	427	374
LORETO	250	250	90	100	100	194	590	670	1,066
AMAZONAS	358	358	102	118	118	268	340	392	420
CAJAMARCA	289	289	97	109	109	221	82	94	127
CUSCO	12,088	10,749	10,958	11,438	11,490	11,819	11,714	12,088	12,640
PASCO	210	210	150	180	127	256	740	889	1,236
AYACUCHO	7,327	8,269	8,347	8,587	9,085	9,255	9,768	10,205	10,690
JUNÍN	1,260	1,417	1,430	1,470	1,553	1,581	1,536	1,603	1,773
PUNO	2,451	2,361	2,661	4,631	2,473	2,743	3,259	3,390	4,176
LA LIBERTAD	0	0	0	0	0	0	31	32	392
Others	0	0	0	0	0	0	0		9
TOTAL	39,625	40,114	37,815	43,873	41,815	44,877	47,014	49,096	53,388

Sources: IDEI (2009 and 2010).

Table 3. Estimated Tonnage of Illicit Coca Leaf by Region

REGIONES / AÑOS	2,001	2,002	2,003	2,004	2,005	2,006	2,007	2,008	2,009
UCAYALI	845	840	689	942	1,731	3,071	3,097	3,179	5,363
HUÁNUCO	11,020	12,126	16,786	30,727	28,754	31,715	33,706	34,897	33,765
SAN MARTIN	3,009	2,334	2,746	2,993	2,809	3,080	891	676	778
LORETO	122	120	65	101	100	201	664	699	1,066
AMAZONAS	192	188	82	132	130	304	386	450	512
CAJAMARCA	154	151	77	121	119	249	91	123	154
CUSCO	12,554	10,940	16,965	24,703	24,541	25,985	25,260	26,496	26,291
PASCO	154	151	164	274	190	396	1,131	1,304	1,866
AYACUCHO	11,478	12,695	19,491	27,973	29,267	30,688	31,687	32,649	34,208
JUNÍN	1,974	2,175	3,339	4,788	5,003	5,243	4,983	5,294	5,674
PUNO	2,099	1,981	3,396	8,246	4,355	4,973	5,847	5,907	7,224
LA LIBERTAD	n.a	n.a	n.a	n.a	n.a	n.a	55	199	674
OTROS	n.a	n.a	n.a	n.a	n.a	n.a	n.a	0	9
TOTAL	43,600	43,700	63,800	101,000	96,999	105,905	107,798	111,873	117,585

Source: IDEI (2009 and 2010)

Table 4. Coca Cultivation Distribution Estimates by Regions 2001-2009

Region	2001	2002	2003	2004	2005	2006	2007	2008	2009	% Total 2008	% Total 2009
Cusco	14,527	14,684	13,898	15,816	15,156	16,162	16,886	18122	18312	32.326	30.56
Huánuco	14,288	14,443	13,670	15,556	14,907	15,896	16,608	17976	17848	32.066	29.79
Ayacucho	8,480	8,571	8,113	9,232	8,847	9,434	9,856	10359	10923	18.478	18.23
Puno	3,048	3,080	2,916	3,318	3,179	3,391	3,542	3425	4244	6.1095	7.08
Ucayali	1,814	1,834	1,736	1,975	1,893	2,018	2,109	1677	2913	2.9914	4.86
Junín	1,360	1,375	1,301	1,481	1,419	1,513	1,581	1642	1773	2.929	2.96
Pasco	826	834	790	899	861	918	960	847	1236	1.5109	2.06
Loreto	699	707	669	761	729	778	812	699	1066	1.2469	1.78
La Libertad	439	444	420	478	458	489	510	482	624	0.8598	1.04
Amazonas	343	347	328	373	358	382	399	400	462	0.7135	0.77
San Martin	278	281	266	303	290	309	323	321	378	0.5726	0.63
Cajamarca	99	100	94	107	103	110	115	110	138	0.1962	0.23
Madre de Dios	3	4	3	4	4	4	4	0	9	0	0.02
Total	**46,200**	**46,700**	**44,200**	**50,300**	**48,200**	**51,400**	**53,700**	**56060**	**59917**	**100**	**100**

Source: Authors' estimates based on UNODC (2010).

Limitations

Yields could differ from those reported in our work. UNODC is revising the conversion factors;

Not only regions producing coca leaf produce coca derivatives;

Same technical coefficients for intermediate consumption/gross production value for all producing regions; and

National average coca and coca derivatives prices for regions.

Table 5. Potential Cocaine Production According to CNC, UNODC, and CADA-CORAH (2007-2009)

	UNODC/DEVIDA			CADA/CORAH			US Government (CNC)		
	Hectares	Cocaine (44%)	Cocaine (72%)	Hectares	Cocaine (44%)	Cocaine (72%)	Hectares	Cocaine(44%)	Cocaine(72%)
2007	53,682.00	308.82	505.34	64,717.11	380.55	622.71	37,340.00	211.36	345.86
2008	56,060.00	321.01	525.30	64,218.06	381.10	623.62	42,000.00	254.98	417.24
2009	59,926.00	352.13	576.22	61,629.21	368.50	603.00	40,665.00	238.12	389.65

		Hectares	Cocaine	
			0.44	0.72
2007	MIN	37,340.00	211.36	345.86
	MAX	64,717.11	380.55	622.71
2008	MIN	42,000.00	254.98	417.24
	MAX	64,218.06	381.10	623.62
2009	MIN	40,665.00	238.12	389.65
	MAX	61,629.21	368.50	603.00

Sources: One source required to be anonymous; UNODC, various years

Table 6. Estimated Yield of Illicit Coca Cultivation by Region (2001-2009)

Regions	2001	2002	2003	2004	2005	2006	2007	2008	2009
UCAYALI	0.91	0.90	1.40	1.91	1.91	1.91	1.94	1.91	1.91
HUÁNUCO	1.07	1.06	1.45	1.97	1.97	1.97	1.99	1.98	1.98
SAN MARTIN	1.16	1.15	1.57	2.13	2.13	2.13	2.16	1.58	1.58
LORETO	0.54	0.54	0.73	1.00	1.00	1.00	1.13	1.04	1.04
AMAZONAS	0.60	0.59	0.81	1.10	1.10	1.10	1.13	1.15	1.15
CAJAMARCA	0.59	0.59	0.80	1.09	1.09	1.09	1.11	1.31	1.31
CUSCO	1.16	1.15	1.56	2.13	2.13	2.13	2.16	2.19	2.19
PASCO	0.82	0.81	1.10	1.50	1.50	1.50	1.53	1.47	1.47
AYACUCHO	1.75	1.73	2.36	3.21	3.21	3.21	3.24	3.20	3.20
JUNÍN	1.75	1.73	2.36	3.21	3.21	3.21	3.24	3.30	3.30
PUNO	0.96	0.95	1.29	1.75	1.75	1.75	1.79	1.74	1.74
LA LIBERTAD	0.97	0.96	1.30	1.77	1.77	1.77	1.77	6.22	6.22
Others	1.04	1.02	1.40	1.90	n.a	n.a	n.a	n.a	n.a
Average Yield	1.02	1.01	1.39	1.90	1.90	1.90	1.90	1.93	1.93

Source: IDEI (2009 and 2010)

Table 7. Summary of Prices

Prices	2001	2002	2003	2004	2005	2006	2007	2008	2009
Illegal Coca Leaf									
Annual Average Farm Dry Coca Leaf (US$/kg)	2.30	2.50	2.10	2.80	2.90	2.50	2.50	3.40	3.20
Exchange rate	3.51	3.52	3.48	3.41	3.30	3.27	3.13	2.93	3.01
Farm Dry Coca Leaf Price (NS/Ton)	8,068	8,794	7,306	9,558	9,560	8,186	7,822	9,948	9,638
Gross Coca Paste									
Average Price Coca Paste (US$/Kg)	560	590	530	632	638	550	600	732	778
Exchange rate	3.51	3.52	3.48	3.41	3.30	3.27	3.13	2.93	3.01
Average Price Coca Paste (NS/Kg)	1,964	2,075	1,843	2,157	2,103	1,801	1,877	2,141	2,343
Washed Coca Paste									
Coca Base (NS/Kg)	2,547	2,691	2,391	2,797	2,727	2,335	2,434	2,777	3,038
Cocaine Hydrochloride									
Cocaine Hydrochloride Price (NS/Kg)	2,793	2,951	2,621	2,952	2,957	2,694	2,659	2,750	3,075
Legal Coca Leaf									
Selling Price (NS/Kg)	3.23	4.28	3.84	3.97	4.09	4.23	4.64	4.64	4.64

Table 8. Gross Value Added Estimates
of Coca and Coca Derivatives Sector 2001-2009 (Thousands of 1994 NS)

Production Accounts for Coca and Derivatives	2001	2002	2003	2004	2005	2006	2007	2008	2009
Illegal Coca Leaf									
Gross Production Value	225,559	245,228	2 89,493	564,647	526,807	459.539	438,783	571,969	573,552
Intermediate Consumption	40,908	42,427	39,803	47,176	46,545	47,530	56,482	69,613	69,210
Value Added	184,651	202,801	249,690	517,471	480,262	411.829	382,300	502,356	504,342
Gross Coca Paste									
Gross Production Value	549,188	578,738	730,625	1,257,490	1,158,975	1,010,589	1,053,078	1,231,416	1,394,448
Intermediate Consumption	217,260	241,577	294,999	578,430	556,508	486,254	473,091	614,179	569,718
Value Added	331,928	337,161	435,625	696,059	602,467	524,335	579,987	617,237	824,731
Washed Coca Paste									
Gross Production Value	318,986	332,911	427,641	746,389	679,761	592,686	616,967	718,067	814,839
Intermediate Consumption	236,968	247,211	318,459	555,193	506,676	443,403	462,803	540,083	610,331
Value Added	82,018	85,700	109,181	191,196	173,085	149,283	154,164	177,984	204,508
Cocaine Hydrochloride									
Gross Production Value	279,876	292,094	375,209	630,355	589,724	547,246	539,324	568,987	659,840
Intermediate Consumption	248,250	258,696	335,790	583,614	535,551	473,285	497,523	584,752	653,455
Value Added	31,627	33,398	39,419	46,741	54,173	73,960	41,801	-15,765	6,385
Total Illegal Coca Value Added									
Gross Production Value	1,373,610	1,448,971	1,822,967	3,215,881	2,955,266	2,609,880	2,648,152	3,090,439	3,442,679
Intermediate Consumption	743,386	789,910	989,052	1,764,413	1,645,280	1,450,472	1,489,899	1,808,627	1,902,713
Value Added	**630,224**	**659,060**	**833,915**	**1,451,468**	**1,309,987**	**1,159,408**	**1,158,253**	**1,281,812**	**1,539,966**
Total Legal Coca Value Added									
Gross Production Value	10,265	13,545	11,482	11,182	11,210	10,979	12,089	12,473	11,517
Intermediate Consumption	1,942	1,962	1,900	1,855	1,829	1,755	1,829	2,013	1,863
Value Added	**8,323**	**11,583**	**9,582**	**9,326**	**9,381**	**9,224**	**10,260**	**10,460**	**9,654**

[1] Sources: Authors' estimates.

Results

A. Long Run Cointegration Analysis:

> The presence of **unit roots;**

> **Long run cointegrating relationship** in the case using IDEI estimates;

> The likely **continued sustainability of these levels of production;**

> A **Long run causal relationship** exists among the two variables; and

✓ The formal sector activity causes changes in the coca sector: $1 \leq$ p-value ≤ 2.

✓ The coca sector activity causes changes in the coca sector: $9 \leq$ p-value ≤ 16.

> The importance of **reliable** estimates of coca GDP by region.

Results (Cont'd)

B. Dynamic panel VAR analysis for coca production

➢Accounts for the **regional heterogeneity** in the relationship between the coca sector and the formal economy.

➢ Distinguishes **regional response** of observable variables to **shocks originating** at the **regional** vs. shocks originating at the **national** level.

Typical specification:

$$\Delta y_{it} = \alpha_{1,i} + \theta_{11,i}\Delta y_{it-1} + \theta_{12,i}\Delta x_{it-1} + \mu_{1,it}$$

$$\Delta x_{it} = \alpha_{2,i} + \theta_{21,i}\Delta y_{it-1} + \theta_{22,i}\Delta x_{it-1} + \mu_{2,it}$$

Results (Cont'd)

After **controlling** for government investment, shocks to illicit coca production initially,

> ➤ Have a similar **negative** less than one for one median regional effect on formal sector GDP, but after three years the effect becomes **positive,** and then eventually goes **to zero**.

An indirect robustness check using **sectorally** disaggregated GDP and banking sector data shows:

> ➤ A shock to the quantity of **international denominated deposits**, both at the regional and national levels, leads to a **decrease** in the **quantity of domestic deposits.**

> ➤ Shocks to **agriculture** at the regional and national levels have very small and statistically **insignificant** effects on **electricity.**

Peru Impulse Responses

Figure 1
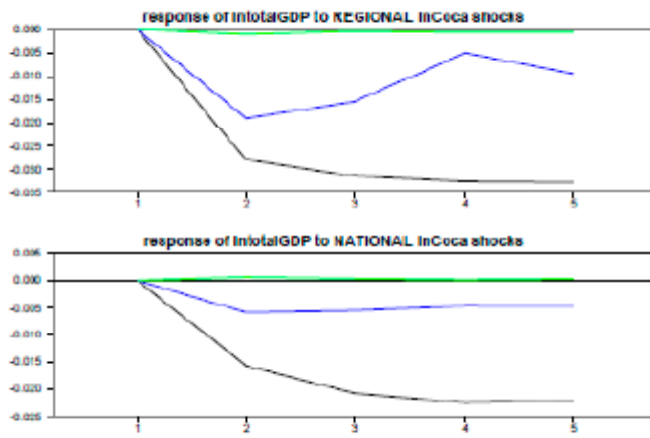
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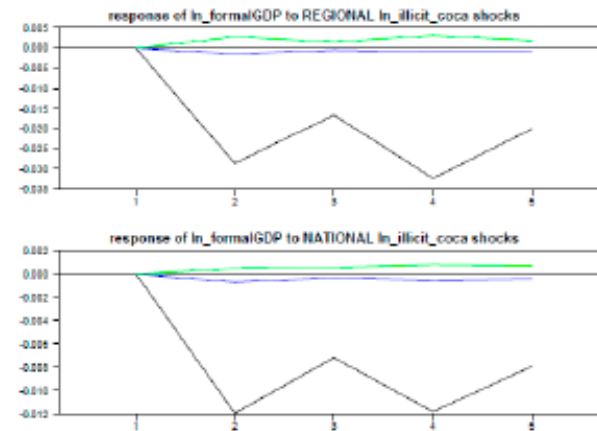
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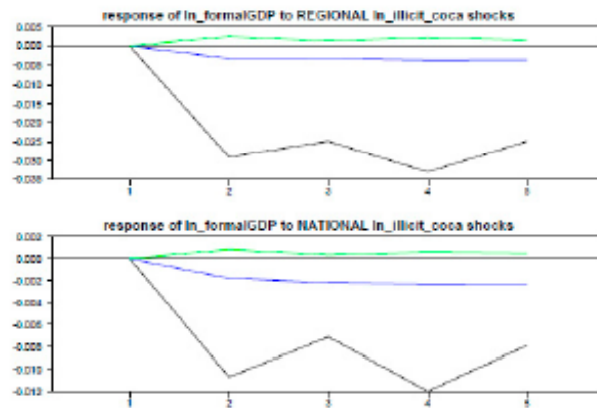
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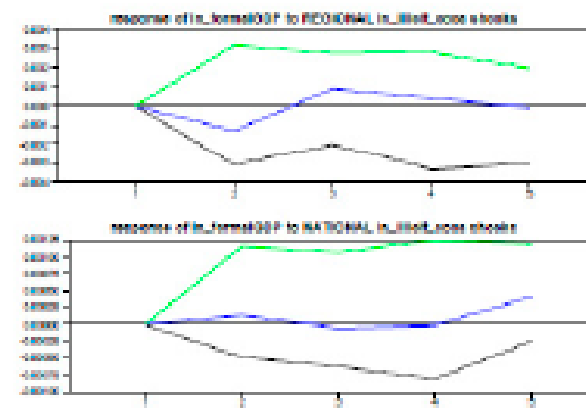
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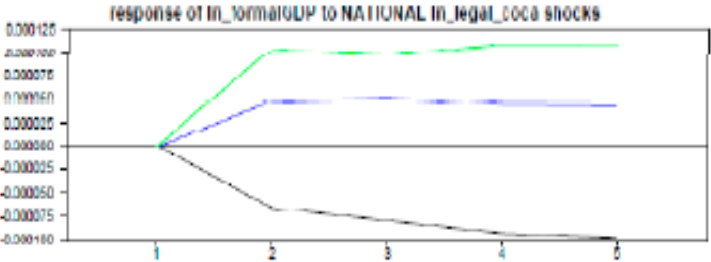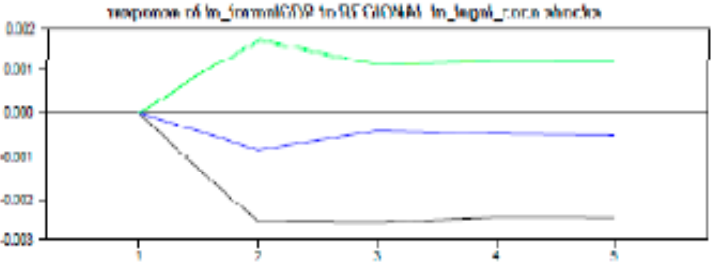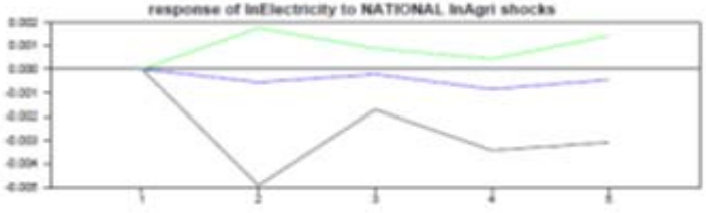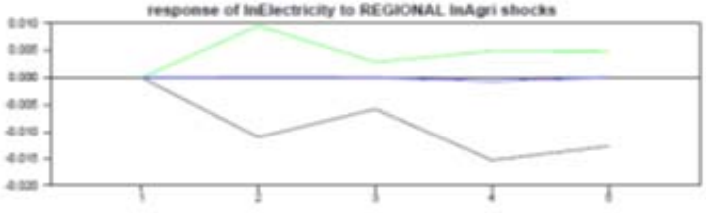

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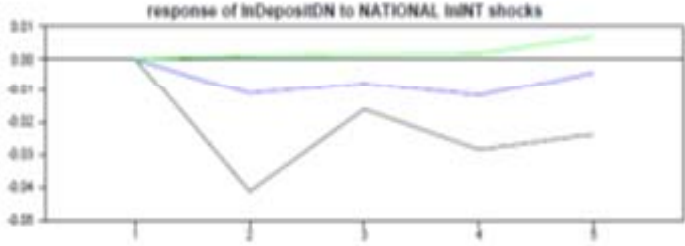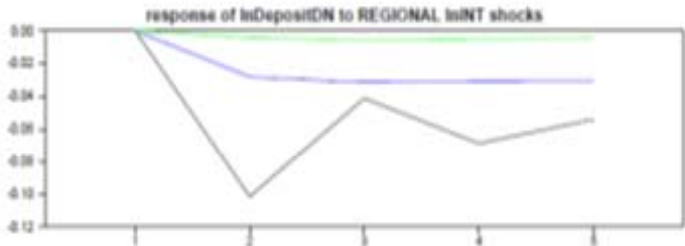
Figure 6

Figure 7

Findings

On balance illicit coca production tends to **crowd out** formal sector production at the regional level.

However, total regional production and income nevertheless tend to increase, as the formal sector production is crowded out by less than one for one.

Conclusions

Good data and good econometrics are necessary conditions for getting reliable findings.

Countries with significant informal activity need to invest in the collection of reliable data estimates.

Valuable to policy makers for directing economic activity in favor of legal sectors of the Peruvian Economy.

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