Evidence on the Role of Oil Prices in Venezuela's Economic Performance*: 1950-2001*

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USAEE United States Association for Energy Economics

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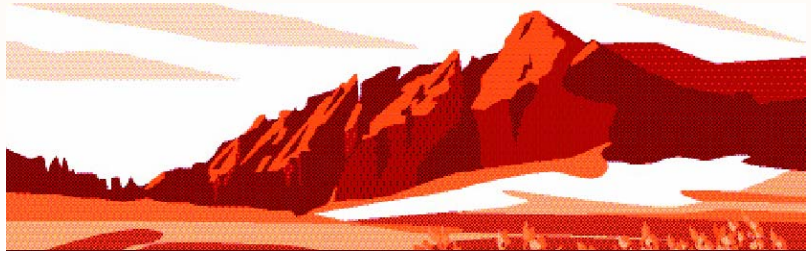


Outline of Presentation

- Introduction and Objective
- Brief History of GDP growth, Investment, and Oil Prices
- Brief Review of Previous Research
- Empirical Model Set-up
- Empirical Results and Interpretation
- Conclusion

Introduction and Objective

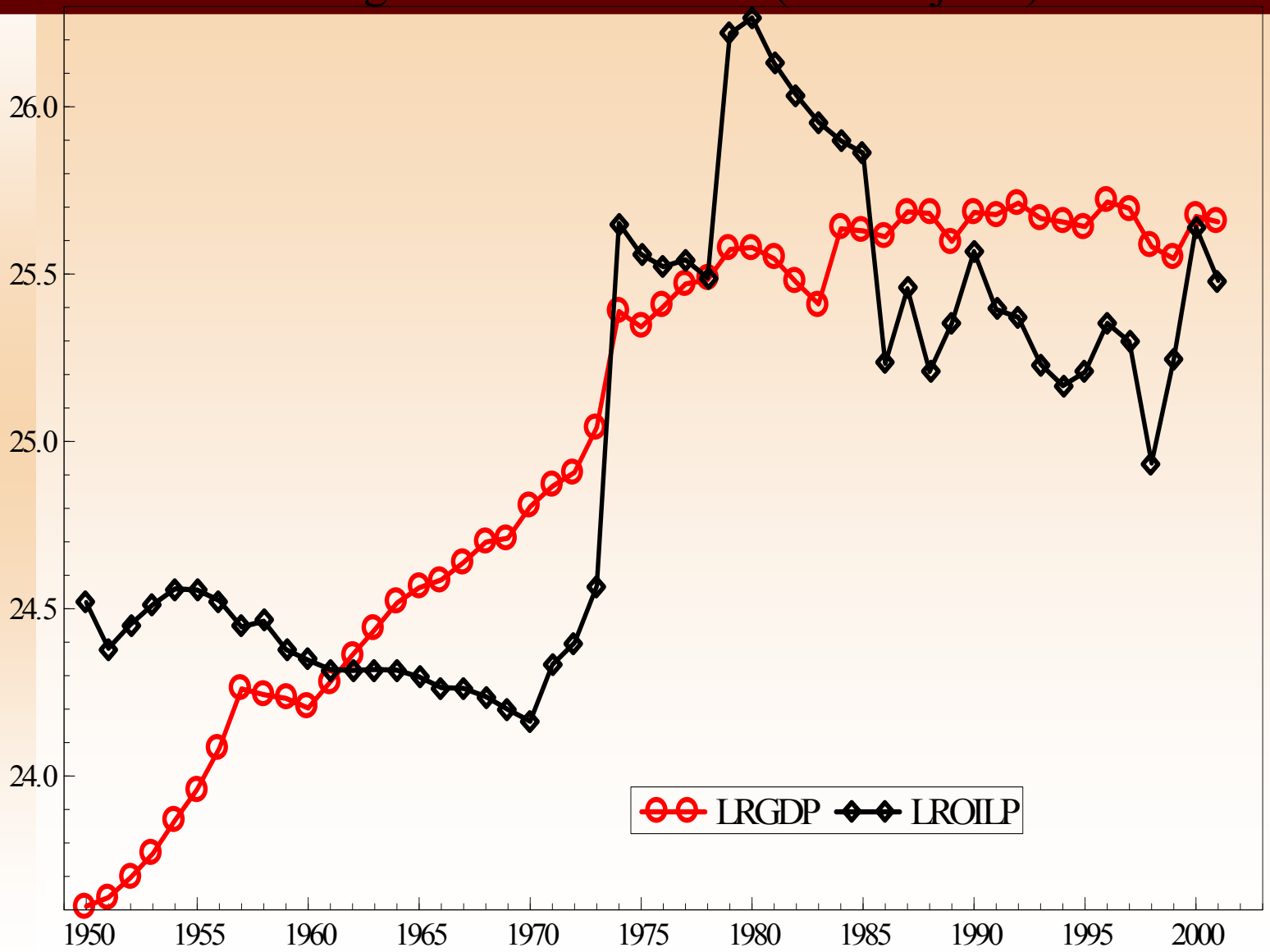
- Economic performance in Venezuela and (world) oil prices have exhibited sharp swings over the last 40-50 years.

- Does Venezuela suffer from the ***"resource curse"?***
- GDP $146Billion (PPP)
- Population 24 million (1.5% growth p.a.)
- Oil Sector 1/3 of GDP
- Oil Exports 3 /4 Government Revenues
- Oil contributes 50% of Government Revenues

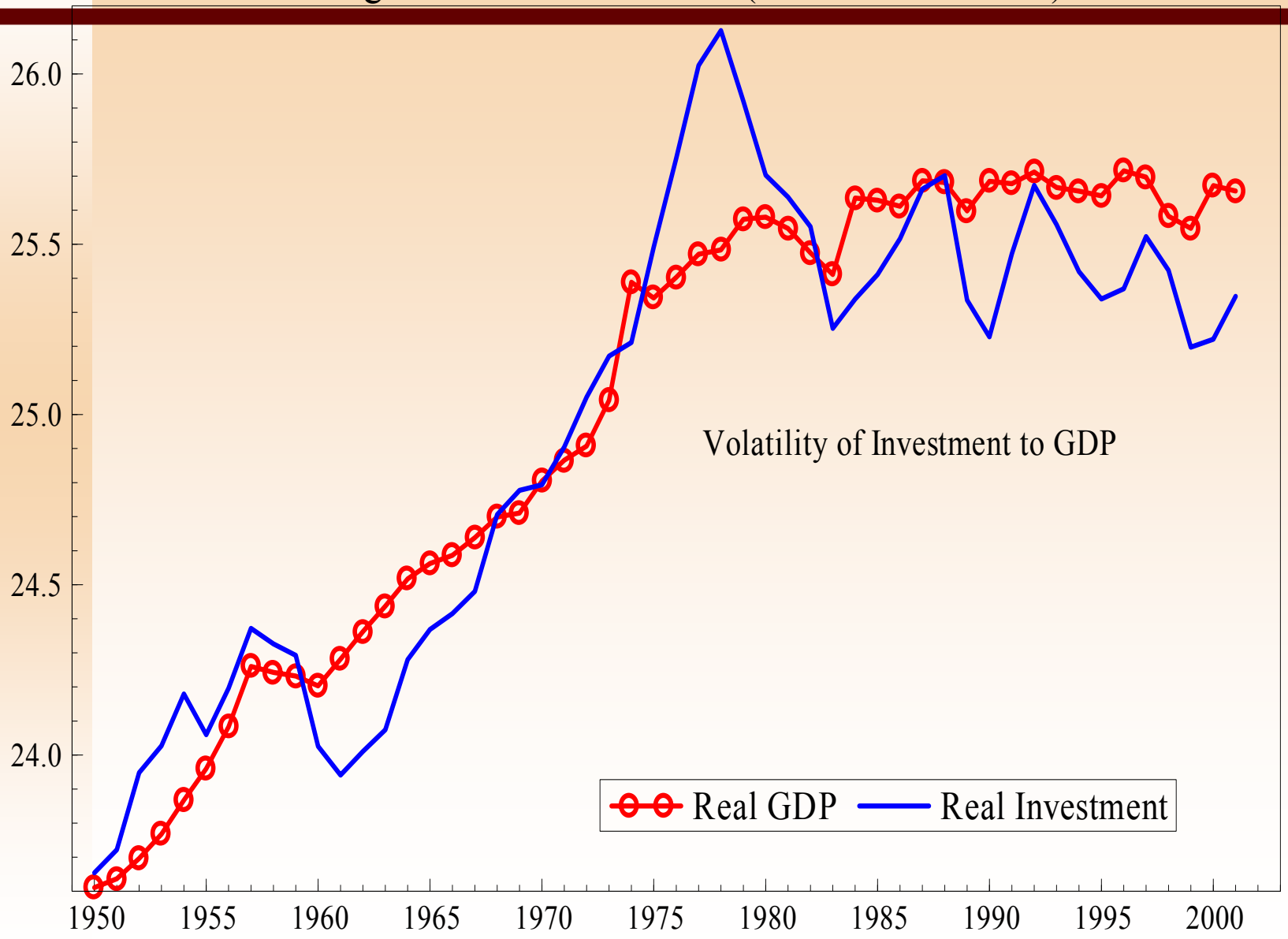
Introduction and Objective

- Does Venezuela suffer from the ***"resource curse"?***
- We investigate the relationship between oil prices government revenues, government consumption spending, GDP, and investment.
- We employ a *General to Specific Modeling* Framework and find two Long-run Relationships.
- The interaction between the variables and oil prices is complex and interesting.

Log GDP and Real Oil Price (Mean Adjusted)



Log GDP and Investment (Scaled GDP 1950)



Explanations for Venezuelan Economic Performance

- **Bourguignon and Gelb (1988)**
  - the stagnation of the Venezuelan economy started after 1978
  - large ***upsurge in consumption*** during the ***decade of revenue windfall***
  - the ***non-oil sector*** did not seem to gain from the 1970s windfall.
  - inappropriate economic policies resulted in steep ***declines in private investment and massive capital flight.***
  - experienced ***severe internal and external imbalances*** that ultimately lead to its decline in economic performance.

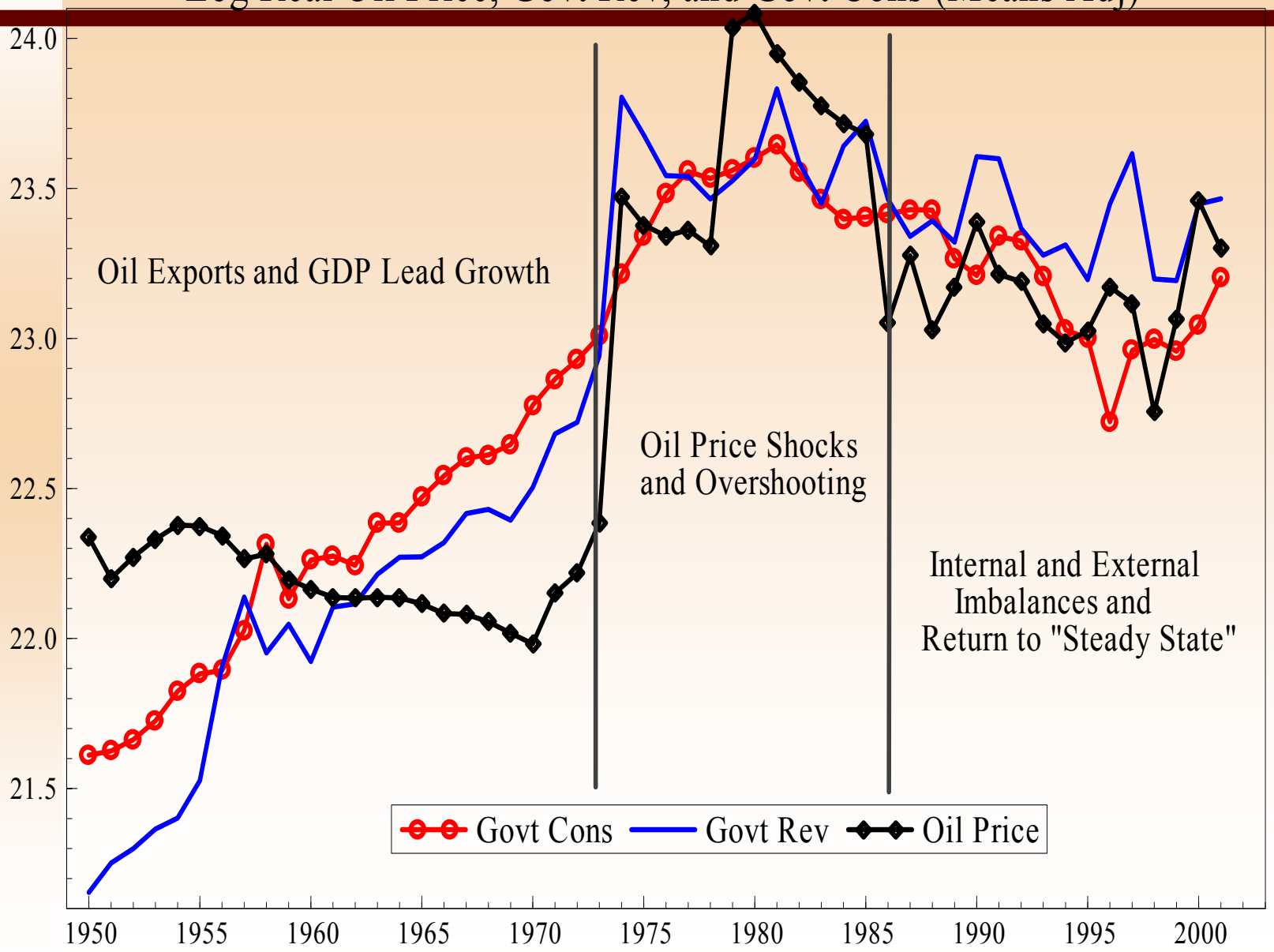
- **Rodriguez and Sachs (1999)** DCGE for the Venezuelan economy.
  - Like other economies highly dependent on oil revenues, ***"overshot"*** its steady state, and its decline in economic performance reflected its converging to the steady state from above.
  - In other words, Venezuela could ***temporarily support unsustainable levels of consumption and investment per capita***, but eventually per capita income ***declined to its steady state levels.***

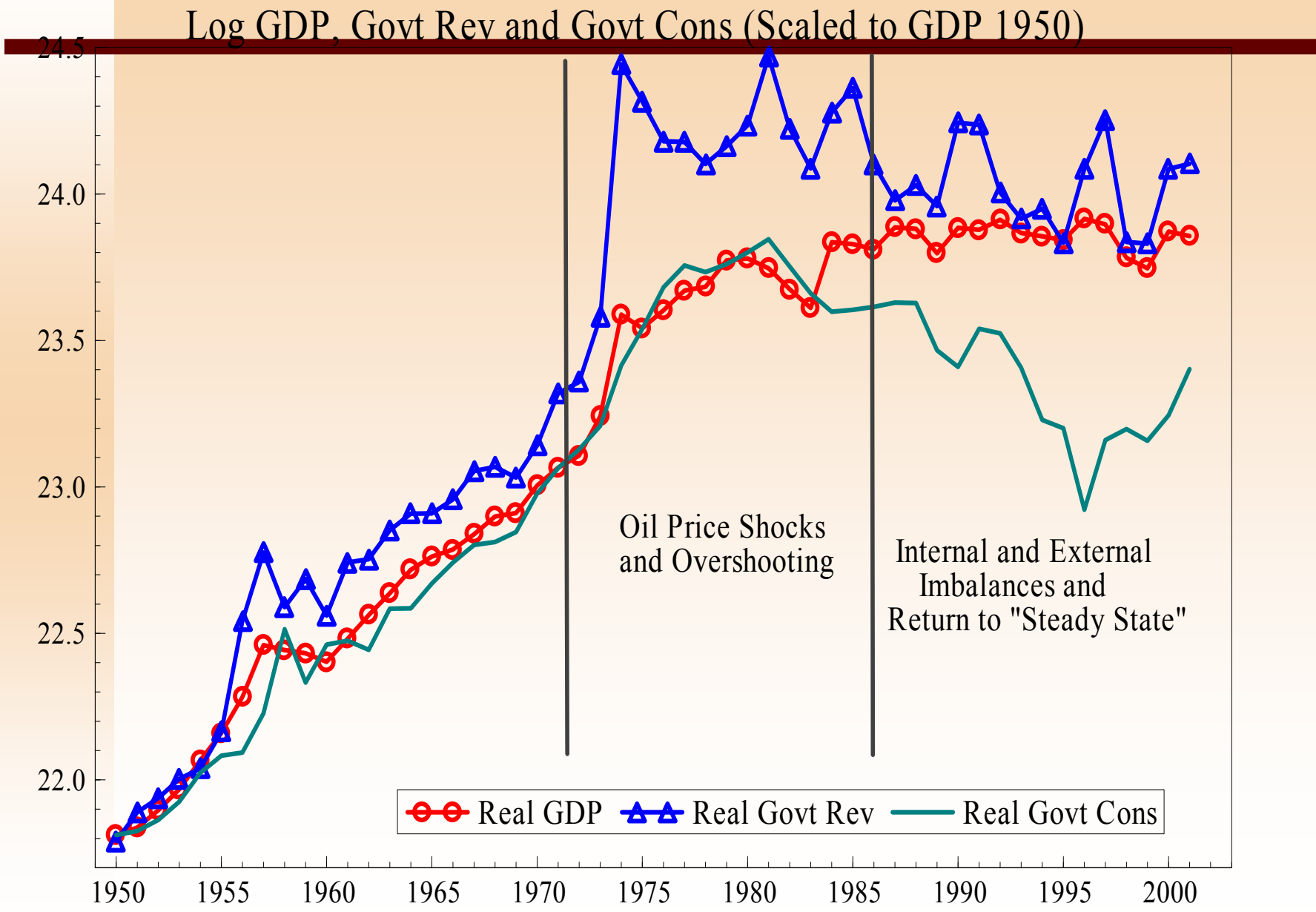
Explanations for Venezuelan Economic Performance

- **Cuevas (2002)** decomposes real oil prices and GDP
- ***common stochastic trend and cycle processes*** for the period from 1970 to 2000. He finds a strong association, at the trend and cycle frequencies
- He also shows that this association has ***weakened considerably during the past two decades suggesting that oil cannot serve as an engine for future growth in Venezuela.***

- **Hausmann (2003)** develops a neo-classical model
- The economy is characterized by perfect capital mobility
- ***Lower oil income*** lowers the demand for non-traded goods
- This results in ***lower capital per worker and output per worker***
- The model is ***only able to account for half the decline*** in output per worker
- He claims the remainder comes from increased country risk driving up real interest rates, resulting in lower desired capital stock, and investment.

Log Real Oil Price, Govt Rev, and Govt Cons (Means Adj)




Log GDP, Govt Rev and Govt Cons (Scaled to GDP 1950)
24.5
24.0
23.5
23.0
22.5
22.0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
Oil Price Shocks
and Overshooting
Internal and External
Imbalances and
Return to "Steady State"
Real GDP
Real Govt Rev
Real Govt Cons

The Empirical Model Framework

- The framework we use is based on the **General-to-Specific** modeling approach.
- We develop a **simple unconstrained VAR statistical model** to investigate the economic performance and the impact of significant oil resources.
- There are **four endogenous variables**:
  - Real GDP
  - Real Private Investment – Gross Capital Formation
  - Government Revenues
  - Government Consumption Expenditures.
- **Real Oil Prices** enter through:
  - The Level
  - Shocks – downturns
  - Volatility – GARCH model.
- We test for **Long-run Relationships** (Cointegration).
- We develop a **Vector Error Correction Model** (VECM) using the Relationships.

A General VAR Model for Venezuela

$$\begin{bmatrix} GovRev_t \\ GovCons_t \\ Invest_t \\ GDP_t \end{bmatrix} = A(L)\begin{bmatrix} GovRev_{t-1} \\ GovCons_{t-1} \\ Invest_{t-1} \\ GDP_{t-1} \end{bmatrix} + B(L)\begin{bmatrix} Poil_t \\ \sigma_{oil,t-1} \end{bmatrix} + D\begin{bmatrix} DP1974 \\ DP1979 \\ DAsymPoil \\ Trend \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ e_{3,t} \\ e_{4,t} \end{bmatrix}$$

- Where
- $\sigma_{oil,t-1}$ Oil Price uncertainty measure from a GARCH model
- DP1974 and DP1979 are dummy variables for those years
- DAsymPoil is for Oil Price Symmetry (an Oil Price decline)
- A(L) and B(L) are lag polynomial operators

Table 1: *Determining the rank of Cointegration*

Rank	eigenvalue	Log likelihood	H0:rank<=	Trace test [Prob]
0		220.39	0	***79.41 [0.00]*** ***
1	0.61	243.19	1	***33.82 [0.02]*** **
2	0.36	254.13	2	11.94 [0.16]
3	0.21	259.75	3	0.692 [0.41]
4	0.01	260.10		

*** Significant at the 1% level.

** Significant at the 5% level.

The estimated final VAR (2) system has four variables in real terms: government revenues, government consumption, investment, and GDP. Other right hand side variables include oil prices (entered in the cointegrating space), first lag of oil prices, first lag of the negative shock dummy, first lag of uncertainty, 1974 dummy, and a constant.

The Identified Cointegrating Relations

Long-Run Fiscal Relation

$$GovRev = 0.48\,GovCons + 0.55\,GDP + 0.42\,POil$$

Long-Run Economic Growth Relation

$$GDP = 0.42\,Invest + 1.21\,POil$$

Reduction from the General Cointegrated VAR

- Process of Reducing the Statistical Model
- Retain Characteristics of the Original Relationships in Data or DGP

- The pattern of short run dynamics is identified by sequentially eliminating insignificant regressors and then estimating the resulting model with FIML.
- Hypothesis Tests used for Model Evaluation and Model Design
- Parsimony
- Maintain White Noise Property of Residuals
- Stability
- Interpretability

- Final Model is Congruent

Table 3: Final Vector Error Correction Model

	ΔRev	ΔInv	ΔGDP	ΔGovCons
ΔRev_1	-0.183*			
ΔInv_1	-0.462***	0.316***		
ΔGDP_1	0.793***	0.514***		0.388**
ΔGovcons_1				-0.196*
ΔOilP	0.283***		0.171***	
NegShock	-0.078***			
Volatility	-2.364***	1.294*	-0.724**	
Dum74	0.45***		0.128*	
Fiscal ECM	***-0.123******	***0.056****		***0.421*****
Econ Grow ECM			***-0.198****	***-0.086*****

*** significant at the 1% level

** significant at the 5% level.

* significant at the 10% level

Interpreting the Final Error Correction Model

- **Feedback from Long-Run Relations**
- Inclusion and estimation of the CVAR provides important insights to **long-run economic performance**
- **And** provides information in the specification and understanding of the **short-run dynamics**.

- **Fiscal ECM enters the change equations for**
  - **Government Revenue** ***(-0.12) quick impact***
  - **Government Consumption** ***(+0.42) sluggish response – cause for "overshooting and resource curse"***
  - **Investment** ***(+0.05) feedback to private sector***
- **Economic Growth ECM enters the change equations for**
  - **GDP** ***(-0.2) quick adjustment to deviations from "steady state"***
  - **Government Consumption** ***(-0.09) fast but minor response to "steady state"***

Interpreting the Final Error Correction Model

- **Short-Run Dynamics (Growth or Changes)**
- Oil prices have a ***direct positive effect*** on GDP
- Increased volatility in oil prices ***directly reduces*** the short-run growth
- GDP is **not affected** by either of the fiscal variables or by investment
- In contrast, real GDP has a **positive short-run impact** on the other three endogenous variables: government revenues and consumption, and investment.
- Thus, changes in oil prices have a ***indirect effect on these three variables*** through their impact on real GDP.
- Oil prices have a ***positive direct dynamic effect*** on government revenues.
- An increase in the volatility of oil prices actually ***reduces*** government revenues.
- Investment is ***directly and positively affected*** by oil price volatility.

Conclusions

- Venezuela has both benefited from oil and suffered the “resource curse.”

- We examined the economic performance and fiscal response to oil prices (revenues) and the volatility of oil prices from the 1950s through 2001.
- There are two long run relations consistent with economic growth and fiscal balances.
- The relations are important not only for the long-run performance, but also explaining the short-run fluctuations.

Conclusions (continued)

- In the past domestic and external imbalances have contributed to the volatile and unsustainable economic performance of the economy.
- President Chavez has directed the PdVSA to provide more direct financial support to social programs.
- In 2003 $1.7B (more than 10% of the PdVSA) was allocated for this purpose.
- In the last 8 years, turmoil in the country has led to under investment in the oil sector.
- Political decisions have been at the root of the re-allocation of funds and may potentially compromise future oil productiton.

Conclusions (continued)

- Venezuela is reported to have about 150TCF of natural gas (associated and non-associated)
- In 2002 selected 5 oil companies to help develop the resource.
- Expects to begin exporting LNG this year.

- Will Venezuela be able to handle the benefits and curses of two resource curses?

- Thank you very much. All comments and suggestions are welcome.

Data for Venezuela 1950 - 2001

Variable	Definition
Investment	Log real investment, defined as gross fixed capital formation deflated by the consumer price index
Govt. Consumption	Log real government consumption. It includes expenditure incurred by general government on consumption goods and services deflated by the consumer price index
Govt. Revenue	Log real government revenues. it comprises of all non-repayable government receipts other than grants deflated by the consumer price index
Real GDP	Log real gross domestic product (deflated by the consumer price index)
Oil Prices	Log real oil prices defined as world average crude oil prices (in US$) deflated by US producer price index.

Interpreting the Final Error Correction Model

Change in	Fiscal ECM	Economic Growth ECM
Government Revenues	*(-0.12) quick impact not persistent volatile prices*	
Government Consumption	*(+0.42) sluggish response – cause for "overshooting and resource curse"*	*(-0.09) fast but minor response to "steady state"*
Investment	*(+0.05) feedback to private sector*	
GDP		*(-0.2) quick adjustment to deviations from "steady state"*

Interpreting the Final Error Correction Model

Change in	Positive Impact		Negative Impact	
Government Revenues	GDP(-1)	0.8	Rev(-1)	0.18
	Poil	0.3	Invest (-1)	0.46
			Shock	0.08
			Vol	2.3%
Government Consumption	GDP(-1)	0.4	Cons(-1)	-0.2
Investment	Invest(-1)	0.3		
	GDP(-1)	0.5		
	Vol	1.3%		
GDP	Poil	0.2	Vol	0.75