Monetary Policy under Balance Sheet Uncertainty

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Banco Central de Reserva del Perú

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Motivación

- **Pregunta: Hay Hoja de Balance?**
  - Correlación entre periodos de Crisis y Depreciaciones

- Cómo debe actuar el Banco Central si no puede responder la pregunta?
  - Es racional el "Fear of Floating"?

- Tiene el Banco Central la capacidad para aprender?
  - Trampa de la Hoja de Balance
  - "Benefits of U.S. Monetary Policy Experimentation" Cogley, Colacito y Sargent (2005)

Agenda para la Presentación:

- Dos Modelos Alternativos - sin y con Hoja de Balance - Certidumbre Absoluta

- Política Monetaria Óptima Bajo Incertidumbre

- Trampa de la Hoja de Balance

- Cómo salir de la Trampa?: Aprendizaje

- Conclusiones

Certidumbre Absoluta

Modelo A

Curva de Phillips

$$\pi_t = \gamma_1 y_t + \gamma_2 \delta_t + \varepsilon_{\pi,t} \qquad (1)$$

UIP

$$\delta_t = -i_t + \varepsilon_{\delta,t} \qquad (2)$$

Demanda Agregada

$$y_t = \theta_1 i_t + \theta_2 \delta_t + \varepsilon_{y,t} \tag{3}$$

donde:

$$\varepsilon_t^{\delta} = \rho \varepsilon_{t-1}^{\delta} + \mu_t \tag{4}$$

El BCR busca minimizar:

$$L = E_t \sum_{s=t} \beta^{s-t} \left(\pi_s^2 + y_s^2 \right) \tag{5}$$

la regla óptima es:

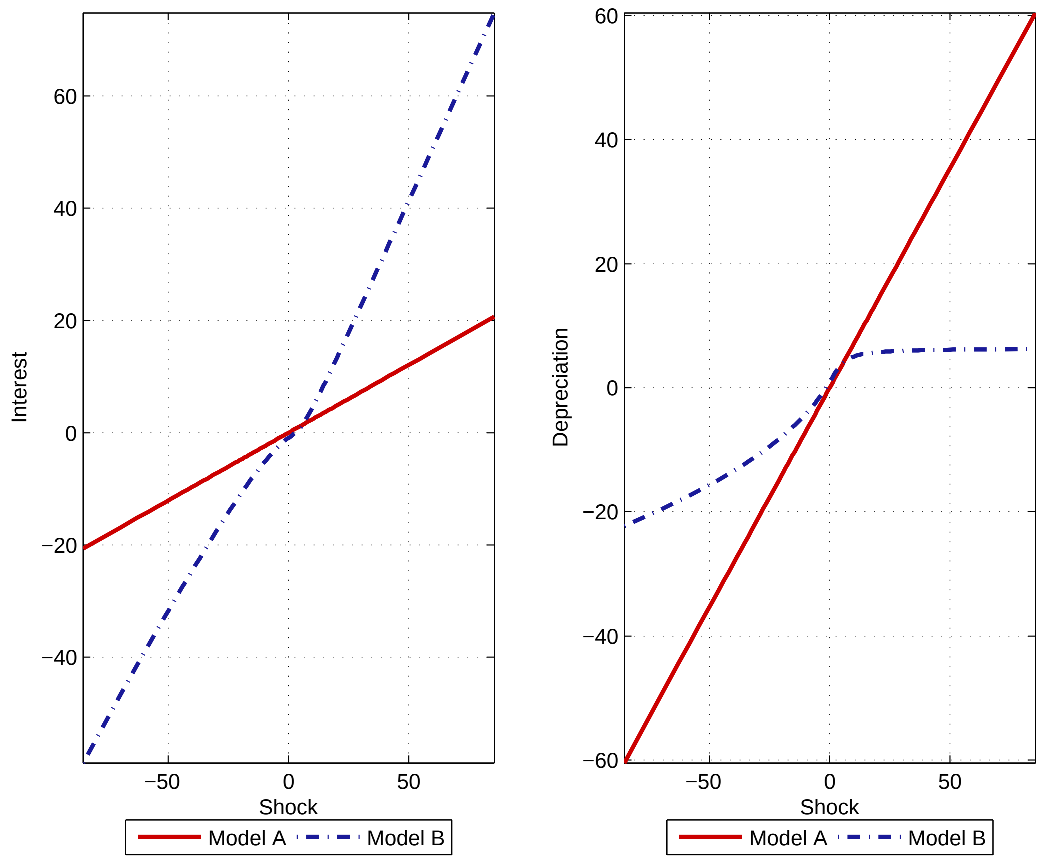
$$i_t = \Lambda \varepsilon_{t-1}^{\delta} \tag{6}$$

Modelo B

Si hay Hoja de Balance la Demanda Agregada es:

$$y_t = \theta_1 i_t + \theta_2 \delta_t + \theta_3 \delta_t^2 + \varepsilon_{y,t} \tag{7}$$

Comparación entre Reglas Óptimas



Política Monetaria Bajo Incertidumbre

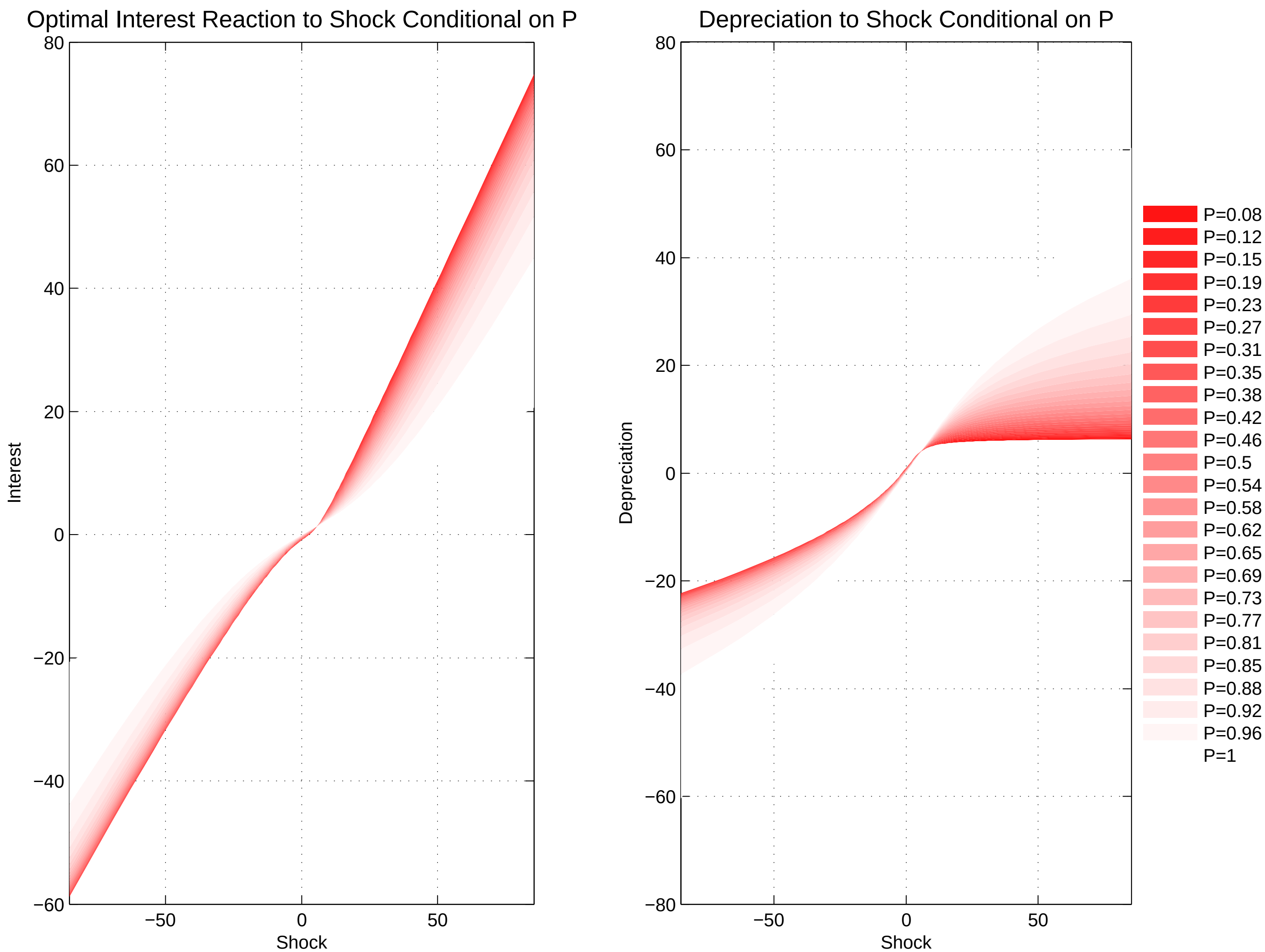
Solución Bayesiana

Bajo incertidumbre se busca minimizar:

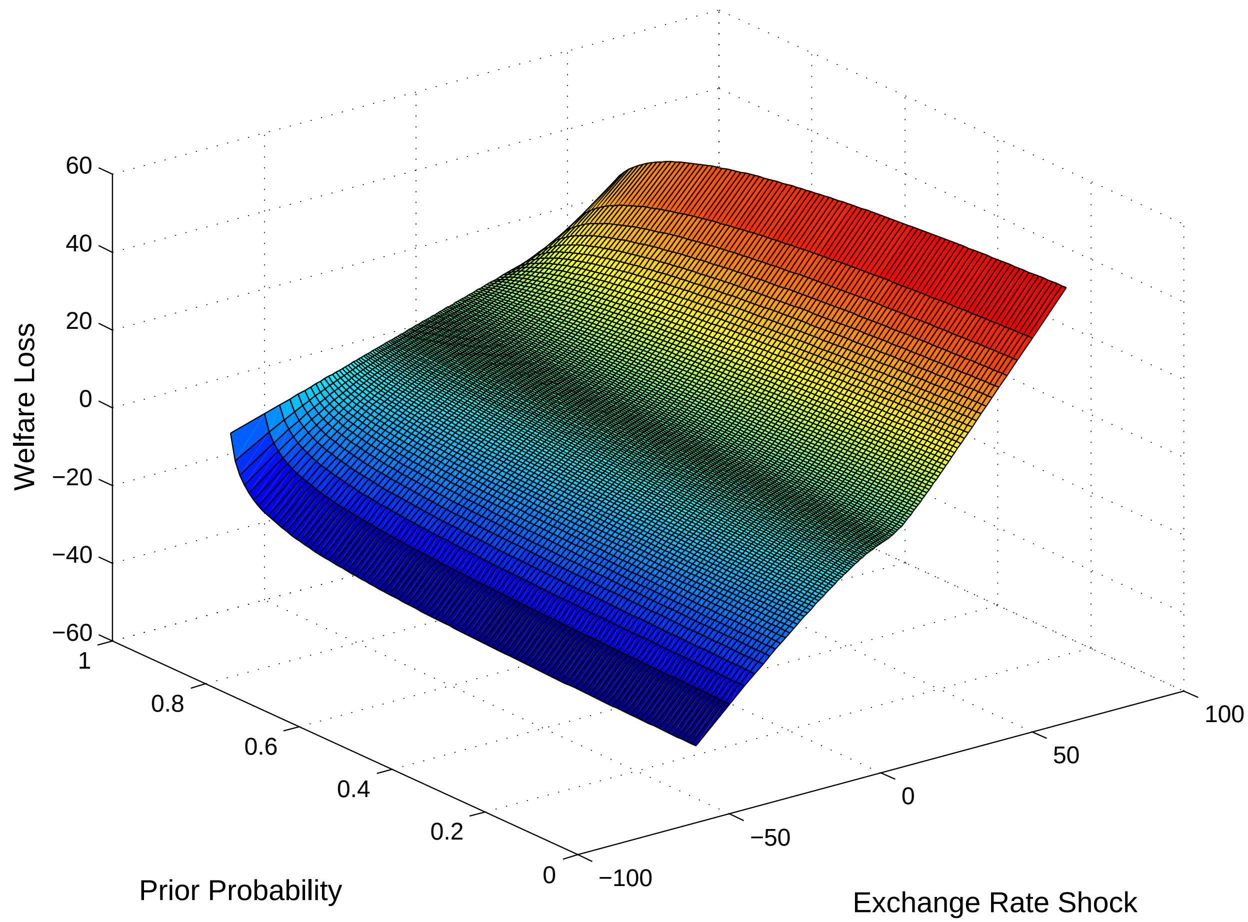
$$L_t = p_t L_{t|A} + (1 - p_t) L_{t|B}$$

Y la probabilidad se asigna de la siguiente manera (ODDS RATIO):

$$p_t = p\left(M^A | Data\right) = \frac{p\left(Data|M^A\right) p\left(M^A\right)}{p\left(Data|M^B\right) p\left(M^B\right) + p\left(Data|M^A\right) p\left(M^A\right)}$$



Optimal Interest Reaction to Shock Conditional on P
Interest
Shock
80
60
40
20
0
−20
−40
−60
−50
0
50
Depreciation to Shock Conditional on P
Depreciation
Shock
80
60
40
20
0
−20
−40
−60
−80
−50
0
50
P=0.08
P=0.12
P=0.15
P=0.19
P=0.23
P=0.27
P=0.31
P=0.35
P=0.38
P=0.42
P=0.46
P=0.5
P=0.54
P=0.58
P=0.62
P=0.65
P=0.69
P=0.73
P=0.77
P=0.81
P=0.85
P=0.88
P=0.92
P=0.96
P=1



60
40
20
0
−20
−40
−60
Welfare Loss
1
0.8
0.6
0.4
0.2
0
Prior Probability
−100
−50
0
50
100
Exchange Rate Shock

La Evolución de los Priors

Los Priors evolucionan según:

$$P_t = \frac{P_{t-1} P\left(Data_t | Data_{t-1}, M^A\right)}{P_{t-1} P\left(Data_t | Data_{t-1}, M^A\right) + (1 - P_{t-1}) P\left(Data_t | Data_{t-1}, M^B\right)}$$

Comparación del Bienestar

Calibración:

$\beta = 0.995$	$\gamma_2 = 0.15$
$\theta_1 = -0.5$	$\sigma_\mu = 10$
$\theta_2 = 0.15$	$\sigma_y = 4$
$\theta_3 = -0.05$	$\sigma_\pi = 4$
$\gamma_1 = 0.3$	$\rho = 0.9$

MOMENT COMPARISON AMONG MODELS WITH PARAMETER CERTAINTY

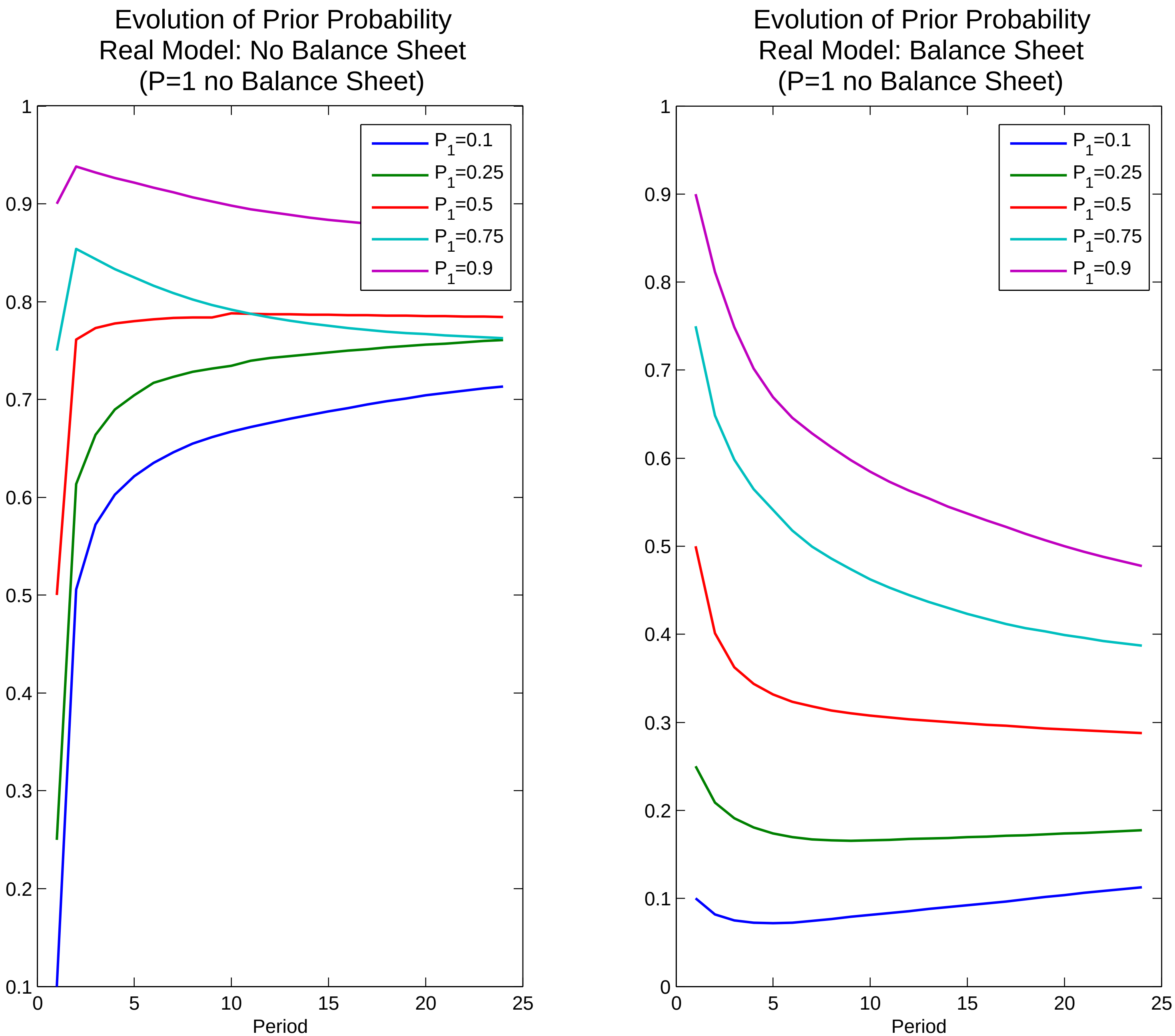
Relative Variance
(as % of the model without Balance Sheet Effect)

Variable	Output	Inflation	Depreciation	Interest Rate
(when the true model is Model A)				
Policy with Certainty	100%	100%	100%	100%
Policy with Misbeleives	212%	101%	83%	412%
Bayesian Policy	99%	105%	110%	137%
(when the true model is Model B)				
Policy with Certainty	957%	160%	83%	412%
Policy with Misbeleives	1572%	225%	100%	100%
Bayesian Policy	9923%	1587%	124%	632%

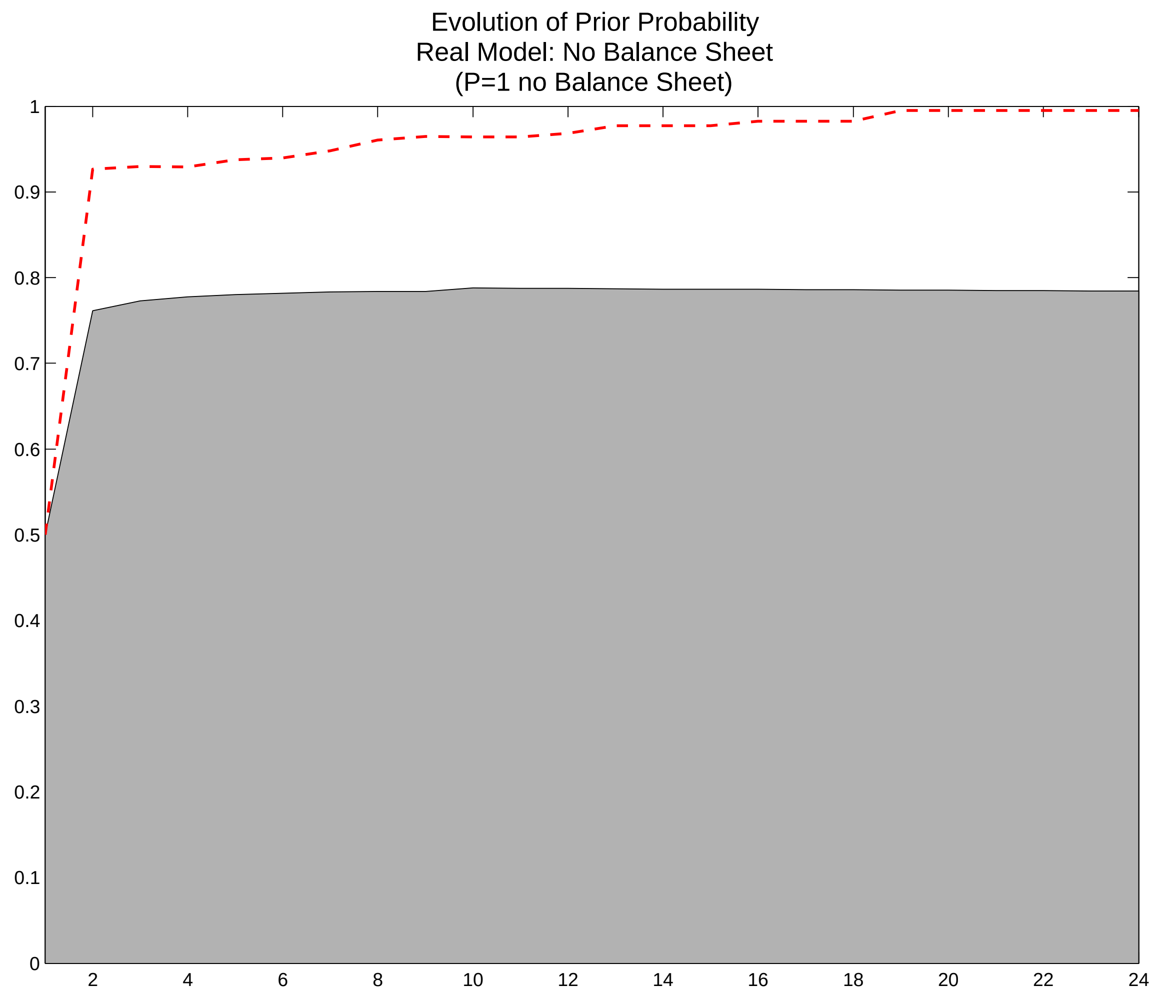
Welfare Comparison
(as % of the model without Balance Sheet Effect)

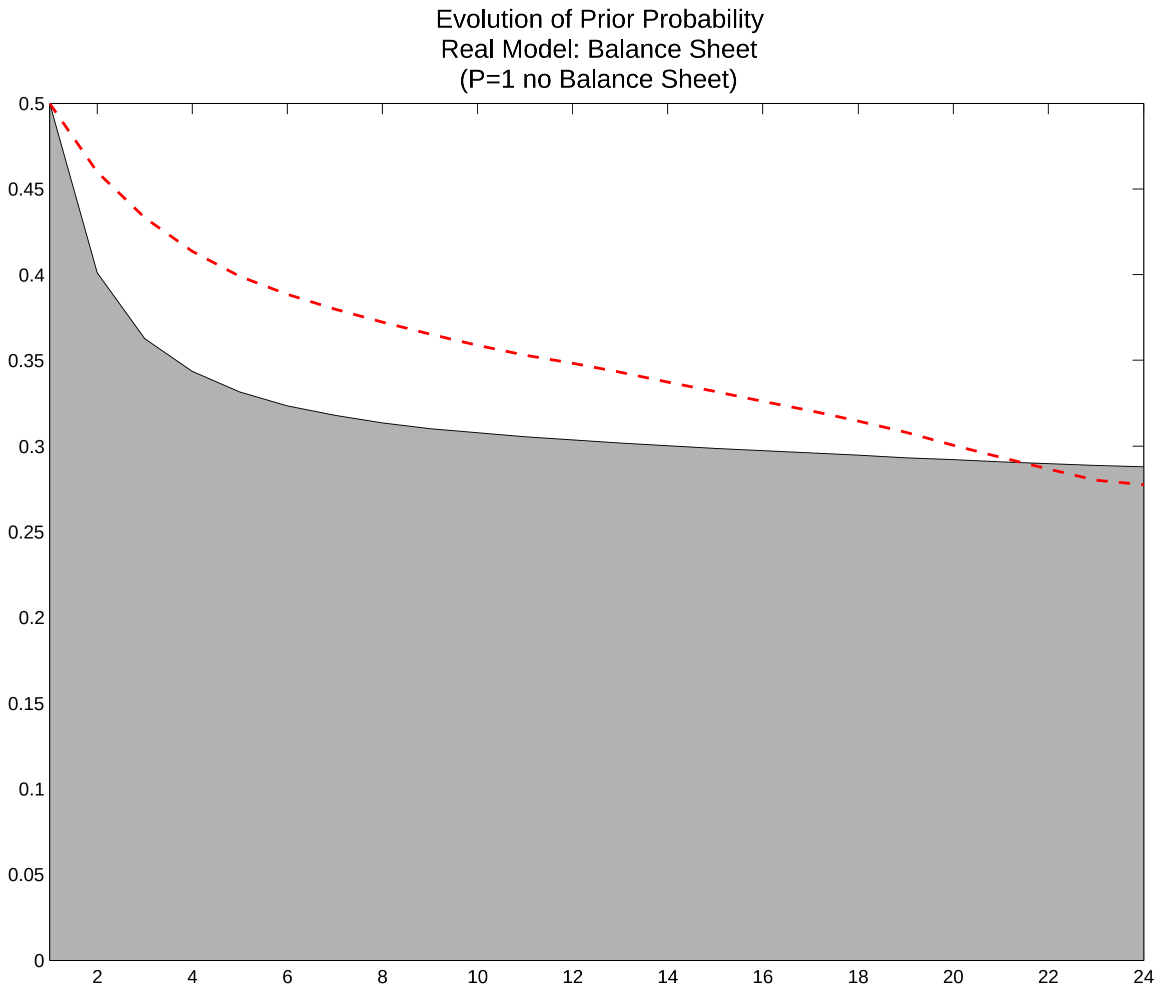
(when the true model is Model A)	
Policy with Certainty	100%
Policy with Misbeleives	165%
Bayesian Policy	114%
(when the true model is Model B)	
Policy with Certainty	717%
Policy with Misbeleives	1189%
Bayesian Policy	728%

La Trampa de la Hoja de Balance


Evolution of Prior Probability
Real Model: No Balance Sheet
(P=1 no Balance Sheet)
P1=0.1
P1=0.25
P1=0.5
P1=0.75
P1=0.9
Period
Evolution of Prior Probability
Real Model: Balance Sheet
(P=1 no Balance Sheet)
P1=0.1
P1=0.25
P1=0.5
P1=0.75
P1=0.9
Period

Una pequeña digresión sobre la incertidumbre en los parámetros


Evolution of Prior Probability
Real Model: No Balance Sheet
(P=1 no Balance Sheet)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2
4
6
8
10
12
14
16
18
20
22
24


Evolution of Prior Probability
Real Model: Balance Sheet
(P=1 no Balance Sheet)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2
4
6
8
10
12
14
16
18
20
22
24

Cómo salir de la Trampa: La Solución Dinámica

Replanteando el Problema:

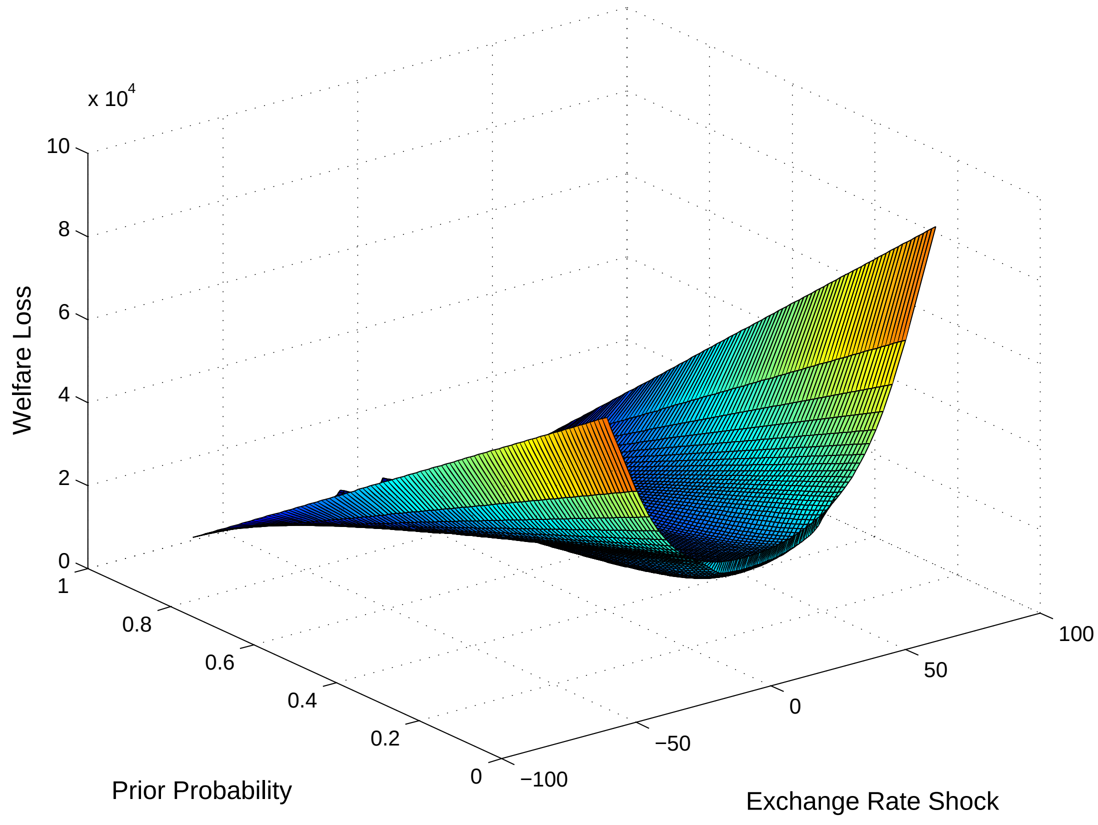
$$L = E_t\left[\sum_{s=t}\beta^{s-t}(\pi_s^2 + y_s^2 \mid P_s)\right]$$

s.t. a la dinámica

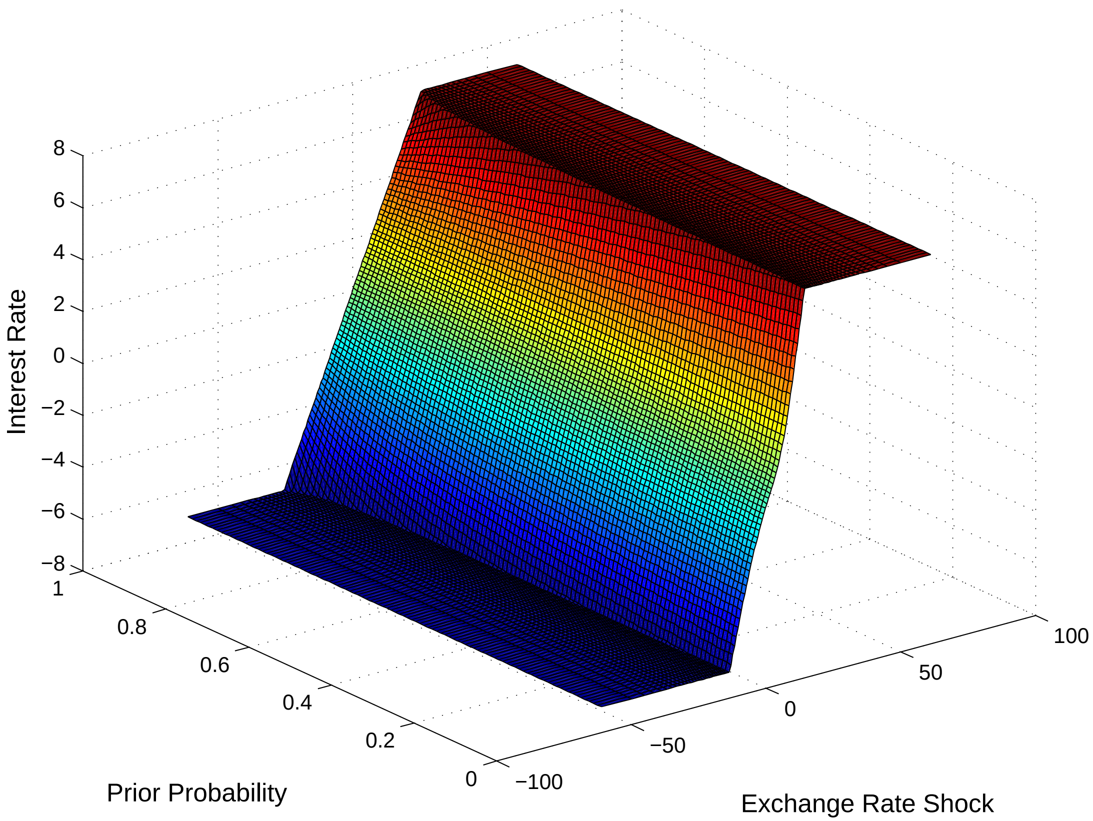
Ecuación de Bellman:

$$\begin{aligned} V(\varepsilon_{\delta,t-1}, P_t) &= \min_{\{i_t\}} E[\pi_t^2(i_t) + y_t^2(i_t) \mid P_t)] + ... \\ &\quad \beta E[P_t V(\varepsilon_t^\delta, P_{t+1}^1) + (1-P_t)E[V(\varepsilon_t^\delta, P_{t+1}^2)] \end{aligned}$$

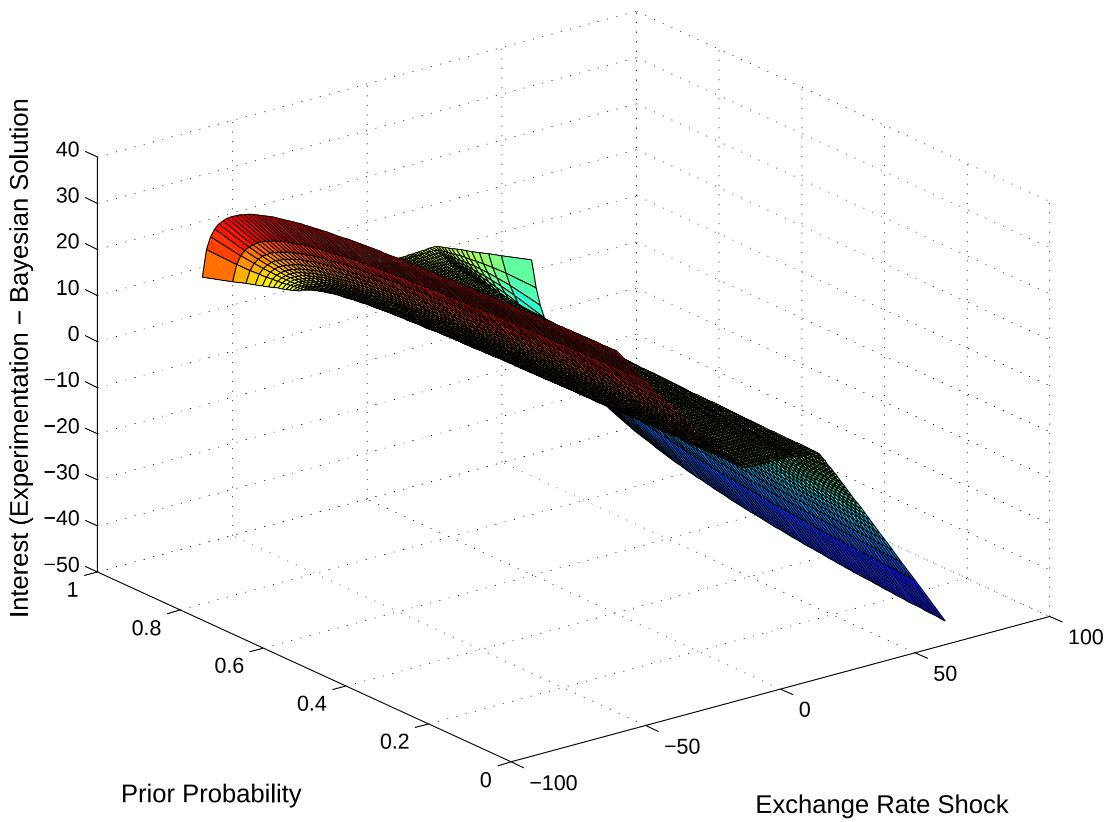
La Función de Valor del Problema



La Regla de Política con Experimentación:
aproximación

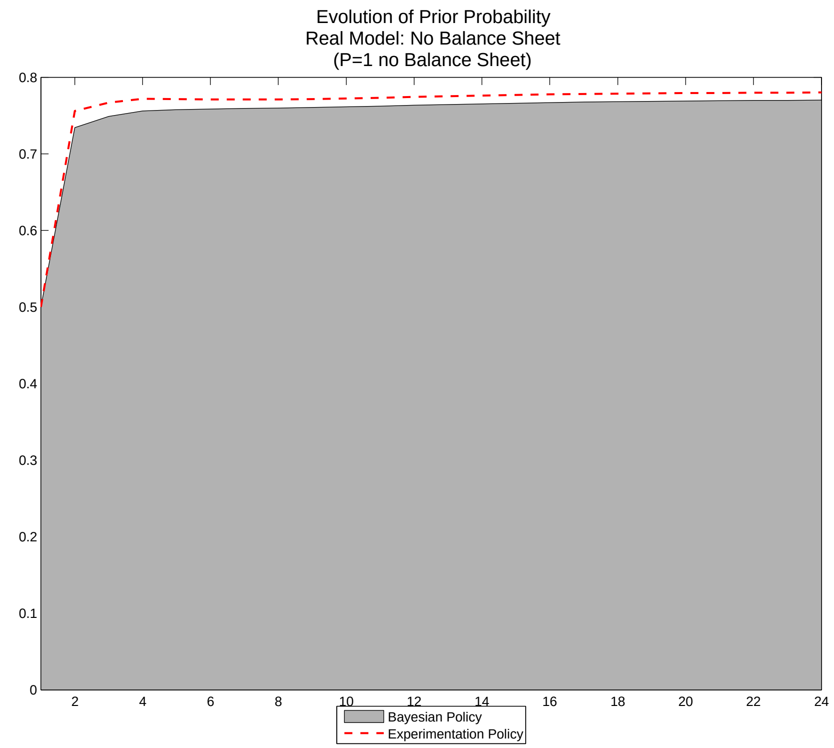


La diferencia entre las dos reglas:

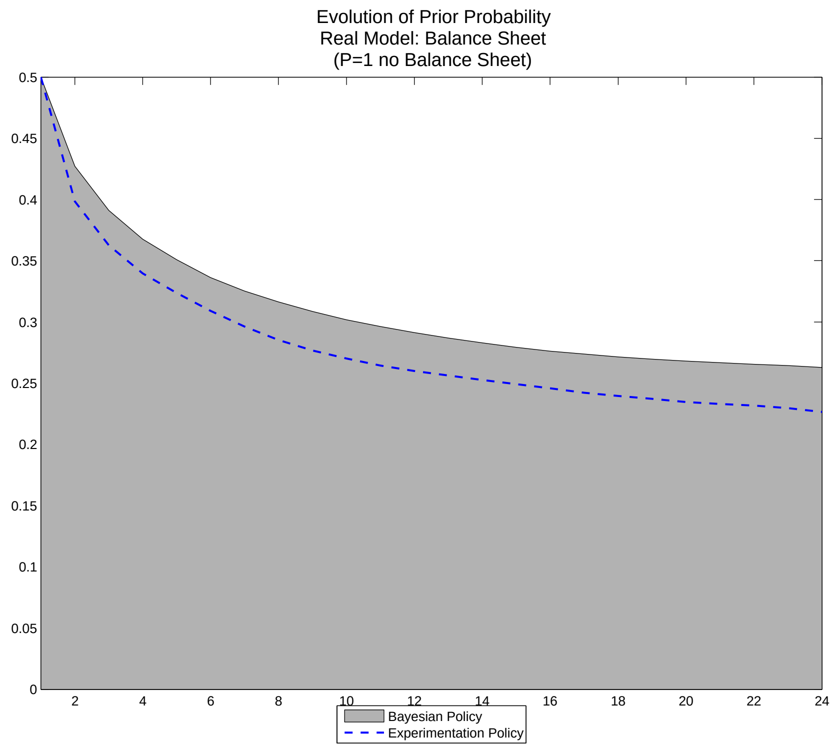


Mejora en el Bienestar?

Evolución de la Probabilidad para el Modelo sin Hoja de Balance



Evolución de la Probabilidad para el Modelo con Hoja de Balance



Comparación del Bienestar con experimentación

MOMENT COMPARISON – EXPERIMENTATION

Relative Variance
(as % of the model without Balance Sheet Effect)

Variable	Output	Inflation	Depreciation	Interest Rate
(when the true model is Model A)				
Policy with Certainty	100%	100%	100%	100%
Bayesian Policy	113%	110%	108%	128%
Policy Experimentation	1110%	197%	109%	93%
(when the true model is Model B)				
Policy with Certainty	2167%	283%	78%	419%
Bayesian Policy	2153%	284%	81%	498%
Policy Experimentation	6125%	197%	109%	109%

Loss Comparison
(as % of the model without Balance Sheet Effect)

(when the true model is Model A)	
Policy with Certainty	100%
Bayesian Policy	113%
Policy Experimentation	108%
(when the true model is Model B)	
Policy with Certainty	895%
Bayesian Policy	994%
Policy Experimentation	3179%

Conclusiones

- Decisiones sobre la intervención deberían incorporar el hecho de que se puede aprender

- Los beneficios del aprendizaje pueden ser mucho mayores si existe aprendizaje por parte de los agentes económicos