International information flows, sentiments and cross-country business cycle fluctuations

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Warszawa, 31.01.2020

Outline

Motivation

- Agents' sentiments affect business cycles
- Noted already long time ago: Pigou (1927); Keynes (1936)
- To a large extent ignored by structural business cycle models
- Recently - more interest.

Literature

- Theoretical:
  - Beaudry and Portier (2006) and Barsky and Sims (2011) introduce technology news shocks into RBC/NK models
  - Angeletos and La'O (2013) and Angeletos et al. (2014) introduce limited communication between agents → shocks to confidence have real effects
- Empirical:
  - Barsky and Sims (2011), estimate NK model with technology news shocks: over 50% of variance of consumption and investment explained
  - Blanchard et al. (2013) consinder noisy signals about permanent productivity in NK DSGE model to show that sentiment accounts for 50% of consumption variability
  - Kamber et al. (2017) VAR models for four developed, SOEs: technology news shocks explain between 6% (NZ) and 40% (UK) of output fluctuations
  - Milani (2017) estimates a DSGE model with learning: sentiment fluctuations explain over 40% of business fluctuations in the United States

Motivation cont'd

- Important question: do international sentiment fluctuations explain business cycles in small economies?
- Why does it matter?
  - business cycles clearly spill over borders
  - but our models find it hard to explain its strength (Backus et al., 1992, Justiniano and Preston, 2010)
  - something is missing - maybe confidence fluctuations?
- Evidence is scarce
  - Beaudry et al. (2011) - technology news shocks can drive cross-country synchronization of cycles
  - Levchenko and Pandalai-Nayar (2019) - Canadian business cycle is driven to a large extent by US sentiment shocks
  - Brzoza-Brzezina and Kotłowski (2018) - Polish business cycle is driven by EA sentiment shocks „via air"

This paper

- Empirical motivation - we show that sentiments travel fast between countries
- Structural approach: we propose a model of international spillovers of sentiment shocks
  - 2-country extension of the noise shock framework by Blanchard et al. (2013)
  - Agents in both countries face signal extraction problem
- Estimate the model to assess the importance of foreign noise shock for small open economy

Main findings

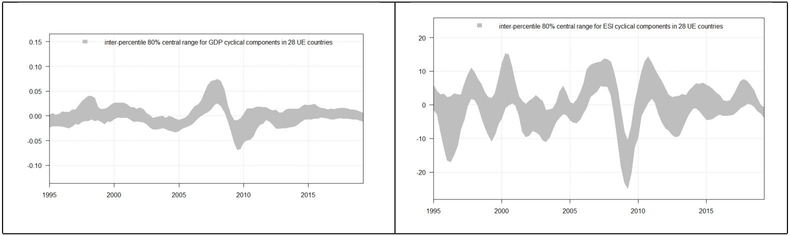
- US noise shock explains significant portion of US consumption:
  - in line with Blanchard et al. (2013)
  - around 30 % of the consumption in the US may be explained by the US noise shock.
- US noise shocks spill over to Canada:
  - on average 15 % of consumption in Canada may be explained by the US noise shock
  - less important for other macro aggregates
  - noise shocks of particular importance during sentiment breakdowns

Outline

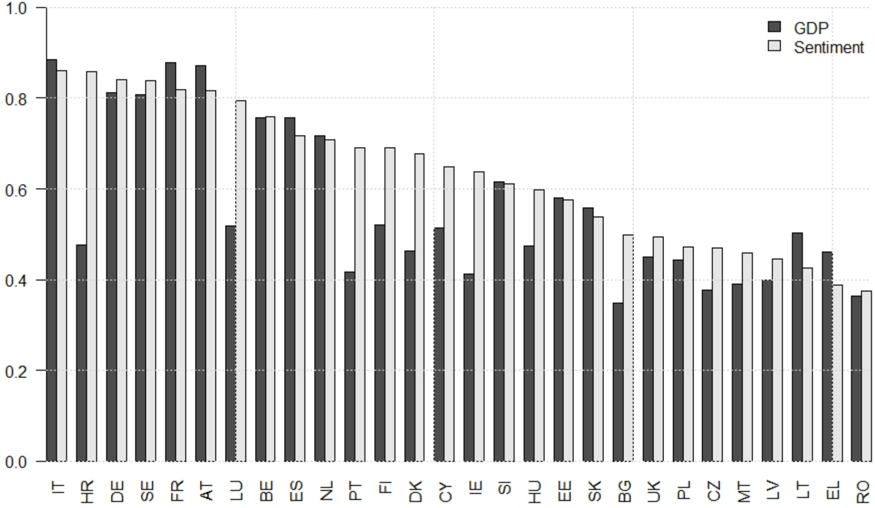
Empirical motivation

- Our mechanism relies on sentiments spilling over borders faster then business cycles do.
- Is there any evidence thereof?
- We investigate the co-movements of sentiments and business cycles in 28 EU economies - tightly integrated in terms of trade and financial linkages
- We compare the strength of co-movement and the time lag for GDP and the economic sentiment indicator (ESI)
  - Quarterly data from Q1 1995 to Q2 2019
  - The cyclical components of GDP and ESI calculated using Christiano-Fitzgerald asymmetric filter
  - The cycle length from 6 to 40 quarters

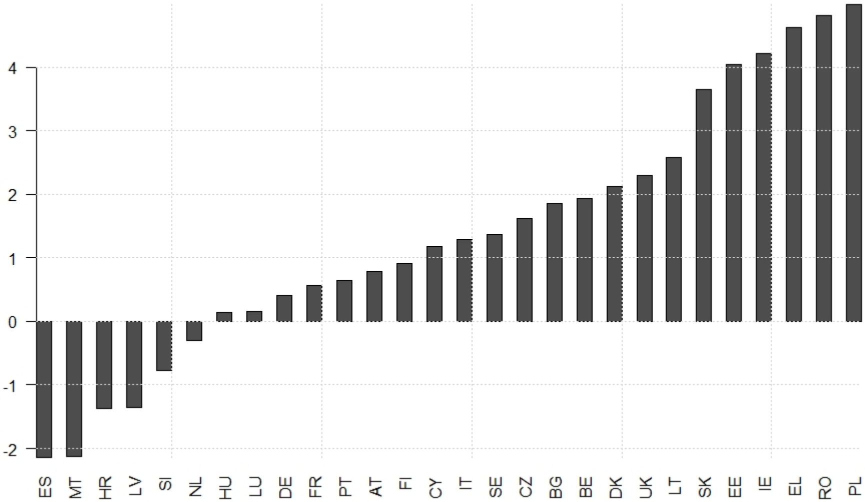
The cyclical components of GDP and confidence indicator



The strength of co-movement with euro area aggregate



The shift in business cycle co-movement toward euro area aggregate



Empirical motivation - findings

- The correlation between confidence indicators stronger than between GDP fluctuations
- The transmission of confidence faster than of GDP for most EU economies
- Ergo: there must be extra channels of confidence transmission - probably media etc.

Outline

Model overview

- 2 countries: small (home, size ω) and large (foreign, size $1-\omega$)
- Households, capital, final and intermediate goods producers, exporters
- Capital adjustment costs, variable capital utilization
- Sticky prices and wages, local currency pricing
- Conventional monetary policy: Taylor-like rule
- Exogenous public spending

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Households

- Households maximize their lifetime utility $U_{0,i}$ w.r.t. c_t, n_{jt}, $b_{H,t}$ and $b_{F,t}$,:

$$U_0 = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log(c_t - hc_{t-1}) - \gamma \frac{1}{1+\varphi} n_t^{1+\varphi} \right]$$

subject to:

$$c_t + b_{H,t} + q_t b_{F,t} + t_t = \\ = R_{t-1} \pi_t^{-1} b_{H,t-1} + q_t R_{t-1}^* \Gamma_{t-1} \pi_t^{*-1} b_{F,t-1} + w_t n_t + d_t$$

and wage stickiness (Calvo).

Intermediate goods producers

- Operate under monopolistic competition
- Rent labor and capital and produce differentiated goods

$$y_{p,t}(i) = k_t(i)^{\alpha}(a_t n_t(i))^{1-\alpha} - \phi$$

- Set prices subject to stickiness assumption (Calvo) for the domestic and foreign markets.

Technology and noisy information

- Technology consists of 2 components: permanent and temporary
- Agents receive noisy signals about the permanent component

US	Canada
$a_t^* = x_t^* + z_t^*$	$a_t = (1 - \lambda^x)x_t + \lambda^x x_t^* + z_t$
$\triangle x_t^* = \rho \triangle x_{t-1}^* + \epsilon_t^*$	$\triangle x_t = \rho \triangle x_{t-1} + \epsilon_t$
$z_t^* = \rho z_{t-1}^* + \eta_t^*$	$z_t = \rho z_{t-1} + \eta_t$
$s_t^* = x_t^* + \varepsilon_{s,t}^*$	$s_t = x_t + \varepsilon_{s,t}$

- Noise ($\varepsilon_{s,t}$, $\varepsilon_{s,t}^*$) is a non-fundamental disturbance. It will be interpreted as shifts in sentiments
- Agents need to infer whether technology changed because of temporary or permanent shocks
- To this end they run a Kalman filter

Data, calibration, estimation

- Parameters: calibrated (well-established) and estimated (Bayesian estimation).
- 19 shocks. Most important: 2 noise shocks, 2 temporary productivity, 2 permanent productivity.
- Sample: US and Canada, 1Q1960 - 1Q2014
- 13 time series used. For both economies: productivity, individual consumption, investments, wages, inflation, nominal interest rate. Plus real exchange rate.

Estimation of the model

- We estimate the full-information counterpart of the model as Blanchard et al (2013).
- Agents infer productivity components from the Kalman filter and treat them as „real" state variables.
- This is possible since in a linear model certainty equivalence holds (Baxter et al, 2010).
- Impulse responses, variance decompositions etc. in the same way.

Selected calibrated parameters

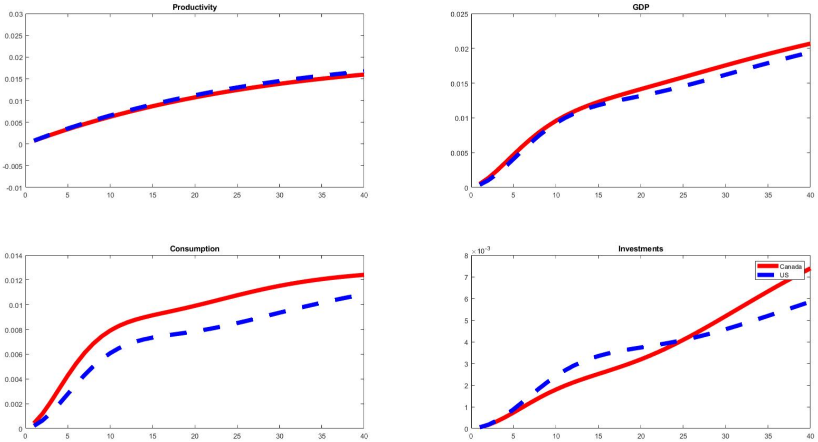
name	value
β, discount rate CAN	0.995
β^*, discount rate US	0.995
η, home bias CAN	0.700
ω, size CAN	0.070
δ, depreciation rate CAN	0.025
δ^*, depreciation rate US	0.025
ξ, exchange rate elasticity w.r.t. foreign debt	0.0013

Selected estimated parameters

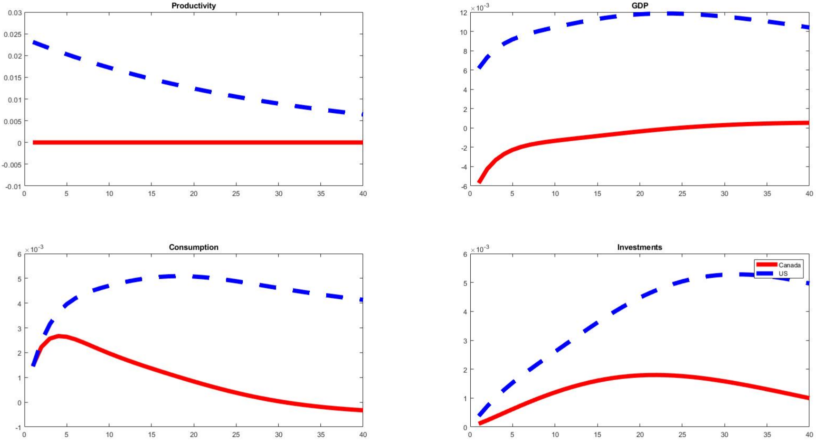
name	prior mean	post mean	90% HPD interval		prior type	prior std dev
λ^x (weight of LE perm prod)	0.800	0.9556	0.9208	0.9916	beta	0.1000
autocorrel. prod. shock CAN	0.900	0.9448	0.9277	0.9599	beta	0.0500
autocorrel. prod. shock US	0.900	0.9678	0.9578	0.9774	beta	0.0500
std dev noise shock CAN	0.010	0.0063	0.0032	0.0095	invg	0.0010
std dev noise shock US	0.010	0.0094	0.0054	0.0141	invg	0.0010
std dev prod. shock CAN	0.005	0.0151	0.0141	0.0162	invg	0.0010
std dev prod. shock US	0.005	0.0235	0.0230	0.0239	invg	0.0010

Plan of the presentation

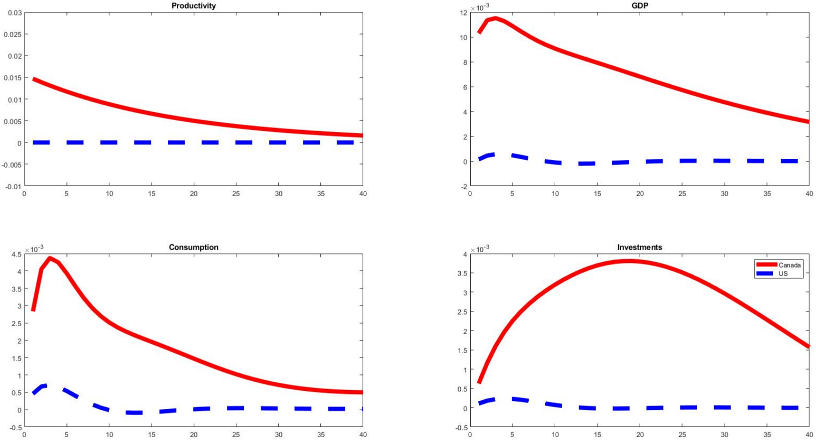
IRF - response to US permanent productivity shock



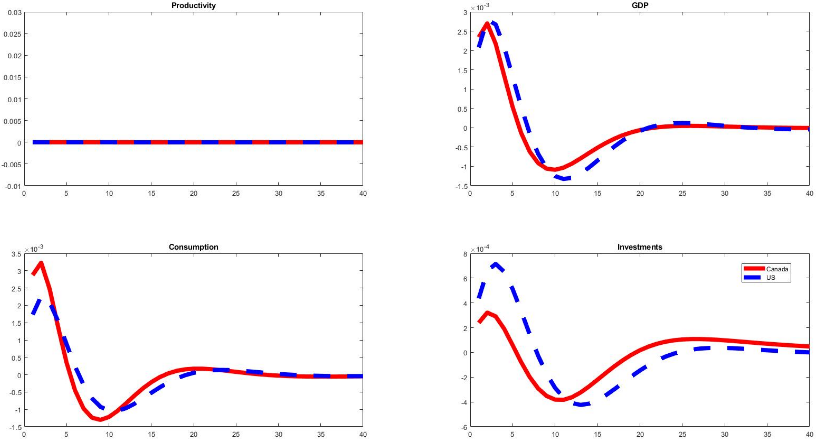
IRF - response to temporary productivity shock in the US



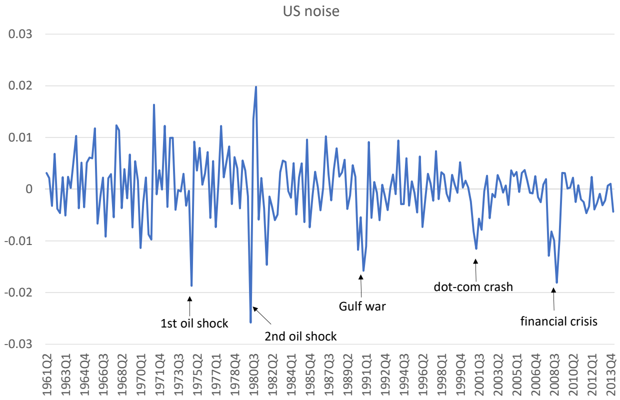
IRF - response to temporary productivity shock in Canada



IRF - response to US noise shock



Foreign noise shock: smoothed path



Variance decomposition: consumption growth in the US

Quarter	CAN pp	CAN tp	US pp	US tp	CAN noise	US noise
1	0.0	2.6	0.5	26.1	0.0	37.6
4	0.0	1.9	8.2	27.4	0.0	25.9
8	0.0	1.7	18.5	21.7	0.0	26.4
12	0.0	1.6	20.1	19.1	0.0	23.4
40	0.0	1.5	20.9	17.7	0.0	21.9

Variance decomposition: consumption growth in Canada

Quarter	CAN pp	CAN tp	US pp	US tp	CAN noise	US noise
1	0.0	16.5	0.4	4.4	0.0	16.9
4	0.0	14.2	4.2	4.2	0.0	15.0
8	0.0	12.0	7.4	3.5	0.0	14.5
12	0.0	11.4	7.8	3.3	0.0	13.8
40	0.0	11.1	8.1	3.4	0.0	13.3

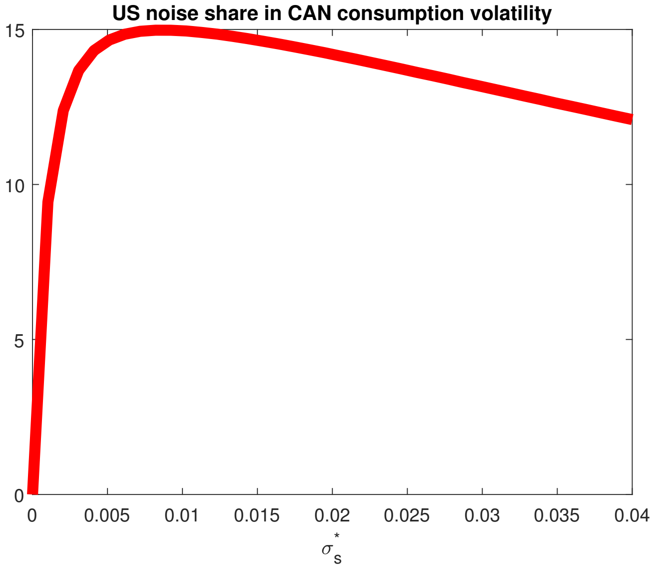
Variance decomposition: GDP growth in the US

Quarter	CAN pp	CAN tp	US pp	US tp	CAN noise	US noise
1	0.0	0.0	0.1	16.1	0.0	1.8
4	0.0	0.0	0.9	14.4	0.0	1.8
8	0.0	0.1	2.6	14.1	0.0	2.5
12	0.0	0.1	3.4	13.9	0.0	2.5
40	0.0	0.1	4.3	13.6	0.0	2.5

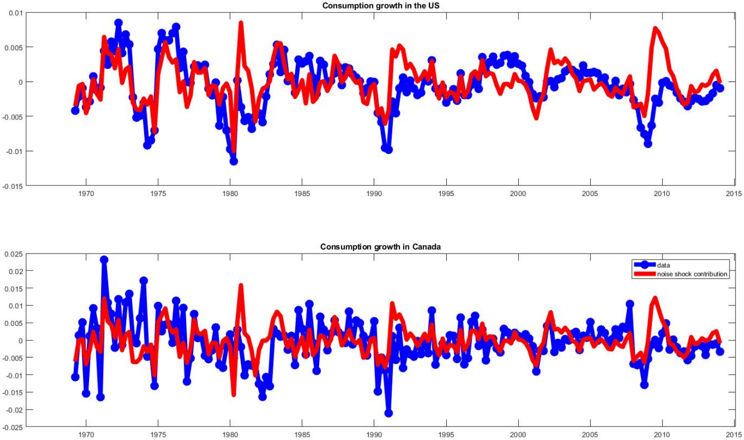
Variance decomposition: GDP growth in Canada

Quarter	CAN pp	CAN tp	US pp	US tp	CAN noise	US noise
1	0.0	32.5	0.1	10.0	0.0	1.7
4	0.0	29.1	0.9	9.7	0.0	1.8
8	0.0	26.1	2.0	8.8	0.0	1.9
12	0.0	25.6	2.5	8.6	0.0	1.9
40	0.0	25.2	3.2	8.4	0.0	1.9

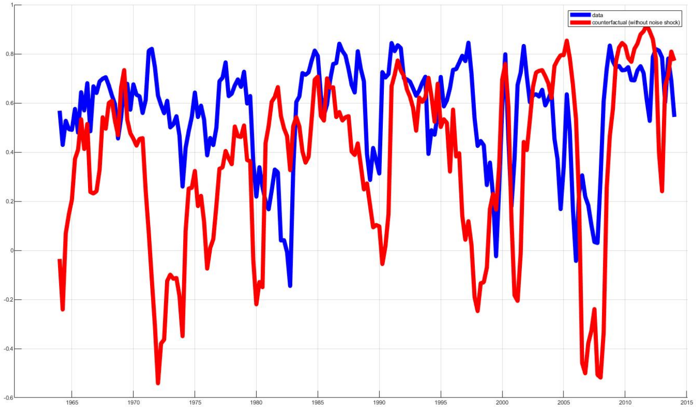
Role of noise variance



US noise shock contribution to consumption growth



Impact of US noise on consumption comovement (12q rolling correlation)



Conclusions

- We ask what role do confidence fluctuations play in driving business cycles and their international co-movement
- US noise shocks spill over to Canada:
    - on average 15 % of consumption in Canada may be explained by the US noise shock
    - less important for other macro aggregates
    - noise shocks of particular importance during sentiment breakdowns

Literature I

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Estimated parameters

	prior mean	post. mean	90% HPD	interval	prior	pstdev
hh	0.500	0.5845	0.5682	0.6012	beta	0.1000
hh_s	0.500	0.7595	0.7322	0.7861	beta	0.1000
cap_theta	5.000	5.1772	4.4045	5.9554	norm	0.5000
cap_theta_s	5.000	4.8040	3.9390	5.6351	norm	0.5000
gamma_u2	0.150	0.0679	0.0237	0.1084	beta	0.0500
gamma_u2_s	0.150	0.1518	0.1406	0.1626	beta	0.0500
gam_r	0.700	0.8612	0.8464	0.8770	beta	0.1000
gam_pic	0.100	0.1057	0.0830	0.1261	beta	0.0500
gam_y	0.100	0.1969	0.1646	0.2234	beta	0.0500
gam_r_s	0.700	0.8016	0.7772	0.8270	beta	0.1000
gam_pic_s	0.100	0.0748	0.0519	0.0945	beta	0.0500
gam_y_s	0.100	0.0133	0.0056	0.0205	beta	0.0500
lambda_x	0.800	0.9556	0.9208	0.9916	beta	0.1000
thetaH	0.750	0.7253	0.6567	0.7834	beta	0.1000
thetaF	0.750	0.9806	0.9718	0.9891	beta	0.1000
thetaH_s	0.750	0.4650	0.4261	0.5100	beta	0.1000
thetaF_s	0.750	0.8827	0.8365	0.9350	beta	0.1000
zetaH	0.750	0.7428	0.6743	0.8073	beta	0.1000
zetaF	0.750	0.7448	0.6520	0.8329	beta	0.1000
zetaH_s	0.750	0.6657	0.6274	0.7057	beta	0.1000
zetaF_s	0.750	0.8141	0.7507	0.8646	beta	0.1000
thetaW	0.750	0.9592	0.9567	0.9611	beta	0.0500
zetaW	0.750	0.5608	0.5083	0.6113	beta	0.1000
thetaW_s	0.750	0.9571	0.9429	0.9716	beta	0.1000
zetaW_s	0.750	0.6267	0.5723	0.6950	beta	0.1000
theta_muH_lag	0.500	0.1203	0.0727	0.1737	beta	0.1000
theta_muH_s_lag	0.500	0.1126	0.0903	0.1408	beta	0.1000
theta_muW_lag	0.500	0.6895	0.6175	0.7630	beta	0.1000
theta_muW_s_lag	0.500	0.8172	0.7691	0.8640	beta	0.1000
rho_x	0.900	0.9448	0.9277	0.9599	beta	0.0500
rho_x_s	0.900	0.9678	0.9578	0.9774	beta	0.0500
rho_i	0.700	0.4604	0.4381	0.4876	beta	0.0500
rho_i_s	0.700	0.4085	0.3808	0.4317	beta	0.0500
rho_muH	0.700	0.5455	0.5128	0.5743	beta	0.0500
rho_muH_s	0.700	0.5604	0.5350	0.5852	beta	0.0500
rho_muW	0.700	0.8626	0.8441	0.8839	beta	0.0500
rho_muW_s	0.700	0.7591	0.7323	0.7871	beta	0.0500
rho_rho	0.700	0.9196	0.9082	0.9313	beta	0.0500
sig_x	0.005	0.0151	0.0141	0.0162	invg	0.0010
sig_x_s	0.005	0.0235	0.0230	0.0239	invg	0.0010
sig_s	0.010	0.0063	0.0032	0.0095	invg	0.0100
sig_s_s	0.010	0.0094	0.0054	0.0141	invg	0.0100
sig_r	0.001	0.0024	0.0022	0.0027	invg	Inf
sig_r_s	0.001	0.0023	0.0021	0.0025	invg	Inf
sig_i	0.010	0.0915	0.0823	0.1003	invg	Inf
sig_i_s	0.010	0.2075	0.1879	0.2280	invg	Inf
sig_muH	0.010	0.0268	0.0192	0.0330	invg	Inf
sig_muH_s	0.010	0.0230	0.0142	0.0324	invg	Inf
sig_muW	0.010	0.0825	0.0684	0.0984	invg	Inf
sig_muW_s	0.010	0.0080	0.0025	0.0144	invg	Inf
sig_rho	0.010	0.0032	0.0027	0.0037	invg	Inf
sig_c_ME	0.001	0.0008	0.0004	0.0013	invg	0.0010
sig_c_ME_s	0.001	0.0037	0.0033	0.0040	invg	0.0010
sig_i_ME	0.001	0.0002	0.0001	0.0003	invg	0.0010
sig_i_ME_s	0.001	0.0012	0.0004	0.0017	invg	0.0010
sig_w_ME	0.001	0.0093	0.0088	0.0097	invg	0.0010
sig_w_ME_s	0.001	0.0081	0.0077	0.0084	invg	0.0010