Discussion of "CES Technology and Business Cycle Fluctuations"

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MONFISPOL CONFERENCE, November 2010

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- **Main Issues.**
- **Lesser Issues.**
- **Conclusions.**

Motivation

Cristiano, Paul & Bo try to do the following ...

- Embed CES aggregate technology in SW-like (2007).
- Take Normalization seriously in an estimated DSGE model.
- Perform an Odds-Ratio comparison with CD based and DSGE-Var based alternatives.

Motivation

Why are they trying to do this?

1. Prior that CD is overly restrictive formulation of aggregate supply.
2. Improve statistical model fit viz-a-viz the data
3. Capture key volatilities better
4. Advance the CES and *normalization* agenda.

Method

- Re-write SW (2007) model with factor-augmenting CES aggregate production technology.
- Re-do the estimation of this “supply-augmented” SW model
- Trend for measurement variables estimated.
- DSGE & DSGE-Var framework.
- Odds-Ratio comparison.

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4. Variance Decomposition

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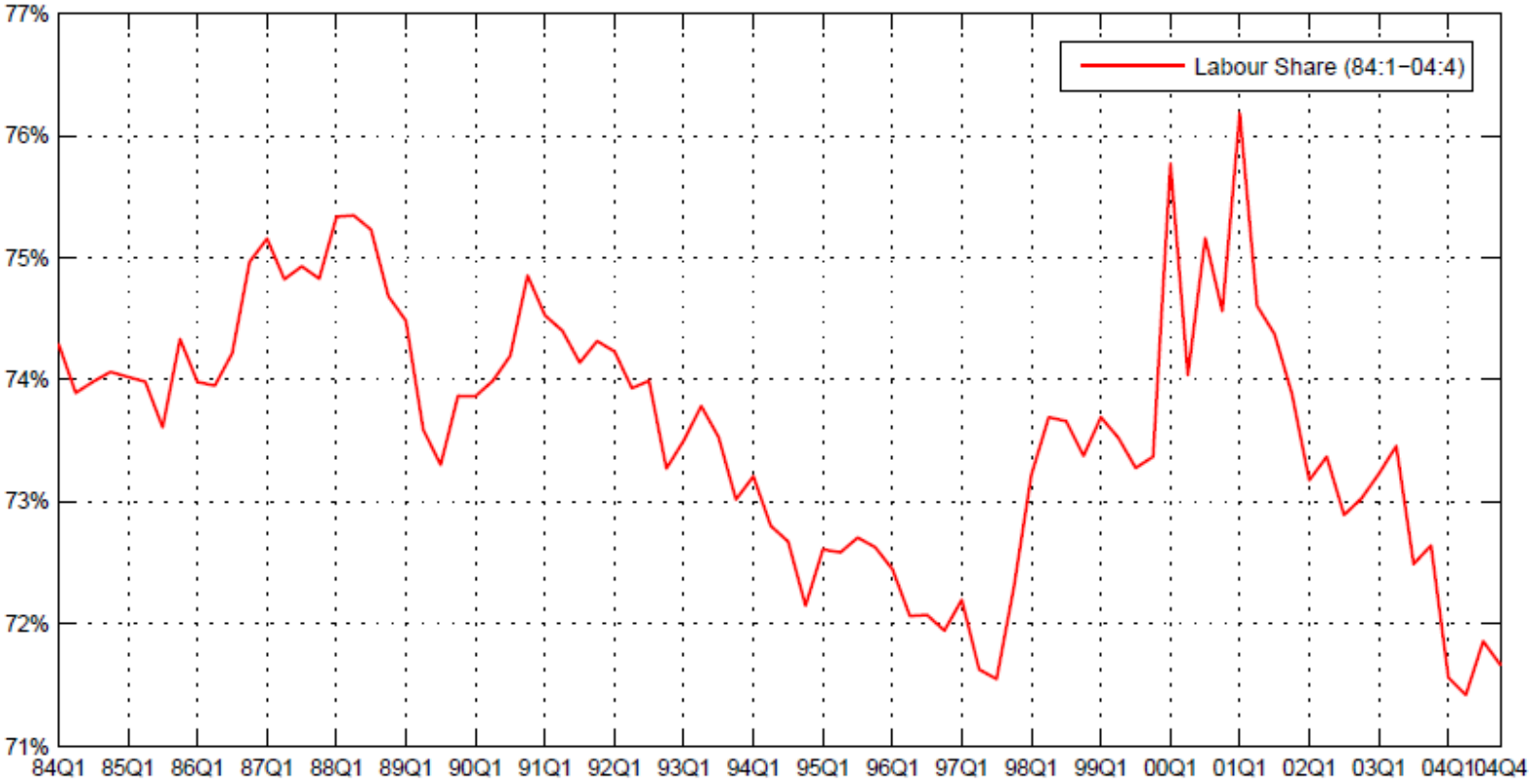
1. Implementation of the normalized CES production function.

- The point of normalization makes more sense as a data sample context, not a steady state growth point.
- Two assumptions being imposed by SS growth point: (1) that the BGP growth rate is constant (ii) that technical progress is Harrod Neutral.
- Neither of these properties hold in the data.
- Implementation of factor-augmenting CES Production should force you to think about balanced growth. If $ZK > 0$ there is no balanced growth. Plot of Labor Share proves it.


Labour Share (84:1−04:4)
77%
76%
75%
74%
73%
72%
71%
84Q1
85Q1
86Q1
87Q1
88Q1
89Q1
90Q1
91Q1
92Q1
93Q1
94Q1
95Q1
96Q1
97Q1
98Q1
99Q1
00Q1
01Q1
02Q1
03Q1
04Q1
04Q4

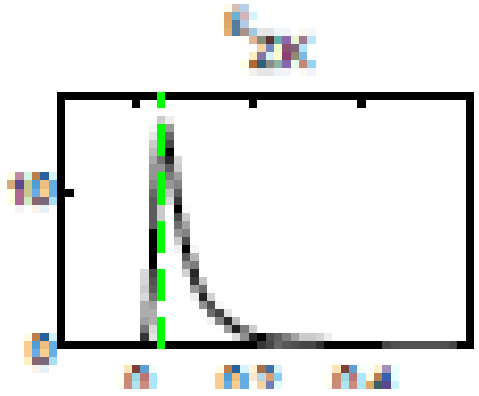
Issues

2. The Empirical Results: Estimation and Identification

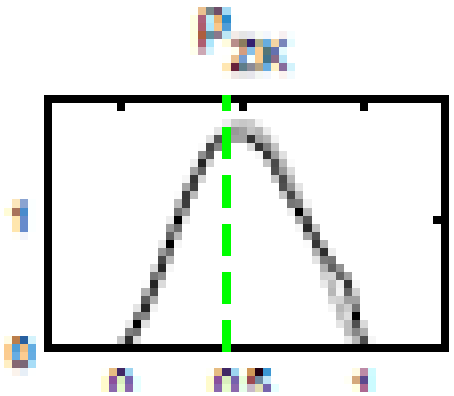
- The data are uninformative about the key parameters, ρ_{Zk} and e_{ZK}.
- PC slope still flat.
- This study forces us into new territory and puts identification issues to the forefront (e.g., capital-augmentation vs. Investment-specific) yet very limited diagnostics presented.

Capital-Augmenting Technology Process Parameters

e_{ZK}



ρ_{ZK}



Issues

3. Variance Decomposition

- Are these decompositions for the levels or the growth rates of the observables? It matters. Technology drives the levels of, say output, but will have less impact on the difference.
- That said, some of these decompositions look big.

		Shocks of the Estimated DSGE Models							
Forecast horizon	Observable variables	Productivity (K)	Productivity (L)	Government spending	Mark-up (price)	Investment	Mark-up (wage)	Monetary policy	Preference
t=1	Output	0.0 (0.00)[*]	5.1 (7.1)	32.8 (31.9)	21.4 (19.4)	14.2 (12.6)	20.3 (23.3)	3.9 (2.9)	2.4 (2.8)
	Consumption	0.0 (0.01)	6.8 (5.0)	4.2 (10.0)	12.2 (7.2)	1.8 (0.9)	32.5 (31.6)	9.1 (3.9)	33.4 (41.4)
	Investment	0.0 (0.01)	5.4 (9.7)	0.2 (2.0)	24.7 (26.4)	51.3 (38.6)	14.8 (19.3)	1.2 (2.1)	2.3 (2.0)
	Inflation	0.0 (0.09)	15.6 (12.3)	2.4 (12.9)	24.7 (13.5)	15.0 (30.7)	16.6 (3.5)	13.5 (17.4)	12.3 (9.7)
	Real wage	0.0 (0.02)	5.7 (3.4)	0.01 (2.3)	49.5 (33.0)	0.02 (0.1)	29.6 (52.8)	4.0 (0.9)	11.2 (7.6)
	Interest rate	0.0 (0.05)	6.4 (7.7)	1.0 (8.0)	9.6 (6.5)	6.1 (18.6)	6.4 (1.3)	65.3 (51.2)	5.1 (6.6)
	Hours worked	0.0 (0.01)	12.3 (12.2)	30.5 (30.2)	19.0 (17.7)	13.2 (11.9)	19.5 (22.8)	3.5 (2.7)	2.1 (2.5)
t=4	Output	0.0 (0.00)	6.8 (7.7)	23.8 (27.9)	25.7 (20.5)	12.5 (10.4)	25.1 (26.9)	3.0 (2.6)	3.1 (4.0)
	Consumption	0.0 (0.01)	7.6 (4.9)	4.5 (10.0)	13.0 (6.9)	2.1 (1.3)	35.3 (32.1)	8.4 (3.8)	29.2 (41.0)
	Investment	0.0 (0.01)	6.6 (9.9)	0.3 (2.5)	30.2 (28.6)	39.5 (30.7)	20.0 (24.6)	0.8 (1.8)	2.7 (1.9)
	Inflation	0.0 (0.06)	11.4 (8.7)	2.3 (10.2)	15.5 (9.9)	25.1 (38.6)	17.5 (3.1)	16.8 (21.8)	11.4 (7.5)
	Real wage	0.0 (0.01)	6.7 (3.4)	0.2 (2.4)	53.1 (33.7)	0.4 (0.4)	25.4 (50.8)	3.7 (0.9)	10.5 (8.5)
	Interest rate	0.0 (0.03)	10.7 (7.0)	2.5 (12.0)	10.1 (3.4)	26.5 (53.5)	16.3 (1.2)	21.9 (15.9)	11.9 (7.0)
	Hours worked	0.0 (0.00)	2.0 (2.4)	10.7 (9.5)	35.2 (31.8)	13.2 (7.9)	36.9 (46.7)	1.5 (1.1)	0.5 (0.6)
t=10	Output	0.0 (0.01)	6.8 (8.3)	23.2 (27.4)	25.2 (20.22)	13.7 (11.0)	24.8 (26.5)	3.1 (2.7)	3.3 (4.0)
	Consumption	0.0 (0.01)	7.6 (4.8)	4.3 (9.8)	12.8 (6.9)	3.3 (3.7)	34.3 (31.1)	8.4 (3.7)	29.4 (39.9)
	Investment	0.0 (0.01)	6.3 (10.5)	0.3 (2.5)	28.4 (27.0)	42.2 (32.8)	19.1 (23.1)	0.9 (1.8)	2.9 (2.3)
	Inflation	0.0 (0.06)	10.9 (8.7)	2.3 (9.9)	16.7 (10.3)	26.1 (38.5)	16.5 (4.0)	16.2 (20.8)	11.3 (7.8)
	Real wage	0.0 (0.01)	6.7 (3.3)	0.2 (2.4)	51.6 (33.0)	0.4 (1.0)	26.1 (51.1)	3.9 (0.9)	11.1 (8.4)
	Interest rate	0.0 (0.03)	8.6 (5.3)	3.2 (12.7)	7.9 (8.7)	41.0 (54.6)	15.5 (1.7)	14.0 (11.9)	9.8 (5.2)
	Hours worked	0.0 (0.00)	1.3 (1.1)	6.0 (4.6)	41.1 (32.3)	7.1 (3.4)	43.5 (57.8)	0.6 (0.5)	0.5 (0.3)
t=100	Output	0.0 (0.01)	7.1 (8.4)	22.2 (27.1)	25.4 (20.4)	13.5 (10.9)	25.7 (26.7)	3.0 (2.6)	3.2 (3.9)
	Consumption	0.0 (0.01)	7.6 (4.8)	4.3 (9.8)	12.9 (7.7)	3.9 (3.8)	34.3 (31.5)	8.2 (3.6)	28.8 (38.8)
	Investment	0.0 (0.01)	6.6 (10.6)	0.3 (2.6)	28.8 (27.3)	40.4 (31.9)	20.2 (23.6)	0.8 (1.7)	2.9 (2.3)
	Inflation	0.0 (0.03)	10.3 (5.6)	2.6 (6.4)	18.1 (16.5)	25.2 (23.8)	18.7 (30.1)	14.8 (12.4)	10.3 (4.6)
	Real wage	0.0 (0.01)	6.9 (3.3)	0.2 (2.3)	51.8 (32.5)	0.5 (1.1)	26.0 (51.8)	3.9 (0.8)	10.8 (8.1)
	Interest rate	0.0 (0.01)	7.9 (3.7)	4.7 (8.0)	13.7 (18.2)	34.8 (25.2)	20.6 (37.8)	10.8 (4.9)	7.6 (2.2)
	Hours worked	0.0 (0.00)	1.0 (0.4)	6.3 (2.1)	45.2 (27.5)	5.2 (1.4)	41.5 (68.3)	0.4 (0.2)	0.4 (0.1)

Table 4: Variance Decomposition - Comparison of CD and CES Specifications (in Percent)[◇]

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4. Odds Ratio

- CES beats CD 100-to-1!
- On the face of it, this looks really powerful!
- But what concept of likelihood are you using: Laplace Approximation, MHM?
- Has the Markov Chain fully converged?
- Log difference is only 10. Are the authors comfortable with making such claims of dominance?

Lesser Issues

- IRFs: actually relatively little difference between CES and CD alternatives.
- IRFs: hump shaped ...?
- Bayesian-Maximum Likelihood?
- “Capital-Biased technical” progress.

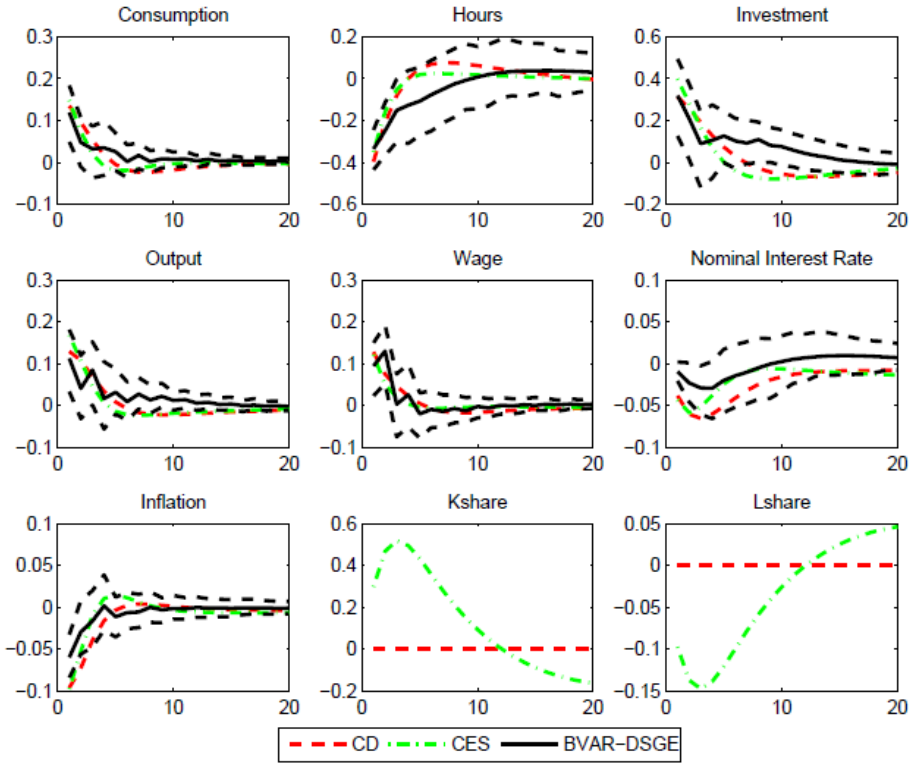

Figure 6: Bayesian IRFs - Labour-augmenting shock$^{\diamond}$

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- Should convince people that the convenience and centrality of Cobb-Douglas production functions in macro is obscuring important issues (*especially so* over b/cycle frequencies).
- Incorporating factor-augmenting CES aggregate production-technology system holds out enormous promise - better models, better understanding of the data.

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- Should convince people that the convenience and centrality of Cobb-Douglas production functions in macro is obscuring important issues (*especially so* over b/cycle frequencies).
- Incorporating factor-augmenting CES aggregate production-technology system holds out enormous promise - better models, better understanding of the data.
- The process of implementation and identification is far from trivial.