

Optimal food price stabilisation policy

Supplementary appendix

Christophe Gouel*

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S1 Equilibrium with futures markets

We define in this section the model's equations in the presence of futures markets. In period t , consumers hedge their time- $t + 1$ consumption by buying Q_t units of futures at the known price F_t . In $t + 1$, they receive $(P_{t+1} - F_t) Q_t$. Since futures do not generate utility *per-se*, consumers' indirect utility is the same, only their income is affected, so they solve the problem

$$\max_{\{Q_{t+i}\}_{i=1}^{\infty}} E_t \sum_{i=0}^{\infty} \beta^i v(P_{t+i}, Y + (P_{t+i} - F_{t+i-1}) Q_{t+i-1}), \quad (\text{S1})$$

which leads to the following first-order condition

$$E_t [(P_{t+1} - F_t) v_Y(P_{t+1}, Y + (P_{t+1} - F_t) Q_t)] = 0. \quad (\text{S2})$$

Provided there are risk neutral agents endowed with rational expectations to hold the corresponding short positions (in our case, it could be the producers, the storers or the government), futures markets will be unbiased and

$$F_t = E_t(P_{t+1}). \quad (\text{S3})$$

Equilibrium with futures markets is defined by equations (6), (8), (10), (11), (S2) and (S3), where in equation (11) consumers' demand is now defined by $D(P_t, Y + (P_t - F_{t-1}) Q_{t-1})$.

S2 Sensitivity to initial availability

We analyse here the sensitivity of results to the initial state by considering, in addition to the benchmark case of an initial availability equal to its steady-state value, two situations where it is 20% below and 20%

*INRA and CEPII (christophe.gouel@grignon.inra.fr)

above the benchmark. Table S1 shows that initial availability has little influence on total welfare gains, but matters for policy incidence.

Table S1. Sensitivity of welfare results to initial availability

	A_0 :	Public storage			Subsidy/tax to production			Both instruments		
		0.8	1 ^a	1.2	0.8	1 ^a	1.2	0.8	1 ^a	1.2
Consumers' gains		0.34	0.33	0.33	0.29	0.30	0.11	0.50	0.48	0.35
Producers' gains		0.01	0.03	0.08	1.06	1.09	0.38	0.69	0.66	0.20
from initial availability		-0.00	0.11	0.31	0.00	-0.00	0.03	-0.00	0.10	0.32
Government outlays		0.27	0.27	0.31	1.34	1.37	0.48	1.10	1.05	0.44
Total gains		0.08	0.09	0.09	0.02	0.02	0.02	0.09	0.09	0.10

^a Benchmark.

Producers' gains can be decomposed in three components: gains from initial availability, welfare change on transitory dynamics and asymptotic welfare changes, these latter being the same whatever the initial conditions.

For the public storage policy, producers' gains increase with availability but not as much as their gains coming from initial availability. This is explained by two countervailing forces. For an initial availability of 0.8, there are no gains to expect from initial availability because no stocks will be carried to next period in such a situation of scarcity, so in the first period the price would be almost the same with or without policy. If initial availability is higher than the storage threshold, producers enjoy gains at the first period, because of the increased price. On the other hand, a high public stock level in the first period, caused by a high initial availability, will depress prices on the transition toward the asymptotic distribution. While for low initial availability, the public stocks accumulation will take place after the first period and increase prices in these subsequent periods. This explains why overall producers' gains appear to change little with initial availability when compared to their first period gains.

For the policy of subsidy/tax to producers, initial availability matters for producers' gains because for low availability producers will tend to be subsidised in the first periods, while for an initial availability of 1.2, they are taxed in the first period (see Fig. 2), which explains their lower gains. This has an effect on consumers too. If producers are taxed, they produce less than otherwise which increases prices in next periods, explaining consumers' lower gains if initial availability is high.

For a policy using both instruments, we observe a combination of the effects of each instrument described above. The effect of the subsidy/tax to production is, however, more limited than if used alone, because the magnitude of intervention is smaller with both instruments.