economics for energy

The welfare cost of energy insecurity

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INTRODUCTION

- The 1973-1974 oil crisis revealed the vulnerability of the industrial countries to oil price shocks.
- Energy security is considered as an important objective of energy policy.
- Together with efficiency and sustainability, the EU includes energy security as one of the three pillars of its energy policy (European Commission (EC) 2008).
- Despite its importance, there is limited information about the economic impact of energy insecurity.

LITERATURE

- Definition:
  - IEA: the uninterrupted physical availability at a price which is affordable.
  - Bohi and Toman (1996): the loss of welfare resulting from a change in the price or physical availability of energy.
- Indicators:
  - Scheepers et al (2007), Supply/Demand Index; IEA (2011), MOSES.
  - Variables: relative level of imports, diversification of supply sources…
- Economic cost:
  - Markandya and Pemberton (2010) use a partial equilibrium model where there is a risk of disruption of energy supply.

OBJECTIVE and FRAMEWORK

- The objective is to quantify the welfare cost of energy insecurity.
- We relate energy insecurity with energy price volatility:
  - In a perfect market, prices reflect all possible events and risks (Kilian, 2009).
  - Energy insecurity is not caused by high prices, but volatility and uncertainty.
- The paper is related to two strands of the literature:
  - Energy price shocks: Kim and Loungani (1992), Rotemberg and Woodford (1996), Finn (2000).
  - The welfare cost of business cycles: Lucas (1987).

THE MODEL

- We use a Dynamic Stochastic General Equilibrium model.
- The model consists of a representative household and a firm.
- Energy is a consumption good for households and a production input for firms.
- Energy is imported from abroad at an exogenous price.
- There is perfect competition in the model.

THE MODEL

1. The representative household maximize the intertemporal utility:

$$\max_{c_t, n_t, eh_t} \; U = E_0 \sum_{t=0}^{\infty} \beta^t \, u(c_t, n_t, eh_t)$$

$$\text{s.t.} \qquad c_t + i_t + p_t eh_t = w_t n_t + r_t k_t$$

2. The firm maximizes profits:

$$\max_{n_t, k_t, ef_t} \; F(n_t, k_t, ef_t) - w_t n_t - r_t k_t - p_t ef_t$$

3. Markets clear:

$$k_{t+1} = (1-\delta)k_t + i_t \qquad\qquad y_t = c_t + i_t + p_t(eh_t + ef_t)$$

4. The relative energy price follows an exogenous process:

$$\ln p_{t+1} = (1-\rho)p_{ss} + \rho \ln p_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, \sigma_t)$$

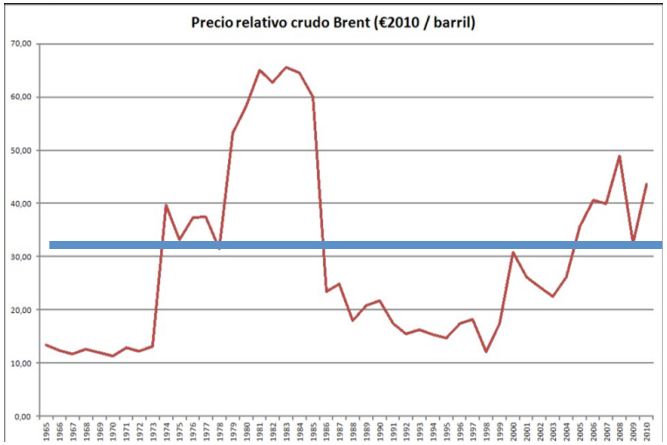
CALIBRATION

- We employ numerical methods to obtain a solution.
- The parameters are chosen to reproduce the main variables of the Spanish economy.
- We use standard values for key parameters of the model: the relative risk aversion, the elasticity of substitution between energy and non-energy consumption, the elasticity of substitution between energy and capital.
- To estimate the price process, we use oil prices rather than energy prices.
- Real data is used to obtain the errors that generate the observed relative energy price.

The Welfare cost of Energy Insecurity. Preliminary results

$$U(c_{ss}, n_{ss}, eh_{ss}) = E[U(c_t(1+x), n_t, eh_t)]$$

$$WC = x\,\frac{c_t}{y_t}$$



- We find that the welfare cost of energy price fluctuations is 1.05%.
- Most of the welfare loss is generated through energy consumption by households.
- Excluding *eh* from the model, the welfare cost is 0.033%.
- Precautionary savings lead to a decrease in non-energy and energy consumption of 0.08% at the steady state.

CONCLUSIONS and FUTURE RESEARCH

- We find that energy price fluctuations lead to significant welfare losses.
- Notice that our model represents an economy without distortions or rigidities. Welfare losses may be even higher.
- Sensitivity analysis to determine how the results change with different values for key parameters.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