***Natural Gas Supply Behavior Under Intervention: The Case of Argentina***

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## Overview

We address the causes behind the significant drop in natural gas production in the 2000s in Argentina, starting from a basic supply model that depends on economic incentives, and adding control variables related to different potential explanations such as firm specific (or area specific) behavior and the role of contractual renegotiation of concessions extensions. Results from a panel data of production areas between 2003 and 2013 show that once a basic supply-past production (or reserve) relationship is modeled, other often mentioned effects become non-significant. Chiefly among them are firm specific effects that were used as a central argument for the nationalization of YPF in 2012. Rather, the evidence shows that the observed downcycle conforms to the prediction of a simple model of depressed economic incentives acting upon mature conventional natural gas fields and hindering investment in reserve additions or new technologies. The results are robust to the nationalization of YPF, after which aggregate production continued a downward trend, but showing a change in the relative performance of YPF and the rest of the sector as a reconfiguration of price incentives and risks.

## Methods

We develop a simple model that is based on an explicit optimization and is simplified to capture the essentials of the factors we perceive as crucial in the particular period of the Argentine natural gas market that we are studying. A heavy interventionist regime was put in place since 2002, with open command-and-control features. Prices have been controlled and kept very low in real terms and in relation to border prices or opportunity cost values. We work in an intertemporal framework were suppliers have optimal supply response in face of a current period of controlled prices and have cuadratic production and investment costs. We obtain a linear supply-reserve relationship that guides our specification for the empirical study of the case. We then perfom panel econometrics to test the determinants of the observed drop in production. Our empirical analysis is based on annual production of natural gas at the area level, after an effort to build our data set from detailed raw data provided by the Instituto Argentino del Petróleo y el Gas (IAPG). This basic data was further evaluated and made consistent to allow a correct identification of the areas across years. We use data on 12 consecutive years of production from 2002 to 2013 from 164 areas. The data identifies the firm that operates the area (there is only one operator per area) and the basin in which is located. We also gather data on exploration investment effort and model such decision along with the production decision. We include controls that inform about price-cost margins, cost of capital, demand shocks or interactions through GDP growth and its change, and an indicator of an (intra-year) shift in demand (towards the summer) that captures demand shocks due to cold winters.

## Results

The results show the relevance the central explanatory variable to condition production performance in our reference model, i.e. cumulative past production. There are other three significant variables in the empirical model. The first is the “medium size firms” variable reflecting the fact that their performance was superior to large firms due to being less exposed to expropriation risks. The second is the “demand shift” variable that captures by a seasonal summer effect, i.e. a shift in demand due to abnormal industrial demand rationing during the winter, which is also a by-product of the depressed-price regime. The third is the (positive) renegotiation effect of one important area (Cerrro Dragón) performed in 2007. These effects (except for the medium firm size variable and to some degree the renegotiation effect of Cerro Dragon) survive to across the regressions that either use cumulative past production or remaining reserves.

A very important result is that once the above mentioned effects (which can be derived from simple first principles of supply behavior) are modeled, other often mentioned reasons for the decline in natural gas production become non-significant. Chiefly among them is the “YPF effect” and the “Loma la Lata effect”, i.e. the main firm and main area, both made responsible in many allegations steaming from casual observation based on descriptive non conditioned statistics. What the results tell us is that, while very important, the drop in these cases, are not dissimilar with respect to other areas or firms. This evidence points to a more general and sector wide phenomena. Nevertheless we also test for changes in the behavior of YPF after nationalization and the results show that in 2012 and 2013, YPF started to perform better than the rest of the sector. This has happened amidst strong government support both in terms of incentives for additional production and access to hard currency. Mirroring this improvement was a deterioration of the performance of other large firms leading to an extension of the drop in aggregate production in the two years after nationalization. Another often mentioned –particularly in the energy business community- effect for natural gas production drop in Argentina is the (absence of) renegotiation of concessions extensions, which do not allow mobilization of resources as the end period approaches. In the simple model of section 2 extensions enlarge the horizon of decisions and (for given a discount rate) may increase the marginal benefit of investment and production in the future. But this inter-temporal allocation of production effort makes the effect on current production ambiguous.Renegotiation dummies effect on the rate of change of natural gas production are in general non-significant, except for the Cerro Dragon area. Thus, our results suggest that the area was underperforming until it renegotiated its concession in 2007, to become more dynamic after that year.

## Conclusions

The main contribution of this paper is to show that the drop in natural gas production experienced by Argentina can indeed be modeled from a basic standard theory approach, which is the natural setting to start exploring the significance of other often cited explanations attributed to underperformance of the leading firm (that lead to its nationalization), areas, renegotiation of concessions and the role of past investment. Our results are clear enough on the scant evidence in favor of firm-specific or area-specific effects that may suggest abnormal behavior and on the relative low power on production dynamics on interventions(including nationalization)-without-economic-signals. Overall the evidence is pretty much consistent with the deleterious effect of very low price signals on an already mature conventional gas pattern. Given this it is unsurprising that the nationalization of YPF have not altered the aggregate dynamics of natural production in Argentina, while changing the relative performance of firms . Nevertheless we detect a change in the relative performance of YFP vis a vis the rest of the firms that reflects the changed incentives after nationalization. The recent move towards non conventional gas with substantially higher prices is a central part of this incipient change.

## References (selected)

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