

Explaining the Last Consumption Boom-Bust Cycle in Ireland

The Role of News and Noise Shocks

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Abstract

The objective of the paper is to explain the last boom and bust in consumption in Ireland by the failure of consumers to correctly distinguish permanent changes in productivity from temporary changes. It uses a business cycle model, where agents update their beliefs about long-run productivity using information—that they receive continuously—about the future state of the economy.

The analysis finds that a large and prolonged disconnect between consumption and long-run productivity occurred in the years leading to the economic crisis, which led to “over-consumption” for several quarters. A strong downward adjustment in 2008 followed when Irish consumers finally realized their mistake.

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Explaining the last consumption boom-bust cycle in Ireland: The role of news and noise shocks*

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1 Introduction

Economic theory suggests that since productivity captures the capacity of the economy to produce income, an infinitely lived agent maximizing inter-temporal utility should base his consumption decisions on future productivity. Consequently, lack of understanding of this economic fundamental produces periods of “over” and “under-consumption”. Because agents cannot observe this macro-variable, they estimate it using not only observed productivity but also using information -that they receive continuously- which can or cannot affect productivity (income) in the future.

Since the mid-1990s to roughly the mid-2000s, strong increases in labor productivity were coupled with a sharp rise in Irish consumption. However, since around the mid-2000s, while labor productivity remained roughly stable, consumption not only continued its ascendant path, but experienced even higher growth. In 2008, a sharp adjustment in consumption occurred while labor productivity remained stable. If agents base their consumption decisions only on observed labor productivity, there should not be such instability in the relationship between these two variables. It seems then that information about future changes in productivity has played an important role in consumption decisions in Ireland.

The aim of this paper is to explain the last boom and bust in Irish consumption by the idea that a large part of the information about the future received by Irish consumers did not have the expected permanent effects on productivity. In particular, our initial intuition is that because of strong increases in labor productivity from mid-1990s to mid-2005, and because of positive signs received about the future, Irish agents believed that the stabilization of labor productivity that occurred in the mid-2000s was only temporary. Consequently, they “over-estimated” future productivity, leading to a period where Irish agents consumed at levels above what economic fundamentals (in this case long-run productivity) suggested. When they realized their mistake, they immediately and strongly adjusted consumption expenditures downwards.

To give empirical support to our intuition, we built on the business cycle with news shocks proposed by Blanchard et al. (*forthcoming*) (henceforth BLL) where agents form their beliefs about future productivity (and hence future income) based on information about the future which sometimes is news, sometimes just noise. Thus, agents face a signal extraction problem that can potentially lead to large disconnects between consumption and economic fundamentals.¹

We find that errors in consumers’ beliefs about future productivity were substantial during the last 15 years in Ireland. In particular, Irish consumers’ behavior reacted with an important delay to changes in this variable during the mentioned period. The most important consequence has been the large disconnect between the considered economic fundamental and consumer beliefs since 2005. Indeed, since that date, long-run productivity started a descent trajectory, while agents still were estimating increases in this macro-variable. A strong adjustment in

¹This analysis would not be possible in a typical model with news shocks where agents perfectly anticipate changes in productivity. See Lorenzoni (2011) and Milani (2012) for a survey of the news shocks literature.

consumption occurred in 2008 when agents finally realized that they were “over-consuming”.

Blanchard et al. (*forthcoming*) and L’Huillier (2012) find qualitatively the same results as our paper using US data. They both find first a slow learning for consumers about changes in the permanent component of productivity. Second they find an overshooting of their beliefs -on long-run productivity in the first paper, and on permanent productivity in the second- around 2005, followed by a sudden downward adjustment in 2008.

The paper continues as follows. Section II presents the basic version of the BLL model. Section III describes the estimation methodology and presents the recovered shocks and states from the estimation. Section IV concludes.

2 The BLL basic model

2.1 The model

We consider a framework where productivity is driven by two disturbances: a permanent and a transitory shock. A key assumption in this model is that consumers do not observe the two shocks separately, but only the realized level of productivity. The permanent shock introduces uncertainty about the economy’s long-run fundamentals. The presence of the transitory shock implies that consumers cannot back out the permanent shock from productivity observations, thus creating a signal extraction problem. We assume that consumers have access to an additional source of information, as they observe a noisy signal of the permanent component of productivity. This adds a third source of fluctuations, a shock to the error term in the signal, which is called in Lorenzoni (2009) and Blanchard et al. (*forthcoming*) a “noise shock”, and which has the features of aggregate demand shocks, i.e. the shock increases output only temporarily. Consumers solve their signal extraction problem, form expectations about future productivity, and choose spending based on these expectations. Finally, we assume the existence of nominal rigidities in the economy, which implies that spending determines output in the short-run. We explicitly list below the specific assumptions of the model.

Productivity a_t (in logs) is the sum of two components, the permanent x_t , and the transitory component z_t :

$$a_t = x_t + z_t \tag{1}$$

The permanent component follows a unit root process:

$$\Delta x_t = \rho_x \Delta x_{t-1} + \epsilon_t \tag{2}$$

The transitory component follows a stationary process:

$$z_t = \rho_z z_{t-1} + \eta_t \tag{3}$$

The coefficients ρ_x and ρ_z are in $[0,1[$, and ϵ_t and η_t are independently and identically distributed (i.i.d.) draws from a normal distribution with zero mean and with variances σ_ϵ^2 and σ_η^2 .

In addition to observing the realized productivity level a_t each period, consumers receive a noisy signal (s) about the permanent component x_t :

$$s_t = x_t + v_t \quad (4)$$

where v_t are also i.i.d. draws from a normal distribution with zero mean and with variance σ_v^2 .

We assume that consumers set consumption (in logs) c_t equal to their long-run productivity expectations:

$$c_t = \lim_{j \rightarrow \infty} E_t[a_{t+j}] \quad (5)$$

where E_t is the expectation conditional on the consumers information at date t , i.e., conditional on current and past values of a_t and s_t .

We simplify the determination of output by assuming that consumption is the only component of demand, and that output is fully determined by the demand side. Thus, output (in logs) is equal to consumption $y_t = c_t$. Finally, we assume a linear production function in labor, so that the labor input n_t adjusts to produce y_t , given the current productivity a_t , and then $n_t = y_t - a_t$.

We now solve for consumption (c_t). Using (2) we can compute the expected value of cumulative productivity in the long-run:

$$\lim_{j \rightarrow \infty} E_t[x_{t+j} - x_t] = \sum_{j=0}^{\infty} \Delta x_{t+j} = \frac{\rho_x}{1-\rho_x} E_t[x_t - x_{t-1}]$$

We replace a with x in (5), since the transitory component disappears in the long-run and, rearranging the equation above, we get consumption:

$$c_t = \frac{1}{1-\rho_x} (E_t[x_t] - \rho_x E_t[x_{t-1}]) \quad (6)$$

Finally, to complete the solution of the model, we need to solve the consumers' signal extraction problem to express the expectations of x_t and x_{t-1} in terms of current and lagged values of the shocks (ϵ_t , η_t , v_t). This is done in the next sub-section using standard Kalman filtering.

2.2 Solving the consumers' signal extraction problem

We define the state vector $X_t = (x_t, x_{t-1}, z_t)'$, the shock vector $V_t = (\epsilon_t, \eta_t, v_t)'$, and the vector of consumers' observations $S_t = (a_t, s_t)'$. The notation $X_{t/t}$ represents the agents' expectation $E[X_t/S_t, S_{t-1}, \dots]$.

We use the Kalman filter to express the agents' expectations $X_{t/t}$ in recursive form as:

$$\begin{aligned} X_{t/t} &= AX_{t-1/t-1} + K(S_t - S_{t/t-1}) \\ &= (I - KC)AX_{t-1/t-1} + KS_t, \end{aligned}$$

where the matrix of Kalman gains K depends on the variance parameters ϵ_t , η_t and v_t . In particular, when the variances parameters are large, s_t and a_t are less precise signals of x_t and agents take longer to adjust their expectation $x_{t/t}$ to the true value x_t (see Lorenzoni 2009 for more details).

Since $X_t = AX_{t-1} + BV_t$ and that $S_t = CX_t + DV_t$, we can re-write the dynamics of $X_{t/t}$ as:²

$$X_{t/t} = (I - KC)AX_{t-1/t-1} + KCA X_{t-1} + (KCB + KD)V_t$$

3 Results

3.1 Maximum likelihood estimation

After having solved in the previous section the consumers' Kalman filter to obtain the dynamics of consumers' expectations, we proceed to estimate the parameters of the model. The equations describing the equilibrium are the ones included in the vectors X_t , $X_{t/t}$, and the equation of the endogenous state (6). The variables observed are c_t and a_t . We use *Dynare* for maximum likelihood estimation.

The consumption series is constructed by dividing real consumption by population. The labor productivity series is constructed by dividing employment by real GDP. Both series are taken in logs. An important issue we have to confront is that, contradictory to our model, productivity and consumption have different growth rates over the sample. This difference reflects factors left out of our simple model such as changes in participation rate, or changes in saving rate (likely linked with the deterioration of the Irish current account during most of the studied period), or changes in the capital-output ratio. Consequently, we remove the drift in the consumption-to-productivity ratio applying the first-differencing filter to both series.

Our dataset spans the period 1997Q1 to 2011Q4. The series for Real GDP, Real Personal Consumption Expenditures, and Employment are from the OECD database. Population data comes from Eurostat and the Central Statistics Office (CSO). Figure 1 plots the data series.

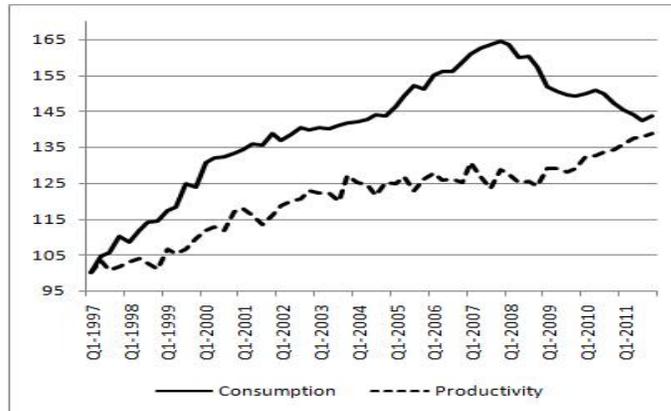
3.2 Recovering shocks and states

Figure 2 shows the recovered shocks from our structural estimation. We remark that permanent productivity shocks are much smaller compared to the size of noise and transitory productivity shocks.³ This result highlights the major signal

²From (1) to (4) it is straightforward that $A = \begin{bmatrix} 1 + \rho_x & -\rho_x & 0 \\ 1 & 0 & 0 \\ 0 & 0 & \rho_z \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$, $D = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

³The high autocorrelation of the permanent shocks is a consequence of the difficulty to identify the precise quarter when the permanent change in productivity occurs.

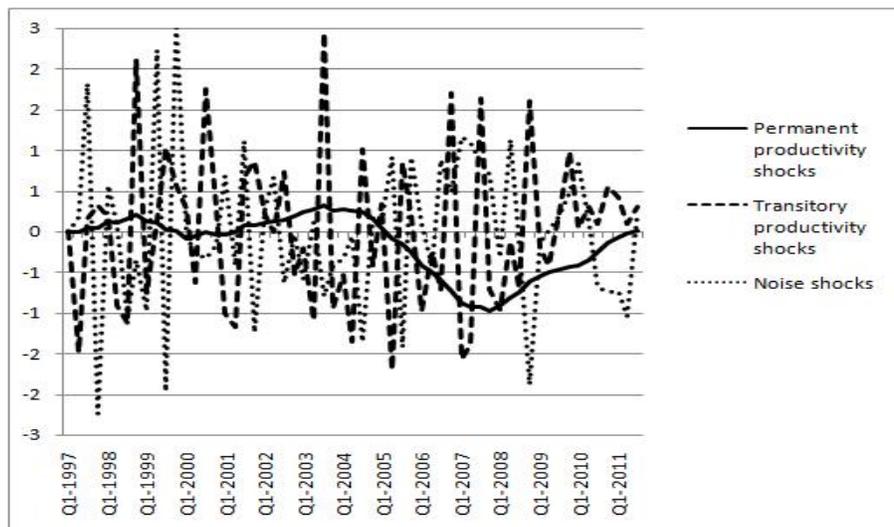
Figure 1: Data Series



Note. Index 100 in 1997Q1 for the two data series.

extraction problem that Irish consumers faced during the considered period when deciding on their expenditures levels, and that, as we will see below, led to large and prolonged errors in the estimation of long-run productivity.

Figure 2: Smoothed estimates of shocks

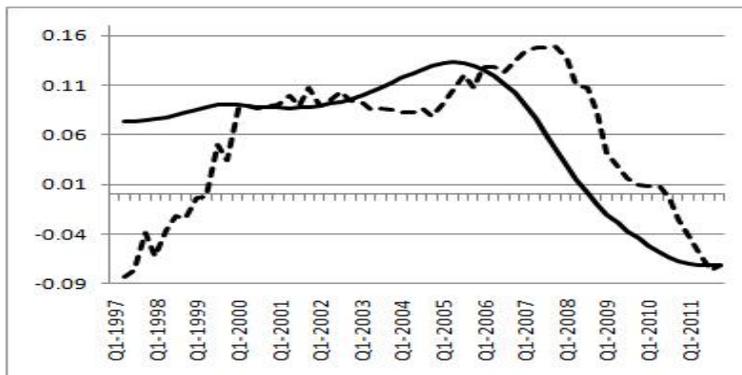


In Figure 3 we plot the estimation of the smoothed series of future productivity (solid line) and the consumers real time beliefs about it (dashed line).⁴ We can clearly distinguish two different sub-periods. During the first sub-period (mid-90s-2005), with the exception of a few quarters, consumers were systematically underestimating long-run productivity, while in the second sub-period

⁴Equation (6) shows the general expression for expected long-run productivity.

(2006-2011) the situation reversed and Irish consumers highly over-estimated this macro-variable.

Figure 3: Smoothed estimates of long-run productivity



The economic interpretation of our results is as follows. The shifting of resources into sectors associated with high productivity growth (chemicals and ICT) (see for instance, Cassidy 2004) led to high increases in long-run productivity from the mid-1990s to mid-2000s in Ireland. Irish consumers seemed surprised with this strong increase and caught up gradually with the high levels of this economic fundamental. After the mid-2000 the story was reversed. Irish people did not realize immediately the decline on future productivity. The observed previous strong increases in labor productivity coupled with positive signs about the future (that ended up being only noise, as Figure 2 shows), made Irish agents believe that the stop in the rise in labor productivity was only temporal.⁵ Almost two years after a period of “over-consumption”, agents finally realized this disconnect, and suddenly adjusted their consumption levels downwards in 2008.

4 Conclusion

This paper has proposed an explanation of the last boom and bust in consumption in Ireland in terms of a failure of Irish consumers to correctly assess long-run productivity. Thus, a prolonged “over-estimation” of future productivity was followed by a large adjustment in consumption, more in line with long-run fundamentals.

A natural extension of this work is to explore the role of agents’ errors about future productivity in the Irish current account recent fluctuations. Indeed, the current account balance became largely negative since the mid-2000s -curiously a

⁵The index of consumers expectations, constructed by the Economic and Social Research Institute (ESRI), shows that the level of the index in 2006 was comparable to the high levels observed in the mi-90s, when the imminent creation of the Euro-zone boosted consumer expectations about future revenues.

time when productivity stopped increasing- to only recover strongly in 2009 and 2010.

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