

FIRST EURO AREA BUSINESS CYCLE (EABCN) CONFERENCE

Frankfurt, 5-6 December 2003

REPORT

The first Euro Area Business Cycle Conference was held in Frankfurt am Main, on 5-6 December 2003. It was hosted by the European Central Bank. The Conference was organised by the EABCN, in conjunction with the CEPR and the ECB. The organisers were **Lucrezia Reichlin** (Université Libre de Bruxelles and CEPR), **Jérôme Henry** (European Central Bank), **Carlo Favero** (Università Bocconi) and **Gabriel Perez-Quiros** (Banco de Espana). The programme was divided into three sessions, namely on 'structural models, evaluation and forecasting', 'econometrics' and 'shocks'. Overall, ten papers were presented and nine researchers acted as discussants. Each session was concluded by a roundtable discussion.

1. Structural Models, Evaluation and Forecasting

The first session was opened by **Stefano Neri** (Banca d'Italia) presentation of 'Resuscitating the Real Business Cycle Hypothesis: A VAR Analysis with DSGE Priors on Impulse Responses', a paper co-authored with **Luca Dedola** (Banca d'Italia). Neri stressed that the Real Business Cycle (RBC) research agenda had been very influential over the past two decades. A recent debate led by, amongst others, Galí and Francis and Ramey, argued that a key RBC conditional prediction, i.e., a technology improvement should raise per capita hours worked, was at odds with the data. This result was important because it promoted increasing scepticism on the idea that technology shocks were a major force of business cycle fluctuations. The authors challenged this finding by using an alternative identification strategy, in a vector autoregression (VAR) framework, which did not rely on long-run neutrality assumptions. Namely, they identified technology shocks with sign restrictions induced from priors, drawn from a uniform distribution, on the parameters of a class of general equilibrium models encompassing both an RBC model with habit formation and the model with nominal rigidity and variable capacity utilisation estimated by Christiano, Eichenbaum and Evans. They showed that, across all identification schemes employed, a technology shock had qualitative consequences not dissimilar from those a RBC scholar would have anticipated: the shock turned out to drive hours worked up.

The idea, developed by Friedman and Schwartz at the beginning of the 60's, that a more accommodative monetary policy could have greatly reduced the severity of the Great Depression was explored in 'the Great Depression and the Friedman-Schwartz Hypothesis' by **Lawrence Christiano** (Northwestern University) and his co-authors **Roberto Motto** (ECB) and **Massimo Rostagno** (ECB). The authors estimated a dynamic stochastic general equilibrium model for the US, with data ranging from 1921 to 1939. The model featured several nominal and real frictions, eight shocks and it included a banking sector. The 'liquidity preference shock' came out to be particularly important in explaining the contraction phase of the Depression. That shock drove households to accumulate currency, at the expenses of bank deposits and other liabilities that were used to fund entrepreneurs. On the other hand, the expansion phase of the Great Depression was slowed down by a rise in the market power of workers, which resulted in an increase in wages and a reduction in employment. The authors proved that, by replacing the historical reaction function of the monetary authority with one more responsive to money demand shocks, a more accommodative monetary policy would have mitigated the economic contraction of the 30's.

Marco Del Negro (Federal Reserve Bank of Atlanta) presented 'a DSGE-VAR for the Euro Area', written with **Frank Schorfheide** (University of Pennsylvania), **Frank Smets** (ECB) and **Rafael Wouters** (National Bank of Belgium). Del Negro emphasised that dynamic stochastic general equilibrium (DSGE) models were emerging as a useful tool for empirical research in macroeconomic, forecasting and quantitative policy analysis. However, it was unclear whether DSGE models outperformed VAR models in forecasting. Del Negro and Schorfheide, in a related work, showed that when a simple three equation New Keynesian DSGE model is used to produce priors for a VAR, the forecasting performance was systematically improved. The presented paper was an attempt to connect a VAR approach, with a more elaborate DSGE model with capital accumulation and various nominal and real frictions, Del Negro argued. In this paper the authors used a variant of the Smets and Wouters model developed in 2001, to generate a prior distribution for an eight-variable VAR of the Euro Area to be estimated with Bayesian methods and used for forecasting. The preliminary results seemed to confirm that a DSGE-VAR approach outperformed some competing methods (simple VAR and DSGE) in forecasting inflation and output.

In his discussion on the paper by Dedola and Neri, **Andrea Fisher** (Swiss National Bank) was puzzled by the fact that the VARs estimated with priors from the RBC and the nominal rigidities model generated very similar hump-shaped impulse responses for hours. On the Christiano et al. paper, he suggested that not only the liquidity shock, but also a shock to the capital stock equation could be important in explaining fluctuations in hours worked and employment as found, for example, in some related works by Carlstrom and Fuerst, and Bernanke, Gertler and Gilchrist.

The second discussant, **Christopher Otrok** (Virginia University), highlighted that the three papers presented in the session tried to blend economic theory and econometrics to build models useful for policy analysis and forecasting. In particular, on the 'theoretical side', Otrok recalled that Dedola and Neri employed sign restrictions, i.e. weak implication from the theory; Del Negro et al. priors from a fully specified DSGE model and Christiano et al. a fully specified theoretical model. Otrok stressed that the inclusion of habit formation into models was of key importance in matching some important features of the data, such as the equity premium. On the first paper, he wondered whether drawing from a uniform distribution was a robust exercise. Finally, he suggested to Christiano et al. to allow the parameters of the model to vary within a given range, and to Del Negro et al. to show clearly how well their model matched the data.

Christopher Sims (Princeton University) acted as the last discussant in this session. He underlined that the observed booming interest for DSGE models was mainly due to the fact that structural models, i.e. models invariant to policy changes, were particularly useful for policy analysis. However, a model, to be well-designed for policy purposes, should also satisfy a second criterion: it should match the data well. Sims argued that the Christiano et al. paper satisfied the first criterion, being fully structural, but not the second. On the other two papers, they provided a good fit to the data, but exhibited a lack of structure. In particular, on Del Negro et al.'s work, he noted that the proposed methodology did not convey a clear interpretation on the parameters of the VAR. Back to the paper by Christiano et al., Sims noted that a robust test of the fit of the model should be based on a simulated in-sample forecast exercise. Moreover, he observed that a counterfactual exercise as the one proposed (introducing a more accommodative monetary authority) was not very realistic because inflation in the 1930's was already high, around ten percent. On the contrary, a successful monetary policy should have been based on two pillars: 1) a more aggressive loan rediscounting strategy, 2) a long-term commitment to a given path for the money supply that, rather than keeping M constant, would have succeeded in preventing the surge of high inflation while accommodating the rising money demand.

Lucrezia Reichlin, head of the EABCN Scientific Committee, chaired the roundtable discussion which concluded the first session of the conference.

Carlo Favero wondered how the shocks in Christiano et al.'s paper looked like, if it was necessary to have 'close to unit root' shocks to produce a good fit to the data.

In replying to discussants, **Luca Dedola** shared the view of Otrok who thought that the Dedola-Neri model was based on little economic theory, relying just on sign restrictions. Dedola argued that the use of habit formation was necessary to account for the fall in hours following a technology improvement.

Lawrence Christiano agreed with Sims on the fact that keeping the money supply constant could not have been successful in moderating the economic slowdown of the 30's.

2. Econometrics (evaluation and forecasting)

In 'Small Sample Confidence Intervals for Multivariate Impulse Response Functions at Long Horizons'

Elena Pesavento (Emory University) and **Barbara Rossi** (Duke University) addressed the issue of constructing IRFs and their confidence intervals without relying on auxiliary assumptions on the order of integration of the variables. In fact, the existing methods for constructing confidence intervals were highly dependent on the order of integration assumed for the set of variable included in the system. Those methods might provide different results, depending on whether the series were assumed to be stationary, exactly integrated, or cointegrated. Moreover, confidence intervals could have poor coverage properties, i.e. small length of the confidence bands, in the presence of highly persistent variables. Thus, the authors proposed a method for constructing confidence bands for IRFs that was robust to the presence of highly persistent processes, that (asymptotically) did not depend on the VAR lag length, and that took into account the sample size in an appropriate way. Pesavento and Rossi presented two applications on the effects of real GDP shock on exchange rates, in which the Eichenbaum and Evans (1995) paper and the Clarida and Galí (1994) one were revisited. They showed that, with respect to the first cited paper, the effect of the shock was more persistent since the estimate of the largest root in the original work was biased downward, i.e. the 'true' series were actually close to having a unit root. On the other hand, they argued that the effect of the shock in Clarida and Galí (1994) was overestimated due to an incorrect identification of some series as I(1).

The second paper of the session was 'Using Turning Point Information to Study Economic Dynamics', presented by **Don Harding** (University of Melbourne). The purpose of the author was to show that the proportion of turning points located in the sample path of a time series could be used to describe the data generating process of that series. The proposed methodology had two main advantages, the author stressed: first, it systematically explored the connection between the patterns guessed by visual inspection and the data generating process. Second, it turned out to be very robust since it did not require that any of the moments of the data existed. The method consisted in using counts and proportions of turning points, identified according to Burns and Mitchell's procedures, in either the levels, deviation from trend or difference of series, to construct statistics that could be used to study the properties of those series. In an application to the US GDP, the author found results supporting to the trend stationary case.

Peter Vlaar (De Nederlandsche Bank) presented the last paper of this session, entitled 'Forecasting Inflation: an Art as well as a Science' co-authored with **Ard den Reijer** (De Nederlandsche Bank). Vlaar pointed out that the aim of the paper was to forecast the Dutch and the aggregate Euro area inflation, defined as year on year growth of the Harmonised Index of Consumer Prices (HICP). The focus was placed on horizons from eleven up to eighteen months ahead. It was recalled that the inflation targeting procedure implemented by the ECB required each national bank to produce, on a quarterly frequency, forecasts of the national inflation indexes, which were used to construct an area wide forecast. The authors developed a three-step model selection procedure which involved a visual inspection of the data and a preliminary selection of the model (VARX in first differences or VECX in first and twelve month differences), the estimation of different specifications for the selected model, and the final choice of the model based on goodness-of-fit, parsimony and out-of-sample forecasting. The paper also addressed the issue of aggregation: the comparison of forecast errors for total HICP between direct aggregate HICP models on the one hand and aggregation of sub-index models, on the other, did not show a clear preference for either procedure. It was concluded that, according to the selection criterion employed by the authors, an optimal forecasting model was not likely to exist, making the use of common sense and judgmental criteria very important.

Filippo Altissimo (ECB), in discussing the Vlaar et al. paper, suggested to use basket weights when aggregating HICP sub-indexes forecasts. Moreover, he wondered whether it could be interesting to include import prices, instead of producer prices, when forecasting the HICP. Finally, he proposed to use factor models which proved to be very efficient for forecasting exercises as shown by Forni et al. in a 2001 related work.

Denise Osborn (University of Manchester), on the paper by Pesavento and Rossi, emphasised that the idea of developing a method to construct confidence intervals for IRFs when there was uncertainty on the order of integration of the variables was very clever and insightful. However, she pointed out that the method did not work when the processes were distant from unit root. For example, the case of $I(2)$ variables was completely ruled out. Commenting on Harding's presentation, she underlined that since turning points were defined as local maxima or minima, the analysis could be heavily affected by the presence of outliers. Moreover, she wondered whether there was a sensible gain from a turning point approach compared to available methods. On the paper by Vlaar et al., she noted that the treatment of seasonality was unconvincing. Moreover, she wondered why interest rates did not enter in any of the forecasting models used.

Adrian Pagan (Australian National University) discussed the paper by Pesavento and Rossi and the one by Vlaar and Den Reijer. On the former, he questioned why the empirical example in the paper was based on a 'half-life' approach, i.e. a methodology that accounts for the persistence of shocks as measured by how many periods it takes the shock to be back to half of its initial value. On the latter, he was sceptic on the inclusion of some 'exogenous' variables, assumed to be perfectly known, in the forecasting model. He also noted that the errors in the estimated VAR(1) exhibited a lot of serial autocorrelation, possibly indicating a problem of omitted variables. Finally, he stressed that the naive forecast of inflation taken as benchmark was based on a random walk process, and this could not represent a correct description of the data generating process for the series.

The following roundtable discussion was chaired by **Carlo Favero** (Universita' Bocconi), member of the EABCN Scientific Committee.

Harald Uhlig (Humboldt University Berlin), on Vlaar et al.'s paper, remarked that results should change a lot when including interest rates into the model.

As an alternative or complementary approach, Pesavento and Rossi could compute confidence intervals based on Bayesian methods, **Christopher Sims** suggested.

Barbara Rossi argued that, in their work, uncertainty on the short-run dynamics was not relevant for long-run considerations. Replying to Osborn, she claimed that the focus was on a I(1) specification because the variables turned out to have a second root which was distant to unity.

Don Harding thought that the treatment of outliers constituted an advantage of his method since considerations in terms of moments would have assigned a too large weight to outliers.

Peter Vlaar replied to Altissimo by saying that producer prices were used instead of import prices because of data availability. Moreover, the exchange rate against the dollar could be thought as a proxy for import prices.

3. Shocks

Athanasios Orphanides (Board of Governors of the Federal Reserve System) presented 'Inflation Scares and Forecast-Based Monetary Policy', co-authored with **John C. Williams** (Federal Reserve Bank of San Francisco). In this paper the authors relaxed the assumption of rational expectations with perfect knowledge and re-examined the role of inflation expectations in the conduct of monetary policy. The idea underlying this work originated from the observation that, in standard macroeconomic models, agents were assumed to form expectations mechanically, based on simple linear function of economic outcomes that were supposed to be perfectly known. This assumption, however, turned out to be highly unrealistic, as Sargent (1993) had shown. Once imperfect knowledge was allowed, the tight mechanical link from economic outcomes to the expectation formation process broke down. Hence, the authors proposed a model where agents did not know with certainty the parameters of the economy but instead constantly updated their estimates based on the information available to them. They compared the performance of policies based on observed outcomes to those based on inflation expectations. Under rational expectations, those two policies produced the same outcomes. Under imperfect knowledge, monitoring and responding to the public's inflation expectations, in addition to monitoring the evolution of actual inflation, led to improved policy outcomes.

The issue of the observed declines in G7 output volatility was addressed by **Vincent Labhard** (Bank of England) in 'What Explains Changes in Postwar Output Volatility: Shocks or Propagation Mechanism?'. Labhard aimed at identifying the causes behind the decrease in volatility. Namely, he explored whether changes in economic structure, as reflected in the propagation mechanism, or changes in the pattern of shocks were more relevant in explaining these facts. The proposed approach was based on recent tests for multiple unknown break dates. First, the author applied these tests to real GDP time series, ranging from 1970 to 2002. The results indicated that for most industrialised countries there was only one break, in 1982 Q3. However, European countries exhibited another break in 1993 Q1, roughly [if I'm not wrong the break was decided in August 1993...]corresponding to the widening of the bands in the exchange rate mechanism. The second step in the approach consisted in obtaining estimates of the propagation mechanisms and shocks for different periods, as identified in step one, and using these estimates to simulate output series under the assumption that structure or shock had not changed. Finally, Labhard examined the volatility of the simulated output series, using once more the tests employed in step one. The analysis was run twice, first assuming that structure and shocks were specific to sub-samples, i.e. structural changes occurred in discrete times. Second, allowing structural changes to be continuous, and using time-varying estimates of structure and shocks. Results indicated that the changes in the shocks, especially between the early 70's and the rest of the sample, could account for the observed behaviour of G7 output.

'The International Business Cycle in a Changing World: Volatility and Propagation of Shocks' was presented by **Denise Osborn** (University of Manchester) and **Pedro Perez-Vasquez** (University of Valencia). The paper was co-authored with **Michael Artis** (European University Institute). The authors' purpose was to explore the nature of the international business cycle. To that aim, they focused on the interrelationships between the short-term growth rates experienced in different countries of the world. A time-varying approach was employed to study how dynamic interrelationships changed over time, and the variations in the volatility of shocks affecting the world economy. Methodologically, the authors estimated six trivariate VAR system specified in output growth rates for the US, an European aggregate (E15) and, in turn, Germany, France, Italy, UK, Canada and Japan. They identified a break at the end of 1979, corresponding to the start of the European Monetary System. Then, they undertook a counterfactual analysis by applying shocks of the pre-1980 magnitudes to the post-1980 and the whole sample model, to understand the relative weight of volatility of shocks and propagation mechanism in the observed changes in the international business cycle. They found that declines in volatility were more marked for the EU as a whole than for the US, probably because of European integration. Furthermore, the effects of US shocks on the EU as a whole, and also on individual European countries, changed over time, having

their greatest role during the 1970's and from around the mid-1990's. The counterfactual exercise showed that both volatility and propagation of shocks were important.

Finally **Harald Uhlig** (Humboldt University Berlin) presented 'What Moves Real GNP?'. The paper aimed at identifying the main forces driving the US real GNP by searching for a limited number of shocks to account for the bulk of the k-step ahead prediction error variances between 0 and 5 years. The author stressed that the idea that a small number of shocks drove the movements of a possibly large set of macroeconomic variables came from the observation that economic variables strongly co-moved, especially at business cycle frequencies. Many papers of the Real Business Cycle school concentrated their analysis on the consequences of productivity shocks, whereas papers which focused on monetary analysis often only modelled monetary shocks, plus perhaps a 'demand' or supply' shock. The approach of the paper was, however, different: rather than postulating a particular type of shock and investigating it from a theoretical standpoint, Uhlig started from the empirics in order to understand which forces were actually crucial for the dynamics of macroeconomic variables. Uhlig found that two shocks were able to explain around 90 percent of the k-step ahead prediction error for real GNP. The first shock, explaining on average 70 percent of the prediction error variance, was interpreted as a productivity shock, in line with the Real Business Cycle literature. The second shock seemed to be a wage-push or inflationary impulse, unrelated to consumption or government spending and moreover not induced by monetary policy.

Luca Dedola (Banca d'Italia), in discussing Uhlig's paper, underlined that a correct identification of the shocks driving the economy was very relevant for policy purposes. In fact, an optimal monetary policy should react to inflationary impulses but not to business cycle fluctuations driven by technology shocks. Moreover, given a somehow unclear interpretation of the second - and smaller - shock in Uhlig's work, he suggested that the shock could resemble a labour supply shifter. The discussant employed the DSGE model developed by Neri and Dedola presented during the Conference, to simulate the effects of a labour supply impulse: the strong response of hours and the weak one of consumption were qualitatively very similar to what had been found by Uhlig.

The paper by Orphanides and Williams was discussed by **Martin Ellison** (University of Warwick). Ellison pointed out that the results of the paper could be affected by a misspecification or an estimation bias problem. In fact, the "inflation scares" analysed by the authors could be due to a misspecification of the reduced form model that agents used to predict inflation, or to a bad estimate of it, rather than to a perpetual learning process in forming expectations. Moreover, the model assumed that the monetary authority could control the output gap. Hence, the discussant wondered what would have changed if an IS curve would be introduced.

Luca Sala (Università Bocconi) discussed the paper by Uhlig and the ones by Osborn et al. and Labhard. On Uhlig's work, he criticised the identification procedure since, aiming at finding the two shocks that explained the majority of the forecast error variance, it did not provide any clear economic interpretation. Furthermore, he showed that Uhlig's measure often attributed more variance to the "big shocks" than it was the case. Finally, he suggested to use an alternative technique, based on factor modelling, which explicitly accounted for rank reduction. On the Osborn et al.'s paper, he questioned whether it was meaningful to consider the US shock as a 'world shock'. He also noted that variations in the volatility of residuals could be due to a problem of omitted variables and he stressed that, recalling a pathbreaking debate between Rudebusch and Sims, VAR residuals could not be clearly interpreted as structural shocks. Commenting on the paper by Labhard, Sala wondered whether the author could discriminate between sudden breaks and smooth transitions. He suggested using some alternative aggregates, as the EU15 aggregate GDP. Finally, concerning the counterfactual experiment, he proposed to generate series from the variance-covariance matrix of residuals to check the robustness of the results.

The following and concluding roundtable discussion was chaired by **Gabriel Perez-Quiros** (Banco de Espana), member of the EABCN Scientific Committee.

Christopher Sims, on the work by Orphanides and Williams, recalled that the Fed used forecasts based on VARs rather than rational expectation methods. Citing a work by Cogley and Sargent, he suggested Labhard to use Bayesian methods to test his model.

Athanasios Orphanides remarked that, in order to understand the sources of the improved economic outcomes of monetary policy, it was necessary to employ structural models estimated with real time data.

Frank Smets (European Central Bank), on the point made by Ellison, argued that adding an IS curve to the Orphanides' model would have not altered much the results since 'inflation scares' were much more relevant than 'output scares'.

Gabriel Perez-Quiros suggested to Labhard considering also the series for sales and inventories, which are very relevant for business cycle analysis, in his exploration of macroeconomic volatility changes in the postwar period.

Athanasios Orphanides, replying to Martin Ellison, said that the results could not be affected by a misspecification problem because agents knew the true data generating process for inflation. On Sims's remark, he underlined that all the new generation of macro models was indeed based on the rational expectations hypothesis.