DOI: https://doi.org/10.59503/29538009-2025.2.16-71

VAR ESTIMATION OF INDUSTRIAL PRODUCTION, UNEMPLOYMENT AND SPREAD FOR THE ARMENIAN ECONOMY

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Abstract: In the context of macroeconomic and financial system policies it is of high importance to have models encapsulating interactions between the real economy and the financial system. In particular, the process of constructing such a model is described within this paper. For that purpose, a VAR model of industrial production, unemployment and loan-deposit interest rate spread is used. The most notable finding of the research is that spread considerably influences both output and employment in the long run.

Keywords: VAR model, real-financial feedback, macroeconomic policy, shock amplification, interest rate

JEL code: E4

Research aims: to construct a robust VAR model that captures interrelationships between the chosen variables and enables modelling of the joint dynamics of the real economy and financial sector.

Research novelty: allowing for feedback effect from the financial system whenever a macroeconomic shock occurs, highligting possible applications for the Armenian economy.

Introduction

In recent years there is a rapidly growing demand for forward-looking and data driven macroeconomic policy decision making systems. The main reason behind this is that the expert judgement that relies on the past experience can sometimes be misleading, which in turn can initiate unnecessary losses in the financial system (Budnik K. et al., 2019). As a result, there can be a significant downgrade in the standard of living. Even though the Armenian economy has never faced such a challenge, it is useful to build a framework that will help decision makers to prevent such course of events. To avoid this kind of situations international authorities like the IMF have come to a conclusion that policy decisions should combine both data and expert judgement for higher efficiency (Lawder D., 2024).

In this paper we represent one of the building blocks of the framework mentioned above. We attempt to uncover the interrelationships between industrial production, unemployment and spread both in the long run and the short run. Containing variables from both real economy and the financial sector, the VAR

model is applicable for accounting for the real-financial feedback loop in system wide stress testing.

Methododlogy of data provision

For the VAR model estimation, the required primary data consists of the time series of the above-mentioned endogenous variables as well as the consumer price index, which was used to convert nominal series into real terms. To get the loan-deposit interest rate spread we subtract deposit rate from loan rate. Both rates are for loans and deposits with maturities that range from 180 day to 1 year. The choice of this maturity range is because loans with higher maturities are more diverse than deposits. We use quarterly data from 2000 Q1 to 2024 Q3.

Research results

The main results of VAR estimation are impulse response functions and forecast error variance decompositions. To derive these results we must make assumptions concerning the causal ordering of the variables in the system (Enders W., 2015). So, we put industrial production up first followed by unemployment and spread. This ordering has a straightforward intuition. Employers make structural changes in labor after interest rates change and only after that we can observe changes in production. This means that neither unemployment nor spread have contemporaneous effects on industrial production. Hence, the Cholesky ordering is justified.

Impulse Response Functions

The impulse response functions are represented in Figure 1. The responses of variables to their own shocks are similar (Figures 1.1, 1.5 and 1.9). Initially there is a positive hike but then due to mean reversion the series converge to zero. This makes sense considering the autoregressive nature of the model. It is worth mentioning that unemployment rate converges to zero slower than other variables, which is consistent with the economic intuition of

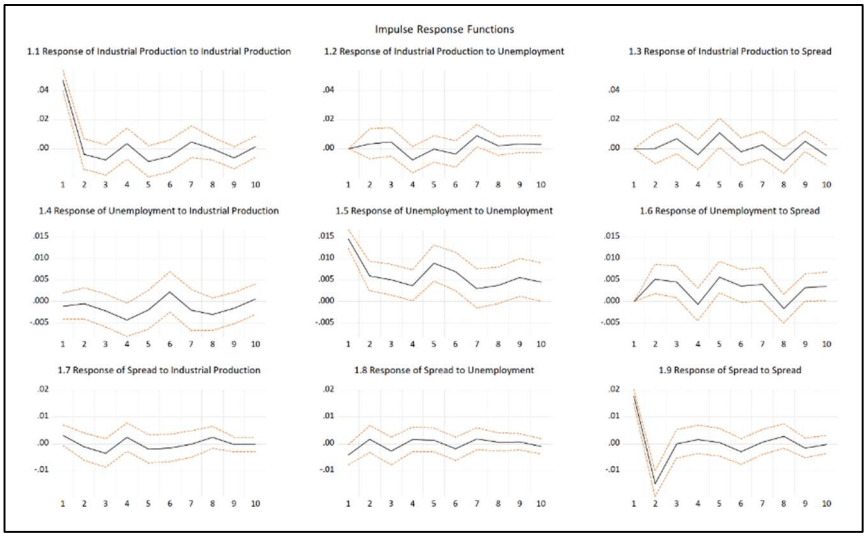

Figure 1. Impulse response functions

these variables. For the rest of the impulse response functions, we will discuss combinations where we observe contemporaneous effects.

A positive shock to industrial production boosts economic activity, thus increasing labor demand, which slightly decreases unemployment rate. Later, the unemployment rate will decrease

further, as employers did not manage to match the demand immediately. Unemployment rate converges to its mean value in the long run (Figure 1.4).

Now let us consider the response of spread to a shock to industrial production (Figure 1.7). A positive shock to industrial production causes growth in spread at first. A reason behind this can be the fact that when there is a boost in economic activity, the demand for loans increases. In the meantime, banks do not offer higher deposit rates to increase profitability. However, the magnitude of the shock in this case is small and the positive effect on spread quickly fades away.

A shock to unemployment does not have direct effect on interest rates either (Figure 1.8). A sharp increase in unemployment indicates economic instability. We can assume that banks will offer higher interest for deposits without significantly increasing the loan rate, thus the spread will decrease.

We can discuss the response of industrial production to both unemployment and spread jointly. We have already assumed that no variable has contemporaneous effect on production. Other than that, we can interpret impulse responses as follows: firms decide output level relying on the demand and their productivity but not on shocks in labor market or the financial system. That is why we do not see contemporaneous effect from unemployment and spread shocks. Furthermore, in the long run, effects of shocks to unemployment and spread on industrial production are moderate.

There is no contemporaneous effect when we observe the response of unemployment to a shock to spread as well (Figure 1.6). However, in the long run, there is a positive effect. When the spread

increases due to a shock it corresponds to tighter credit conditions, therefore, the unemployment should increase.

Variance Decompositions

The other major result of VAR estimation is the variance decomposition of each variable in the system. We will represent variance decompositions according to the Cholesky ordering assumed earlier. First, we will look at industrial production (Figure 2). At the end of the horizon the share of exogenous shocks to spread (10.29%) is greater than the share of exogenous shocks to unemployment (7.02%).

At first this may seem counterintuitive, however as spread partially indicates financial conditions, an exogenous shock can influence investment in both capital and labor.

The results become more interesting when we move on to variance decomposition of unemployment (Figure 3). Exogenous shocks to spread have a significant effect on the forecast error variance of unemployment in the long run (20.07%), meanwhile the share of industrial production is moderate (7.15%). Not only a higher value of spread indicates tight credit conditions, but also in separate cases it can indicate higher bank profitability. So, a positive shock to spread can have different outcomes for unemployment in the long run.

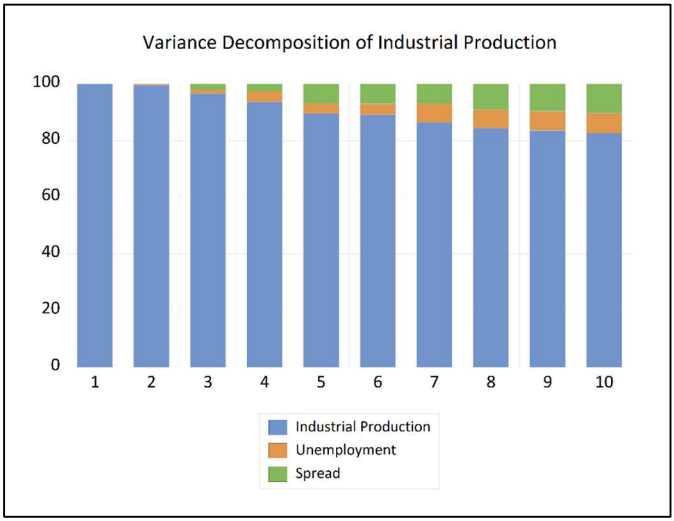

Figure 2. Variance decomposition of industrial production

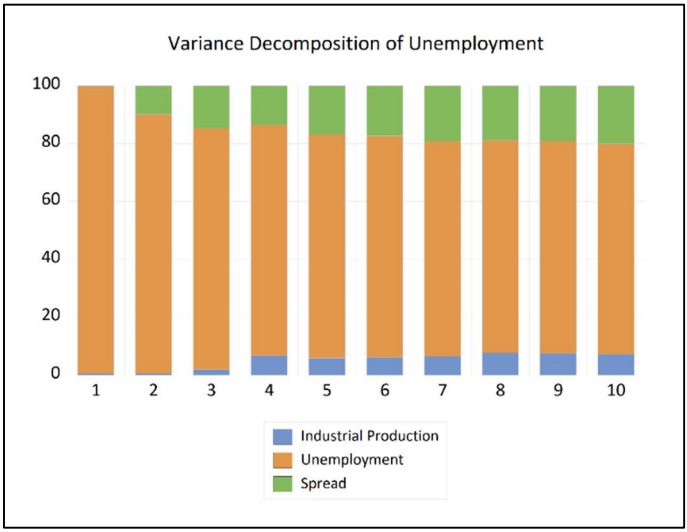

Figure 3. Variance decomposition of unemployment

Due to the absence of direct transmission channels, the share of shocks to both industrial production and unemployment in

forecast error variance of spread is moderate (Figure 4).

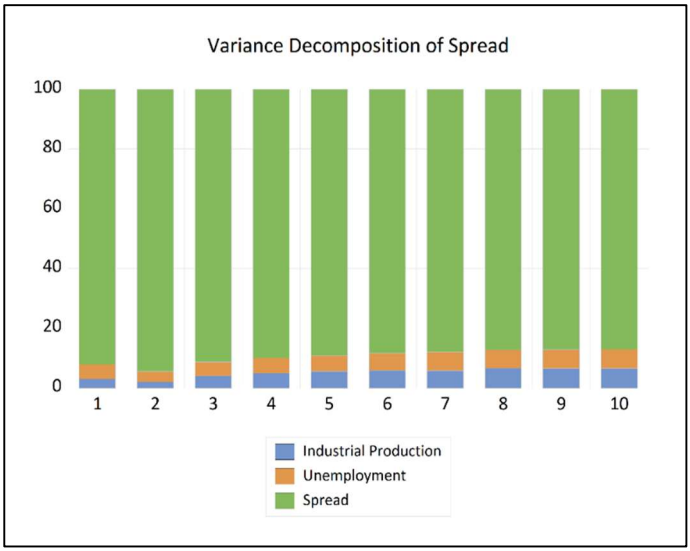

Figure 4. Variance decomposition of spread

Conclusion

We constructed the VAR model of industrial production, unemployment and spread. As these variables represent real economy and financial system, we can say that our model accounts for the real-financial feedback loop. Indeed, the estimated VAR model is simple, however it can be considered as the initial building block for a more comprehensive decision-making module.

The most important finding of the research is the fact that spread (the financial system conditions) has significant effect on unemployment and output (real economy) in the long run. This means that the ordinary stress testing models, which do not account

for the real-financial feedback effect, considerably underestimate losses in the financial system in a stress scenario. Thus, the inclusion of a model that accounts for that feedback effect is essential from the macroeconomic policy point of view.

Overall, as we mentioned, there is a lot to be done, as the model we estimated is very simplistic. There are several variables that may capture the behavior of banks more efficiently than loan-deposit interest rate spread. Also, financial system consists not only of banks but also from other financial institutions as well, that can be included in the model later on. Finally, it would be useful to have a module for policy instrument calibration following the retrieval of results from the VAR model.

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ԱՐԴՅՈՒՆԱԲԵՐԱԿԱՆ ԱՐՏԱԴՐՈՒԹՅԱՆ, ԳՈՐԾԱԶՐԿՈՒԹՅԱՆ ԵՎ ՍՊՐԵԴԻ VAR ԳՆԱՀԱՏՈՒՄ ՀՀ ՏՆՏԵՍՈՒԹՅՈՒՆՈՒՄ

Գուրգեն Գասպարյան
Երևանի պետական համալսարան, տ.գ.թ.

Հովհաննես Վարդանյան
Երևանի պետական համալսարան
մագիստրատուրայի ուսանող

Բանալի բառեր – VAR մոդել, իրական հատված-ֆինանսական համակարգ հետադարձ կապ, մակրոտնտեսական քաղաքականություն, շոկերի ուժգնացում, տոկոսադրույք

Մակրոտնտեսական և ֆինանսական համակարգի քաղաքականությունների համատեքստում տարեցտարի առանձնահատուկ կարևորություն է ձեռք բերում համապարփակ մոդելների ներառումը որոշումների կայացման գործընթացում: Այս աշխատանքում ամփոփված է նմանատիպ, թեև համեմատաբար պարզ, մոդելի կառուցման քայլերի հաջորդականությունը:

Հոդվածում գնահատվել է արդյունաբերական արտադրության, գործազրկության մակարդակի և սպրեդի VAR մոդել: Մոդելի այսպիսի ընտրությունը պայմանավորված է այն հանգամանքով, որ այս փոփոխականները նկարագրում են համապատասխանաբար տնտեսական ակտիվությունը, աշխատանքի շուկան և ֆինանսական համակարգի վիճակը,

հետևաբար այդպիսի մոդելի որակյալ գնահատումը մի շարք հարցերի պատասխաններ կարող է տալ:

Հետազոտության արդյունքները, ազդակի արձագանքման ֆունկցիաները և վարիացիայի դեկոմպոզիցիաներն են, որոնց միջոցով էլ կարողացել ենք գնահատել իրական հատվածի և ֆինանսական համակարգի փոխադարձ ազդեցությունների դինամիկան:

Submitted: 15.09.2025; Revised: 01.10.2025; Accepted: 15.10.2025