Five-year macro-econometric forecasts for the US: Solutions from a model including income distribution, price changes and government financing

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Resumo:

O objetivo deste artigo é fornecer previsões para as principais variáveis macroeconômicas nos EUA utilizando um modelo macroeconométrico estrutural simples desenvolvido em trabalhos anteriores, e que se baseiam em projeções para tendências futuras das variáveis exógenas do modelo. As previsões indicam que, em termos gerais, os próximos cinco anos serão marcados pelas trajetórias que prevaleceram na crise da covid, ou seja, crescimento moderado, inflação elevada e altas taxas de juros. Por outro lado, considerando a desagregação entre os setores produtivos, o crescimento econômico será mais forte na atividade comercial (incluindo os transportes) e quase nulo no segmento de manufatura e construção.

Abstract:

This paper's goal is to provide forecasts for main macroeconomic variables in the US using a simple structural macro-econometric model developed in previous papers, and that are based on predictions for future trends of the model's exogenous variables. These forecasts indicate that, in general terms, the next five years will be marked by the trajectories that prevailed in the crisis of covid, i.e., moderate growth, and high inflation and interest rates. On the other hand, considering the disaggregation between the production sectors, economic growth will be stronger in commercial activity (including transport), and almost nil in the manufacturing and construction segment.

Five-year macro-econometric forecasts for the US:
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price changes and government financing

(February 2023)

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Introduction

This text's goal is to provide forecasts for main macroeconomic variables in the US, using a simple structural macro-econometric model developed and analyzed in previous papers (da Fonseca, 2021 and 2022). These forecasts are based on predictions for future trends of the model's exogenous variables that, taking into account time series for the last fifty years, can be considered midpoint or neutral.

In Section 1, the essentials of the forecasting exercise are presented together with the main assumptions used. The second Section contains the model's solutions for five years ahead (2023-27). Section 3 concludes the text.

1. Assumptions and procedures for the model's solutions: *ex-ante* forecasts

In an earlier paper, the fundaments and main characteristics of the model that was used here were discussed (da Fonseca, 2021). Also, the data set for the model's variables and coefficients has previously been presented, together with the estimates for the behavioral equations based on these series (da Fonseca, 2022). In the present text, in turn, the emphasis is on solutions obtained from the model and, therefore, the information on the data set and estimation procedures are considered known. From a mathematical standpoint, the model is a set of nonlinear equations that are dynamic in nature, and that have time treated as a discrete variable – from this perspective, the solutions for the model's endogenous variables are solely based on the values for the exogenous variables in each period.[1]

From an economic perspective, both the endogenous and exogenous variables represent macroeconomic components that evolve in time, and, in the solution's procedures, one period stands out – i.e., the current one, t = 0. If the model is solved for t < 0, then the values for the exogenous variables can be considered given, and the main purpose of the solutions is to evaluate the model accuracy. In order to assess the properties of the model, it is also possible to change the values of one or more exogenous variables and compare the results with the

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[1] Rigorously speaking, in each period there is a system of nonlinear equations that must be solved.

base solution. This comparative assessment is commonly referred to as multiplier analysis (da Fonseca, 2022).[2]

On the other hand, if solutions are obtained for t > 0, then one must predict the values of the exogenous variables, or apply reasonable assumptions for the future path of these variables, usually taking into account the historical record.[3] This latter approach was used here and it is displayed in the bottom half of Table 1. The historical records of the exogenous variables are also depicted in Graph 1.

An additional aspect emerges when the model is appropriately viewed as a dynamic system – i.e., given an initial (or base) period, values for the endogenous variables in periods t, t – 1, t – 2, … should be used in the solutions for period t +1. In the case of *ex-ante* forecasts, this is necessarily the case.[4] However, it is not required that the base period used in the solutions' procedure coincides with the current one. Actually, in the solutions developed here, the pattern of previous papers (da Fonseca, 2021 and 2022) is followed, and the base period selected was 1980. In other words, the forecasts presented in this text are, in reality, the last stage of a fifty-year simulation (approximately). This certainly seems an awkward choice, but the fact is that, as a general rule, solutions of a multi-equation dynamic model depend on the base period chosen and, contrary to intuition, to bring this base period closer to the present does not necessarily improve the model's accuracy.

Considering the model's exogenous components, which are depicted in Graph 1, they can be divided into four broad types:

> a. Non-controlled exogenous, that is, variables that are not directly affected by Government or public agencies: Y_{AGR}, EX-IM, Inputs, e.

> b. Exogenous variables determined, or strongly affected, by public agencies' decisions: G, T, IndTax, Subsidies, Govt sector, L-Gov, α.

> c. Varying coefficients resulting mainly from decisions made by individuals and private institutions in financial markets: μ, V.

> d. Labor (input-output) coefficients, which result from technical patterns that vary in time.

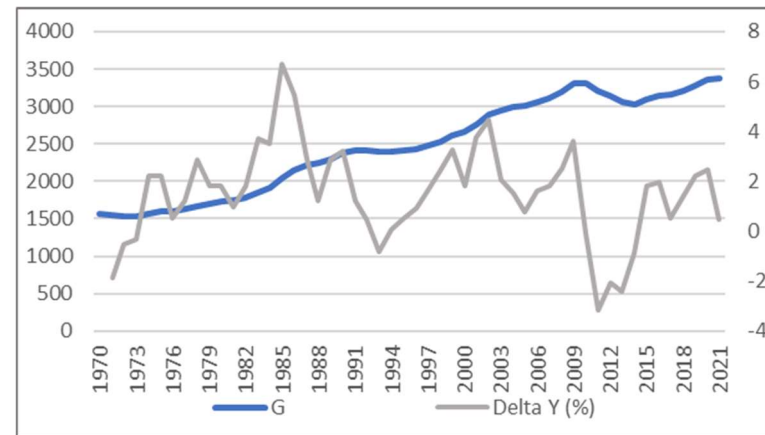
[2] Solutions for t < 0 are also called *ex-post* forecasts.
[3] When t > 0, solutions are referred to as *ex-ante* forecasts.
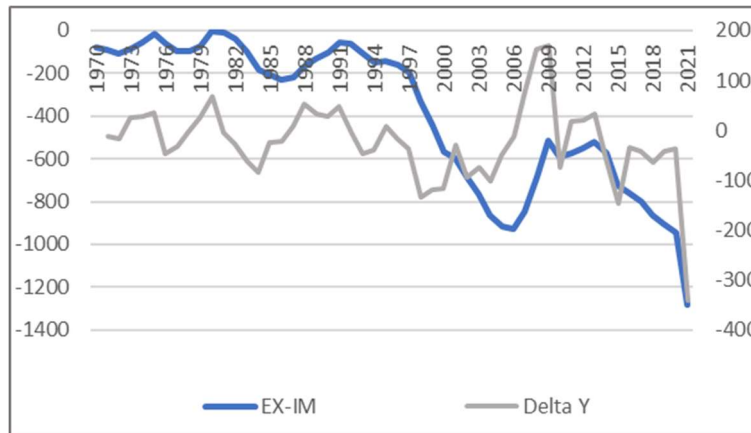[4] In *ex-post* forecasts, historical values for the endogenous variables could be used for previous periods.
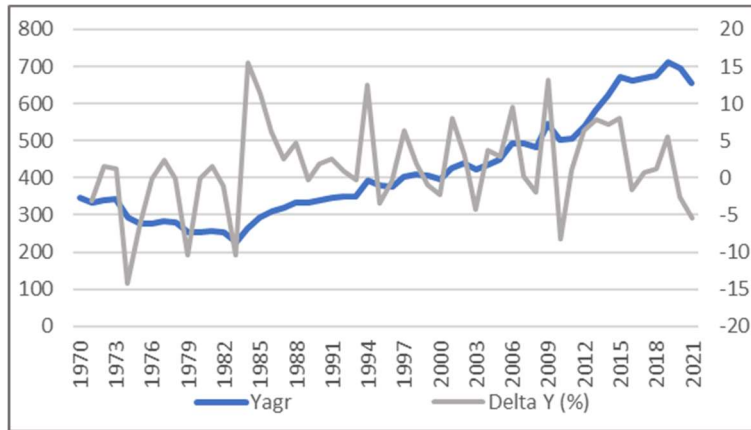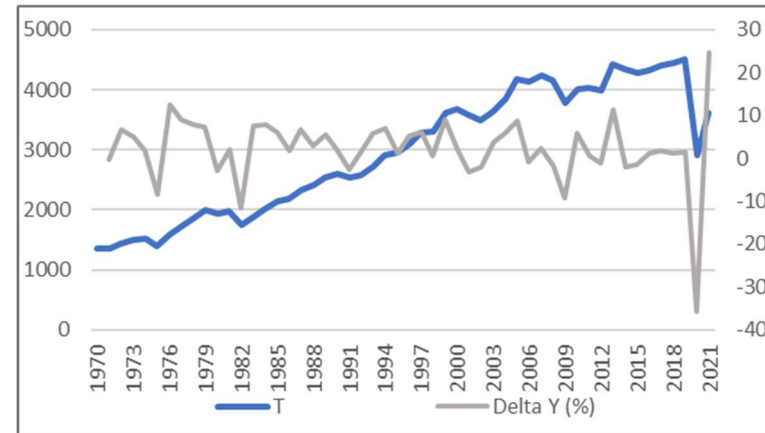
Y_{AGR} – Real value added in agriculture, forestry, fishing, and hunting;
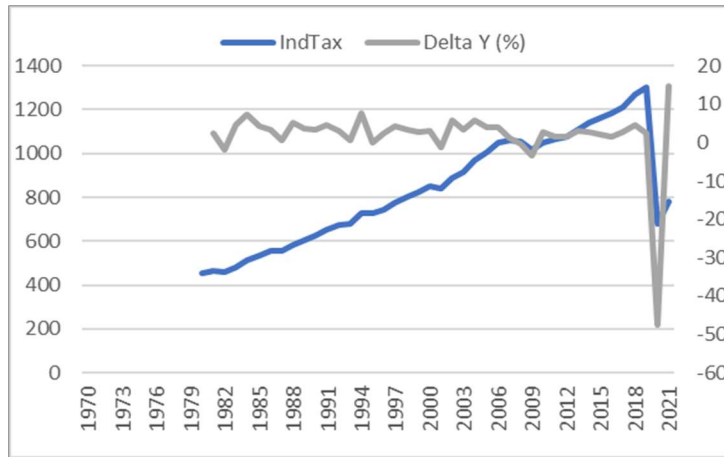

G – Government purchases;

EX-IM – Net exports

T – Real taxes;

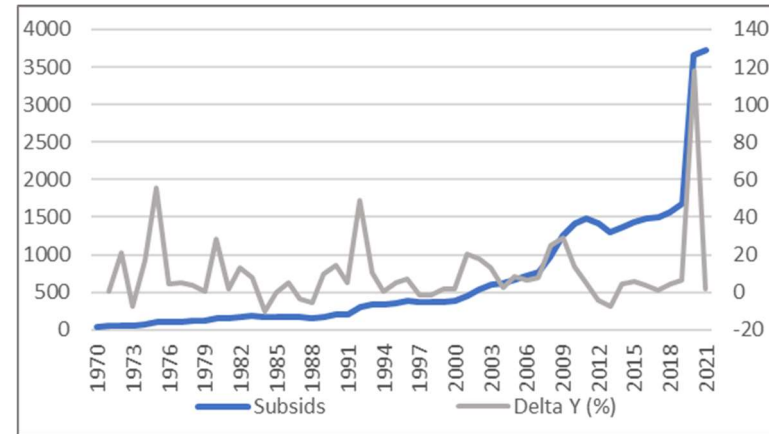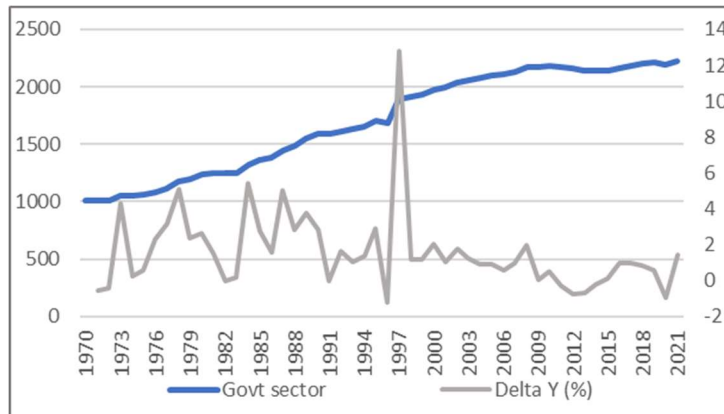**Graph 1. Historical paths of the model's exogenous variables and varying coefficients: 1970-2021.**

IndTax – Tax on products less subsidies

Subsids – Federal Government subsidies

Govt sector – Real value added by the Government sector
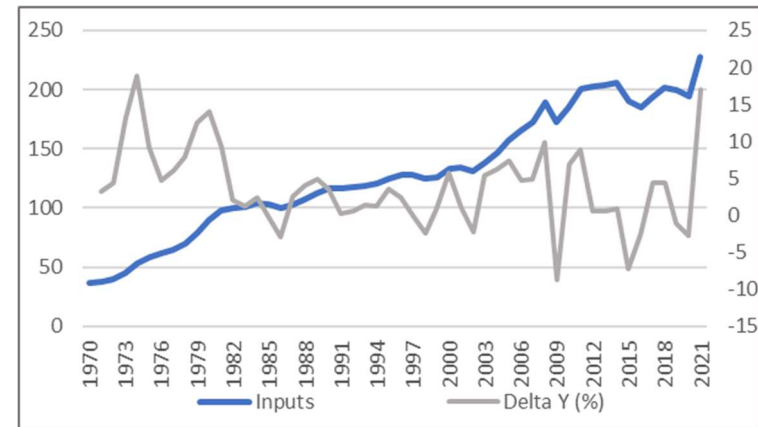
Inputs – All commodities, Producer Price Index

Graph 1. Historical paths of the model's exogenous variables and varying coefficients: 1970-2021 (cont.).
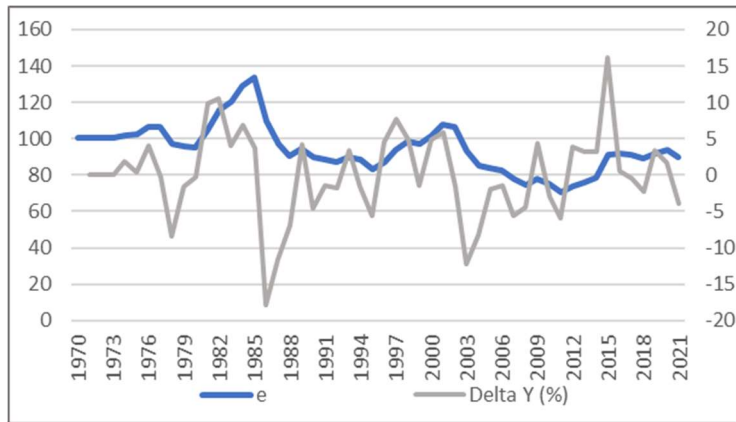
e – Trade weighted U.S. dollar index (1973=100)
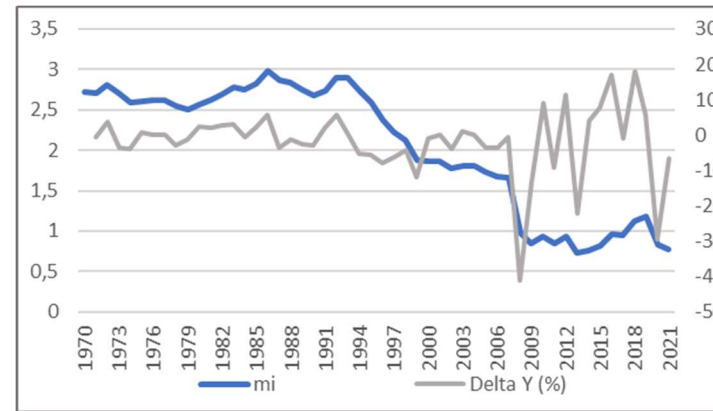
μ – M1 multiplier
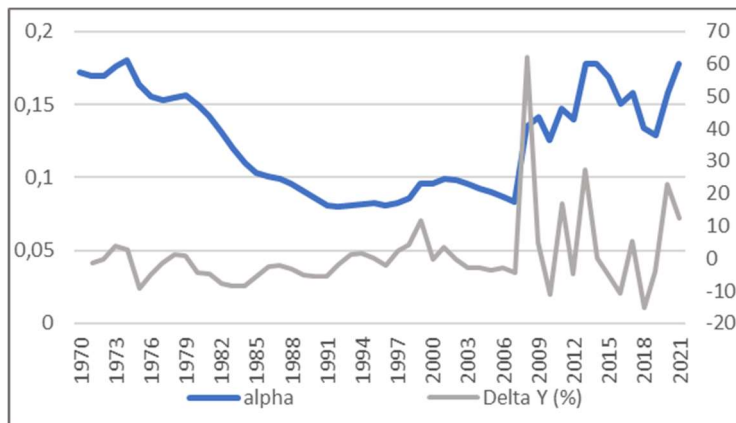
α – Share of monetary base on the sum (base + debt)
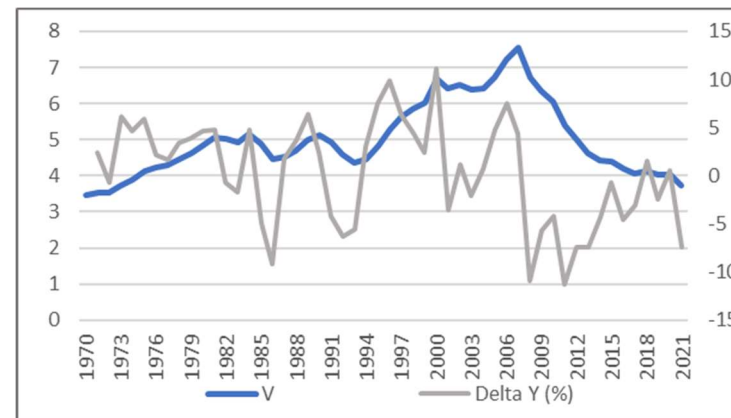
V – M1 income velocity

Graph 1. Historical paths of the model's exogenous variables and varying coefficients: 1970-2021 (cont.).
Note: For descriptions of the variables and coefficients, see da Fonseca (2022).

2. Five-year solutions based on the macro-econometric model

The data used in Graph 1 are also included in the bottom half of Table 1. The columns in this Table contain two types of information – i.e., on the endogenous and exogenous variables of the model. In the first case, the data displayed reflect major changes in economic growth and employment, inflation and interest rates, and monetary and fiscal policies. Concerning this latter item, the information in the top half is on the effects of these policies on money supply and the federal debt – the fiscal policy variables themselves are treated as exogenous.

The bottom half of Table 1 includes, for the most part, what is also available in Graph 1, that is, information on exogenous variables and varying coefficients. As stated above, these coefficients ultimately derive, on one hand, from decisions made by private agents, especially in the case of money demand – the M1 multiplier (μ) and income velocity (V). Further, there are coefficients that reflect technological patterns prevailing in the production sectors. As described in the Table, for a given period, there are significant differences in productivity among sectors. Moreover, as it could be expected, for a given sector, there are major increases in productivity since 1971 – with the exception of the Services sector.

The last column of Table 1 contains two types of forecasts. On the bottom half, there are projected values for the exogenous variables and varying coefficients used in the model. On the top half, in turn, solutions obtained from the model – that are derived from the values for the exogenous components – are included. For the periods specified in Table 1, all the information appear either as annual growth rates (geometric averages), or as sample (arithmetic) averages.

Considering the model's exogenous variables, it can be perceived from Table 1 that, as a rule, the forecasts are predominantly based on the patterns of the ten-year period before the emergence of the covid crisis. In this sense, these forecasts can be considered "neutral", or "midpoint" estimates.

Table 1 – Historical data and forecasts

Rates of growth -- annual averages (%)

		1971-80	1981-90	1991-00	2001-09	2010-19	2020-22*	2023-27
Endogenous variables								
Y		3,16	3,32	3,44	1,66	2,25	1,69	1,38
Ymnf		1,39	2,74	3,25	-0,28	1,91	0,93	0,20
Ytrd		3,70	4,15	5,43	0,87	2,36	-0,75	2,50
Ysrv		5,55	3,69	3,83	2,49	2,66	1,34	1,66
r	#	1,60	6,61	5,38	3,51	2,30	-1,09	0,16
P		6,91	4,18	2,06	2,21	1,69	4,23	5,17
M		6,66	7,22	2,81	5,00	8,90	7,05	4,85
B		7,27	6,79	6,62	14,52	5,39	23,12	4,85
Debt		9,11	13,72	5,34	9,01	6,54	8,48	4,85
w		7,24	4,07	3,23	3,20	2,37	3,28	8,52
L		2,12	1,75	1,64	-0,10	1,40	-2,02	1,35
wL/P		- -	3,18	3,63	0,96	2,24	-0,05	4,57
Pi/P		- -	3,34	3,20	2,63	2,22	-0,06	-1,28
Exogenous variables								
Yagr		-3,09	2,98	1,56	3,69	2,66	-1,82	2,66
G		0,98	3,22	1,15	2,45	0,03	0,84	0,60
EX-IM	#	-69	-139	-222	-756	-684	-1170	-893
T		3,70	2,98	3,56	0,27	1,80	-6,51	1,80
IndTax		- -	3,22	3,11	2,05	2,46	-14,97	2,46
Subsids		14,23	2,92	6,87	14,06	3,03	7,72	3,03
mi	#	2,63	2,78	2,43	1,57	0,92	0,84	0,92
alpha	#	0,16	0,11	0,08	0,10	0,15	0,16	0,15
V	#	4,12	4,89	5,26	6,70	4,62	4,13	4,62
Inputs		9,30	2,62	1,33	2,98	1,46	4,90	1,46
e	#	101	108	92	88	83	89	83
Govt sector		2,03	2,57	2,22	1,05	0,20	0,24	0,20
L-Gov		1,22	1,25	0,57	0,87	0,04	-0,79	0,04
aw1	#	8,71	9,17	5,95	3,95	3,45	2,99	3,10
aw2	#	17,66	15,29	11,50	7,63	6,58	6,52	6,57
aw3	#	29,22	26,53	18,62	11,20	10,26	9,87	9,87
aw4	#	8,94	8,47	8,96	9,30	8,31	8,02	8,16
Kw	#	2346	2627	2936	3093	3100	3142	3124

Notes: For descriptions of the variables and their units of measure-
ment, see da Fonseca (2022).
* Estimates for 2022, with the exception of Y, P, r, G and EX-IM.
# Sample averages.
 Source: Estimates and forecasts obtained by the author.

3. Concluding remarks

The forecasts that were obtained with the macro econometric model indicate that, in general terms, the next five years will be marked by the trajectories that prevailed in the crisis of covid, i.e., moderate growth, high inflation and interest rates, and more moderate expansion of the federal debt and money supply. On the other hand, the model's solutions point to relatively robust employment growth rates, accompanied by a stronger increase in the average wage.

On the other hand, considering the disaggregation between the production sectors, economic growth will be stronger in commercial activity (including transport), and almost nil in the manufacturing and construction segment. The Services activities, on the other hand, will present growth rates at an intermediate level in relation to the other two sectors.

These results for the endogenous variables of the model in the period 2023-27 result from projections for the future path of exogenous components based on relatively "neutral" hypotheses – more specifically, these predictions are based on the trajectories in the decade immediately preceding the years marked by the covid epidemic. All these forecasts are included in the last column of Table 1.

5. References

Da Fonseca, Manuel A. R. A hundred-year overview of the US economy: An appraisal from the perspective of simple macro-econometric models. Rio de Janeiro: GPEF – MBA in Finance, Text for Discussion, no. 9, October 2021. Available at:
https://modelosfinanceiros.com.br/assets/documentos/gpef_-_texto_para_discusso_no_9_-_20212.pdf

_____. A macro-econometric model containing income distribution, price changes and Government financing: Solutions and dynamic analysis for the US. Rio de Janeiro: GPEF – MBA in Finance, Text for Discussion, no. 11, July 2022. Available at:
https://modelosfinanceiros.com.br/assets/documentos/gpef_-_texto_para_discusso_no_11_-_20222.pdf