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ESTIMATION AND FORECAST OF THE CURRENT ACCOUNT BALANCE IN AZERBAIJAN

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Abstract

The purpose of the research is to identify the main determinants of the components of the current account balance (CAB) in Azerbaijan and build a forecasting model for CAB at the disaggregated level. Individual sub-components of CAB are estimated using a wide range of different macroeconomic variables. For estimation purposes quarterly data for the period 2003Q1-2020Q4 is used and then the forecasts for the next year are obtained. The econometric technique employed in the research is autoregressive distributed lag (ARDL) model. 3 forecast scenarios are generated under differing assumptions on oil price, on government spending, proxied by M2 monetary aggregates, as well as on growth projections. According to the results of the estimation, the variables showing the most significance in explaining the changes in different CAB sub-components are found to be oil prices, oil production, government spending, non-oil REER, income of population and the lags of the respective dependent variables. Overall, the model allows us to identify main determinants of CAB components and forecast CAB. Especially, the accuracy of the forecast of trade balance is high. However, for a few components the forecasting accuracy appears to be low, as they suffer from high forecast errors.

***Key words*:** current account balance, trade balance, forecasting, ARDL model

JEL classification: F1, F4

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1. Introduction

The position of the current account is one of the main indicators for assessing the overall health of the economy at any given time. It has particular importance for central bankers, especially in countries with a fixed exchange rate regime, where any imbalance in current account will have direct implications for central bank's exchange rate policy and have an impact on international reserves. On the other hand, in countries with a more flexible exchange rate regime, large current account imbalances will need to be compensated by equally large imbalances in capital and financial accounts, and this in its turn will have implications for exchange rate and directly affect the competitiveness of country's exports in international markets. In this regard, identifying the main determinants of the current account balance (CAB) and forecasting the CAB is of utmost importance for policymakers. Taking into account the aforementioned, this paper attempts to identify main determinants of CAB in Azerbaijan and build a robust forecasting model of CAB.

Most of the relevant literature focuses on identifying the main determinants of aggregate current account balance or its trade balance component. Our research uses a disaggregated approach. The four components of CAB – trade balance, services balance, primary income balance and secondary income balance are further divided into respective sub-components. Each individual sub-component is estimated separately using various macroeconomic indicators as explanatory variables and then the forecasts for the next year are obtained for three different scenarios under different assumptions for oil prices, government spending and growth projections. The forecast of the total CAB is obtained as the sum of the forecasted value of its components. The accuracy of the forecasts were tested in 2 ways: 1) by conducting in-sample forecast and comparing actual realized values with that of forecasted, and 2) by looking at the ratio of the forecasting errors obtained from our model (RMSEs) to the errors obtained using univariate AR (1) forecasting.

According to the results of the estimation, the dynamics of various CAB sub-components are mainly explained by the changes in oil prices, the level of the oil production, non-oil GDP growth, government spending, non-oil REER and the lags of the relevant CAB sub-components. The accuracy of the forecasts for CAB and for its trade balance component is quite high. However, for some components the model suffers from high forecast errors. Expert judgements have been employed for reducing forecast errors and improving the accuracy of the forecasts for only one sub-component – imports of construction services in oil sector. It is concluded that two other sub-

components – imports of other services in oil sector and imports of government services is better forecasted using univariate AR(1).

The rest of the paper is structured as follows. Section 2 reviews relevant literature and lays the basis for our research. In section 3 the data and methodology is explained in detail. Section 4 presents the results of the estimation and assesses the forecasting power of our model and section 5 concludes.

2. Literature review

Most of the literature on the subject highlights fiscal balance, net foreign assets, demographic factors, oil reserves, economic growth, public debt, real effective exchange rate, savings, and FDI as the main determinants of current account balances in the medium term.

Dynamic macroeconomic models have been widely used in the literature to assess the CAB. Such dynamic models are the best choice for analyzing the dynamics of the CAB, especially in the medium and long term. The main idea is that the current account acts as a shock absorber in the face of short-term shocks to reduce fluctuations in consumption and maximize welfare. Thus, the country can revive consumption by financing the CAB deficit through external borrowing, FDI or international reserves. This theoretical framework has been used in a number of empirical studies (Tang: 2019, Shewchuk 2019, Knight: 2019, Morsy: 2009, Cusolito and Nedeljkovic: 2013).

Tang (2019) examined the impact of the development and integration of the financial market in the European Union member countries in Central and Eastern Europe on the CAB from 1996 to 2015 using the OLS method. The results confirmed that financial integration has led to an increase in the CA deficit. Yang (2011) conducted empirical research on CAB determinants in emerging Asian markets. Based on an intertemporal approach, the research studies both the long-term and short-term effects of net foreign exchange reserves, the degree of openness of international trade, the impact of real exchange rates and revenues on the CAB of 8 emerging Asian economies between 1980 - 2009. Empirical research was conducted using the Vector Autoregressive (VAR) methodology.

Unlike most of the studies on the subject that focus on developed countries and emerging markets, the empirical study conducted by Chinn and Prasad (2003) focus on medium-term determinants of CAB in newly industrialized and developing countries, using cross-sectional and panel OLS models. The main disadvantage of the cross-sectional and panel analysis approach is that the

results can give a generalized opinion about a group of countries, not about individual countries, and can only explain the "average" behavior of the CAB in these countries.

In this regard, research focusing on one country cases employing time series econometric techniques are of particular interest. Knight, Nedeljkovic and Portugal-Perez (2019) employed the “jack-knife model averaging” method for empirical assessment of the determinants of the CAB in Turkey using data for the time period 1986-2017. The results of the study suggest that the current account balance shocks in Turkey are less persistent than is typically found in the cross-country literature, implying that CAB adjusts more rapidly in response to shocks. Significant explanatory variables included private sector loans, GDP growth relative to the rest of the world, trade openness, global oil prices, past net foreign assets, global uncertainty, FDI, and the real exchange rate. Shewchuk, Synchak, Zaverbnyj and Baranetska (2019) used structural vector autoregressive model (SVAR) to estimate the determinants of the CAB and the total output in Ukraine. It has been established that the budget surplus has a significant impact on both the CAB and the improvement of the economic cycle.

Yeshineh (2012) assessed the determinants of Ethiopia's foreign trade balance through ARDL model. The study examines the short-term and long-term interactions of the trade balance with domestic and foreign income, money supply, real exchange rate and budget balance in Ethiopia during the time period 1970-2010. Empirical results show that the exchange rate has a weaker role in forecasting Ethiopia's trade balance. Revenues, budget balance and money supply, on the other hand, have a significant impact on the trade balance.

Research conducted by Morsy (2009) is of particular importance for us both in terms of the sample studied and the variables considered. The study identified the determinants of CAB in 26 oil exporter countries by using a dynamic panel evaluation model by country. The results show that the factors determining the CAB of oil-exporting countries are the budget balance, oil balance, oil wealth, the degree of maturity of oil production and the coefficient of age dependence.

3. Data and methodology

The econometric technique used in the research is autoregressive distributed lag model (ARDL). Detailed discussion of ARDL are presented by (Pesaran & Shin, 1995) and (Pesaran, et al., 2001). The papers show that with correct choice of order length, ARDL (p, q) leads to consistent estimators and the inference is valid. The main advantage of ARDL is that it can be applied even

if the equations contain I(0) and I(1) variables simultaneously[5]. We are mainly interested in intertemporal dynamics of the variables, thus we use ARDL in the following representation (level equations form)[6]:

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i y_{t-1} + \sum_{j=0}^{q} \beta_j x_{t-j} + \varepsilon_t \qquad (1)$$

where: y_t is variable of interest, x_t relevant explanatory variables, α_i and β_j are coefficients to be estimated, and ε_t is disturbance term. Disturbance term assumed to follow white noise process. Correct lag length has been selected to make sure that disturbances are not correlated. The lag length selection criterion is Akaike information criterion (AIC).

Since the aim of the research is short-run forecasting of BoP, ARDL is mainly chosen for achieving correct lag length in the equations. Although the long-run effects and cointegrating relationships are of secondary concern, they have been used as a guide in the selection of proper variables in the equations. Thus, the main advantage of employing ARDL model in our research is to determine the existence of cointegration among variables (if there are any). ARDL model (1) can be reformulated in the following error correction form:

$$\Delta y_t = \alpha_0 + \alpha(y_{t-1} - \theta x_{t-1}) + \sum_{i=1}^{p-1} \varphi_i y_{t-1} + \omega \Delta x_t + \sum_{j=1}^{q-1} \delta_j x_{t-j} + \varepsilon_t \qquad (2)$$

where, Δ stands for (first) difference, α, θ, φ, ω, δ are the combination of the parameters of (1). $(y_{t-1} - \theta x_{t-1})$ is Error Correction (EC) term. EC term shows the long run relationship between the variables. α is the adjustment parameter. It shows how fast the system moves toward equilibrium. The sign of α is expected to be negative.

Due to relatively short sample, maximum lag length is set to 4. During the model building, the equations have been checked for serial correlation and heteroscedasticity. Causality issues have been addressed mainly based on the relevant theory, previous research on relationships between economic variables in Azerbaijan and expert judgements.

[5] Other cointegration techniques require the variables to be integrated of the same order. ARDL can be applied with a mix of I(0) and I(1) variables, but not I(2).

[6] For simplicity we consider one dependent and one independent variable case. Generalization to many independent variables case is straightforward.

For estimation purposes quarterly data for the period 2003Q1-2020Q4 is used and then the forecasts for the next year are obtained. All data is annualized[7]. All variables that are expressed in national currency are converted into US dollars. Augment Dickey-Fuller (ADF) test is employed to test for the presence of unit roots. The results of the test show that most of the variables are either stationary or I(1). A few of the variables are found to be I(2), namely exports and imports of tourism services, imports of communication services, growth in tourism and trade sectors of economy, budget expenditures, natural gas prices, REER, and nominal wages. These variables are included in the estimation in log differenced form. The variables used in the estimation and their sources are listed in Table 1.

Table 1. List of the variables used in the estimation and data sources

Variables	Data source
BOP components and sub-components	Central Bank of the Republic of Azerbaijan (CBAR)
Oil prices (Europe Brent spot price)	US Energy Information Administration (EIA)
Oil production	State Statistics Committee of Azerbaijan (projections from Ministry of Economy)
Gas prices (average of Indonesian in Japan, Netherlands TFF, US domestic)	IMF
Gas production	Interstate Statistical Committee of the Commonwealth of Independent States (CISSTAT)
GDP growth in Russia, Turkey and Euro area	IMF
Real and nominal GDP	State Statistics Committee of Azerbaijan
Real and nominal non-oil GDP	State Statistics Committee of Azerbaijan
Growth of GDP and non-oil GDP	State Statistics Committee of Azerbaijan
GDP by economic sectors	State Statistics Committee of Azerbaijan
Investments in oil and non-oil sectors of economy	State Statistics Committee of Azerbaijan (projections from Ministry of Finance)
CPI	State Statistics Committee of Azerbaijan
Total deposits and credits	CBAR
Refinancing rate	CBAR
REER and non-oil REER	CBAR
Monetary aggregates	CBAR
Budget expenditures	Ministry of Finance
Average nominal wages	State Statistics Committee of Azerbaijan
Real income and real income per capita	State Statistics Committee of Azerbaijan
Central Bank's official international reserves	CBAR
Assets of the State Oil Fund	State Oil Fund of the Republic of Azerbaijan
Central government deposits	CBAR
Freight turnover (excluding pipelines)	CISSTAT

[7] For flow variables value for each quarter is calculated as the sum of that quarter and previous three quarters. This does not apply to stock variables and percent changes.

Exchange rate (USD/AZN)	CBAR
LİBOR	Federal Reserve Bank of St. Louis
Google trends (Baku, Azerbaijan)	Google

The forecast is carried out in three different scenarios, where oil prices, M2 monetary aggregates, budget expenditures, as well as economic growth in total economy and its different sectors of econom are set to vary between scenarios. We forecast such variables as investment in the non-oil sector of economy, total REER and non-oil REER, freight turnover, and nominal income of population inside our model to be used in the forecast of CAB sub-components. The variables used in the forecast of these indicators is given below in Table 2. The forecast of economic growth and growth in different sectors of economy for different scenarios, as well as the forecast of inflation is given by Central Bank's Modelling division. Expected investment in oil sector for next year is obtained from the budget envelope for 2021. It is assumed that natural gas production and prices will be equal to the average values of the previous year, while total deposits and credits, nominal wages, reserves of State Oil Fund and Central Bank, as well as LIBOR will be equal to the last observation from the previous year. The forecast of the growth rate of population is given by the Ministry of Economy. Finally, economic growth forecasts for main trading partners, namely Turkey, Russia and Eurozone is obtained from IMF, World Economic Outlook.

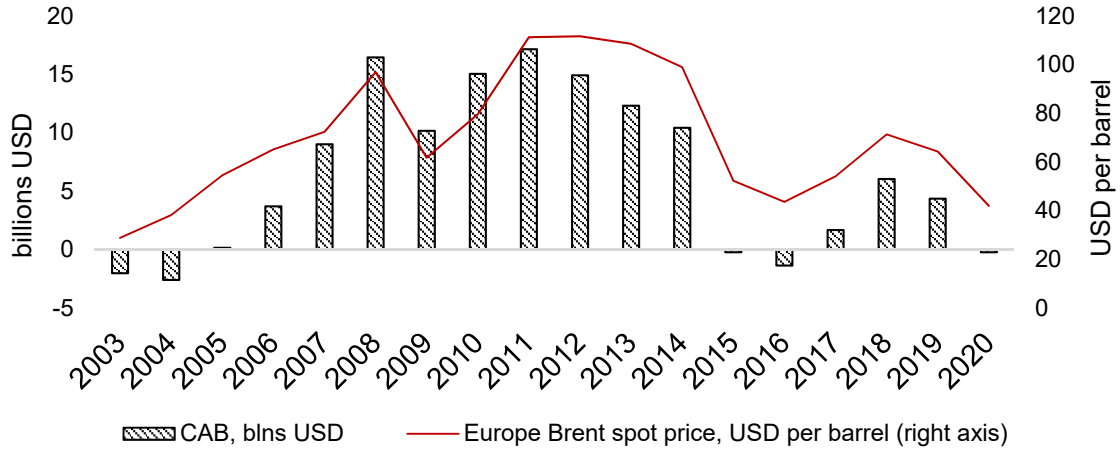
M2 money aggregate is used as a proxy for government spending, since the data for budget expenditures is a preliminary data and is subject to revisions, which significantly reduces its reliability. In any case, we used budget expenditures and M2 interchangeably and compared the results to determine which one of these variables behaves better in our model. As expected, the model using M2 produced better results, that's why M2 is preferred over budget expenditures in almost all equations.

Table 2. List of the series forecasted inside model to be used in the forecast of CAB sub-components

Forecasted series	Variables
investment in non-oil sector	M2 monetary aggregates, total credits
freight turnover	non-oil GDP growth, economic growth in Turkey and Russia
REER	oil prices
non-oil REER	oil prices
nominal income of population	non-oil GDP growth, M2 monetary aggregates

Historically CAB in Azerbaijan has been mainly driven by oil prices. Azerbaijan economy is heavily dependent on oil sector, which accounted for about 86% of total exports in 2020. As a result, the CAB surplus in Azerbaijan reached an all-time high of 17.2 billions of dollars in 2011, with crude oil prices hovering around 111 dollars per barrel (Europe Brent spot price) and plummeted to a deficit in the amount of 1.4 billions of dollars in 2016, after the oil price shock (Figure 1). Considering high importance of oil prices for the economy, 3 forecast scenarios of CAB are generated under differing assumptions on oil price. Besides oil price, M2 monetary aggregates and growth forecasts for GDP and for various sectors of economy are set to vary between different scenarios.

Figure 1. Current account balance in Azerbaijan and global oil prices



Data source: Central Bank of Azerbaijan, U.S. Energy Information Administration

4. Results

Estimation has been carried out for each of the CAB sub-components separately and various economic indicators have been used as explanatory variables of different sub-components. The full list of the variables used in estimation and forecasting is illustrated below in Table 3.

Table 3. Variables used in each estimating equation

Dependent variables			Explanatory variables‡	
CAB component	***CAB sub-component***			
	Goods	Export	*oil sector*	**Oil price***, oil production***, natural gas price, natural gas production**

Trade balance			*non-oil sector*	**Non-oil REER, M2 monetary aggregate***, GDP growth in Russia* and Turkey,** budget expenditures, oil price, oil production, total credits
		Import	*oil sector*	**Oil price, oil production***,** investments in oil sector, natural gas price, natural gas production, REER
			non-oil sector (excluding gold)	**non-oil REER***, nominal income of population*****, non-oil GDP growth, budget expenditures, total credits, M2 monetary aggregate
Services balance	Transport services	Export	**GDP growth in transportation sector, freight turnover***, oil price, oil production, GDP growth in Russia and Turkey, tourism exports, non-oil REER	
		Import	**GDP growth in transportation sector, freight turnover****, oil price, oil production, GDP growth in Russia and Turkey, tourism imports, non-oil REER	
	Tourism services	Export	**Non-oil REER, GDP growth in Russia and Turkey, oil price, oil production**, **GDP growth in tourism sector,** the number of tourists, Google trends (Azerbaijan, Baku)	
		Import	**Non-oil GDP growth***, non-oil REER,** oil price, oil production, nominal wages, the number of tourists	
	Communication services	Export	**Non-oil REER***, tourism exports,** GDP growth in ICT sector, GDP growth in transportation sector, M2 monetary aggregate, infrastructure indicator	
		Import	**Non-oil REER*, tourism import, M2 monetary aggregate,** GDP growth in ICT sector, budget expenditures, infrastructure indicator	
	Construction services	Export	*non-oil sector*	**Non-oil REER, GDP growth in Turkey, oil price, GDP growth in construction sector,** oil production, GDP growth in Russia, GDP in construction sector, investment in trade partners
		Import	*oil sector*	**investments in oil sector**, budget expenditures, oil price, oil production
			non-oil sector	**Non-oil GDP growth, investments in non-oil sector,** oil price, oil production, budget expenditures, total credits, non-oil REER
	Government services	Export	**M2 monetary aggregate*,** REER, budget expenditures, GDP growth in the sector of public administration	

		Import	**M2 monetary aggregate**,** REER, budget expenditures, GDP growth in the sector of public administration	
	Other services *(including financial services)*	Export	*non-oil sector*	**Non-oil REER, GDP growth in Russia and Turkey,** oil price, oil production, non-oil GDP, total credits
		Import	*oil sector*	**investment in oil sector,** REER, oil price, oil production
			non-oil sector	**M2 monetary aggregate***, non-oil REER,** budget expenditures
Primary income balance		Inflow	*oil sector*	**Oil price**, LIBOR
			non-oil sector	**LIBOR, total foreign exchange reserves (includes forex reserves of SOFAZ and Central Bank of Azerbaijan),** GDP growth in Russia and Turkey, oil price, oil production
		Outflow	*oil sector*	**Oil production**, oil price***
			non-oil sector	**Non-oil GDP growth, interest rate on the credits in foreign currency**, REER, LIBOR, external debt
Secondary income balance		Inflow	**GDP growth in Russia,** GDP growth in Turkey, oil price, the number of the emigrated citizens	
		Outflow	**Nominal wages***, oil price, the number of the immigrated citizens, non-oil GDP growth	

Note: Ordinary fonts indicate all the explanatory variables used for estimation, **bold fonts** indicate only the variables included in the final model, ***** signs indicate the relevant statistical significance level of the variables:
* p<10%, ** p<5%, *** p<1%.

‡Apart from the indicated variables, their respective lags and the lag values of the relevant dependent variables have also been included in the estimation. The statistical significance of the variables shown in the table indicate only the significance of contemporaneous effects, in many cases the lags of the variables have more statistical significance. Lag order is chosen by AIC and differs between equations and variables.

Trade balance. The dynamics of CAB in Azerbaijan is mainly determined by the trade balance. Exports and imports of goods have been estimated separately for oil and non-oil sectors. As expected, oil prices and the level of oil production are found to be the two main determinants of *exports and imports of goods in oil sector*. Although included in the estimation, natural gas prices and the production of natural gas do not appear to be significant determinants of the exports in oil sector. This can be explained by two reasons. First of all, although natural gas exports have long

been important source of revenue for Azerbaijan, its volume has dramatically increased during last few years with Southern Gas Corridor initiative. As such the model cannot capture the importance of natural gas exports, which has only been increasing for the last few years and are expected to peak during upcoming years. Secondly, the data for natural gas prices used in the estimation is the average of the spot prices of three different types of natural gas traded in global markets (Indonesian in Japan, Netherlands TFF, US domestic). This is a very rough approximation, considering the fact that the price for natural gas is mainly determined by individual contracts and can vary substantially. Unfortunately, it was not possible for us to obtain time series data for Azerbaijani natural gas prices from different contracts.

Identifying the determinants of the *imports and exports in non-oil sector* is also of crucial importance for policymakers. Reducing the dependence of exports from oil resource and promoting exports in non-oil sector is one of the main objectives of government policy in Azerbaijan. On the other hand, the bulk of total imports of Azerbaijan are imports of goods in non-oil sector and it has major role in the provision of consumer demand in the domestic market.

According to the estimation results, exports of goods in non-oil sector is mainly determined by M2 monetary aggregate, which is a proxy for government spending. This variable has high statistical significance in explaining the behavior of non-oil exports. GDP growth in Russia is another variable that significantly affects non-oil exports. Some other explanatory variables, deemed crucial in explaining the behaviour of exports, were also included in estimation, such as REER in non-oil sector and GDP growth in another major trade partner – Turkey, although these variables did not have significant coefficient estimates. Imports in non-oil sector, on the other hand, are mainly determined by non-oil REER and the income of population, both of which have high statistical significance.

Overall, our model is able to capture the main determinants and accurately forecast trade balance. Both in-sample forecasts (Figure 2, a) and the ratio of forecast errors from our model to that of simple univariate model (Table 4) show high accuracy for the forecast of this component of CAB.

Services balance. The estimation and forecasting of the services balance have proved to be the most challenging out of all CAB components. When we look at the ratio of forecasting errors (RMSE) from our model to that of simple univariate AR (1) model (Table 4), we can see that although for aggregate services balance the forecasting accuracy of our model is quite high, the forecast of some sub-components of services balance suffer from high errors. This in turn leads

to a deviation of the actual values of services balance from forecasted values according to the results of the in-sample forecast (Figure 2.b). The problems mainly stem from a few sources.

Table 4. Ratio of forecast errors (RMSE) from ARDL model to that of AR (1) model

	in	out
1. CAB	0.11	0.76
1.1 Trade balance	0.25	0.98
Oil sector	0.20	0.47
Non-oil sector	0.78	0.94
1.2 Service balance	0.55	0.89
Transportation	0.96	0.95
Tourism	0.51	0.90
Communication	0.67	0.45
Construction	0.88	1.11
Oil sector	-	1.04
Non-oil sector	0.88	0.51
Government services	0.54	1.99
Other services	0.82	0.92
Oil sector	-	0.99
Non-oil sector	0.82	1.09
1.3 Primary income balance	0.76	0.29
Oil sector	0.98	0.36
Non-oil sector	0.70	0.38
1.4 Secondary income balance	0.71	0.59

Note: Ratio being less than 1 indicates that ARDL model has better forecasting accuracy than univariate AR(1) model.

The main source of high forecast errors is *imports of construction services in oil sector*. The import of these services are highly correlated with petroleum projects and can dramatically increase during the implementation of these projects and decrease afterwards. As such the model is unable to forecast these imports without any prior information about expected start and end dates of petroleum projects. The only explanatory variable included in the estimating equation is investments in oil sector, but the coefficient estimate is statistically insignificant. This can be due to the low quality or different scope of the data for investments. Meanwhile, first lag of the dependent variable have highly significant coefficient estimates and it seems that the imports of construction services in oil sector is mainly determined by its own lagged values. To increase the forecasting accuracy, the forecasts of imports of construction services in oil sector can be included exogenously in the model based on expert judgements, taking into account the information available about the continuation of different ongoing projects.

The above reasoning is true for the *imports of other services in oil sector* as well, which is also very dependent on petroleum projects. Investment in oil sector, as well as lags of the dependent variable are included as the explanatory variables in the estimation. Only the first lag of the dependent variable has high statistical significance. The reason for the inaccuracy of in-sample forecasts for this variable is mainly explained by the fact that our in-sample forecasting is conducted using the estimation results for the time period 2003Q1-2018Q4, while the implementation of certain petroleum projects caused dramatic increase in imports of other services in oil sector in 2019 and 2020. We expect that the implementation of those projects will continue in 2021 and as such, the results of the forecasting for 2021 should be accurate.

Imports of other services in non-oil sector also suffers from high forecast error. Non-oil REER and M2 monetary aggregates, along with 4 lags of the dependent variable are included in the estimation of this CAB sub-component. Only M2 and the first lag of the dependent variable has high statistical significance. However, the coefficient estimate of the first lag of the dependent variable is significantly high (0.93). Considering the fact that the forecast errors are high, coupled with high magnitude and significance of the coefficient estimate for the first lag of the dependent variable, we think that using simple AR(1) model to forecast this sub-component of CAB will yield better results.

The last sub-component of CAB that has a high forecast error is *imports of government services*. We only use M2 monetary aggregates as a proxy for government spending in the estimation of this sub-component, along with dependent variable's own two lags. The coefficient estimate for M2 is positive and has high statistical significance, confirming our supposition that government spending is the main driver behind imports of government services. Both lags of the dependent variable have high statistical significance, with the first lag having high and positive coefficient estimate (1.06). However, the forecast errors of this specification are quite high compared to simple AR(1) model. Taking into account the facts stated above, this sub-component of CAB can be forecasted using simple AR(1) model to reduce forecast errors.

Two major sub-components of services balance are transportation and tourism services, as such we deem it crucial to go into more detail about the estimation and forecast of these services.

Both *exports and imports of transportation services* are modelled using freight turnover and GDP growth in the transportation sector as explanatory variables, along with several lags of the dependent and independent variables. In both cases freight turnover has significant coefficient

estimates: its coefficient on the imports of transportation services is positive, while for the exports of transport services it is found to be negative. The model forecasts a slight decrease in the balance of transportation services in 2021, which seems intuitive when considering past dynamics.

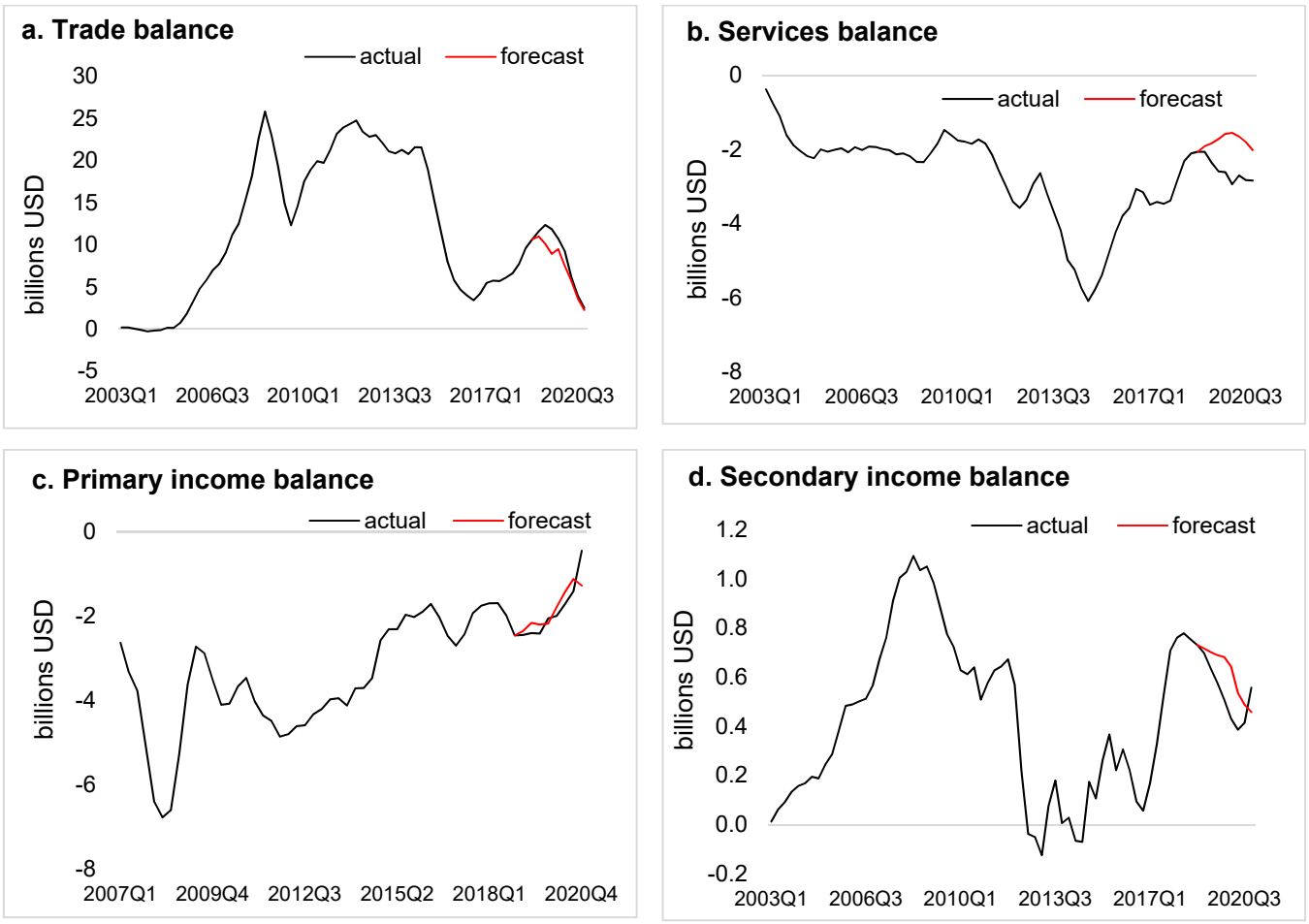
Our model is surprisingly successful in the forecast of the exports and imports of tourism services, considering the fact that for in-sample forecast we chose the time period between 2020Q1-2020Q4, which coincided with the outbreak of Covid-19 pandemic that had a significant impact on tourism sector. Non-oil REER, GDP growth in main tourism partners Russia and Turkey, GDP growth in tourism sector, as well as oil prices and oil production were used as the main explanatory variables for the estimation of tourism exports. Non-oil REER represents price competitiveness factor in attracting foreign tourists. GDP growth in main tourism partners shows the demand for tourism services of Azerbaijan. The rationale for including oil revenues as an explanatory variable of tourism exports stems from the fact that Azerbaijan is famous for hosting international cultural and sports events that attract foreign tourists to the country, but the spending required to organize these events can be highly correlated with the main source of revenues for the country, i.e. oil revenues. We intended to use the number of tourists visiting Azerbaijan as an additional explanatory variable, but unfortunately reliable data for the number of tourists in monthly frequency is only available for the last 2 years, which prevented us to include this variable in the model. Estimation results show that the main significant variable explaining the tourism exports is its own first lag, which has a very high coefficient estimate as well. Some lags of oil production and GDP growth in tourism sector of economy also have significant coefficient estimates.

For imports of tourism services, we used REER and GDP growth in non-oil sector as the main explanatory variables. The main determinants of tourism imports are found to be its own first lag and GDP growth in non-oil sector of economy, which represents the demand of local population to tourism services.

Primary income balance. The outflow side of the primary income balance is dominated by oil sector, while non-oil sector is dominant in the inflow side.

Primary income outflow in oil sector is explained by its own two lags, oil production and oil prices. The explanatory power of the model is quite high. *Primary income inflow in non-oil sector* is explained by its own first lags, LIBOR and foreign exchange reserves. The rationale behind including these variables into the estimating equation is that primary income inflows in non-oil sector are mainly generated from assets invested abroad.

Figure 2. In-sample forecasting of CAB components



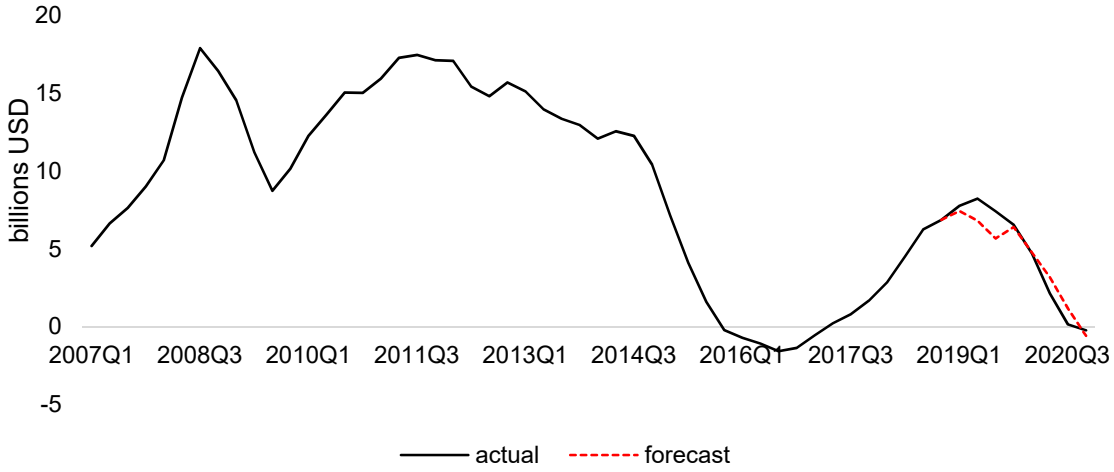
Note: The figures in the graph are annualized

Secondary income balance. The bulk of *secondary income inflows* (92% in 2020) consists of money transfers from emigrated citizens. According to the statistics provided by States Statistics Committee, Russia accounted for 48% of all emigrants from Azerbaijan in 2019. Taking this into account, we attempt to explain secondary income inflows mainly by GDP growth in Russia, as well as the dependent variable's own lags. However, to our surprise, the estimation results show that secondary income inflows do not respond to economic activity in Russia significantly. This variable only responds to its own lags, which means that it does not change with different oil price scenarios. Expectations about quarterly money transfers could highly improve the forecasting capacity of the model.

Secondary income outflows are explained by its own lags and the average nominal wage in Azerbaijan.

Overall, the model allows us to accurately forecast current account balance in Azerbaijan and the forecast errors are quite low (Figure 3).

Figure 3. In-sample forecasting of CAB in Azerbaijan



Note: The figures in the graph are annualized

5. Conclusion

The purpose of the research is to identify the main determinants of the current account balance (CAB) in Azerbaijan and build a forecasting model for CAB at the disaggregated level. Each sub-component of CAB is estimated separately, using ARDL methodology on quarterly data spanning from 2003Q1 to 2020Q4. The forecasts of CAB sub-components are obtained for 3 different (pessimistic, baseline and optimistic) scenarios, under differing assumptions on oil price, government spending and economic growth. The accuracy of the forecasts are tested by conducting in-sample forecasting and by looking at the forecast errors.

Overall, our model allows us to identify main determinants of CAB in Azerbaijan and forecast CAB with accuracy. According to the results of the estimation, variables showing high significance in explaining the dynamics of various CAB sub-components are found to be oil prices, oil production, GDP growth, government spending, non-oil REER, income of population and the lags of the respective dependent variables. The accuracy of the forecast for CAB, and especially for its trade balance component is quite high. However, some sub-components suffer from high forecast errors. This is especially true for the imports of construction services in oil sector, imports of other services in non-oil sector and imports of government services. As the services in oil sector are heavily dependent on the petroleum projects, the model is unable to accurately forecast these

flows. The accuracy of the forecasts for this sub-component can be improved using expert judgments based on prior information available about petroleum projects. For the forecast of imports of other services in non-oil sector and imports of government services, univariate AR(1) model is preferred over ARDL model.

Reference list

Chinn, M.D., Prasad, E.S. (2003). Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration. *Journal of International Economics*, 59(1), pp.47–76.

Herrmann, S., Jochem, A. (2005). "Determinants of current account developments in the central and east European EU member states - consequences for the enlargement of the euro area", *Deutsche Bundesbank Discussion Paper Series*, 1: Economic Studies, 32.

Knight, N., Portugal-Perez (2019). "Turkey: An Empirical Assessment of the Determinants of the Current Account Balance", *World Bank Policy Research Working Paper*, 8982.

Morsy, H. (2009). Current Account Determinants for Oil-Exporting Countries. *IMF Working Papers*, 09(28), p.1.

Pesaran, M.H., Shin, Y. (1995). "An Autoregressive Distributed-Lag Modelling Approach to Cointegration Analysis", *Cambridge Working Papers in Economics* 9514, Faculty of Economics, University of Cambridge.

Pesaran, M.H., Shin, Y. and Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), pp.289–326.

Shevchuk, V.O., Synchak, V., Zaverbnyj, A.S. and Baranetska, O.V. (2019). DETERMINANTS OF THE CURRENT ACCOUNT BALANCE AND OUTPUT IN UKRAINE. *Financial and credit activity: problems of theory and practice*, 3(30), pp.186–195.

Sugema, I. (2005). "The Determinants of Trade Balance and Adjustment to the Crisis in Indonesia", *Centre for International Economic Studies Working Papers* 2005-08*,* University of Adelaide, Centre for International Economic Studies.

Tang, D. (2019). Determinants of the Current Account Balances among Central and Eastern European Countries in the European Union. *European Review*, 27(02), pp.220–245.

Yang, L. (2011). "An empirical analysis of current account determinants in emerging Asian economies", *Cardiff Economics Working Papers*, E2011/10.

Yeshineh, A.K. (2016). Determinants of Trade Balance in Ethiopia: An ARDL Cointegration Analysis. *SSRN Electronic Journal*.