THE RELATIONSHIP BETWEEN UNEMPLOYMENT, NAIRU AND INVESTMENT. MICROFUNDATIONS FOR INCOMPLETE NOMINAL ADJUSTMENT

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Summary

This paper proposes a simple method to estimate a macro shock-specific Okun elasticity: it measures by how much the unemployment rate falls over a certain horizon when output increases by one percentage point over the same horizon because of a specific macroeconomic shock. Inference is based on simple instrumental variable regressions of cumulative unemployment on cumulative output. Using data for the Republic of Moldova I consider government spending, tax, monetary policy, financial, technology, and oil shocks. We obtain eight key results:

• At medium horizons (2-3 years), Okun elasticities are largely stable across different kinds of shocks.

• At shorter horizons, differences are more pronounced. The speed at which unemployment adjusts relative to output depends on the shock driving fluctuations. This highlights the importance to consider longer horizons. Otherwise, one could incorrectly conclude that the elasticity breaks down for some cycles.

• The elasticity is larger for financial shocks. Importantly, it is larger than for monetary policy and government spending shocks.

• The largest elasticity is for technological shocks followed by oil shocks.

• An increase/decrease in unemployment by (0.14 p.p.) caused an increase/ decrease in GDP by 1 p.p. period 2011--2015.

• An increase/decrease in unemployment by (1.79 p.p.) caused an increase/ decrease in money supply by 1 p.p. period 2011--2015.

• An increase/decrease in unemployment by (0.17 p.p.) caused an increase/ decrease in GDP by 1 p.p. period 2007--2011.

• An increase/decrease in unemployment by (0.06 p.p.) caused an increase/ decrease in money supply by 1 p.p. period 2007--2011.

Keywords: *Unemployment; investment; monetary policy; rational expectations; interests rates; credit index implications*

JEL: *E43;E52;E61;J68.*

UDC: *331.56+330.322*

Introduction. Today world seems to be more and more disintegrated and "no gate" news media influence as much as more in 1980's and leading newspapers condemning the **casino mondiale** (world casino), the shift in the world economy away from production and real goods and into pure financial speculation, and warming of a crash to come, unless changes were made. In line of mathematics, we

can write such as $a^2 + b^2 = c^2$ but this is more far away from a technical modeling which could be drawn as in common own space: $\alpha x^2 + \beta y^2 = \gamma z^2$

If we do not leave any blank lines we will continue to make and transforming equations, create indentation and hit a new paragraph of economic analysis.

Okun's (1962) Law predicts the short-run output elasticity of unemployment, i.e. by how much the unemployment rate falls, on average, when output increases by one percentage
point. A stable Okun's Law is a key ingredient in macroeconomics textbooks, and business cycle models. Yet, little is known about whether the elasticity depends on the force driving the business cycle. For instance, whether unemployment and output co-move differently in recessions triggered by financial turmoil or an oil supply disruption is unclear ex-ante. The lack of evidence is surprising considering worries that the relationship breaks down occasionally and is particularly weak during recoveries from recessions rooted in financial market distress (e.g. Gordon, 2010).

We argue these findings can help to understand the initially "jobless" recovery following the 2007 financial crisis. Our mission is to investigate in an empirical framework, Okun Law in the Republic of Moldova, in the context of Covid 19, and pandemic of 2020's. Our paper is closely related to Daly et al. (2013) who also estimate shock-specific Okun elasticities. We build on their work along three dimensions. First, we consider a more general selection of macroeconomic shocks. Second, we propose a new one-step approach to estimate the elasticities, whereas Daly et al. (2013) follow a two-step procedure. This increases efficiency and simplifies the construction of confidence bands. Third, my method allows us to perform weak-IV robust inference. The last point is crucial because the forecast-error variance contribution of macro shocks to the variables of interest is often small (Gorodnichenko and Lee, 2017).

In the 2020, seasonally adjusted GDP decreased by 6.825% in the euro area and by 6.375% in the EU, compared with the previous year, according to a preliminary flash estimate published by Eurostat, the statistical office of the European Union. These declines, related to COVID-19 containment measures, follow a strong rebound in the third quarter of 2020 (+12.4% in the euro area and +11.5% in the EU) and the sharpest decreases since time series started in 1995 observed in the second quarter of 2020 (-11.7% in the euro area and -11.4% in the EU). According to a first estimation of annual growth for 2020, based on seasonally and calendar adjusted quarterly data, GDP fell by 6.8% in the euro area and 6.4% in the EU.

For Economy of the Republic of Moldova, seasonally adjusted GDP decreased by 14.0 in the second quarter, 9.7 in the third quarter and 3,3 in the forth quarter, starting with recovery period of boom and bust, respectively for 2021, first quarter -1,8, second quarter – 21,5, third quarter 8,3 and the forth quarter 18,9. According to a first estimation of annual growth for 2020, based on seasonally and calendar adjusted quarterly data, GDP fell by 6.9% in 2020, but smoothly recovery was been registered at 12.3.

Throughout last two years, economy of Republic of Moldova has gone through recurrent periods of boom and bust. This is the fascinating phenomenon of business cycles and economic fluctuations. Although long periods of high economic growth have sometimes led people to believe that the business cycle was dead, statistical data show that it is still alive and well: economic activity continues to fluctuate in an

irregular cyclical manner around its long-run growth trend and the persistence of the shocks describe the origin: financial shocks, demand shocks and inflation shocks classical theory of modeling to nuisance: short-run shocks, disequilibrium shocks and innovative shocks, but also unobserved variables: long-term trends, gaps and shocks (rather than otherwise technological). and at the start of the present decade the growth rate of real GDP per capita turned negative in all of the three largest OECD economies. A fundamental challenge for macroeconomic theory is to explain why the economy goes through these cyclical movements rather than evolving smoothly over time.

The two previous years of COVID-19 implications derived the capitalist market economies of the world through recurrent periods of dynamic trends. At the start of the present decade the growth rate of real GDP per capita turned negative in all of the three largest Eastern European Economies: Russia, Ukraine and Romania. We concludes that that numerous disarrays identifying with the arrangement of strategies utilized by Monetary Policy in a specific space of study financial variables and parameters can reconsider anticipated time-arrangement and/or uncertainty in terms of model errors. Economic activity today depends crucially on expected economic conditions tomorrow. A drop in the economy's expected future growth rate will tend to reduce the propensities to consume and invest by reducing the expected future earnings of households and firms. Hence the aggregate demand curve will shift down, causing an immediate fall in current output. As another example, a change in the expected rate of inflation will shift the aggregate supply curve by feeding into the nominal wages negotiated by workers and firms. It may also move the aggregate demand curve through its impact on the expected real rate of interest.

Literature review. What is the shock of unemployment? The arrangement banters during the Great Recession prompted an overflow of examination on this inquiry. The greater part of studies have tracked down gauges of unobtrusive multipliers in total unemployment, frequently beneath solidarity. Assuming that unemployment are for sure this low, they propose that expansions in government spendings are probably not going to animate confidential movement what's more, that financial solidifications that include spending diminishes are probably not going to cause a lot of damage to the confidential area.

The majority of the evaluations depend on midpoints for a specific country over a specific verifiable period. Since there is no extension for controlled, randomized preliminaries on nations, all assessments of total government multipliers are essentially reliant upon verifiable chance. Hypothesis lets us know that subtleties like the industriousness of expenditure changes, how they are supported, how financial strategy responds, and the snugness of the work market can fundamentally influence the extent of the unemployment especially non-acccelerating inflation rate of unemployment (NAIRU). Sadly, the information don't give us clean regular investigations that can respond to these inquiries. While the new Moldovan economy boost bundle was simply shortage supported and embraced during a time of high joblessness what's more, accommodative money related strategy, it was established because of a frail economy and thus any total assessments are dependent upon concurrent conditions predisposition.

During the most recent decades, the writing has started to investigate whether evaluations of unemployment shocks differ contingent upon conditions. One strand of

this writing thinks about how conceivable it is that government investment are different during downturns (for example Auerbach what's more, Gorodnichenko (2012), Bachmann and Sims (2012), Baum et al. (2012), Auerbach and Gorodnichenko (2013), Fazzari et al. (2013) and Riera-Crichton et al. (2014)). Another strand of the writing thinks about what money related approach means for government investment. New Keynesian DSGE models show that when loan costs are stuck at the zero lower bound, multipliers can be higher than in ordinary times (for example Cogan et al. (2010), Christiano et al. (2011), Coenen and et al. (2012)). This paper adds to the exact writing by exploring whether government investment vary as per two possibly significant elements of the economy: 1) how much leeway in the economy and (2) whether loan fees are close to the zero lower bound. Expanding the underlying examination in Owyang et al. (2013), we exploit the way that the whole twentieth Century contains possibly more extravagant data than the post-WWII information that has been the focal point of the majority of the new exploration. We make another quarterly informational collection for the Moldova reaching out back to 1992. This example remembers episodes of immense varieties for government investment, wide vacillations in joblessness, delayed periods close to the zero lower bound of transfers, and an assortment of duty reactions. This paper broadens the little, however developing, writing on government reliance of multipliers in two alternate ways. In the first place, none of the current papers that gauge state subordinate models consider the zero lower bound on interest as a government. Subsequently, our paper is quick to investigate state-reliance including the zero lower bound under unemployment. Second, we add to state-subordinate multiplier writing by featuring a few key strategic issues that emerge. Specifically, we show that the absolute most generally referred to discoveries of higher investment rate during downturns are because of unique subtleties of the computation of multipliers and are not powerful to conceivable speculations. Utilizing Jordà's (2005) neighborhood projection technique, which we view as a more powerful strategy, we find no proof that the government investment is higher during high joblessness period. Most gauges of the multiplier are somewhere in the range of 0.6 and 1. We perform broad power checks as for our proportions of the model, test period, recognizable proof strategy and the way of behaving of duties and track down little change in the appraisals. We exhibit that the vast majority of the distinctions in ends between our work and that of Auerbach and Gorodnichenko (2012) lie in unpretentious, yet urgent, suspicions hidden the development of motivation reaction capabilities on which the investment are based. Rather than direct models, where the estimation of motivation reaction capabilities is a clear endeavor, building motivation reaction capabilities in nonlinear models is loaded with confusions. We additionally find little proof that the investment is higher at the zero lower bound (monetary policy interest rate in the reaction function equation). The just case in which the stabilizers recognizably surpasses solidarity in the zero lower bound state is at the point when we prohibit the proportioning times of Covid 19 and pandemic of 2020's.

Assumption The single-run simulation results should be displayed to show short-term boom-bust cycles, different for length and intensity, along a long-run growth path. During periods of faster growth, the increase in capacity utilization boosts investment, profits, consumption, and creates asset price inflation. The strong

demand generates a positive feedback loop by pushing for further increases in investment. As a side effect, the strong investment expenditure leads to increase in leverage (raising also the debt service) and share of secondary workers. At the peak, the decrease in consumption caused by secondary workers and the reduction in investment due to high interest rates and bankruptcies reach a critical threshold. The positive feedback of loop is now reversed as testified the increase in bankruptcy ratio and the decrease in secondary workers. These two effects, with the exit from the market of the weakest firms and the increase in the share of primary workers, pave the way for the transition to a new expansionary phase. In our story, price evolution is partially disentangled from output (correlation approximately equal to 0.1) mostly because of the use secondary workers as a cost-containing strategy. Both primary workers' and secondary workers' wages are strongly and positively correlated with output (about 0.6), so in the absence of (large) wage differentials we would observe a standard cost-push inflation. However, the increase in the share of secondary workers that occurs during sudden jumps in aggregate demand drives costs down and contains the inflationary pressure. In fact, Λt is positively correlated with output (0.6) and negatively with inflation (−0.4). As discussed with reference to figures 4-5, the model satisfactorily mimics the response of the aggregate economy to shocks. The agent-based approach allows for an investigation of the changes at the micro level that determine the macroeconomic outcomes. In particular, we focus here on the effect on inflation of shocks on foreign exchange and on export. The previous empirical results shows the bivariate distribution for inflation and number of workers before and after a depreciation, which in this model is represented by an increase in the price of raw materials. The shock generates an increase in dispersion in both distribution and higher use of temporary workers, as testified by the movement of firms' density towards the South-East corner of the space. The median of the distribution of Λ shifts to the right, determining a change in the opposite direction for firm-level inflation. A decrease in employment and a proportionally larger use of secondary workers leads to a containment of the inflationary effect that would otherwise result from an exogenous increase in costs. Also, results in the same way, plots the same bimodal distribution, showing the changes caused by a negative variation in export. For this plot we simulated the same negative variation in export that Moldovan experienced in 2013-2022, equal to 5 times the standard deviation of the export time series. After the shock, firms with relatively little secondary workforce absorb the shock by increasing the share of secondary workers, exacerbating the deflationary effect.

Our results determined through the use of empirical data from past recessions in the 1970s, 1990s, and 2000s that Okun's law was a useful theory. All recessions showed two common main trends: a counterclockwise loop[clarification needed] for both real-time and revised data. The recoveries of the 2021s and 2022s did have smaller and tighter loops in the benchmark.

Quarterly Projection Model. Conventional macroeconomic models often assume that the expected future values of economic variables depend only on the past history of those variables. Indeed, we postulate that the expected inflation rate for the current period is simply equal to the actual inflation rate experienced in the previous period. The assumption of backward-looking expectations may be plausible in 'quiet' times when the macroeconomy is not subject to significant shocks. When people have

no particular reason to believe that the tightness of labour and product markets next year will be much different from what it is today, it seems reasonable for them to assume at next year's inflation rate will be more or less the same as this year's. However, if the economy is hit by an obvious and visible shock such as a dramatic change in the price of imported oil or if there is a clear change in the economic policy regime, say, due to a change of government it does not seem rational for people to assume that next year's economic environment will be the same as this year's.

- It is a **structural model** because each key equation has an economic interpretation, but the equations are not fully micro-founded. In other words, for every key model equation that exists in the model we can explain an underlying economic mechanism that this equation approximates. For example, how the central bank sets the interest rate or how the output is determined. We will discuss this in more detail in this module.
- It is a **general equilibrium model** because it describes how the equilibrium is established in the economy as a whole, and not only in some particular markets or sectors.
- The model is **stochastic** because it allows for stochastic shocks (ex. financial shoks or interest rate shocks) in its equations. Later in the course, you will see a set of the so-called structural shocks in the key equations for domestic variables, such as aggregate demand shock, cost push shock, exchange rate shock, and monetary policy shock.
- This model also assumes the **rational** formation of **expectations** for inflation and exchange rate or, in other words, model-consistent expectations.
- The QPM is a tool suitable for **monetary policy analysis and forecasting**.
- The QPM is a tool suitable for Balance of Payments and international investment position statistics (BOP-IIPx)

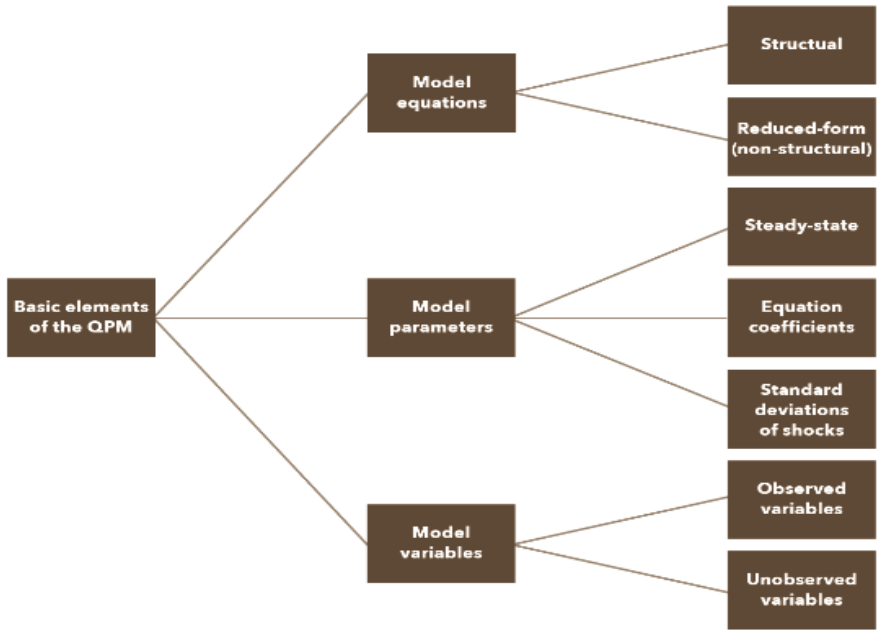

Figure 1: **The building elements of the canonical QPM, classified in three main dimensions.**

Source: International Monetary Fund via EdX platform. https://www.edx.org

I define the macro shock-specific Okun elasticity as the cumulative change in the unemployment rate over the next h periods caused by a macroeconomic shock that changes real GDP by 1 ppt over the next h periods:

$$\beta_h = \frac{\delta \sum_{i=0}^{h} u_{t+i}/\delta_{\varepsilon_t}}{\sum_{i=0}^{h} y_{t+i}/\delta_{\varepsilon_t}}, \text{h} \geq 0 \quad (1)$$

y denotes log real GDP, u the unemployment rate, and $\delta_{y_{t+h}}/\delta_{\epsilon_t}$ is the marginal effect of
an exogenous macroeconomic shock ε_t on $\$y_{t+h}$. $\beta_h$measures relative changes of u and y at
an increasing horizon. This is important because both variables adjust to shocks slowly.
I estimate the macro shock-specific Okun elasticity using the statistic:

$$\beta_h = \frac{\delta \sum_{i=0}^{h} IR_i^u}{\sum_{i=0}^{h} IR_i^y}, \text{h} \geq 0 \quad (2)$$

$IR_i^u$is the causal impulse response of variable y to a macroeconomic shock ε_t at horizon h:

$$IR_i^u = \text{E}(y_{t+h} \mid \varepsilon_t = 1, c_t) - \text{E}(y_{t+h} \mid \varepsilon_t = 0, c_t) \quad (3)$$

where c_t is a vector of control variables. β_h measures the cumulative causal effect of a shock
on the unemployment rate over h periods, relative to the cumulative causal effect of a shock
on output over h periods. With an instrumental variable i_t for the shock ε_t we can estimate the shock-specific Okun elasticity via a sequence of IV regressions.

$$\sum_{i=0}^{h} = b_h \sum_{i=0}^{h} y_{t+i} + d_h' + e_{t+h} \quad (4)$$

where i_t instruments $\sum_{i=0}^{h} y_{t+i}$. I conduct inference on the elasticity using (a) HAC (Newey
and West, 1987) standard errors and (b) a HAC and weak-IV robust method based on inverting the Anderson and Rubin (1949) statistic (see Andrews et al.2019).

Macroeconomic shocks and estimation details.

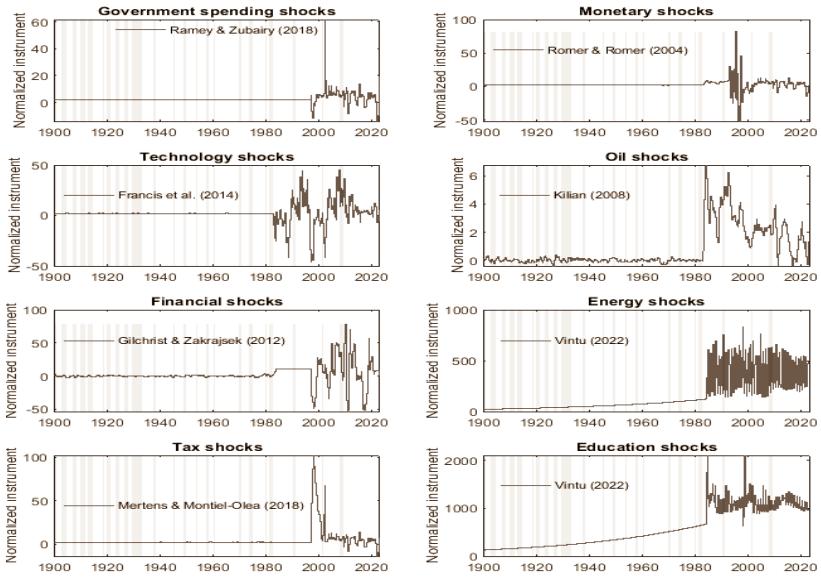

Figure 2. **Instrument for macroeconomic shocks.**
Source: Author's calculation

For financial and technology shocks, we add further controls for identification. Following Ramey and Zubairy's (2018) suggestion, I allow for quadratic deterministic trends in the unemployment rate and log output.

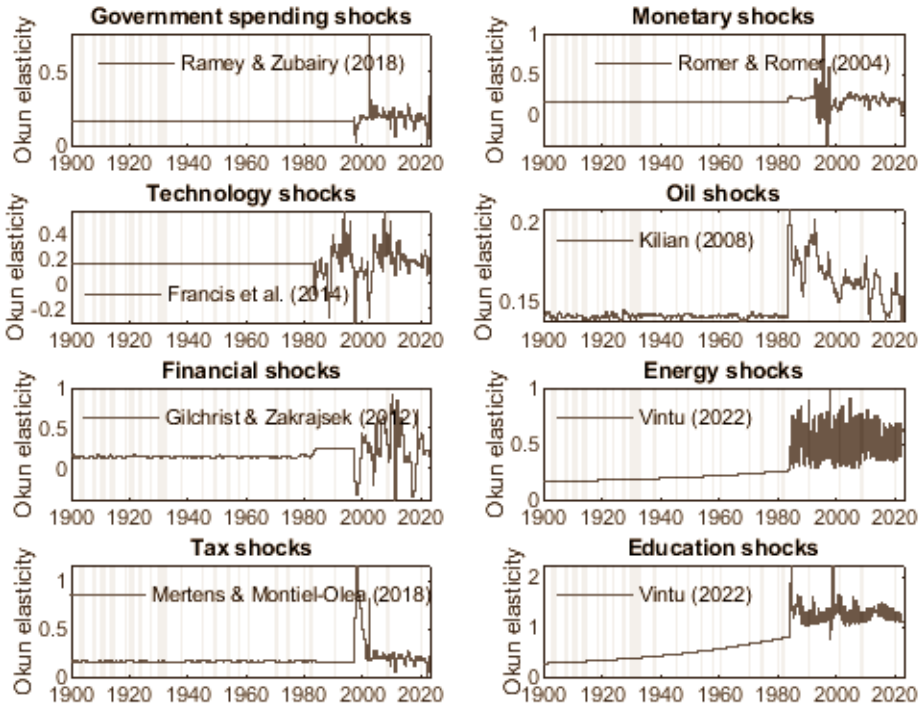

Figure 3. **Macro shocks-specific Okun Elasticity.**
Source: Author's calculation

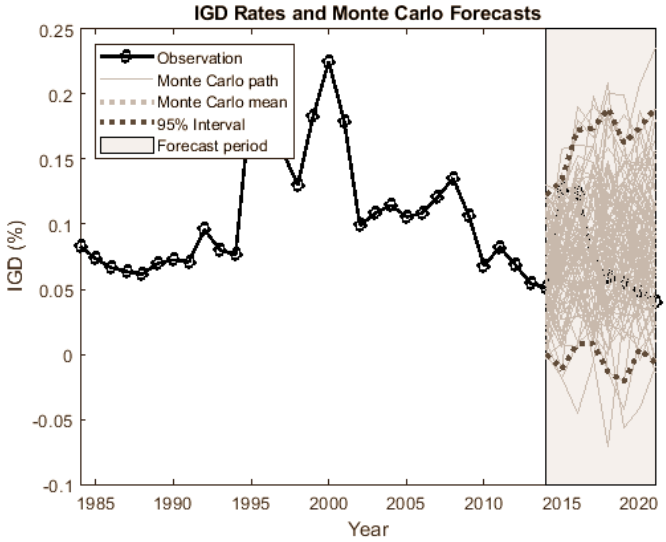

Figure 4. **Behavior of long term interest rate (Keynesian economics): shocks and gaps approach**

Source: Author's calculation

Data. In this sense it should be viewed as an effort to gather and process all the available information in order to cover the gaps in the specific statistical needs to model the euro area. The cut-off date for this update is 27 July 2018 is based on the 18th update of the Area-wide Model (AWM) database. This update, and final version is 3 years out-of-up-to-date, and comparission.

Macroeconomic-Cointed Data Model compared to the previous one carried out in 2017, extends the database to 2017Q4. As in previous versions, it has been constructed using both euro area data reported by the ECB or Eurostat, where available. It has then been backdated using the numbers of the previous version of the database (in general history pre-1996 has been frozen since the 5th update). This paperwhich we created during your experience at "National Institute of Economic Research" . And "Analysis of Financial Stability: The Construction of a New Composite Financial Stability Index for Euro Area"

The coverage of fiscal variables is relatively limited . Users interested in fiscal issues, should refer to the euro area fiscal database, which provides a very rich and more consistent framework for the fiscal series. The AWM database covers a wide range of quarterly euro area macroeconomic time-series. The updated database starts for most variables in 1970Q1 and is now available until 2017Q4. This note elaborates on the methodology and procedures used to update the Area-wide Model database. The first section draws on previous versions of the documentation and briefly explains the sources and methodology to build the historical data. The second section explains how the data for earlier periods are re-scaled to bring the figures in line with recent euro area aggregates. The subsequent sections list the units and seasonal adjustment of the series, elaborates on the main changes with respect to the previous version of the database and gives a tentative timetable for the next

update. The document closes with a summary and an appendix with the codification of the database.

Discussions. In context of Covid 19 and 2020's pandemic, modern advancement has been a significant reason for monetary development. Yield extension has been related with send out advancement, expanded exchange opening, monetary progression and a better business environment in the Republic of Moldova. Nonetheless, net exports and particular government investment have been utilized too.

As neediness in many emerging nations is an overwhelmingly provincial issue, expanded agrarian efficiency is much of the time a key to destitution decrease at the beginning of monetary turn of events. This has been the case for example in Moldova. Nations that have begun their monetary changes - as Moldova did.

With farming change or generally underscored provincial improvement have - toward the start - commonly experienced declining disparity because of a diminishing of country caching down and speed of convergence.

Results and Conclusions. The results from Monte Carlo simulations are displayed in Figure 4. The empirical data are yearly averages from year 2000. In the graph, the results for inflation and share of secondary workers are isolated because they are the results of the optimization in the parameter estimation. The model is able to replicate on average the main quantitative features of the Moldovan economy of the last twenty years in terms of growth and demand structure. The job creation rate reported for the simulation is the variation in the aggregate number of permanent workers. The unit used for labor demand is the number of hours, which is a more suitable proxy for this specific quantity than the number of employees (which we use to measure the distribution of workforce between primary and secondary, in the absence of hourly data). We employ impulse-response function to test the reaction of GDP to a shock in export (figure 2), the reaction of inflation to a shock in the exchange rate, and the response of inflation to a shock in export. In all cases the model satisfactorily mimics the outcome of the real data for direction and duration of the response. However, for the case of inflation and shock of export, the standard deviation appears to be too large to draw a definitive conclusion.

Figure 4 shows that the average individual firms decay in price correlation is faster than the aggregate price as found by Yoshikawa et al. (2015). In terms of outcomes at the firm level, the size of firms measure by capital, number of workers, and sales all display right-skewed distributions. The lognormal distribution well fits the populations for capital and number of workers at each point in time, while for sales the tail is well approximated by a power law, as displayed in figure 7 (see Growiec et al., 2008, for a discussion of the emergence of power law and log normal distributions in firms size).

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