Economic Policy - the Forth Dimension of the Economic Theory

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ABSTRACT

We consider mandatory components of the economic theory: two scales and four dimensions composed by collective agent's economic variables, transactions and expectations and by the economic policy. We consider all economic variables, transactions and expectations on an equal footing and don't emphasize any principal. Time scale Δ defines time averaging of economic parameters. "Space" scale l defines rate of aggregation of the economic agents distributed by their numeric continuous risk grades in the economic domain. Different scales (l, Δ) produce theoretical approximations of the economy with a different accuracy. Economic policy may perturb agent's expectations and that cause perturbations of transactions and economic variables. These perturbations may generate small economic waves that can propagate inside and along borders of the economic domain. Amplifications of economic wave amplitudes by positive feedback can significantly penetrate economic sustainability. Agent's economic activity induces change of agent's risk grades and that results in collective flows of economic variables, transactions and expectations in the economic domain. These flows cause fluctuations of macroeconomic variables usually called as business cycles. Economic policy may smooth business cycle fluctuations but cannot stop agent's collective economic flows in the economic domain. Description of uncertainty - volatility of the economic variables, transactions, expectations and the economic policy outcomes requires development of the second-order economic theory that models relations between sums of squares of agent's variables, transactions and expectations. We point out the theoretical frame and the direction for theoretical approximations of the real economy but this remarkable activity has no final result.

Keywords : economic theory, economic policy, transactions, expectations, risk grades

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1. Introduction

In this paper we discuss the necessary components of the economic theory. As so we consider macroeconomic variables, agent's transactions those cause change of economic variables and agent's expectations those conduct agent's market transactions. Any economic theory should take into account the economic environment – the rules, regulations and legislations those control economic relations, transactions and expectations. Economic policy measures are developed and based on observations and predictions of trends of economic variables, transactions and expectations and are the only tools for regular change of the economic environment. Their mutual impact requires consider economic environment and economic policy as an inherent part of the economic theory.

Economic policy and economic theory are mostly subjects for different audiences. Blinder (2019) proposes that they are developed by two Civilizations. Economic policy is generated by authorities and politicos as their contribution to national prosperity and their particular proposals appeal to voters and general public. Currently, economic theories usually discussed and developed by few academics and professors and aim explain the last decade crisis or verify the long-lived economic beliefs and preconceptions. However, acting power politicos hire exclusive economic ambassadors to serve them as economic advisers and deliver smidgen of academic wisdom to economic policy proposals. Symbiosis of exclusive economic academics and benevolent noble politicos establishes economic policy that can be intelligibly presented to voters and makes lowest harm for national economic development.

Both issues – the economic policy and the economic theory – are developed in tandem for many decades. We do not study historical roots of the economic policy and economic theory and refer only some articles from the bottomless and boundless literature on these issues. Our references are completely subjective and probably not too useful for the novices. As a must read of the economic policy studies we consider Friedman (1968) and Blinder (2019). Written with interval of 50 years they provide contemporary and complementary modern state of economic policy development. Friedman's discussion on what monetary policy can do, cannot do and how it should be conducted is complemented by Blinder's considerations of two distinct civilizations– politicos and economists - those develop and apply economic policy and Dante Alighieri's like rings of policymaking. Both outline significance of the time-terms that are required for getting results and uncertainty induced by the policy implementation. "..we cannot predict at all accurately just what effect a particular monetary action will have on the price level and, equally important, just when it will have that effect"

(Friedman, 1968). “It is a commonplace to say that politicians have short time horizons—lasting only until the next election. Policy options must be appraised over longer time frames” (Blinder, 2019). Almost all branches of the economic policy are presented in studies collected and edited by Feldstein (1994) that can be treated as a single source, but not as an introduction, of the monetary and tax policy, budget and exchange rates policy, economic and financial regulation, trade, health and policy toward the aged, and etc. The core of the economic policy that probably attracts most attention composed by the monetary and tax policy. Economic policy and its most distinguished branch - monetary policy, studied by (Douglas, 1946; Fabricant, 1961; Blanchard, 1980; Mussa, Volcker and Tobin, 1994; Williams, 2003; Hamilton, 2019; Bianchi, Lettau and Ludvigson, 2022). Interaction of monetary policy and fiscal regulation (Blinder, 2021) underlines the role of Central Banks (Goodhart, 2010; Kim and Mehrotra, 2019). Complexity of economic policy (Kirman, 2016), its uncertainty (Pastor and Veronesi, 2012) and investigation of ways, public get informed on economic policy proposals require separate considerations. Politicos and economists those trust into rational expectations have take into account that, due to Blinder and Krueger (2004), respondents select TV (46,7%) as the most important source of the economic policy information and books got votes of only 0,5%! That is the best confirmation of agent’s rationality, if they don’t switch TV channels to soap at the most important economic points. It is evident that many researchers study relations between monetary policy, macroeconomic modelling and financial stability (Thorbecke, 1997; Rudebusch and Wu, 2002; Benigno et.al., 2012; Acemoglu and Robinson, 2013; Dou et.al,. 2020).

Development of economic and monetary policy is based on studies of economic theory that has long history and exceptional interest. It is wonderful that 100-250 years old studies (Cantillon, 1755; Cournot, 1838; Clark, 1915) are read now as contemporary texts and most problems discussed there are still under consideration. Modern economic theory was founded by Keynes (1936), Hicks (1937) and continued by many others we don’t mention. Significant contribution was made by Leontief (1955; 1973) who developed “input-output view of the world economy”. We are sure that readers are familiar with studies that contribute and critique present modern treatments of the economic and financial theories (Burns, 1954; Morgenstern, 1972; Blaug, 1985; Cochrane and Hansen, 1992; Diebold, 1998; Wickens, 2008; Shubik 2011; Cochrane, 2017; Farmer, 2019) and, for example, (Vines and Wills, 2018) that present collection of recent reassessments of the equilibrium theory’s frame.

However, economic system evaluates altogether with society, technology and our ability to generate, collect and operate economic and financial information. Development of the

economic relations causes development of the economic theory that should respond new requirements for adequacy, accuracy and predictability. Economic theory should respond growing complexity of the economic processes and hence should use complex methods and models. The dream of simple economic theory that able generate such economic policy that satisfies KISS principle (Keep it simple, stupid) (Blinder, 2019) is, probably, gone. Interdependence between economic theory and economic policy states the problem of their mutual interaction.

To "see the wood for the trees" it is reasonable to draw up a general theoretical frame that could balance mutual interface between the economic theory and the economic policy issues. We don't chose any principal economic variable like employment or investment, demand or production and etc., as the most influential or significant for the economic theory. We consider all economic variables, transactions and expectations as comparable, equivalent issues that equally contribute into construction of the economic theory. We omit all math and equations but refer for technical math clarification to our previous studies. Each particular, special theory could make its own choice, develop own hierarchy of few selected variables, transactions and expectations and describe consequences of their mutual interactions under selected approximation of the general theoretical frame.

Below we present our understanding and treatment of the necessity components of any theoretical description of real economic processes and assess a place of the economic policy as a mandatory component of the economic theory.

2. Principal scales of economic theory

Any theoretical model simplifies the real economic process. Modelling of any economic relations requires selection: what scales of the real processes would be described and what scales would be neglected, averaged, omitted. We consider two principal scales that determine usage and applicability of any economic theory – the time and "space" scales. At first we discuss the time scales and then explain the meaning of the "space" scales.

Time scales are principal factors that identify any economic or financial model. Irregular or random appearance of the economic, financial, market processes presented by their time-series and numerous factors that randomly disturb them imply that any reasonable model should operate with smoothed or averaged variables and parameters. This leads to usage of at least two time scales: the internal scale Δ and the external scale T. Time scale Δ determines that all variables and properties of the model use time axis with min division equals Δ. In other words – all model variables are smoothed or averaged during interval Δ. Such

approximation establishes bounds on the applicability of the model and it can be used on time terms less then external scale T only. In simple words – the external scale T determine time term on which model variables averaged or smoothed during the internal scale Δ become so irregular or random due to action of various disturbing factors that assumptions used by the model and the model predictions becomes unclear on time-terms more then T.

We consider "space" scales as the second significant and mandatory issue of any economic theory. Any macroeconomic description should start with some initial representation of economy as a whole. As so we consider the system of numerous economic agents those perform various mutual economic and financial transactions. Agent-based models (ABM) are developed for decades (Poggio et.al., 1999; Tesfatsion and Judd, 2006; Ross, 2007; Hommes and LeBaron, 2018). ABM mostly study decision-making (Zhang and Zhang, 2007), game-theories (Shubik, 2011) and even application of kinetic models to economics (Loy and Tosin, 2021). We consider agents as simple units of the economic system those have a lot of economic and financial variables. Agents have expectations those conduct their numerous economic and financial transactions with other agents. Aggregations of agent's economic or financial variables determine macro variables. Any macroeconomic variable has roots in agent's variables. We consider description of agent's variables as a ground for modelling macroeconomic variables. Description of variables of separate agent is almost impossible. To simplify the problem one should collect certain group of agents and describe evolution of the group's variables. That brings a challenge of distribution of economic agents by some parameters that can describe the groups of agents. There are known different distributions of economic agents: by industries (Leontief, 1955; 1973), by geography (Asada and Ishikawa, 2007), by wealth (Hubmer et.al, 2016) and etc. We describe economy, economic agents and their collective variables, transactions and expectations using distribution of agents by their continuous numeric risk grades (Olkhov, 2016a-2020a). Very briefly: we replace letter-based risk grades used by leading rating agencies Fitch (2018), Moody's (2018), S&P (2014) by numeric grades proposed decades ago (Duran, 1941; Myers and Forgy, 1963) and move from discrete to continuous risk grades. We assume that transition from letter-grades to numeric continuous grades is the problem of the unified methodology and business regulation, but not the economic problem. Taking into account that notations of the risk grades are voluntary, we propose that values of numeric continuous risk grades of the single risk (for example - credit risk) fill the unit interval [0,1] and note it as the economic domain. We consider risks as irremovable factors generated by the economic activity of agents and many other reasons – market, technological, political climatic, and etc. Any evolution of the economy is performed

under action of $n=1,2,3,..$ most significant risks. Evolution of the economic agents, their economic and financial variables and evolution of the economy as a whole under action of n risks can be described in the economic domain - the unit cube $[0,1]^n$ of R^n (Olkhov, 2016a-2020a). Description of separate agents is almost impossible and one should smooth or average variables to derive reasonable regular models of the real economic and financial processes. To do that one should collect agents with risk grades – risk coordinates, inside a small volume dV of the economic domain and consider the collective economic variables of such a group of agents. If the volume dV equals the economic domain then the collective variables of agents inside the economic domain (the unit cube in R^n) define macroeconomic variables of the entire economy. For example, sum of the investment of all agents (without duplication) defines macroeconomic investment. Collective variables of agents aggregated in the volume dV inside the economic domain define collective variables smoothed or averaged by this volume. The choice of the small volume dV is determined by the "space" scale l, $0 < l \leq 1$. The small volume $dV \sim l^n$ in n-dimensional economic domain determines the level of agent's aggregation and defines the approximation of the economic model. Aggregation or averaging of agents in the small volume dV during the time scale Δ allows smooth or average collective variables in time and develop regular evolution model of variables of the group of agents. Agent's risk ratings change in time due to agent's economic activity or other factors. Change of agent's numeric continuous risk grades or risk coordinates in the economic domain is described as agent's motion with some velocity. Being in motion in the economic domain, agents carry their economic and financial variables and that is described as collective flows of economic variables and causes evolution of the collective economic variables. We derive equations that describe evolution of collective economic variables and their flows in the economic domain and call this approximation as the economic continuous media approximation (Olkhov, 2016a-2020a).

Two major scales – time scale Δ and "space" scale l: $l^n \sim dV$ define the rate of the smoothing, rate of averaging of the economic variables and parameters and indicate the rate of the economic approximation. The sequence of averaging time scales $\Delta_1 < \Delta_2 <..$ and the sequence of the "space" scales $0<l_1<l_2<..\leq 1$ define the sequence of the economic models that describe economy in different approximations. Enlargement of time scale Δ decrease accuracy of the model but can increase the external time scale T – the horizon of predictions.

3. Three dimensions of the economic theory

The choice of the "space" scale l: $l^n \sim dV$ aggregates agents with risk coordinates near point $\boldsymbol{x}$ of the economic domain inside small volume dV and defines collective economic and financial variables of this group. The time scale Δ permits smooth or average group's variables during the time interval Δ. If the "space" scale $l=1$ one obtains macroeconomic and financial variables smoothed or averaged during the time scale Δ. That theoretical frame permits describe evolution of collective variables in the economic domain (Olkhov, 2016a; 2016b; 2017a; 2017c; 2019c).

Economic variables

Collective economic variables determined by the "space" scale $l<1$ or macroeconomic variables determined by the "space" scale $l=1$ describe the conventional picture of the economic state and evolution. We refer Blaug (1985) who collected major economic models and concepts those describe interaction between macroeconomic variables averaged during some time Δ as a main goal of the economic theory. Thus it is reasonable denote the macroeconomic variables as the ***first dimension***, first principal component of the economic theory. Definitions, measurements, modelling and predictions of the collective economic variables establish the principal part of the modern economic theories.

However, macroeconomic variables do not impact on or change *directly* other economic variables. For example, rise of macroeconomic consumption doesn't change *directly* investment, but increase or decline economic and financial activity of agents. Rise of consumption *directly* impact agent's expectations those conduct agent's transactions and agent's transactions *directly* impact evolution of macro variables. As we discussed above, any macro variables are composed as sums (without doubling) of agent's variables. The only tool that *directly* change agent's variables – economic or financial transactions between agents. Only agent's transactions change the amount of commodities those belong to agents. Only agent's trades change the price of agent's assets, even if that particular agent wasn't involved into any transactions. Only agent's transactions implement agent's economic activity. Exactly only economic and financial transactions change agent's variables and hence change of macroeconomic variables. Leontief (1955; 1973) was one of the first who start study collective transactions between the industries as a major factor that describes economic evolution.

Economic transactions

Description of separate transactions between agents is as difficult as description of numerous variables of separate agents. To describe macroeconomic impact of various agent's transactions and market trades we use the approximation similar to one that describes agent's collective variables. The choice of "space" scale l: $l^n \sim dV$, allows collect agents involved into transactions with risk grades inside dV near risk points $\boldsymbol{x}$ and $\boldsymbol{y}$ in the economic domain. That determines collective transactions between points $\boldsymbol{x}$ and $\boldsymbol{y}$. The time scale Δ allows smooth or average collective transactions between agents at risk points $\boldsymbol{x}$ and $\boldsymbol{y}$ in time. Such approximation gives macroeconomic description that has certain parallels to Leontief's (1955; 1973) model. However, to describe impact of collective transactions we substitute Leontief's cross-section of the world economy by industries, by another cross-section of the economy determined by risk grades or risk coordinates in the economic domain. We derive equations that describe dynamics of agent's collective transactions and their flows averaged during time scale Δ using similar economic continuous media approximation (Olkhov, 2017b; 2018a; 2019b; 2019c; 2020a).

The fact that agent's economic and financial transactions and trades are the only factors that *directly* change agent's variables and hence result evolution of the macroeconomic variables allows note the market trades and transactions as the ***second dimension***, second principal component of the economic theory.

Economic expectations

Economic expectations compose the ***third dimension***, the third principal component of the economic theory. Indeed, agents take trade decisions and perform economic and financial transactions under their personal *expectations* (Muth, 1961; Lucas, 1972; Sargent and Wallace, 1976; Manski, 2017; Farmer, 2019). Agent's expectations configure agent's trade decisions, determine evolution of agent's variables and hence impact change of macroeconomic variables. Largely, agent's expectations are formed by state and predictions of macroeconomic variables on one hand and by state and forecasting of collective trades on the other hand. Agent's expectations conduct agent's transactions and thus their aggregation and averaging should be evaluated for each type of collective transaction under consideration. Distribution of the agents by their risk grades – risk coordinates, and aggregation of the agents inside $dV \sim l^n$ near point $\boldsymbol{x}$ of the economic domain allows determine collective expectations of agents inside that domain with respect to each particular type of collective transactions. Each type of collective transactions determines its own values of collective agent's expectations. Averaging of collective expectations at point $\boldsymbol{x}$ during time scale Δ with respect to particular type of collective market transaction permit derive equations that

describe evolution of collective expectations and their flows in a way similar to evolution of collective economic variables and collective transactions in the economic continuous media approximation (Olkhov, 2018b; 2019b; 2019c; 2021d). The unified approach to description of the collective economic variables, market transactions and expectations in the economic domain as functions of risk coordinates introduces the sequence of approximations determined by "space" scales l, $0 < l \leq 1$, $l^n \sim dV$ that define rate of agent's aggregation by their risk grades in the economic domain and by time scales Δ that define the scales of smoothing or averaging by time. The time scale Δ determines the min division of the time axis of the particular economic approximation.

The trinity – collective economic variables, transactions and expectations for each selected pair of "space" and time scales (l, Δ) determines the theoretical problem of exceptional complexity that takes into account different series of economic variables, transactions and expectations under different assumptions on their mutual interactions.

However, the economic theory's story is far from completion.

4. Economic policy – the forth dimension

It is evident that any social processes and economy, in particular, are implemented under numerous restrictions, regulations, laws, legislations, rules and generally accepted habits. Codes of legislations, cultural, religious and etc. regulations establish the economic legislative environment that impacts agent's expectations and through them influences evolution of agent's transactions and economic variables. Any given economic environment impacts agent's economic activity, causes change of agent's risk grades and that generates collective motions of agents in the economic domain. Consequences of such collective risk motion of agents in the economic domain appear in slow fluctuations of different significant macroeconomic variables as macroeconomic credits and investment, supply and demand, production output and consumption and etc. (Olkhov, 2017c; 2018a; 2019a; 2019c; 2020a). These fluctuations are known and observed as business cycles and can lead to financial crisis, decline of GDP, falling income and etc. It is reasonable that economic and financial authorities, Central Banks, government and politicos are engaged into corrections, improvements, development and reconstructions of the economic legislative environment with goodness hopes, desires and intentions to "improve" economic outcome. Such "corrections" of the current economic and financial legislation are known as economic policy, monetary policy, fiscal policy and etc. Change, disruption, improvements of the economic legislation takes form of various policy tools and actions (Douglas, 1946;

Blanchard, 1980; Benigno et.al., 2012; Blinder, 2019; Hamilton, 2019; Dou et.al., 2020; Blinder, 2021; Bianchi et.al., 2022).

For our study it is important to underline that any tools, methods and actions of various branches of the economic policy *directly* impact agent's expectations only. Agent's expectations are formed on and are determined by current economic legislative environment. Any political and regulation novelties that change future taxes, returns, wages and etc., result in change and small or high perturbations of agent's expectations. Perturbations of expectations result in perturbations of trade decisions, variations of collective transaction and projected in disturbances of collective economic and financial variables.

It should be recognized that the economic policy and economic legislative environment are responsible for collective agent's expectation that determine collective transactions and through them establish the state and trends of macroeconomic variables. Hence we assume that the economic environment and economic policy should be recognized as ***the forth dimension*** of the economic theory.

Ensemble of the ***four dimensions*** – collective variables, transactions, expectations and the economic policy that change the economic legislative environment establishes the min set of components that compose the self-consistent economic theory in the approximation determined by the given choice of the "space" and time scales *(l, Δ)*. This implies that economic policy should be different for different economic approximations determined by different scales *(l, Δ)*. Hence, economic policy proposed by politicos with "next election" time horizon requires ground in economic theories approximations based on short time scales *Δ* with relatively small application interval *T*. That doesn't serve long-term economic stability and implies necessity for repeated policy interventions to reduce emerging economic perturbations. Short-horizon politicos often perturb economic development.

Our approach to the economic theory explains why and how the same decisions of the economic policy result different collective expectations of agents aggregated near different points of the risk economic domain and cause different economic response. Macroeconomics in various phases of the business cycles determined by different mean collective risks related to particular economic variable or particular type of market trade responses in a different manner to the same tools and decisions of the economic policy. Indirect confirmation can be found in (Blinder, 2004; 2019).

Mutual relations and interdependence of ***four dimensions*** of the economic theory violate universal KISS principle (Keep it simple, stupid) (Blinder, 2019). However the above

theoretical frame of the ***four dimensions*** of the economic theory is only the preliminary introduction into the complexity of the real economy modelling.

5. Economic policy - permanent source of economic perturbations

Economic legislative environment and economic policy, as the only measure that changes the economic environment, are irremovable sources of the economic perturbations. Discrete character of legislative, monetary, fiscal, budget commitments and time-terms (tax payment terms, budget terms, bank reporting terms, credit obligations terms and etc.) result in perturbations of agent's expectations. Distributions of agents by risk grades as coordinates in the economic domain cause different response of the collective expectations over the economic domain. The amplitudes of disturbed agent's expectations depend on the phases of the business cycles and on the agent's place inside the collective economic flows generated by the business cycles in the economic domain.

Perturbations of expectations generated by the relatively stationary economic legislative environment are complemented by disturbances arising by the regularly changed measures of the economic policy. Monetary and fiscal, budget and labor, export and exchange rate policy measures and innovations multiply perturbations of agent's expectations. Same economic policy measures implemented in different phases of the business cycles produces different impact on agent's expectations.

Existing economic legislative environment supported by holy intentions of politicos to rule out sustainable economic development and prosperity play role of internal random amplifier of agent's expectations in almost unpredictable manner. Small waves of irregular perturbations of collective agent's expectations, transactions and variables can propagate inside the economic domain and along its borders and due to possible positive feedback and backward linkages can be magnified (Olkhov, 2017a; 2017b; 2018b; 2019c). This problem is complicated by the fact, that transition from expectations of separate agents to collective agent's expectations should be performed for each type of collective transactions. Different collective market transactions determine different collective expectations that conduct these transactions (Olkhov, 2018a; 2019b; 2019c; 2021d). Thus perturbations of agent's expectations induced by "static" economic legislative environment and "dynamic" economic policy decisions are projected into randomly disturbed market transactions and finally into penetration of the economic and financial variables. Positive feedback of relations that determine mutual impact of collective variables, transactions, expectations and their flows in

the economic domain can produce exponential magnification of initially small perturbations and finally result in "crisis" disbalance of macroeconomic performance.

Development of the economic theory of collective economic variables, transactions and expectations and their numerous flows in the unit cube of the economic domain under economic continuous media approximation uncovers existence of hidden waves of different nature. Economic waves can be generated by small perturbations of expectations and can propagate inside economic domain and along its borders. Magnifications of wave amplitudes may result in economic and financial crisis (Olkhov, 2017a; 2017b; 2018b; 2019c). Development of the economic policy measures should take into account possible generation, propagation and amplification of economic waves induced by implementation of the economic policy. Further investigation could develop more secure economic policy.

It is obvious, that the economic development is under numerous perturbations of different nature. Agent's economic activity, technological, climatic, political and other factors, and even solar bursts can disturb economic evolution. We just underline that the economic policy and economic environment contribute to permanent perturbations of economic development.

Behavioral models and econometric measurements that assess impact and perturbations of agent's expectations as result of "static" economic legislative environment and "dynamic" economic policy decisions carry a lot of uncertainty. That uncertainty is multiplied by implementation of agent's expectations into performance of market transactions and further into the state of numerous macrovariables. Uncertainty or volatility plays significant role in description of asset pricing, financial markets, economic evolution and economic policy outcomes. It should be recognized that theoretical description of the economic uncertainty adds a lot of additional "headache" to the economic theory and economic policy.

6. Uncertainty and the Second-Order Economic Theory

Uncertainty is an irremovable property of any economic processes, economic theory and economic policy. However, uncertainty is a measurable property and current theories partially seek modelling uncertainty related with economics, financial markets and assets pricing (Diamond and Rothschild, 1978; BIS, 1996; Engle, 2003; Justiniano and Primiceri, 2008; Fernandez-Villaverde at.al, 2011; Hansen, 2013; Hansen and Sargent, 2017).

We assume that economic uncertainty expressed by the volatility is the problem that requires development of the separate additional stage of the economic theory. Most studies of uncertainty relate to the volatility of financial markets, price and returns volatility (Diamond and Rothschild, 1978; BIS, 1996; Engle, 2003; Fernandez-Villaverde et.al., 2011; Hansen,

2013; Cortes and Weidenmier, 2017; Lochstoer and Muir, 2020). In turn, the asset price volatility defines ground for the option pricing (Hull and White, 1987; Britten-Jones and Neuberger, 2000; Dew-Becker et.al., 2019) and thus impact of the price volatility spreads over the financial markets. Actually, definition of the market price volatility is based on averaging during selected time interval Δ. Indeed, any market price data are presented by the time-series and averaging of the time-series during Δ delivers assessments of the mean price, price volatility and etc. Thus, we again return to the fact that the choice of the time scales Δ determines approximation of the price volatility, as well as volatility of any economic variables. Any modeling and forecasting of the volatility based upon implicit or explicit selection of averaging times scales. However, the asset price volatility, price autocorrelation as well as price statistical moments and price probability as a whole cannot be considered independently from the random properties of financial markets. For any given time averaging scale Δ the price statistical moments, the market price volatility and price autocorrelation, are completely determined by the statistical moments of the market trade value and trade volume averaged during the time scale Δ (Olkhov, 2020b-2021c; 2022a-b). The mean price, price volatility, price autocorrelation, the market price probability as well as the random properties of returns are completely determined by the random properties of financial market trades. As we discussed above, the market transactions, as ***the second dimension*** of the economic theory, are the only tool that determine evolution of ***the first dimension*** - macroeconomic variables. Origin of the stochasticity of the market transactions is hidden, among other things, by the randomness of ***the third dimension*** - agent's expectations, which in turn are under unforeseen influence of ***the forth dimension*** – quite accidental economic policy and "stationary" economic environment. That random economic can of worms or Pandora's market box leads us to recognizing that numerous conventional economic theories (Blaug, 1985) are only a tip of the economic theory iceberg.

The problem is remarkably clear but extremely arduous. Indeed, conventional economic theories (Blaug, 1985) describe relations between mean economic variables or variables determined by sums of agent's economic properties of the first-degree. Macro investment, demand, production are determined by aggregation of agent's first-degree investment, demand, production (Fox et.al., 2017). Only macro finance theories attempt model asset price and economic fluctuations (Cochrane, 2017). However, theoretical description of the economic volatility requires introduction of the set of variables like existing but determined by sums of ***squares*** of agent's variables in contrast to sum of agent's first-degree variables that define conventional set of macrovariables. Remember, that volatility is determined as

difference between mean squares and squares of mean. For example, to assess uncertainty or volatility of macroeconomic investment (mean investment) determined by sum over entire economy of agent's investment (without doubling) during time scale Δ, one should complement it by macro 2-investment, determined by sum over entire economy of agent's ***squares*** of investment (*mean square investment*). The same second-order twins-variables should be introduced for all three conventional ***dimensions*** of the economic theory - macroeconomic variables, transactions and expectations (Olkhov, 2021d; 2021e). The ***forth dimension*** – the economic policy, impacts the second-order variables in a manner, completely different from action of conventional first-order economic variables, transactions and expectations. Those, who desire model Skewness of the market asset price should know that it would require the third-order economic theory and assessment of parameters determined by sums of the third degree of agent's variables. Description of the Kurtosis of the market asset price requires the forth-order economic theory and so on (Olkhov, 2021d; 2021e). Economic policy and its branches as monetary, fiscal, labor, financial and etc. are determined by and are impact at first, second and etc. orders of the economic theories in a different manner and their mutual dependence take relatively complex form.

Development of the ***4-dimentional*** economic theories of the first order that could clarify our knowledge about trends and relations between first-degree economic properties – variables, transactions and expectations and construction of the second-order economic theory that would resolve the uncertainty puzzle of the first-order theory may take some time. We are sure that it will be time of interesting studies.

7. Conclusion

Our considerations of the required theoretical frame, components and scales of the economic theory respond the question – What issues should compose the economic theory?, but do not explain – How it can be done? It is clear that the step-by-step approximations are required to establish reasonable ***4-dimensional*** economic theory of the first order. Successive approximations that take into account one or two dimensions of the economic theory and consider mutual relations between few selected economic variables, transaction and expectations with the background of small pieces of economic environment and economic policy can step-by-step fill the puzzle of theoretical description of the real economy. Uncertainty of the economic policy measures as well as uncertainty of the econometric data, financial markets and economic forecasting requires development of the second-order economic theory. Successive approximations of the first and the second order economic

theories for different "space" and time scales *(l, Δ)* will present sequence of the theoretical economic estimations that complement each previous model. This program could not match KISS principle (Blinder, 2019) but may lead to development of the reasonable economic policy that will be the constitutive component of the economic theory.

Development of any economic theory requires the economic legislative environment: codes of rules, regulations, legislations and etc., those govern agent's economic relations, transactions and conduct expectations. Economic policy and its branches as monetary and fiscal, budget and exchange rates, economic and financial regulations and etc., are the only measures that change current economic legislative environment and *directly* impact agent's expectations and through them market trades. Some monetary and fiscal measures can *directly* change the states of the markets and amount of the available resources but also impact agent's expectations. Any implementations of the economic policy are hand-made tools that change agent's expectations and thus change the economic theory regarding the model of mutual dependence between three dimensions – economic variables, transactions and expectations. Anyway, economic theory cannot be developed without the economic legislative environment and permanent variations of the economic environment impact economic evolution. On the other hand, it is impossible design economic policy without observing and forecasting economic trends. One should remember, that the economic theory approximations determined by different time averaging scales *Δ* generate different economic policy measures required for "improving" the economic outcome at different time horizons. Economic forecasting could not be implemented without taking into account perturbations of economic legislative environment imposed by economic policy measures. Thus the ***three dimensions*** of the economic theory – economic variables, transactions and expectations should be complemented by the ***forth dimension*** – economic policy.

Any economic policy cannot eliminate business cycles as collective risk motion of agents in the economic domain (Olkhov, 2017c; 2019a; 2020a). We consider that risk taking and risk generating as the internal irremovable feature of economic relations between humans. Development of human society will permanently arise new problems to be solved and described by the economic theory. We point out the direction for theoretical investigation of the economy but this remarkable activity has no final result.

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