Development of Modern Macroeconomics: An Expository Note*

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Introduction

The speed of the nominal price adjustment is often used as an important factor when macroeconomic models are classified. That is, mainstream macroeconomists claim that Keynesian models describe an economy with fixed prices, while neoclassical models analyze one with flexible prices. Among several representative textbooks of introductory macroeconomics, this paradigm has been very popular and influential.

Macroeconomists, however, do not necessarily agree that the speed of the nominal price adjustment is the most important dimension of macroeconomic models. Even among modern Keynesians, they have a very different attitude towards modeling price rigidities. Ball and Mankiw[1] take a traditional Keynesian stance where nominal rigidities are the most essential part of macroeconomics. Howitt[2], on the other hand, argues that traditional Keynesians make a fundamental mistake in that they stick to price rigidities. *Lectures on Macroeconomics* by Blanchard and Fischer[3], which is one of the most influential textbook of advanced macroeconomics, includes as Keynesian models not only models with nominal rigidities, but also other classes of models. Their disagreement suggests that whether nominal prices are rigid or flexible may not always be the most crucial criterion in classifying macroeconomic models.

When microeconomic foundations, in particular the rational expectations hypothesis, were introduced into macroeconomics by new classicals in the 1970's, the nominal price adjustment was still an important issue for both new classicals and new Keynesians. The former argued that fixed prices were inconsistent with microeconomic rationality, while the latter sought some models in which nominal rigidities coexisted with rational expectations. One thing to be noticed here is that even

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1) "A Sticky-Price Manifesto," 1994, NBER Working Paper, No. 4677.

2) *The Keynesian Recovery and Other Essays*, 1990, New York: Philip Allan.

3) *Lectures on Macroeconomics*, 1989, Cambridge: The MIT Press.

new classicals often used the traditional IS-LM framework as a reference model during the 1970's.

Several new dimensions other than price rigidities, however, have been emphasized since a basic macroeconomic model was switched from the IS-LM framework to neoclassical growth models in the 1980's. As shown later, neoclassical growth models substantially differ from the IS-LM approach in every implication. Since nominal rigidities cannot be an issue within real analyses such as neoclassical growth models, a dramatic conflict between these two frameworks should arise because of something other than price rigidities or flexibility.

This note discusses which economic factors lead to such dramatic differences. In particular, we stress two important dimensions by which macroeconomic models can be classified. The first dimension is whether models are *history-dependent* or *future-dependent*. Here, we call an economy history-dependent when the current economic state is crucially influenced by historical courses. Conversely, an economy is called future-dependent when the current economy reflects the future path of economy. Initially, macroeconomists thought that the difference between history-dependency and future-dependency just reflected whether agents were myopic or rational. More recently, however, they have recognized that there are deeper factors behind that dissimilarity; they have found that market frictions and externality (non-price interaction) make macroeconomic models history-dependent even under the rational expectations hypothesis.

The second is whether models can be described by a *representative agent* or by *heterogeneous agents*. This point is critically related to how macroeconomic theories characterize an aggregate economy. One typical starting point is to simply assume as if there were a single agent. The issue here is when we can adopt this extreme assumption, while there are seemingly different agents such as a government, different firms, and heterogeneous consumers in a decentralized economy. As shown later, the plausibility of the representative agent framework presumes that markets function fully. When markets do not work very well or economic agents interact with each other bypassing markets, the representative framework breaks down immediately and alternative models are called for.

This expository note first compares the IS-LM framework with neoclassical growth models. Then, it argues that the conflict between these two frameworks raises important issues within macroeconomics. This note concludes by discussing how these new issues have been approached by alternative macroeconomic models.

II IS-LM Framework

The IS-LM model with the mechanism of the nominal price adjustment is able to describe goods markets, money markets, bonds markets, and labor markets in a very systematic way. Within this framework, assuming fixed prices initially, the model finds an equilibrium where goods markets, bonds market, and money markets are cleared simultaneously. The output level at this equilibrium is called the aggre-

gate demand. On the other hand, the model defines the output level at which labor markets are cleared as the potential output or the full-employment output.

The most important feature of this model is that the aggregate demand is not necessarily equal to the potential output. When the aggregate demand is below the potential output, there is unemployment in labor markets. The basic reason for this disequilibrium at labor markets is obviously attributed to the rigidity of nominal prices and money wages. Since real wages cannot be adjusted to the equilibrium level instantaneously, labor markets may have excess supply or demand temporarily. Until labor markets recover an equilibrium, an economy experiences the slow adjustment of both nominal prices and money wages.

history-dependency. In addition to nominal rigidities, this model possess several important features. First, the standard version of the IS-LM model is history-dependent. Under the price adjustment mechanism, the current level of nominal prices is determined by the past (typically, one-period before) condition of labor markets. Furthermore, the current nominal price determines the present condition of labor markets. Since this process repeats itself, the current labor market will determine the future level of nominal prices. In other words, the present influenced by the past will influence the future. This process is typically history-dependent.

The above history-dependency can be observed not only in the price adjustment, but also in the determination mechanism of expenditures such as consumption and investment. In the standard Keynesian model, the current consumption is a function of the present and past disposable income, while the aggregate investment is influenced by both the current interest and cash positions. According to microeconomic theories, the expected future income, the future profitability, and other expected variables may potentially influence both the aggregate consumption and investment. Nevertheless, the standard IS-LM framework is very silent about the possibility that the future determines the present.

heterogeneous agents. Another feature is that different agents interact with each other; consumers, firms, and a government including a central bank play within the IS-LM framework. The behavior equation is specified separately for different types of agents. The important consequence of their interaction is the multiplier effect. An initial increase in an expenditure of one sector has multiplied effects on the aggregate demand. For example, a reduction in income taxes on households implemented by a government can lead to an increase in aggregate demand through the multiplier effect.

liquidity. In addition, the IS-LM framework characterizes the structure of assets markets very uniquely. First, the model implicitly assumes the separation between flow variables and stock variables in terms of decision making. That is, the decision of savings (a flow variable) is independent of the allocation (portfolio) of assets (stock variables). Second, the portfolio decision is made mainly between liquid assets (money) and illiquid assets (bonds). In this setup, bonds are held at the expense of losing liquidity. Consequently, nominal interest rates on bonds over

money (having zero nominal interest) can be interpreted as liquidity premia. As discussed later, the above characterization is very peculiar from a neoclassical point of view.

III Neoclassical Growth Model

Since around 1980, new classicals have adopted neoclassical growth models as their basic model. As shown below, neoclassical growth models have dramatically different implications relative to the IS-LM framework.

Neoclassical growth models assume that a representative consumer efficiently allocate resources from today (the present) to tomorrow (the future) subject to technological constraints. Then, applying the second welfare theorem[4], new classicals interpret the resulting efficient intertemporal allocation of consumption and the accumulation of physical capital as corresponding to the time-series of macroeconomic variables such as aggregate consumption and total capital. In other words, they interpret macroeconomic phenomena using the microeconomic notion of intertemporal efficiency. Since monetary assets never exist in this framework, neoclassical growth models concentrate on real effects on macroeconomy.

future-dependency. One of the most important features is that this model is future-dependent. When this model is solved mathematically, problem-solvers first find a goal (a steady state) to which an economy is going; then, they reach the present economy step by step backward from a steady state. During this backward process, they carefully pay attention to whether the condition of intertemporal efficiency is satisfied. Given this solution method, once something affects a steady state, the current level of consumption and investment immediately reflects a change in a steady state. For example, if real shocks (technological innovations) permanently affects technological opportunities, then a steady state immediately moves in a certain direction. Consequently, the present consumption and investment change.

Furthermore, the standard version of neoclassical growth models usually has a single steady state, and the path from the present economy to the steady state is uniquely determined. Accordingly, there is no room for a representative agent to choose one among alternative paths towards a steady state. If an economy moves away from a uniquely determined path, microeconomic rationality is violated. Conversely speaking, rational agents never choose paths other than a single path determined by neoclassical growth models.

Both consumption and investment are also future-dependent. The current consumption level depends on the discounted value of the expected future income (or the permanent income). Investment is, on the other hand, determined based on the comparison between profitability (measured by the discounted value of the future profits) and cost of capital. When the ratio between these two factors, so-called

4) The second welfare theorem claims that one efficient allocation can be supported by a decentralized market allocation.

Tobin's q, is above (below) one, investment is triggered (withdrawn).

representative household. Another important feature is the assumption of a representative agent (household). In a neoclassical setup, firms represent only technological opportunities, and do not contain any organizational entities. In addition, firms are owned by a representative household through equity investment. Moreover, a government is just a shadow of a representative household because the budget constraint of a government can be taken into that of a rational representative agent. Given the above feature, both firms and a government are just fictitious entities in a neoclassical framework.

Reflecting that both firms and a government are subject to the decision of a representative household, neoclassical growth models generate some neutrality theorems with respect to the function of financial markets. According to the Modigliani-Miller theorem, for example, how a representative household determines investment through firms is completely independent of how firms finance investment. Here, the financial decision of firms is equivalent to spliting cash-flows among different financial payoffs. On the other hand, it is not a firm, but a representative household that determines investment which generates the future cash-flows.

Another version of neutrality is the Ricardian equivalence theorem which claims that an economy is neutral with respect to the financial decision of a government given a governmental expenditure plan. That is, a macroeconomic performance does not depend at all on whether a government finances a given expenditure through taxes or bonds. The reason for this is very simple. From a household's point of view, issuing government bonds simply implies repaying them by future taxes; therefore, bond issues and current taxes differ only in terms of the timing of taxing.

risk and return. Finally, let us take a look at the determination mechanism of interest rates. In a neoclassical framework, returns on assets depend on two factors, how investors are willing to sacrifice the current consumption for bond-holding and how they are willing to take risky payoffs. For example, if investors desire to consume now, only high interest makes them give up the current consumption. If investors are unwilling to take fluctuating returns, only high expected returns may convince them of holding risky assets.

One thing to be noticed here is that there is no room for interest to reflect liquidity premia. In this setup, assets are never priced according to degrees of liquidities. For example, why there is no demand for a particular risky asset is not because it is hard to trade in financial markets, but because its expected return is too low for the riskiness of this asset.

IV Conflicts between Two Approaches

As shown so far, the IS-LM framework contrasts with neoclassical growth models in every respect. The former is history-dependent, while the latter is future-dependent. The former has the interaction among firms, consumers, and a govern-

ment, whereas firms and a government are subject to a representative household in the latter. The two models treat with liquidity premia very differently. Such conflicts are not easy to overcome even if the nominal price adjustment is shelved for the moment.

Initially, macroeconomists thought that the Keynesian phenomena might reflect irrational or myopic behavior of agents. This judgement was based mainly on methodological differences between these two approaches. They conjectured that Keynesian features were due to the absence of rational agents within the IS-LM model. This initial response unfortunately led to unnecessary ideological conflicts between Keynesians and new classicals; Keynesians claimed that rationality was a bad starting point for describing human behavior, whereas new classicals argued that rationality was a good assumption. This kind of debate, however, can never be productive or fruitful, since rationality itself is just one assumption, not any observable consequence; the choice of models should be based on testable predictions derived from basic assumptions.

What frustrated macroeconomists more was that many empirical predictions available from neoclassical growth models were rejected strongly by data. For example, the Ricardian equivalence and the Modigliani and Miller theorem were not supported empirically, and the permanent income hypothesis and the q theory were often rejected strongly. Furthermore, the intertemporal efficiency was rejected frequently. If those rejections were interpreted as the consequence of irrationality, arguments would go nowhere again.

Fortunately, macroeconomists quickly moved away from such unfruitful and naive debates on rationality, and have made tremendous efforts to provide better models within the rational agent framework. Many alternative models pay serious attention to modifying simple, maybe too simple, assumptions of neoclassical growth models.

V Imperfect Financial Markets and History-Dependency

Whether one model is future-dependent or history-dependent depends crucially on how financial markets function. Why the present consumption is determined by the permanent income is that consumers can borrow money against the future income. Why investment is a function of Tobin's q is that firms can make financial contracts in which they promise to pay payoffs such as interest and dividends from future profits. Thanks to well-functioning financial markets, thus, the current economy reflects the future economy.

What if financial markets do not work very well? For example, when a consumer fails in convincing a lender of the reliability of his future income, a lender may be very reluctant to provide a consumer with money. Similarly, if there is a possibility that a firm will cheat outside lenders by misrepresenting profits, lenders may not contract with such a firm, or may lend money only when a firm owns collateral assets. In these cases where financial markets refuse to provide money, con-

sumption and investment may be determined by cash at hand (cash-flows, income, or deposits).

When financial markets do not function well, the linkage between the future and the past may break down. One interpretation of the Keynesian consumption and investment functions is that these functions are contingent on the failure of financial markets.

VI Market Incompleteness and Heterogeneity

Let us next think when a representative agent framework is appropriate. Roughly speaking, we need two basic assumptions for a representative agent model to work properly. The first assumption is that both financial and insurance markets work very well, whereas the second is that agents interact only through existing markets. This section discusses the first assumption, while the next section comments on the second.

Suppose that financial and insurance markets work very well. When all consumers have access to well-functioning financial markets, they face almost identical investment opportunities. Consequently, consumers construct very similar portfolios. On the other hand, well-behaved insurance markets successfully pool person-specific shocks, and consumers do not have to expose themselves to those idiosyncratic shocks.

Under the above condition, it is easy to imagine that consumption profiles are similar to each other among consumers partly because there is no idiosyncratic components in the individual consumption thanks to insurance effects, and partly because identical or similar investment opportunities generate very similar investment outcomes.

When individual consumption profiles are very similar, there is a parallel relationship between the aggregate and individual consumption. In this case, looking at the aggregate consumption is almost identical to looking at the individual consumption. Consequently, a representative agent model based on only aggregate behavior may not be so misleading.

As shown above, whether a representative agent model is appropriate depends on whether financial and insurance markets work very well. Conversely speaking, when financial or insurance markets are incomplete, it is necessary to construct macroeconomic models using not only aggregate variables, but also wealth or income distribution from which individual behavior is inferred.

There are many instances where a macroeconomic performance is subject to distribution effects. For example, suppose that education loans are available only for middle-income and rich classes. If income are distributed equally among consumers, many people have access to education. At aggregate levels, human capital may be accumulated quickly, thereby raising aggregate outputs. Conversely, if income distribution is skewed upward, many consumers are ruled out from education opportunities; consequently, a macroeconomic performance may be deteriorated.

VII Non-price Interaction

What if agents interact with each other through externality or bypassing existing markets? Such a case often generates the equilibria which are very different from those of neoclassical growth models. One typical example of externality is network externality. Take electric mail for example. The more people are on electric mail, the larger benefit they can get from using electric mail. The effect of the number of e-mail users on individual benefits arises outside markets. An exchange network with money as a medium of exchange has similar network externality as well. Money used for a particular transaction may circulate within a network, thereby enhancing other trading opportunities.

Labor markets are also subject to such network externality. Suppose that a labor market is not a centralized market, instead it consists of search activities between workers and firms. When firms are very active in recruiting, workers may expect that they are more likely to find suitable jobs; it may give workers an additional incentive to search jobs. In this case, firms' recruiting activities directly affects workers' search activities bypassing markets.

Models with network externality often generate multiple steady states. Taking search activities for example, there may be two steady states, an equilibrium with high employment where both firms and workers search actively and one with low employment where both are inactive. In this case, not only steady states, but also paths toward each steady state may be multiple or often infinite (continuum equilibria). One serious difficulty with the above multiplicity is that a model cannot endogenously determine either which steady state will be attained or which path to a particular steady state is chosen. In other words, microeconomic rationality is helpless in choosing one among multiple equilibrium paths.

In the presence of multiplicity, thus, factors other than rationality may play an important role in the equilibrium selection. For example, a historical accident is one candidate; macroeconomists may interpret the current path as the consequence of a particular historical event. In this interpretation, the history-dependency is not inconsistent with the rational expectations hypothesis at all. Another example is a phycological factor. When both firms and workers are optimistic about the future economy, they may be active in search; consequently, an initial optimistic view may be fulfilled by their own behavior based on such optimistic expectations. As in this case, psychological factors (optimistic or pessimistic) may influence whether an economy reaches an equilibrium with high employment or one with low employment.

Naive decision rules and individual experiences also contribute to the choice of equilibria. According to evolutionary theories, better (more efficient) naive rules may be handed over from the present generation to the next generation. One particular equilibrium may be chosen through such an evolution of simple rules or strategies. The learning literature, on the other hand, suggests that individuals may revise their belief according to their experience and observation. Again, this learn-

ing process may lead an economy to a particular path.

In addition, multiplicity may give another interpretation to the Keynesian notion of nominal rigidities. It is known that, when strong externality is present in a transaction network, paths of nominal prices are often infinite given a process of money supply. In this case, fixing nominal prices may be interpreted as the selection mechanism of continuum equilibrium paths of nominal prices.

What should be emphasized here is that non-rational factors such as history, psychology, naive rules, learning, and nominal rigidities become economically important when microeconomic rationality is no longer almighty for the equilibrium selection. This model-building strategy is very different from the approach where rationality is ruled out from the beginning.

VIII Endogenous Growth Model

Since the late 1980's, an intrinsic criticism against neoclassical growth models has arisen among new classicals. This criticism is very important in the context of modern macroeconomics because it has resolved to a great extent the conflict between Keynesians and new classicals.

One obvious feature or drawback of neoclassical growth models is that an equilibrium path is influenced mainly by changes in production opportunities. Fluctuations in productivities lead to business cycles, while technological progress is an engine of economic growth. In particular, when an economy is in the neighborhood of a steady state, the current economy is influenced directly by a change in a steady state due to technological shocks.

Within the framework of neoclassical growth models, the condition of production opportunities is not determined endogenously, but given by data or exogenously specified production functions. In other words, exogenous conditions or data basically determine both business cycles and economic growth. In addition, neoclassical growth models often translate straightforward from exogenous technological shocks to endogenous variables; in other words, any endogenous (propagation) mechanism is weak or absent in neoclassical setups. Because of this feature, many macroeconomists including new classicals started to cast serious doubt on the legitimacy of neoclassical growth models as a model of business cycles or economic growth.

In particular, there is serious inconsistency between theories and observation when we take a look at a cross-country difference in economic growth. Suppose that technologies are quickly transmitted from one country to another, and that all countries consequently face identical production opportunities. According to neoclassical growth models, all countries should have the identical steady state, say in terms of per-capita output. In other words, per-capita outputs will eventually converge to the identical level across countries. The growth experience of developed and developing countries, however, rejects this convergence prediction very strongly. High income countries often grow faster than low income countries; accordingly, per-capita outputs tend to diverge rather than converging.

In response to the above inconsistency, new classicals present new growth theories, or so-called endogenous growth models. To endogenize growth mechanism, they include many elements discussed in Section 5, 6, and 7 (imperfect financial markets, heterogeneities, externality, and non-price interactions). These elements which often make macroeconomic models history-dependent are now used to reformulate neoclassical growth models. Using modified models, new classicals try to interpret a cross-country difference in economic growth as the consequence of a cross-country difference in historical experiences.

Once new classicals introduce the factors discussed in the preceding sections, predictions peculiar to neoclassical growth models may be weakened, and even disappear. As discussed before, on the other hand, predictions peculiar to the IS-LM framework may be reconcilable with microeconomic rationality. As a result, it is very hard to clearly differentiate neoclassical features from Keynesian features at this stage. In other words, the traditional distinction between Keynesians and new classicals (neoclassicals) may not be a relevant classification any more.

IX Conclusion[5)]

This expository note is summarized as follows: (1) there are several important dimensions other than nominal rigidities in characterizing modern macroeconomic models. (2) the difference between the standard Keynesian phenomena and the typical neoclassical phenomena reflects not a superficial distinction between irrationality and rationality, but deeper differences in market structures and non-price interactions. (3) in the presence of multiple equilibria, non-rational factors such as history, psychology, rules, learning, and nominal rigidities become economically important for the equilibrium selection. (4) the development of endogenous growth models enables us to analyze both Keynesian features and neoclassical features within the same framework.

5) The notion of liquidity also has been analyzed by new models, although there is a large room for theoretical research to go further. As discussed above, a liquidity premium is very different from an equity premium. The latter is a reward for giving up safe returns, while the former is a reward for loosing flexibility of portfolios; when a portfolio is switched from liquid assets to illiquid ones, an investor looses flexibility in rebalancing a portfolio in the future. In this sense, liquidity is very important when much uncertainty is yet resolved. Investors may hold liquid assets until uncertainty is resolved, and they will later switch to illiquid investments such as large-sized fixed investment when uncertainty is fixed.