

The Visual “Big Picture” of Intermediate Macroeconomics: A Pedagogical Tool to Teach Intermediate Macroeconomics

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Abstract

The primary purpose of this paper is to introduce a holistic, visual “big picture” of the concepts and diagrams that are commonly covered in the course of intermediate macroeconomics. Intermediate macroeconomics discusses numerous concepts and diagrams in order to finally show how aggregate supply (AS) and aggregate demand (AD) are derived in an economy. A further learning objective defined for the intermediate macroeconomics course is to enable students to investigate the overall effects of macroeconomic policies on AS and AD in the economy. In order to better attain the aforementioned learning objectives, the present paper proposes a visual “big picture” which can be applied as a pedagogical tool in teaching intermediate macroeconomics classes. This visual “big picture” logically connects twenty-seven macroeconomic diagrams which are usually introduced in the intermediate macroeconomics course, and also describes the general pattern and overall structure of macroeconomics in terms of four separate markets in a visual way, namely labor market, capital market, money market, and goods market. Finally, it is suggested that this visual “big picture” should be provided to the students taking the course of intermediate macroeconomics so that they can readily grasp the logical order of the concepts and the underlying complex structure of the markets that are discussed in the course.

Keywords: intermediate macroeconomics, neoclassical and keynesians IS/LM/AS/AD models, aggregate supply, aggregate demand

1. Introduction

Intermediate macroeconomics is a course that outlines how the general equilibrium in an economy is theoretically modeled at a macro level. Dealing with the general equilibrium in the sense of the equilibrium between aggregate supply (AS) and aggregate demand (AD) in the economy, intermediate macroeconomics involves a large number of diagrams that finally result in the derivation of AS/AD diagram. This numerousness of diagrams mandates macroeconomics instructors to devise an effective strategy to construct the complex structure of intermediate macroeconomics in learners’ minds. In addition to this, one of the primary learning objectives of the intermediate macroeconomics course is to enable students to examine the overall impacts of macroeconomic policies on AS and AD in the economy under different economic settings and environments. Achieving such a learning objective is almost impossible without providing students with a comprehensive visual “big picture” that clearly and graphically describes how macroeconomic variables and concepts are connected in the world of intermediate macroeconomics.

In her notable book entitled “Teaching at its Best”, Nilson (2010) states that “structure is so key to how people learn and has such far-reaching implications for teaching.” She also points out to the fact that “without structure there is no knowledge.” She believes ‘information’ is easily accessible everywhere nowadays. However, in her opinion, this is organized bodies of ‘knowledge’ that is not so available everywhere. Nelson tends to define ‘knowledge’ as a structured set of patterns that we have identified through observation over time. She indicates that “students are not stupid; they are simply novices in the discipline,” and as a consequence of this, they usually do not readily grasp the “big picture” of the patterns, generalizations, and abstractions that experts often recognize very clearly. She goes on to say that without such a “big picture”, students will encounter another learning hurdle in addition to their other obstacles that they may already have (Arocha & Patel, 1995; DeJoneg & Ferguson-Hessler, 1996). Indeed, the present paper is an attempt to help economics students not face such a

learning hurdle in the intermediate macroeconomics course.

According to Nilson (2010), the human mind processes, stores, and retrieves knowledge not as a collection of facts, but as a logically organized whole with interlinked components. Without having a structured framework of the material in their minds, students will not be able to comprehend and retain new material (Anderson, 1984; Brandsfor et al., 1999; Rhem, 1995; Svinicki, 2004). Nelson states that the clearest way to provide students with the “big picture” – which is indeed the entire organization of the course (or field) content - is in a graphic syllabus, and as she suggests, instructors should refer back to the visual “big picture” to clarify for students in what ways and where the topics being discussed fit into the mentioned “big picture” (Note 1). The present paper aims to enable intermediate macroeconomics instructors to easily provide their students with such a “big picture.”

In his paper entitled “Teaching economics and providing visual “big pictures”, Moosavian (2016b) has reviewed the existing literature on economics and visualization concluding that “it seems there is enormous potential with visualization to improve the quality of teaching and learning in economics, which has not yet been fully employed to resolve some of the issues with the teaching of economics.” He then goes on to say that the numerousness and diversity of concepts, variables, diagrams, and models that are discussed in economics can cause serious confusion for many economics students. He also adds that “furnishing students with a visual “big picture” that illustrates the ways through which those numerous, diverse concepts are connected to each other could be an effective solution to clear up the mentioned mental chaos.” Although Moosavian (2016b) brings up the visual “big picture” of macroeconomics as an example to show what he means by the term visual “big picture”, he does not elaborate on how the visual has been designed and what are the components of the visual. In fact, these points are supposed to be addressed in the present paper. In short, the present paper is essentially an attempt to help macroeconomics instructors and students teach and learn intermediate macroeconomics in a more effective manner by using the visual “big picture” that is to be elaborated throughout the paper.

Putting the definition of the term “big picture” here in accordance with that of Moosavian (2016b), the expression “big picture” can be defined as “a visual representation including a set of items concepts, models, and diagrams which are closely related and logically connected, illustrating how those elements are linked to each other, what types of relationships they have with each other, and in what their origins lie.”

Thus far, an introduction to the subject matter has been provided, in which the problem was identified, the purpose of study was stated, and the literature on the subject at hand was reviewed briefly. The organization of the remainder of the paper is such that in the main discussion section, the visual “big picture” of intermediate macroeconomics is introduced, and its main components - including the diagrams and the ways in which they are related to each other and their specifications and features - are explained in detail. Next, it will be demonstrated how the “big picture” can be divided into four separate markets. After that, the advantages of providing such a “big picture” are discussed on the basis of the related evidence and findings reported in the literature. Finally, a conclusion of the whole discussion will be made, and a few suggestions will be offered.

2. Main Discussion

Reviewing the literature on teaching in college and specifically teaching economics suggests that providing visual “big pictures” of the material being covered during college courses is still a common missing part in many traditional classes. Now, after reviewing the existing literature on the subject at hand, and identifying the problem, it is time to introduce and discuss the macroeconomics “big picture” in greater detail. This “big picture” is in fact an attempt to highlight all the relationships among related macroeconomic concepts and models. Some, but not all, of the concepts that are supposed to appear in this “big picture” are as follows: the income-leisure choice problem, labor market, aggregate production function, Solow-Swan model, money supply/demand functions, full employment line, user cost of capital model, desired capital stock, Keynesian cross, national saving and investment model, IS/LM diagram, AS/AD diagram, and the Philips curve. In Appendix 2, a full list of the diagrams introduced in the “big picture” of intermediate macroeconomics has been presented.

As shown in Figure 1, the macroeconomics “big picture” consists of six rows in total, each of which aims to describe some aspect of macroeconomics (Note 2). On the left side of the “big picture”, there is a column which includes several basic ideas and definitions corresponding to the concepts being introduced in each particular row. The general direction of transition in the “big picture” toward the derivation of AS/AD diagram is from left to right, meaning that each row starts with expressing a very basic idea upon which other concepts and diagrams in that particular row are based. These fundamental ideas in the first column on the left can be thought of as the first building blocks of their corresponding rows. The general pattern of this “big picture” is such that one can easily be navigated from very fundamental ideas in macroeconomics on the left toward AS/AD diagram on the

right hand side of the “big picture”. That way, one can clearly and readily observe how apparently separate concepts and diagrams in intermediate macroeconomics are logically connected to one another in an orderly fashion toward the derivation of AS/AD diagram.

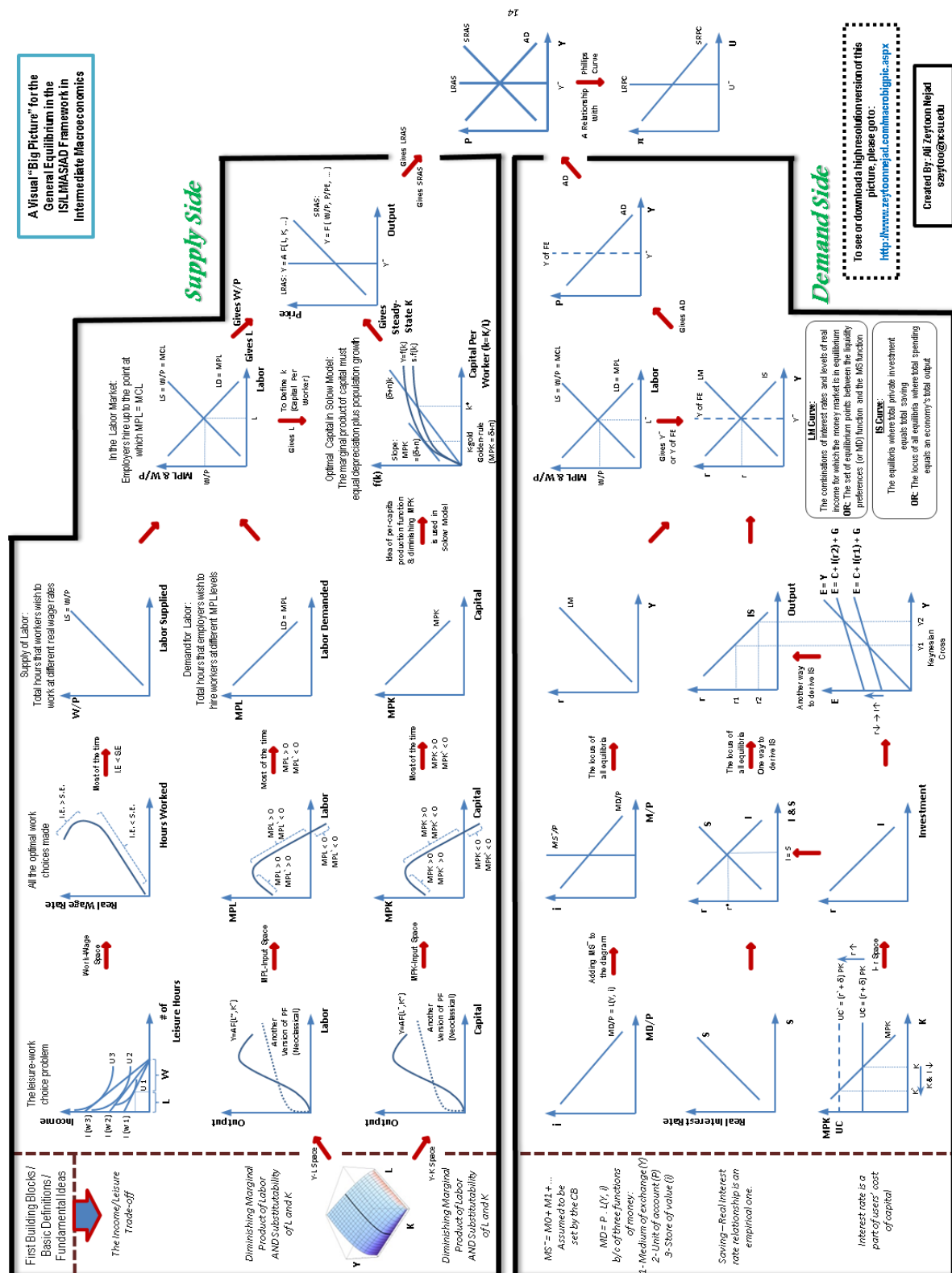


Figure 1. The visual “big picture” of intermediate macroeconomics

The pairwise relationships illustrated in the macroeconomics “big picture” are indeed of three types. The first type, called “derivative relationship” in the present paper, is the case where one diagram is derived from another, or somehow helps another diagram be derived in a way. An example of this kind is the relationship between IS/LM diagram and AD diagram. This type of relationship accounts for a large majority of the relationships in the presented “big picture”. A second type of relationship among the diagrams existing in the visual is the case where a diagram is indeed the most commonly occurring part of a more complex diagram in the real world. In such cases, when one has to choose one part of the curve to keep the conveying of the big picture simple, she should pick the most usual part of the diagram, which more often happens in reality. As an example, in order to bring up and discuss the concept of the equilibrium in the labor market, we usually select the upward-sloping portion of the backward-bending supply curve of labor, rather than the downward-sloping portion which is believed to be a rare case to happen in the real world (or in some sense, a rare case to occur at a macro level). This manner of selection is sometimes a source of confusion for users and students, and it can be removed by putting a short note on the “big picture”. There also exists a third kind of relationship among the diagrams in which two perspectives or viewpoints of essentially the same concept are linked and related with each other. An example of this sort is the relationship existing between “Keynesian cross” vs. “Classical cross” in the provided “big picture”. Appendix 3 presents a full description of the types of pairwise relationships between any of two diagrams in the visual “big picture.”

There are multiple considerations that ought to be taken into account when using the visual “big picture” presented in Figure 1. To begin with, there may be different titles commonly used for a single diagram (e.g. consumption-leisure diagram or work-leisure diagram or income-leisure diagram) or different traditions, or some notational differences in labeling diagrams (“ IC_1 ” representing indifference curve 1 or “ U_1 ” representing utility level 1) which all indeed point to exactly the same concept, so these differences are not of importance essentially. Further, each of these diagrams may take an intermediate macroeconomics instructor one, two, or more than two lectures to provide her students with, since each of them has its own subtleties and details involved. Additionally, students must work with the “big picture” adequately to gain mastery of conducting analysis using that. That is, it takes them some time to become familiar with the “big picture”, and store the “big picture” in their minds. They may also need to do some problem-solving to practically “see” and “experience” how the concepts are related. Needless to say, an instructor can include more diagrams into the big pic according to her preferences, or according to the scope of the course she is teaching. She can also opt to come up with two separate versions of the “big picture” – e.g., one simple version to use in the cases when simplicity matters more, and one comprehensive version of the “big picture” to employ in the situation in which comprehensiveness matters more. Alternatively, the instructor can pick some parts of the “big picture” to discuss in some sessions in order to better focus on what she is planning to cover in that particular session. After all, as Moosavian (2016b) suggests, what she should not or cannot do is to leave her students without a visual “big picture” finally, and if she does so, she will be leaving them with the nightmare of lacking a mental framework of the material covered.

The “big picture” presented in this paper is an appropriate visual aid for the teaching of intermediate macroeconomics for several reasons, which are as follows: being an adequately holistic “big picture” by including 27 commonly-discussed diagrams in intermediate macroeconomics; pointing to the types of the relationship among the concepts in the hope of clearing up potential confusions in that regard; being designed such that it removes confusions due to several different forms of a certain graph; inclusion of short necessary notes for avoiding confusions; including some of major definitions in order to help student recall material easily and avoid potential confusions; providing fundamental ideas behind the first building blocks of the “big picture”, each of which somehow constitutes the micro-foundation of each corresponding row; and finally being pluralistic in some parts by providing both versions associated with the Keynesian as well as Classical views at the same time.

Having a “big picture” of the subject matter in mind would help students improve the comprehensiveness of their analyses. Suppose a situation in which an instructor wants to quiz his or her students on how a shock in the economy affects the other parts or even the final general equilibrium. By having all the concepts logically connected in a visual way, students will be able to trace the impacts of any changes or shifts of a curve easily from the first stages to the end, since they have capability to track visually a change from the initial stages to the end.

In Figure 2 on the next page, the macroeconomics “big picture” is divided into four separate markets, namely labor market, capital market, money market, goods market. The first row starts with a basic idea in production theory, i.e. income-leisure trade-off, upon which the whole theory of labor supply is based. The second row, which has its origin in the production function, aims to explain labor demand. It is crucial to note that the notion

of neoclassical production function has two major features which serve as two essential building blocks in the macroeconomic “big picture.” These two building blocks are as follows: substitutability between labor and capital, and diminishing marginal product of labor and capital. Then, labor supply and demand curves come to one single diagram together, forming the labor market diagram. After that, in the third row, the capital market is defined on the basis of the fundamental idea of diminishing marginal product of capital, and subsequently, the Solow-Swan model (Note 3) through which the optimal capital in the economy is obtained. Finally, optimal labor quantity and optimal capital quantity together will make the neoclassical long-run aggregate supply (AS). Another version of aggregate supply that has been derived in the “big picture” is the Keynesian short-run aggregate supply which is derived principally by looking at the labor market and variables such as real wage and price expectations.

In the lower half of the macroeconomics “big picture”, there are three rows, of which the first one demonstrates the money market (putting the fourth diagram in this row aside, which is in fact the replication of the labor market diagram, which is placed there to reproduce the full-employment output line in IS/LM diagram which is conventionally placed in IS/LM diagram), and the last two rows represent goods market in an economy.

As Figure 2 shows and the discussion presented in the two preceding paragraphs imply, one can easily see that the higher half of the picture has an emphasis on the supply side of the economy, which essentially corresponds to the Classical approach to macroeconomics while the lower half of the picture possesses an emphasis on the demand side of the economy, which essentially corresponds to the Keynesians’ approach to macroeconomics. As clearly shown in Figure 2, in the higher half, there is a great deal of microfoundation which is specific to classical and neoclassical approach to macroeconomics. However, in the lower half, almost everything is ad hoc, i.e. lacking microfoundation, which corresponds to Keynesians’ approach to macroeconomics. Therefore, this is another big advantage of such a “big picture” that enables an instructor to visually show in what ways Neoclassicals and Keynesians are different not only in terms of their emphases but also in terms of their methods and approaches in macroeconomic analyses. On the next page, the macroeconomics “big picture” will be presented in terms of the four separate markets outlined above.

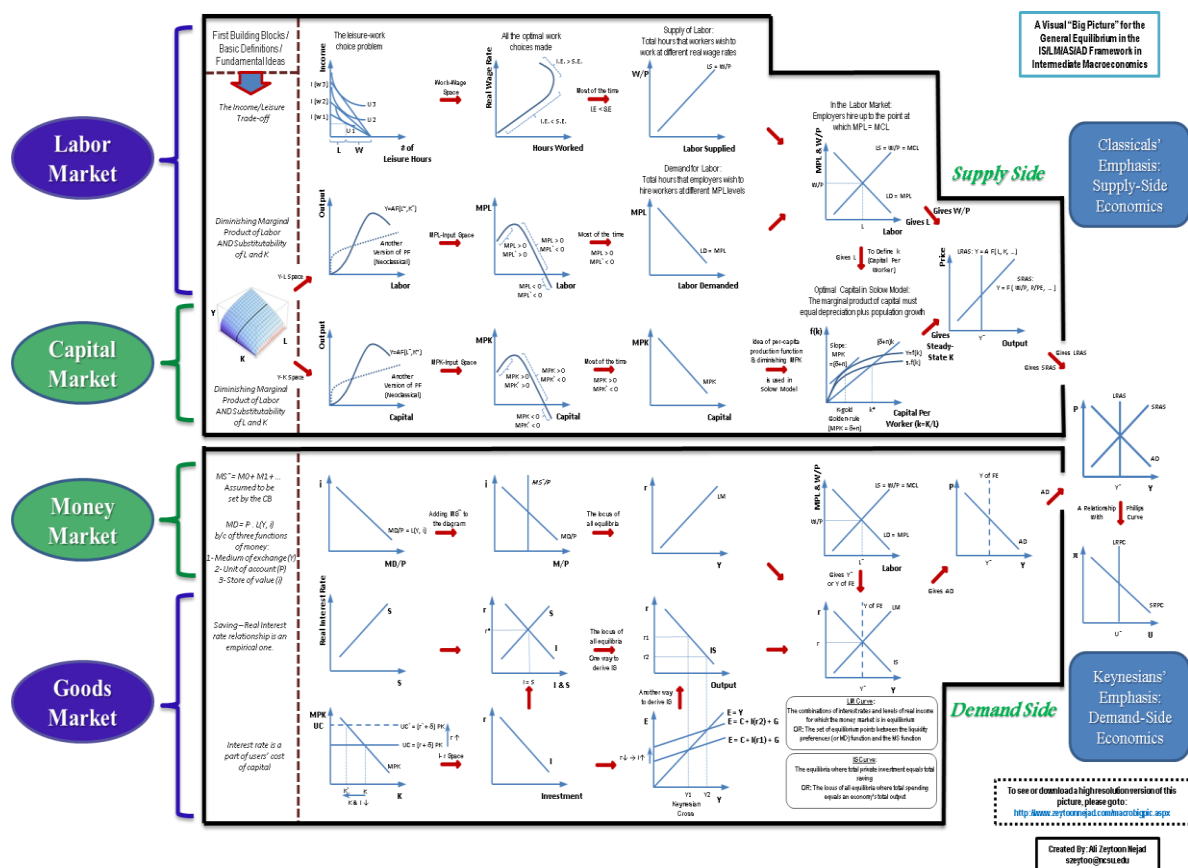


Figure 2. The visual “big picture” of intermediate macroeconomics in terms of different markets and economics schools of thought

As pointed out already, one may argue that in the “big picture” provided in this paper, every diagram is in static form, except for the Solow-Swan model, which inherently is a dynamic macroeconomic model. In reply to such an argument, it should be noted that this is in fact the “big picture” of “intermediate macroeconomics”, not that of macroeconomics per se, which may be subject to different approaches to be taken to. That is, the pattern provided in the “big picture” is consistent with the material commonly covered in a typical “intermediate macroeconomics” course. Hence, the existence of the dynamic model of Solow-Swan in this “big picture” is essentially due to the way that intermediate macroeconomics has been designed as a course. Besides this, in the modern macroeconomics and particularly in the New Keynesian monetary models, many components of this “big picture” such as IS curve and the Phillips curve have their own dynamic counterparts such as the Dynamic IS (DIS) and the New Keynesian Phillips Curve (NKPC), respectively. Thus, keeping static components separate from dynamic components is not a big issue in that sense in the modern macroeconomics.

Some authors (e.g. Kennedy, 2008) believe providing visual “big pictures” matters further at the first stages of teaching. Others may argue that a “big picture” is a tool that should be used to put things together at the final stages of a course. However, the truth of the matter is that it can be helpful at every stage of a course, and it usually becomes more crucial as the course moves forward toward its final stages. According to Moosavian (2016b), if we take a course as consisting of three time phases, a “big picture” can aid a class in all of these three time phases. More specifically, it can be treated as a graphical outline in the first phase. Next, it can be regarded as a road map or a broad overview of the material being covered in the middle phase, which exhibits exactly what part of the course the instructor is talking about at the time. Finally, it can be employed as a tool to put things together in the final phase in order to wrap up a course at the end of the semester. Doing so will help students achieve a high level of confidence that they have indeed learned something from the course along with a strong mental framework of it. Over time, it is natural that some students forget some portions of the course material; however, the part that can stay in mind for long, or at least on a piece of paper to be reviewed fast in the future if necessary, is the visual “big picture” of the course. Figure 3 depicts the roles of a visual “big picture” in the mentioned three phases in a visual way.

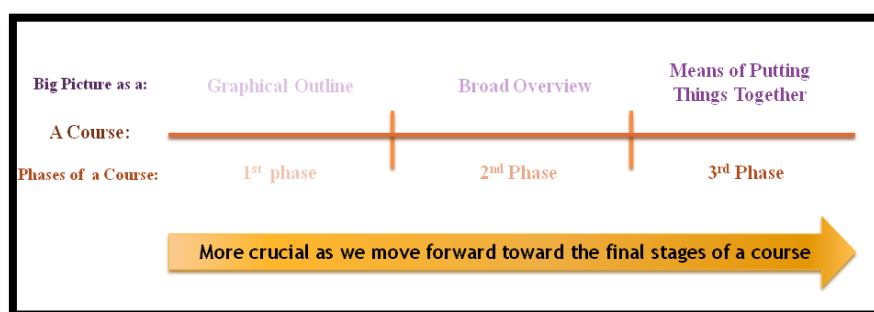


Figure 3. “Big picture” in every stage of a course

In the next part, a list of advantages of providing visual “big pictures” is presented.

3. Advantages of Providing Visual “Big Pictures” (With a Special Emphasis on the Visual “Big Picture” of Intermediate Macroeconomics)

Providing a visual “big picture” in the classroom can bring about many advantages not only for students, but also for instructors. In this section, by looking at the issues and difficulties involved in the teaching and learning of economics, which were already addressed in the literature review section, and also considering the potentialities and capabilities of “big pictures”, which were introduced in the previous section, we can identify some of the issues that can be solved through potential capabilities of visual “big pictures”. Here is a short list of these advantages:

a- Creating a strong mental framework of the subject matter and showing the origins of ideas

As discussed earlier, visual “big pictures” provide such a mental framework of the subject matter that can remain in mind for a long time. They help student comprehend more readily, and analyze big-picture-related problems easier and more thoroughly by considering all the aspects involved in a given situation. Wilson and Dixon (2009) point out that the economic abstractions discussed in many of micro- and macroeconomics textbooks have origins that are not clearly discussed. They also claim that in many of economic textbooks, the contexts of

discovery and actual relations to other principled discourses are ignored to be discussed. The visual “big picture” of intermediate macroeconomics indeed helps macroeconomics instructors solve such problems to a large extent.

b- Preventing students from getting lost among various materials under discussion in the course

As Wilson and Dixon (2009) elaborate, “although most lecturers can ‘talk’ a good syllabus, the real teaching challenge is to ensure that most students are not lost in the process.” However, a well-designed visual “big picture” can serve as a road map, preventing students from getting lost in the course materials. Moosavian (2016a) has come up with the idea of the Interactive Graphic Syllabus which provides a great help to this end.

c- Helping students increase their comprehension level

Referring to the results of the studies conducted by Cain and Oakhill (1999) and Nation et al. (2005) about the ways through which different comprehenders learn, another advantage of a fine visual “big picture” lies in the fact that it can help less-able comprehenders comprehend more easily. It may also serve more-able comprehenders to comprehend more readily. Therefore, providing a visual “big picture” directly by instructors can help both of the mentioned groups of comprehenders comprehend more readily.

In his book entitled “Super six comprehension strategies,” Oczkus (2004) provides an excellent resource for practical ways to build comprehension in students’ reading. According to Oczkus (2004), essentially, there are six comprehension strategies which are as follows: making connections, visualization, asking questions, inferring, determining importance, and synthesizing. As it can be easily inferred here, providing visual “big pictures” involves with the first two strategies mentioned above, namely making connections and visualization. That is to say, providing a “big picture” can indeed be regarded as a mixed comprehension strategy consisting of making connections and visualization. Despite this, it also has to do with the other comprehension strategies in some indirect ways, whose discussion is beyond the scope of the present paper. This is in fact one of the reasons why providing a “big picture” is central to the process of learning.

d- Teaching students practically how to connect logically related concepts towards training critical thinkers

As explained earlier, not only can providing a “big picture” directly by instructors help the students comprehend more readily, but it also practically teaches them how to logically connect related concepts in order to obtain a higher level of comprehension which is going to be useful for their future learning purposes. Being able to connect logically related concepts in order to obtain a higher level of comprehension to solve problems of the real world is in turn a required feature for critical thinkers to possess.

e- Enabling students to conduct holistic analyses by considering all the major aspects involved

On a piece of paper, we are indeed limited to two- or at most three-dimensional space, meaning that we are not able to show n-dimensional relationships between various concepts, while most of the economic concepts involve multiple aspects. For example, it is practically difficult to demonstrate how output (Y) is related to price level (P) and interest rate (r) at the same time and on a single diagram. One way to tackle this limitation is to come up with a holistic illustration that shows all the major effects and their interactions and interrelationships of the variables under investigations. Hence, a typical “big picture” can help instructors demonstrate also the relationships involving more than three dimensions by presenting and connecting multiple two-dimensional diagrams. Now that students can see the whole idea in one picture, so they can conduct holistic analyses. Being a big-picture thinker is another feature that can help students become excellent critical thinkers.

f- Increasing the confidence of both parties of a class – instructors and students

A visual “big picture” serves the class as a whole. That is, providing visual “big pictures” help not only the students of a class, but also the instructors of the class. Having a “big picture” in hand and subsequently in mind could also help instructors to have a well-framed knowledge about the topic under discussion. Furthermore, it allows instructors to have more confidence when facing spontaneous questions while lecturing in a class. It deepens students’ questioning and understanding of the subject as well as those of instructors, which enables them to elaborate further on the material being covered. According to Moosavian (2016a), it also helps instructors identify the existing snags in their course design.

g- Allowing instructors to take a multimodal approach to teaching

As many researchers such as Davenport et al. (2008) and Gilbert (2010) have claimed, taking multimodal approaches to teaching can result in large learning gains eventually. Since providing a visual comprehensive “big picture” when teaching economics can serve as a separate mode of teaching, it can help instructors somehow take a multimodal approach to their teaching. In fact, lectures, lecture notes, texts, single diagrams, tables, and

the like are the traditional modes of teaching economics while wisely-designed visual representations such as “big pictures” can be classified as a one of the modern modes of teaching economics. In order to stress the significance of the use of multimodal presentations, Gilbert (2010) states that “the ability of ‘translating’ between visual representations and verbal presentations, and integrating them with each other can be enhanced by the use of multimodal teaching.” According to Mayer (2005), multimodal teaching is the use of multiple relevant modes and forms when teaching a particular idea. In this sense, “big pictures” can be regarded as one of the modes of teaching economics that enables economics instructors to take a multimodal approach to teaching economics.

4. Conclusion

Intermediate macroeconomics covers numerous concepts and diagrams in order to finally show how aggregate supply and aggregate demand are derived in an economy. A further learning objective defined for the intermediate macroeconomics course is to enable students to investigate the overall effects of macroeconomic policies on aggregate supply and aggregate demand in the economy. In order to achieve the mentioned objectives, this paper proposed a comprehensive visual “big picture” that can be used as a supplementary resource in offering the intermediate macroeconomics course. This visual “big picture” describes the general pattern and overall structure of macroeconomics in terms of four separate markets in a visual fashion. These markets are as follows: labor market, capital market, money market, and goods market. It was also explained that though Moosavian (2016b) brings up the visual “big picture” of macroeconomics just as an example to show what he means by the term visual “big picture”, he does not elaborate on how the visual has been designed and what the components of the visual are. In fact, these points have been addressed in the present paper.

The “big picture” presented in this paper is an appropriate visual aid for the teaching of intermediate macroeconomics for several reasons, including being sufficiently comprehensive, clarifying the types of the relationships among the diagrams, removing various confusions with different sources, and providing fundamental ideas behind the diagrams. A big advantage of such a “big picture” is that it enables macroeconomics instructors to visually show their students in what ways Neoclassical and Keynesian economists are different not only in terms of their emphases but also in terms of their approaches to macroeconomic analyses. It was also explained that a “big picture” is a tool that can be helpful at every stage of a course, and it usually becomes more crucial as the course moves forward toward its final stages. Taking a course as consisting of three time phases, a “big picture” can be regarded as a road map or a graphical outline in the first phase, a broad overview of the material in the middle phase, and a means of putting things together in the final phase.

It was also argued that providing visual “big pictures” can bring about multiple pedagogical advantages, such as creating a strong mental framework for students of the subject matter, preventing students from getting lost among various topics, helping students increase their comprehension level, teaching students practically how to connect logically related concepts, enabling students to conduct holistic analyses, and allowing instructors to take multimodal teaching approaches.

The visual “big picture” introduced in this paper was presented for the case of intermediate macroeconomics. To see two additional examples of visual “big pictures” in the context of economics, you can see Naumenko and Moosavian (2016) and Moosavian (2016c,d). The first paper presents the visual “big picture” of production theory for the course of advanced microeconomics. The two last papers present the visual “big picture” of consumer theory for the course of advanced microeconomics. These two figures are two additional examples of visual “big pictures” for economics courses.

Finally, it is suggested that this visual “big picture” should be provided to students during the process of teaching intermediate macroeconomics courses so that they can readily grasp the logical order of the concepts and the underlying complex structure of the markets being discussed in the course. This visual would serve as the course structure in the students’ minds. Scattered pieces of information in minds do not stay for long, and as a result, instructors should not leave their students without the big-picture view of the course. In the end, once again, it is stressed that achieving the learning objectives of the course of intermediate macroeconomics is almost impossible without providing students with a comprehensive visual “big picture” that clearly and graphically describes how macroeconomic variables and concepts are connected in the world of intermediate macroeconomics.

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Notes

Note 1. Zeytoon Nejad (2016a) introduces a more innovative variation of syllabus called the Interactive Graphic Syllabus, and elaborates how one can design such an effective syllabus in the context of economics.

Note 2. To see or download a high-resolution version of this figure, you can go online to the following address: <http://www.zeytoonnejad.com/macrobigpic.aspx>

Note 3. It is important to note that, in intermediate macroeconomics, almost all diagrams and models are static ones, except for the Solow-Swan model which is essentially a dynamic model. In fact, the Solow-Swan model uses the idea of decreasing marginal rate of capital to identify the steady-state amount of capital in an economy. Since here the “big picture” of “intermediate macroeconomics” is supposed to be derived and the Solow-Swan model is an inseparable part of the course, if one wants to include it in the visual “big picture” of intermediate macroeconomics after all, the best place to do so would be the place that has been chosen for this purpose in Figure 1. Nevertheless, users should still have in mind the conceptual differences of static analyses vs. dynamic analyses. In what follows, this distinction will be discussed in greater detail.

Appendix

Appendix 1. Symbols and Notations

– : Fixed

~ : Changing

I: Income

I(w 1): Income at wage rate 1

U: Utility level OR Utility Indifference Curve

L: Leisure hours

W: Hours Worked

W: Nominal wage rate
w: Real wage rate OR W/P
P: Price level
I.E: Income effect
S.E: Substitution effect
L: Labor supplied OR Labor hours worked
LS: Labor supplied (Supply of labor)
LD: Labor demand (Demand for labor)
MCL: Marginal cost of labor
MPL: Marginal product of labor
Y: Output (Income)
A: Technology level OR Total Factor Productivity (TFP) level
PF: Production function
MPL': Derivative of marginal product of labor with respect to L
MPK: Marginal product of capital
MPK': Derivative of marginal product of capital with respect to K
F(.) OR f(.): Function of
 δ : Depreciation rate
LRAS: Long-run aggregate supply
SRAS: Short-run aggregate supply
AS: Aggregate supply
AD: Aggregate demand
FE: Full employment
 Y^- of Y of FE: Output level at full employment
PE: Price expectation
 MS^- : Money supply
M0: Sum of currency in circulation (notes and coins) plus banks' reserves with the central bank
M1: Currency in circulation plus current (checking) accounts plus deposit accounts transferable by checks
i: Nominal interest rate
r: Real interest rate
MD: Money demand (Demand for money)
LM: Liquidity-Money equilibrium curve
L(Y, i): Liquidity function
S: National saving
I: National investment
IS: Investment-Saving curve
K: Capital stock
UC: User cost of capital
E: Expenditures
G: Government Expenditures
I(r1): Investments made at the interest rate "r1"
C: Consumption

π : Inflation rate

U: Unemployment rate

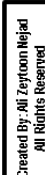
U^- : The natural rate of unemployment

LRPC: Long-run Philips curve

SRPC: Short-run Philips curve

Appendix 2. The List of the Names of the Diagrams and Models

1. The Leisure-Work Choice Problem
 2. Individual Labor Supply Curve (Backward-Bending Supply Curve of Labor)
 3. Labor Supply Diagram
 4. Two-dimensional Production Function Diagram (Y-L Space)
 5. Marginal Product of Labor (MPL) Diagram
 6. Labor Demand Diagram
 7. Labor Market Equilibrium Diagram
 8. Three-dimensional Production Function Diagram (Y-L-K Space)
 9. Two-dimensional Production Function Diagram (Y-K Space)
 10. Marginal Product of Capital (MPK) Diagram
 11. Capital Demand Diagram
 12. Solow Model
 13. Aggregate Supply (AS) Diagram
 14. A Diagram for General Equilibrium in the Macroeconomy
 15. Money Demand Diagram
 16. Money Market Equilibrium Diagram (Money Supply and Demand)
 17. LM Diagram (Liquidity-Money Diagram)
 18. Labor Market Equilibrium Diagram
 19. Aggregate Demand (AD) Diagram
 20. Phillips Curve
 21. Saving vs. Interest Rate Diagram
 22. National Saving and Investment Model (aka “Classical Cross” Model)
 23. IS Diagram (Investment=Saving Diagram)
 24. IS-LM Model
 25. User Cost of Capital Model
 26. Investment vs. Interest Rate Diagram
 27. Aggregate Expenditure Line (aka “Keynesian Cross” Model)
- (You can find the corresponding diagrams on the next page by looking at the red numbers)



Note. In order to find the corresponding arrow indicating the pairwise relationships between any two diagrams provided below, you must refer to the numbered version of the macroeconomics “big picture”, which has been provided on the previous page, and look for the corresponding green numbers.

1. **Derivation Relationship:** Theoretically, wage-work curve is derived through changing an individual's income (wage) and recording the changes in the hours worked.
2. **Common-Part Relationship:** The most usual part of the wage-work curve occurring in the real world is the upward-sloping one.
3. **Combining Diagrams:** A diagram including both supply-of-labor line and demand-for-labor line in order to find the equilibrium point.
4. **Derivation Relationship:** MPL curve is derived from the production function curve. It is in fact the slope of the production function in the two-dimensional space of output-labor.
5. **Common-Part Relationship:** The most usual part of MPL curve occurring in the real world is the positive portion of the downward-sloping part. In fact, it is the second stage of the production in which producers usually produce. MPL is indeed the labor demand curve.
6. **Combining Diagrams:** A diagram including both supply-of-labor line and demand-for-labor line in order to find the equilibrium point. This is a representation of the labor market.
7. **Derivation Relationship:** Labor market information (such as labor supplied 'L' and real wage rate 'W/P') is used to derive long-run, aggregate supply and short-run, aggregate supply.
8. **Derivation Relationship / Another space:** If we plot output vs. labor out of a three-dimensional production function by holding capital constant, we will end up with a two-dimension version of the production function in the output-labor space (per-capita production function).
9. **Derivation Relationship / Another Space:** If we plot output vs. capital out of a three-dimensional production function by holding labor constant, we will end up with a two-dimensional version of the production function in the output-capital space.
10. **Derivation Relationship:** MPK curve is derived from the production function curve. It is in fact the slope of a production function in the two-dimensional space of output-capital.
11. **Common-Part Relationship:** The most usual part of MPK curve occurring in the real world is the positive portion of the downward-sloping part. In fact, it is the second stage of the production in which producers usually operate.
12. **Part of the Solow Model:** The concept of MPK is employed in the Solow model in order to finally obtain the optimal quantity of capital and/or steady-state quantity of capital in the economy, which in turn help us get the optimal investment.
13. **Derivation Relationship:** The quantity of capital, K, in the economy is applied to derive the LRAS.
14. **Combining Diagrams:** The next diagram is a combination of LRAS, SRAS, and AD.
15. **Combining Diagrams:** The next diagram is a combination of MD- and MS-diagram.
16. **Derivation Relationship:** LM-diagram is derived from MD- and MS- diagrams. In fact, it is the set of equilibrium points between the liquidity preferences (or MD) function and the MS function.
17. **Combining Diagrams:** The next diagram is a combination of LM-diagram, IS-diagram and full-employment output diagram.
18. **Derivation Relationship:** Full-employment output line (Y of FE) is derived from the equilibrium of the labor market.
19. **Derivation Relationship:** AD diagram is derived from the equilibria of the IS-LM model. It is in fact all the combinations of aggregate quantity of goods demanded and price level in which all of the labor market, capital market, money market, and goods market are in equilibrium.
20. **Combining Diagrams:** The next diagram is a combination of LRAS, SRAS, and AD.
21. **Other perspective to the same idea:** Essentially, looking at short-run and long-run Phillips curve is somewhat the same idea as looking at short-run and long-run aggregate supply and aggregate demand, but from a different perspective. The Phillips curve shifts when the aggregate supply curve of the aggregate supply-demand diagram shifts and the point moves along the existing Phillips curve when the aggregate demand curve shifts.
22. **Combining Diagrams:** The next diagram is a combination of S-diagram and I-diagram.
23. **Derivation Relationship:** IS-diagram is derived from I- and S-diagrams. In fact, it is the equilibria where

total private investment, I , equals total saving, S . This way of deriving IS-diagram uses the concept of the Classical cross.

24. **Combining Diagrams:** The next diagram is a combination of LM-diagram, IS-diagram and full-employment output diagram.

25. **Derivation Relationship:** The next diagram is derived from the previous diagram. According to the previous diagram, the higher the real interest rate (r) is, the higher user cost (UC) will be, and the lower the optimal quantity of capital (K) will be. Therefore, when " r " increases, the optimal quantity of capital (K), and in turn, investment (I) will decrease.

26. **Combining Diagrams:** The next diagram is a combination of S-diagram and I-diagram.

27. **Derivation Relationship:** When moving along the I-curve, the real interest rate changes. Then, the expenditure line will shift.

28. **Derivation Relationship:** IS-diagram is derived from the concept of Keynesian cross. In fact, it is the locus of all equilibria where total spending equals an economy's total output. (This is another way of deriving the IS-diagram.)

29. **Derivation Relationship:** The equilibrium quantity of labor, L , in the economy is used as an exogenous variable in the Solow model in order to define per-capita variables such as per-capita capital, k , and per-capita output, $f(k)$.

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