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A Comprehensive Model for Using the GDP Flow Chart in Various Economics Courses

In most economics principles textbooks, the GDP chart is presented as a descriptive tool. Its full potential as a teaching aid is minimally utilized. In this paper I have extended the chart and shown how this can help students understand different ways of calculating GDP. Various methods of verifying GDP equilibrium are illustrated. While teaching, instructors can utilize these for more effective presentations. Students can also improve their grasp of the content by using the chart and experimenting with different numbers. I have used this for the last 40 years and have found it to be highly effective.

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1. Introduction

Most economics courses, especially introductory microeconomics and macroeconomics courses, are not shy about using graphs. Instructors of these courses use plenty of graphs because the visual representation helps students understand and retain the concepts better. But, in the case of GDP, only incomplete flow charts exist which do not show various underlying relationships. The common practice is to teach the national income identity without going too deep into flow charts. This approach may cause them to miss many of the teaching benefits that graphs, and more specifically dynamic graphs, provide.

The benefit of using graphs to enhance learning is well-known and is leveraged in many subjects, like physics and biology. For example, in physics, there are countless equations to learn regarding energy, voltage, power, current, etc. However, it is commonplace to reinforce the concepts using graphs, allowing students to truly understand the relationships across the variables. Similarly in biology, students could read paragraph after paragraph about processes such as the metabolic pathways that create ATP. However, this is always supplemented with diagrams showing the processes, which help the students visualize and understand them better.

The focus of this paper is to show how existing incomplete GDP charts can be expanded and extended to make them dynamic. Although static images (available in standard textbooks) may help students understand ideas better than equations alone (due to their being able to visualize the flow of money, understand the concepts, and retain the image in their memories), there is increased value in using dynamic graphs that students can manipulate to see how different scenarios work. When students can work using a dynamic graph they see the connections between various flows, and they get a more solid grasp of the concepts. The imagery remains in their memories for a long time, and they can recall it more easily than equations or narrations.

The driving force behind creating a modified GDP Flow Chart (GDPFC) and writing this paper is that students have different types of learning preferences. While some may be able to grasp complex economic concepts using national income identity alone, others may require a more visual representation of flow charts for a complete understanding. Even with the former group, adding the dynamic chart allows them to learn the concepts with more ease, which allows them to go deeper in their understanding.

I have used this chart very successfully during 44 years of teaching economics at a college in the Midwest. I have found my visual and interactive approach using the modified GDPFC to be extremely effective. The purpose of writing this article is to make these ideas available to other economics instructors so that some of them may use it, improve it, and hopefully help students see the issues more clearly.

2. Literature Review

The benefits of interactive teaching and allowing students to engage with content span across subjects and grade levels. Research has shown that students have increased long-term retention when they can engage with the material, compared to when they simply watch an interactive demonstration. Studies have also shown increased class participation and motivation for learning when students engage in active participation. Increased understanding of concepts is another benefit (Halliday et al., 2024).

For these reasons I have chosen to incorporate dynamic flow charts in my classroom. A student may see a static chart and think that everything is simple and clear, but often this clarity is only at that specific moment while the instructor is highlighting the concepts. Later

when studying independently the student often does not remember what the instructor said about the static chart. Dynamic charts, on the other hand, allow students to actively learn the concepts, understanding them in a stepwise fashion, and ultimately seeing how they connect.

Buckles and Hoyt (2006) also highlight some of the benefits of active learning techniques, which include activities that require students to apply and use concepts. These benefits include more in depth understanding by students, increased student attention, increased likelihood of engaging students, and enhanced learning and enjoyment. Additionally, Taylor (2000) highlights the importance of teaching macroeconomics concepts in an understandable and memorable way to beginner-level students.

Despite the known benefits of innovative teaching and the fact that macroeconomics is a difficult concept to teach, there are only a handful of articles that provide new methods to teach the subject in a more engaging and understandable way than traditional textbook approaches.

Articles that do use innovative methods are focused on teaching specific topics related to GDP (like Wolla (2018), which focuses on GDP and exports), as opposed to highlighting its overall implication and illustrating the use of GDP in multiple areas of macroeconomics and international economics. Additionally, most of these methods do not use an aggregate graphical approach to teach these ideas. I am not aware of any paper that describes the teaching of GDP related issues, partial or comprehensive, using the generic or a modified circular flow of income chart.

Wolla (2018) provides specific recommendations for improving GDP instruction, however, this is focused specifically on Net Exports. Maximova, Muchiri, and Paraschiv (2023) provide an interactive approach for students to better understand and relate to real GDP per capita. An image-based activity is described, using photographs of household living conditions in combination with data on real GDP per capita and making comparisons within and across countries.

Ruediger and Batova (2020) describe a classroom activity that extends the "Candy Price Index" (Hazlett & Hill, 2003) to calculate additional parameters and to provide insight into differences between the GDP deflator and the CPI. The assignment can be extended to discuss nominal and real wages and nominal and real interest rates, among other topics. The authors describe a positive response from students.

Graphs are used by Elmslie and Tebaldi (2010) in an exercise they describe that uses actual data with the Solow growth model. This activity specifically helps students understand the impact of corruption on GDP per worker and improves their understanding of the distinction between level effects and long-run growth effects.

Neveu (2020) suggests an updated approach to explaining monetary policy that allows students to receive a modern description of the banking system.

Baltgailis (2019) offers an interactive approach to comparing the economic development of countries by asking students to study and use ratings to learn about economic processes. Per the author, this is particularly useful for students motivated to study the basics of entrepreneurship.

A uniquely creative approach to teaching macroeconomic principles is described by Luccasen, Hammock, and Thomas (2011). Here, examples from cartoons are used to illustrate various macroeconomic principles. For GDP the focus is on mismeasurement of GDP.

A game using playing cards is described by Goeree and Holt (1999), which can be used to teach concepts in circular flow, real and money wages, unemployment, Keynesian theories, and other topics.

A graph is used in the approach by Taylor (2000) to teach modern economics at the principles level. This graph shows economic fluctuations by comparing inflation to real GDP.

Each of these articles provides a custom approach to teaching one or more economics concepts. There is little overlap across the concepts and activities described in the articles. However, none of the papers found and surveyed used the GDP chart, modified or as it is, to illustrate many crucial issues of GDP and other areas of macroeconomics. I believe that the approach developed in this article will be highly useful to teach several macroeconomic courses. In addition, the chart gives a concrete vision of the abstract ideas. From a student's point of view, there is limited time to do a lot of learning and to do well on exams. Like algebra or geometry, learning macroeconomics with this chart should be more intensive than cursory reading without the GDP chart. This paper provides an additional unique approach that modifies a well-known tool and provides an interactive way for students to learn important macroeconomic concepts.

3. Survey of Circular Flow of Income Model in Various Macroeconomics Textbooks

The GDPFC is routinely seen in introductory macroeconomics textbooks and is commonly referred to as the Circular Flow of Income (CFI) Diagram. In prevailing economics textbooks there are two kinds of flow charts. Charts such as the ones in Tucker (2018) or Krugman and Wells (2006) are overly simplified with only two sectors in them, households and firms. This is useful to give an overview to beginner students with no idea about GDP and the flows around it. However, the absence of two vital sectors, government and foreign, makes it less useful in explaining real-world macroeconomic issues. The very basic macroeconomic equilibrium requirement that GDP should equal the sum of consumption, investment, government expenditures, and net exports, cannot be illustrated in these charts. In addition, they do not allow extension of the analysis to other economic issues like budget deficit, or the role of trade balance in domestic macroeconomic equilibrium, to name a few.

Other textbooks, including Tucker (2018), Arnold (2019), Gwartney et al (2022), and Baumol et al (2020) present a more detailed CFI diagram, and some include a four sector model. However, these charts lack the details and clarity needed for a freshman undergraduate student. In some charts, the reader has to follow the link between a sector and the corresponding market along a curvy line crossing other lines as it progresses, reminding us of the puzzle where we have to identify which child is holding which kite flying in the sky. The lines representing the flow of goods, services, and money are also not clearly identified. By reading the associated descriptions that some of these graphs present it is possible to get a theoretical idea, but this does not provide students with the clarity required for an in-depth understanding and to be able to apply the concepts to in-class activities.

This paper will elaborate on the GDPFC and will show how some economic concepts can be explained using it. More importantly, it will show how students can use the GDPFC for various in-class or homework activities using real macroeconomic numbers for any country, or by using simulated numbers.

4. Proposed GDP Flow Chart Explained

Pedagogic Value of GDPFC

I have not undertaken any formal scientific study to determine the effectiveness of the GDPFC in my classroom. However, I have witnessed numerous instances that suggest that the GDPFC has made some impact on my students' learning. These are described below.

1. During the beginning phase of using the GDPFC, I carried out an experiment. I taught one section by using the standard national income identity equations (shown in Section 5.1), and the other section by using the GDPFC. I gave both sections the same questions, e.g., "starting from an equilibrium if *C* goes up and *T* does not change what are the likely consequences?" I distinctly observed that very few students from the first group (taught by standard pedagogy only) could answer correctly, while the success rate from the second group was quite noticeable. (The first group was allowed to use national income identity equations, while the second group was given blank GDPFC templates).

2. Many of my students are not very comfortable in dealing with algebraic equations. To them, understanding or proving why $NS = I$ if $Y = C + I + G$ is a big challenge. However, by looking at the GDPFC they have shown a better understanding of the issue. I have seen this countless times.

3. Likewise, students exposed to the GDPFC have shown improved success in answering my favorite question: "What can happen to the economy if the budget deficit increases?"

Different students have different learning styles. While some are very comfortable with equations, many can comprehend better with a chart. It is the second group that will benefit most from the GDPFC.

GDPFC Overview

The modified GDPFC has 14 *Flows*. Each *Flow* represents annual dollar value. The 14 *Flows* are shown in Figure 1A and are described in Table 1.

Figure 1A: Gross Domestic Product (GDP) Flow Chart

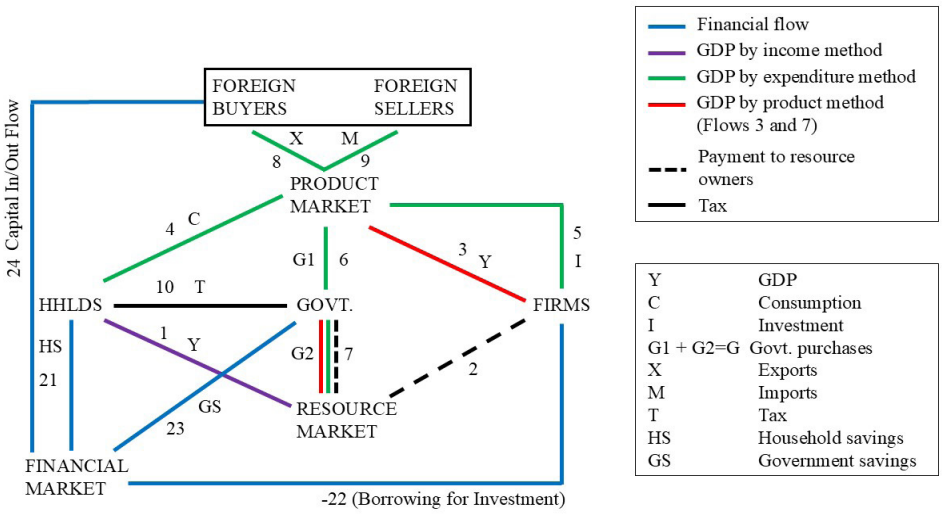


Table 1: GDP Flow Chart Explanations

FLOW	DEFINITION
1	MONEY RECEIVED BY HOUSEHOLDS FOR THE USE OF THEIR RESOURCES (wages and salaries + rent + interest + profit/loss)
2	MONEY PAID BY FIRMS TO HOUSEHOLDS (THROUGH THE RESOURCE MARKET) FOR USING RESOURCES TO MAKE GOODS
3	VALUE OF THE FINISHED GOODS PRODUCED BY FIRMS $\Sigma p_{\mathrm{i}} q_{\mathrm{i}}$
4	MONEY PAID BY HOUSEHOLDS TO BUY CONSUMER GOODS (*C*)
5	MONEY PAID BY FIRMS TO BUY CAPITAL GOODS (*I*)
6	MONEY PAID BY THE GOVERNMENT TO BUY GOODS (*G1*)
7	MONEY PAID BY THE GOVERNMENT TO BUY RESOURCES IT ALSO MEASURES THE VALUE OF GOODS MADE BY THE GOVERNMENT (*G2*) IT ALSO MEASURES THE GOVERNMENT'S PURCHASE OF ITS OWN GOODS (*G2*)
8	MONEY RECEIVED FROM EXPORTS (*X*)
9	MONEY PAID FOR IMPORTS (*M*)
10	MONEY PAID BY HOUSEHOLDS AS TAXES (*T*)
21	MONEY SAVED IN FINANCIAL INSTITUTIONS BY HOUSEHOLDS (*HS*)
22	MONEY BORROWED BY FIRMS TO FINANCE THEIR INVESTMENTS (*BORROWING FOR I*)
23	MONEY BORROWED OR SAVED BY GOVERNMENTS (*GS*)
24	NET CAPITAL INFLOW OR OUTFLOW (*EQUALS -NX OR -(X - M)*)

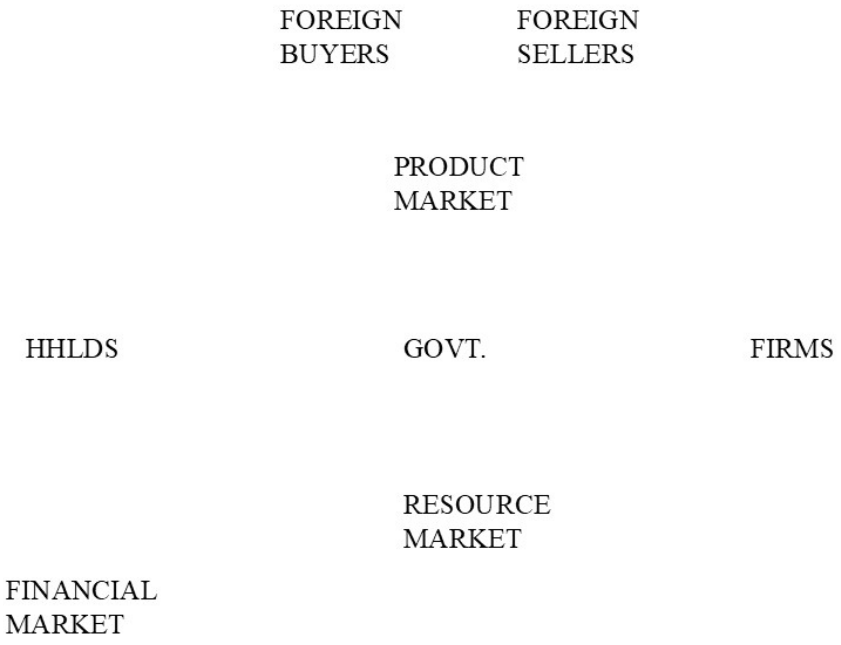
Notes: Flow 3 above does not fully capture GDP by the Product Method, as shipping of the goods to the market, and services of sales people in the store, are also part of GDP. To accommodate this we assume the product market as only the sales point, and all shipping and services of sales people are recorded in the Firm box in the right side of the GDPFC. To keep the exposition simple, it has been assumed that Flow 7 = 0. That is, the government does not produce any finished goods or services. However, this can be easily changed once the students fully grasp the basic model. I have included Flow 7 in some of my advanced course lectures.

5. Uses of GDPFC in Various Economics Courses

In this section, I provide examples of how the GDPFC enhances students' understanding across various economic topics.

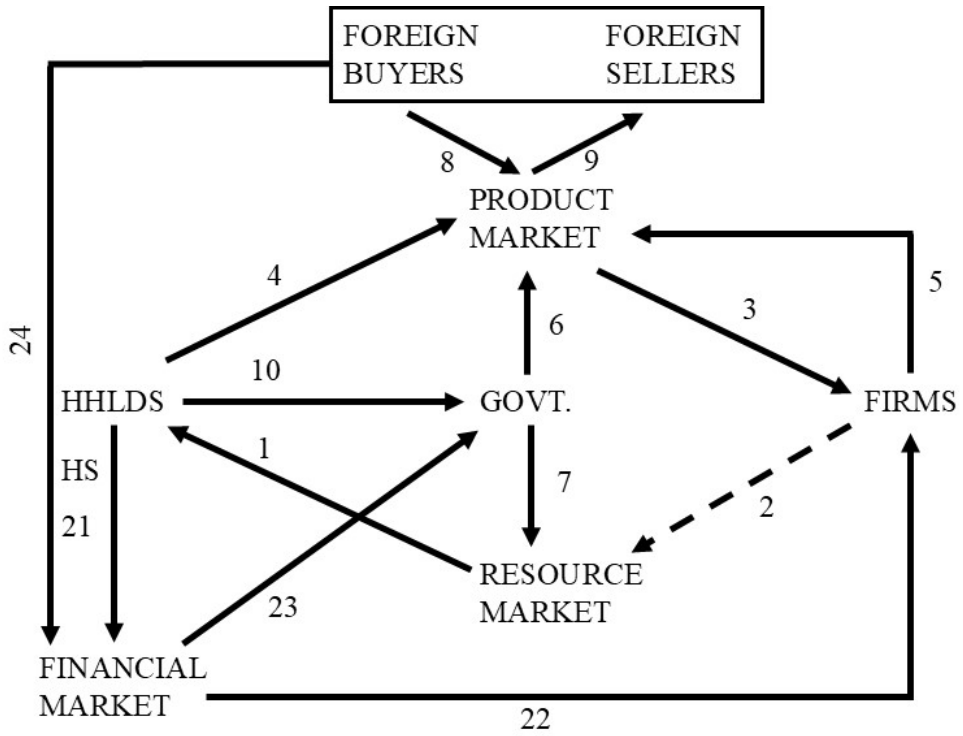
I introduce the GDPFC to students by first handing out a basic skeleton of the chart, which does not contain any flows or numbers (Figure 1B).

Figure 1B: Introductory GDPFC Skeleton Without Flows



I then project a basic version of the GDPFC onto the classroom wall (Figure 1C), and I describe the various flows and flow numbers.

Figure 1C: GDPFC Template with Flows and Numbers Added



Note: The arrow direction of Flow 24 depends on whether X>M or M>X. The current arrow represents M>X. The arrow direction of Flow 23 depends on whether there is a budget deficit or surplus. The current arrow represents a budget deficit.

The students draw these flows onto their chart skeletons as I explain them.

Now the students are ready to use their templates to learn the basic concepts described below. Once they learn the fundamental concepts using their simple versions of the chart, I project the GDPFC from Figure 1A, which includes the Flow letters, and also has color-coding to reinforce what they have learned.

Explaining Basic Questions of Measuring GDP Using the GDPFC (A Simple, Interactive Introduction for Students)

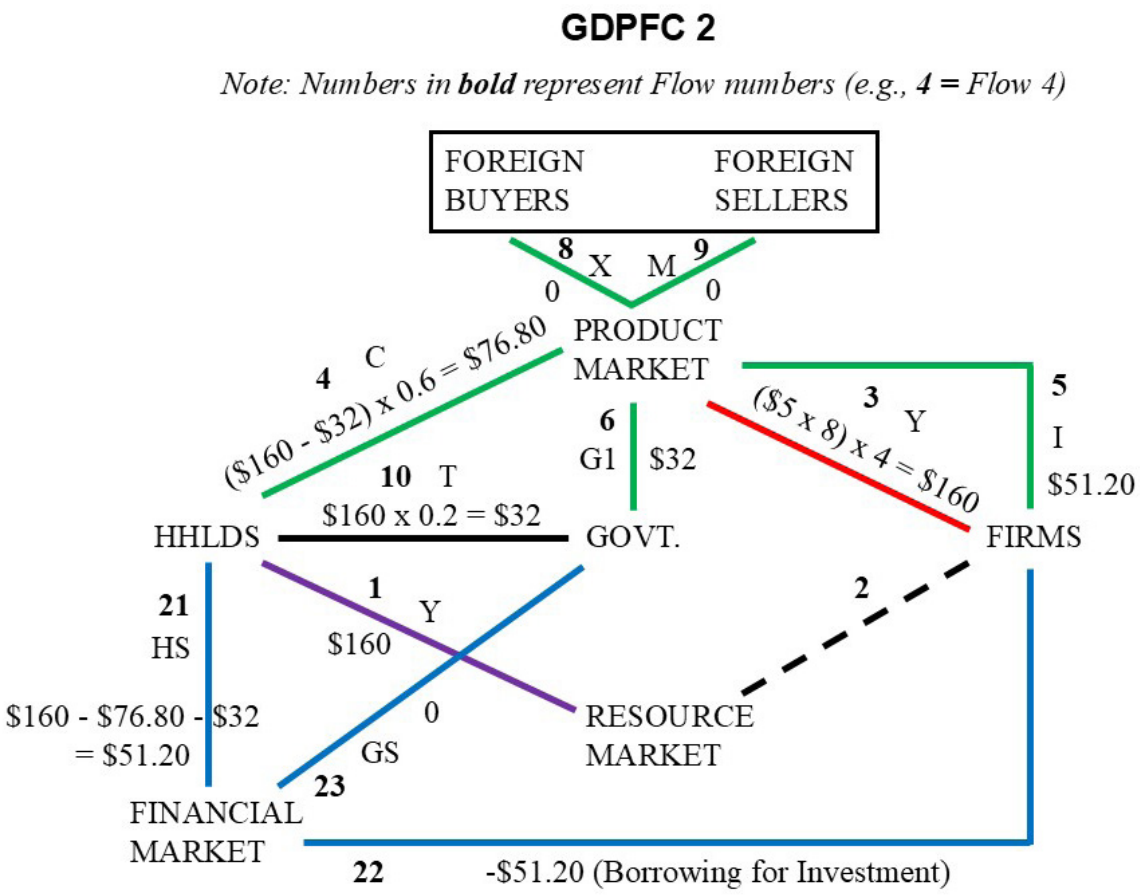
The students now have their GDPFC templates in front of them while I describe a basic setup: suppose a country has the following quantities of resources: labor = 10, capital = 4, land = 5, and entrepreneurs = 2. These resources go to Firms (through *Flows 1* and *2*), where, say, four types of goods are produced. For simplicity let us assume the quantities are 8 each and their prices are $5 each. These goods are sent to the product market through *Flow 3*.

Students calculate the dollar value of these goods (8 goods x $5 per good x 4 types of goods = $160) and enter it on *Flow 3*. This is the GDP by the **Product Method**.

This $160 comes back to Households as a resource payment through *Flow 1*. This is GDP by the **Income Method**.

I then tell the students to assume that Households pay 20% as tax and spend 60% of after-tax income to buy goods. They calculate *T* and *C* and place these values on *Flows 10* and *4*. Households save the rest through *Flow 21*, which is borrowed by Firms to buy investment goods. The completed GDPFC, including the calculations, can be seen in Figure 2. In this chart *GS* = 0 because we assume a balanced budget. This will be changed later.

Figure 2: Introductory Interaction with GDPFC



Now students find on their own, GDP by the **Expenditure Method**, which is

Flows $4 + 5 + 6 + 8\text{-}9 = C + I + G + NX = 160$.

They see that all three methods give the same value in equilibrium.

Note: In this paper, we will refer to Flow 6 as G instead of G1, as Flow 7 (G2) is not discussed (see Note below Table 1).

Student Activity

To confirm that students can perform these calculations independently, they are now given a GDP, say, 200, and are asked to fill in a blank chart assuming Tax = 20% of GDP and C = 70% of after-tax GDP. By changing these values, several more **interactive learnings** can be generated.

Using GDPFC to Learn More In-depth Concepts

Now that the basic foundation for the GDPFC has been introduced, the students are ready to learn how to apply the chart to more in-depth economic concepts. In the following sections, I will explain a few different scenarios. For each scenario I start with the standard pedagogic approach. I follow this with a description of how using the GDPFC can provide a deeper understanding for the students. Finally, given that a large number of scenarios can be explained using the GDPFC, I provide a summary table that lists the various scenarios. Only three of these scenarios are fully discussed in this paper.

5.1 Closed Economy Macroeconomics

Scenario 1. Balanced budget, T = G

Students are reminded that with a balanced budget the government does not borrow from or save in the Financial Market. Government Savings (*GS, Flow 23*, which is measured by *T* (*Flow 10*) minus *G* (*Flow 6*)), is zero.

Standard Pedagogy (Using National Income Identity Equations):

Without the GDPFC, the standard pedagogic approach is as follows:

Equilibrium Condition 1

The instructor presents:

$$Y = C + I + G$$

Equilibrium Condition 2

The instructor now states the second equilibrium condition:

$NS = I$, where

$NS = \text{National Savings} = HS + GS$

$HS = \text{Household Savings} = Y\text{-}C\text{-}T$

$GS = \text{Government Savings} = T\text{-}G$

The instructor emphasizes and proves that if condition 1 happens, then condition 2 must also happen.

Proof:

$$Y = C + I + G$$

$$Y = C + T\text{-}T + G + I$$

$$Y = C + T\text{-}(T\text{-}G) + I$$

$$Y = C + T + I\text{-}(T\text{-}G)$$

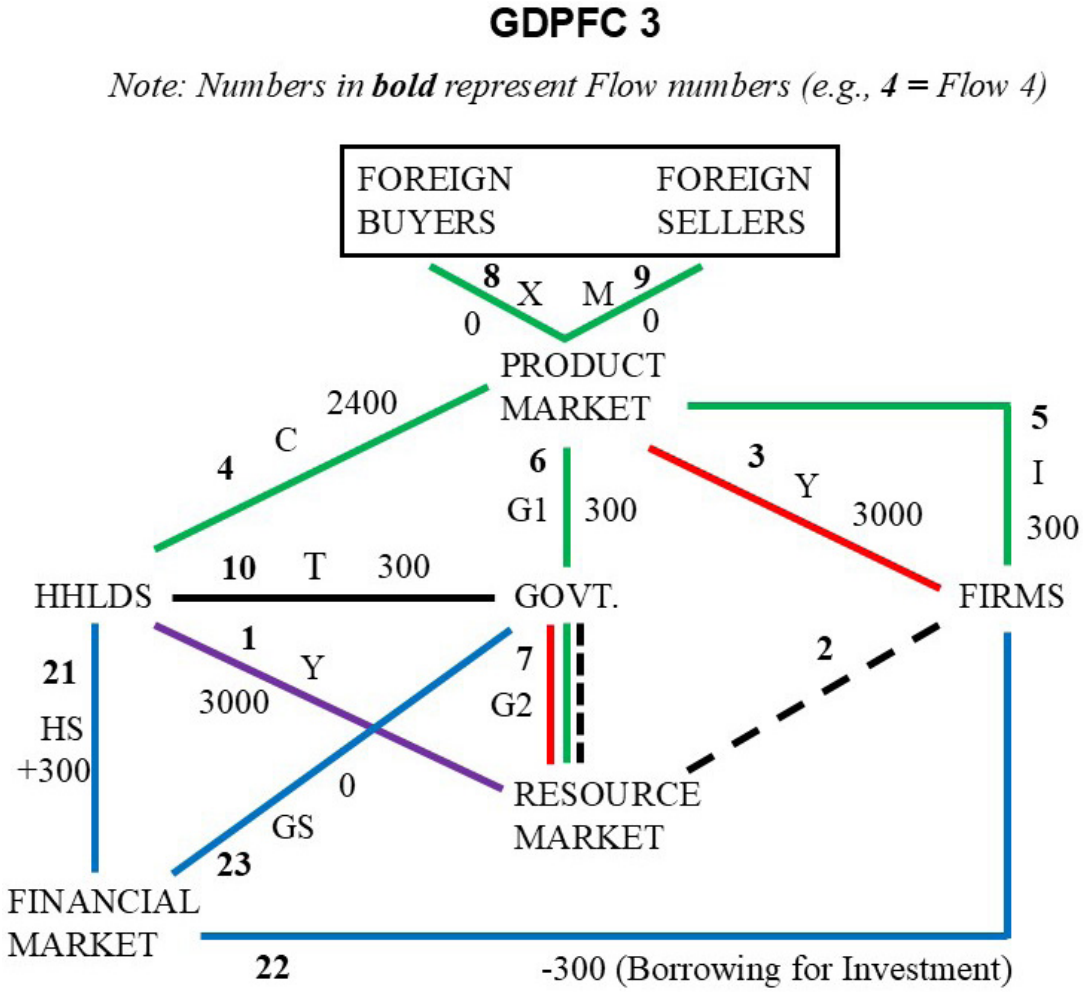
$$Y – C – T + T\text{-}G = I$$

$$HS + GS = I$$

$$NS = I, \text{proved}$$

Explanation Using the GDPFC

Figure 3: GDPFC Completed Example in a Closed Economy with a Balanced Budget



Equilibrium Condition 1

Starting with a blank GDPFC, I first assign numbers or ask students for suggestions for $Y, C, T, \text{and } G$. Suppose the following numbers are chosen: $Y = 3000, C = 2400, T = 300, G = 300$. Students are then challenged to find the value of I so that it satisfies the first equilibrium condition $(Y = C + I + G)$. Some may come up with the right answer, $I = 300$. I also mention that I is financed by borrowing, through *Flow 22*.

Equilibrium Condition 2

Students are then asked to put all six values in the GDPFC: *Y (Flows 1* and *3)*, *C (Flow 4)*, *T (Flow 10)*, *G (Flow 6)*, *I (Flow 5)*, and *Flow 22*. The six values can be seen in the GDPFC in Figure 3.

Students calculate Household Savings (*HS*, *Flow 21*) by subtracting *Flows 10 and 4* from *Flow 1* $(Y–T–C)$. They find this to be 300, and they enter this for *Flow 21*.

They also calculate *GS* by subtracting *Flow 6* from *Flow 10*, which gives them 0, and they put this on *Flow 23*. The completed example is shown in Figure 3.

Now the students can see that $\text{Flow } 21 + \text{Flow } 23 = 300 = I$.

So, $NS(HS + GS) = I$, proved.

Students have learned the proof in a hands-on activity, similar to performing an experiment in a physics laboratory.

Scenario 2. Deficit budget, T < G, and Trade Balance

***Standard Pedagogy*:**

The equilibrium conditions are now:

Equilibrium Condition 1

$Y = C + I + G$

Equilibrium Condition 2

$NS = I$

Proof:

$Y = C + I + G$

$I = Y\text{-}C\text{-}G$

$I = Y\text{-}C\text{-}T + T\text{-}G$

$I = HS + (–GS)(\text{Here } GS < 0)$

$NS = I, \text{proved}$

Now a third equilibrium condition is normally introduced.

Equilibrium Condition 3

Leakages = Injections, where Leakages $= HS + T$, and Injections $= I + G$.

Proof by Standard Pedagogy:

We have already proved $NS = I$, or

$HS + GS = I$

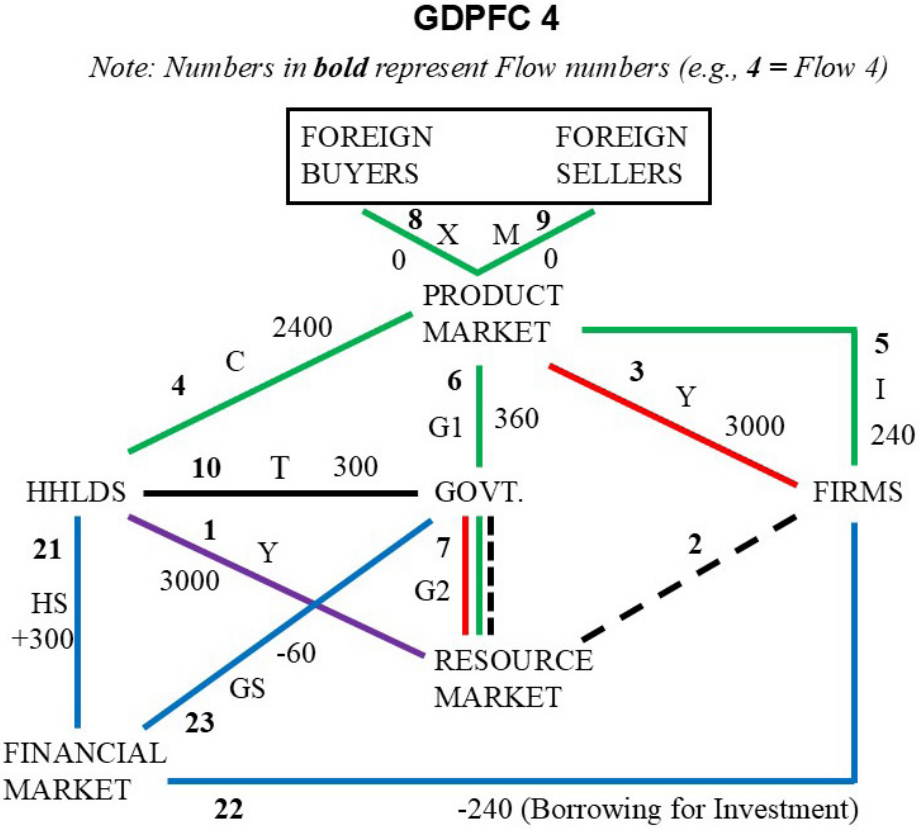
$HS + T\text{-}G = I$

$HS + T = I + G$,

Therefore Leakages = Injections, proved.

Explaining These Conditions Using the GDPFC (With a Budget Deficit, or Flow 6 > Flow 10).

Figure 4: GDPFC Completed Example in a Closed Economy with a Budget Deficit



Students are asked to go back to Figure 3 and find equilibrium by increasing *G* by any number, say 60, while keeping *C* and *T* unchanged. Some come up with the solution: *GS* (*Flow 23)* becomes -60, and *I* (*Flow 5*), is reduced by 60 to 240. As a byproduct, students also get a visual illustration of crowding out: how an increase in *G* creates a reduction in *I*. Now they create a modified GDPFC, Figure 4, using the newly created values.

The three equilibrium conditions (under budget deficit) can now be verified interactively using Figure 4.

Equilibrium Condition 1

$$Y = C + I + G$$

$$Y = 3000$$

$$C + I + G = 2400 + 240 + 360$$

$$= 3000$$

$$\text{So}, Y = C + I + G, \text{proved}.$$

Equilibrium Condition 2

$$NS = I$$

$$NS = HS + GS$$

$$= 300 + (\text{-}60)$$

$$= 240$$

$$I = 240\,(\text{Flow } 5)$$

$$\text{So } NS = I, \text{proved}$$

Equilibrium Condition 3

Leakages = Injections

From Figure 4 the students calculate Leakages $= \text{Flow } 21 + \text{Flow } 10 = 300 + 300 = 600$. They also calculate Injections$= \text{Flow } 5 + \text{Flow } 6 = 240 + 360 = 600$.

Now they realize that in equilibrium, Leakages = Injections. (I describe a bathtub example to illustrate this, where a faucet adds the same amount of water that it drains, keeping the water level in the tub in equilibrium).

Classroom Activity

To provide the students with a new interactive experience I ask them to create a fresh GDPFC like Figure 4 but showing a budget surplus of 60 along with GDP equilibrium. Various combinations are possible. It is also possible to put extra restrictions in place, like Household Savings has to be 250 or Tax has to be 350, etc.

5.2 Open Economy Macroeconomics

Scenario 1. Budget Deficit and Trade Surplus (Domestic Underspending)

Standard Pedagogy:

Equilibrium Condition 1

$$Y = C + I + G + NX$$

where $NX = X–M$ (this is negative with a trade deficit)

Equilibrium Condition 2

$$NS = I + NX$$

Proof:

$$Y = C + I + G + NX$$

$$Y\text{-}C\text{-}G = I + NX$$

$$Y\text{-}C\text{-}T + T\text{-}G = I + NX$$

$$HS + GS = I + NX (\text{because } HS = Y–C - T \text{ and } GS = T - G)$$

$$NS = I + NX, \text{proved}$$

Equilibrium Condition 3

Leakages $(HS + T + M)$ = Injections $(I + G + X)$

Proof

$$Y = C + I + G + X\text{-}M$$

$$Y\text{-}C\text{-}T + T + M = I + G + X$$

$$HS + T + M = I + G + X$$

Leakages = Injections, proved

Equilibrium Condition 4

Domestic underspending (or domestic surplus) = trade surplus, and vice versa

Proof:

Domestic underspending $= Y\text{-}(C + I + G)$

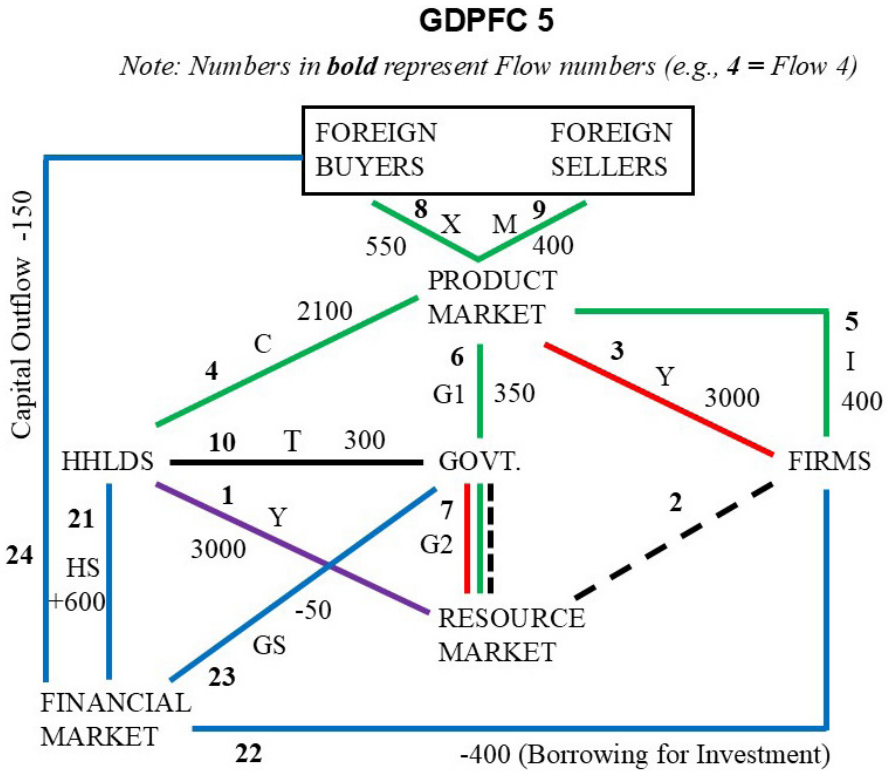
$= C + I + G + NX–C–I–G$

$= NX$ or trade surplus, proved

Explanation Using the GDPFC

Let us now see how the above ideas are developed through an interactive GDPFC.

Figure 5: GDPFC Completed Example in an Open Economy with a Budget Deficit



I create a new GDPFC (Figure 5), by starting with a GDP of 3000. (*Flow 1* or *Flow 3*). I then choose *C* (*Flow 4*) to equal 2100, and Tax (*Flow 10*) to equal 300. Then Household Savings, *HS* (*Flow 21*) = 600.

I also assume *G* = 350 (*Flow 6*), which makes the budget deficit (Flow 23), or *T* – *G,* equal to -50. (Note the instructor can also ask for a volunteer to perform the above steps on the board (with guidance), or all students can perform them independently on paper, as they follow along with the instructor).

At this point, I ask the students to give me a value for *I* (*Flow 5*), which can be any value less than 550. Suppose they say 400.

They are then asked to calculate Domestic Expenditures $(\text{Flows } 4+5+6)$.

$$C+I+G=2100+400+350=2850\,(\text{Flows } 4+5+6)$$

We know that GDP = 3000. Therefore, Domestic underspending is 150 (3000-2850).

Finally, I explain to the students (or they notice on their own) that the country needs to have a trade surplus of 150 for equilibrium to cover the underspending. (I also urge them to corroborate that the other three equilibrium conditions of Section 5.2 can also be verified once an equilibrium GDPFC is created).

To show a trade surplus of 150, I put reasonable values in the chart for *Flow 8* (X) and *Flow 9* (M), like 550 and 400, that yield a trade surplus of 150. In this example, I can be anything less than 550. If $I = 550$, then trade has to be in balance, and if $I > 550$, a trade deficit is needed.

Now students can verify and learn on their own that all four equilibrium conditions are satisfied in Figure 5.

Note: Trade surplus is also shown as capital outflow and trade deficit is shown as capital inflow in the GDPFC. This apparent contradiction is explained in Appendix A.

Additional Scenarios That Can Be Explained by the GDPFC

Based on the state of the budget, total domestic spending, and trade, we can identify nine scenarios. These are shown in Table 2.

Table 2: Summary of Nine Scenarios That Can Be Explained Using the GDPFC

Scenario	Budget	Economy	Trade	Flow Chart Example
1	T = G Balanced	Y = C + I + G Domestic Equilibrium	X = M = 0 Closed Economy (Balanced)	Figure 3
2	T = G Balanced	Y > C + I + G Domestic Surplus	X > M Surplus	Not discussed in this paper
3	T = G Balanced	Y < C + I + G Domestic Deficit	X < M Deficit	Not discussed in this paper
4	T > G Surplus	Y = C + I + G Domestic Equilibrium	X = M Balanced	Not discussed in this paper
5	T > G Surplus	Y > C + I + G Domestic Surplus	X > M Surplus	Not discussed in this paper
6	T > G Surplus	Y < C + I + G Domestic Deficit	X < M Deficit	Not discussed in this paper
7	T < G Deficit	Y = C + I + G Domestic Equilibrium	X = M = 0 Closed Economy (Balanced)	Figure 4
8	T < G Deficit	Y > C + I + G Domestic Surplus	X > M Surplus	Figure 5
9	T < G Deficit	Y < C + I + G Domestic Deficit	X < M Deficit	Not discussed in this paper

Each scenario can be analyzed by **standard pedagogy** or by using **GDPFC-based interactive teaching.**

In this paper we have thoroughly analyzed three scenarios from Table 2. Instructors may choose to use these scenarios, or they may select other scenarios from Table 2 to explain in class.

A wide range of student activities can be developed for any of the scenarios, similar to those described in this paper. To add variation the instructor may assign specific values for some of these variables, like C, I, X, etc., while leaving other variables unsolved, before assigning activities to the students.

In his book, Mankiw (2016) has analyzed the algebraic part of GDP relationships using more aggregation. He considered only national aggregate data and did not look into surplus or deficit in government budgets, i.e., his chart does not have column 2 of Table 2. His classifications are stated in his book, which is represented below with minor adaptations.

In my Intermediate Macroeconomics classes I have explained all three panels of Figure 6 using the GDPFC.

Figure 6: Various Scenarios Involving International Trade

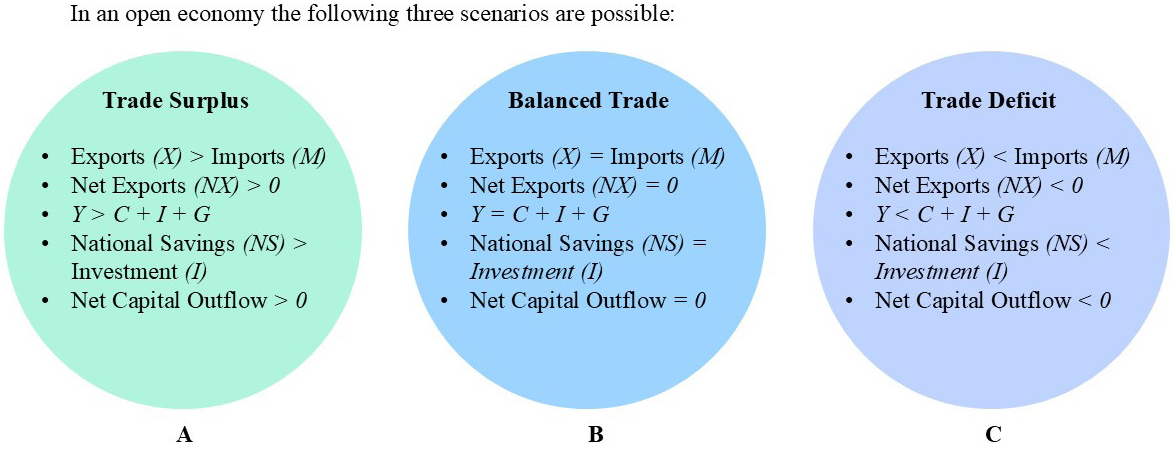


Figure adapted from Mankiw, N. Gregory. (2016). Macroeconomics (9th ed.). Worth Publishers.

To show real-world relevance, I mention that for a long period, the US had domestic overspending (deficit) and our economy was rescued by a comparable amount of trade deficit, which means the US situation is comparable to Scenario 9 in Table 2 or Panel C in Figure 6. Then I give the students homework to verify all the equilibrium conditions using US data from any recent year.

Final Classroom Activity to Reinforce Concepts

To help students grasp the above-described concepts I now introduce an activity that allows them to think independently about the GDPFC flows and their connections. Students are divided into groups of four, and each group is asked to create a GDPFC with domestic underspending/surplus equal to the sum of their ages. They work together to choose the rest of the numbers, with the requirement that the numbers must make economic sense. Finally, they verify from their flow charts that **Domestic surplus = Trade surplus.**

A Few Extra Applications of GDPFC

Below I have listed some additional ways that I use the GDPFC.

1. **Principles and Intermediate Macroeconomics (Econ 201, Econ 320)**

   Classical Full Employment Equilibrium: NS goes to the Financial Market through *Flows 21* and *23*. This becomes I by the adjustment of the rate of interest in the Financial Market.

   Keynesian Underemployment Equilibrium: If the rate of interest is not fully flexible it may not adjust enough to make $NS = I$, ending in underemployment equilibrium.

2. **International Economics (Econ 319)**

   As discussed in Section 5.2, the GDPFC can be used to discuss the role of trade balances as a safety valve to neutralize domestic overspending or underspending.

3. **Economics of Developing Countries (Econ 223)**

   Mobilizing domestic resources can be explained by demonstrating how Household Savings (*Flow 21*), Taxes (*Flow 10*), and Government Savings (*Flow 23*) or Capital Inflow (*Flow 24*) contribute to *I* (*Flows 22 and 5*).

   Also, I emphasize that if the above resources are not enough for the required I, foreign resources can help. To show this I draw several lines to the Financial Market from the left side and name them IMF, World Bank, and USAID.

Explaining the Keynesian Multiplier Using GDPFC

One final topic I will discuss is how the GDPFC also comes in handy in illustrating the operation of the Keynesian Multiplier (KM).

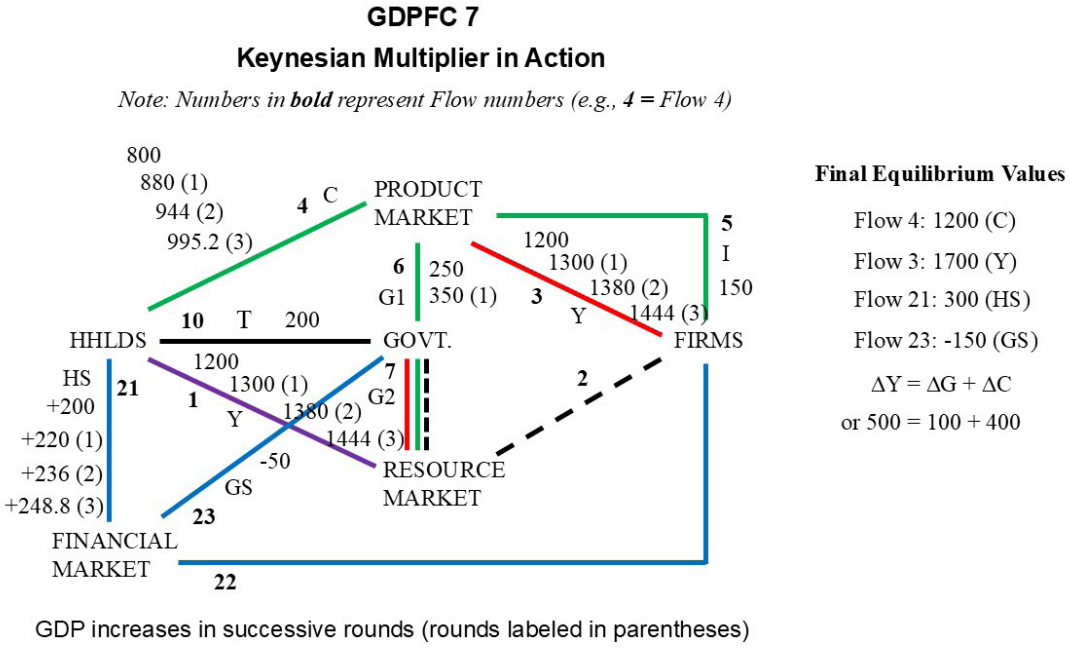
Suppose Marginal Propensity to Consume (MPC) is 0.8, so the KM is 5 (KM = 1/(1 – MPC)).

In the fiscal policy version, if G goes up by any amount, say, 100, Y will rise by G times the KM (in this case 100 x 5, or 500).

In one variation of monetary policy, if the money supply increases, the interest rate falls, I goes up, and Y rises by KM times. The real work of the multiplier starts after the increase of G or I, and the **process is the same for both.**

To illustrate this, we have created a simple GDPFC (Figure 7). We assume that autonomous consumption is zero, along with MPC = 0.8, so that *C* is always 80% of disposable income $(Y–T)$. We have also assumed a closed economy, so *Flows 8 and 9* are not included.

Figure 7: GDPFC Completed Example Showing the Keynesian Multiplier in Action



In this GDPFC, GDP is in equilibrium at 1200.

$$1200(Y) = 800(C) + 150(I) + 250(G)$$

Now we let either G or I increase by a certain amount, say, 100. To meet the extra demand, Y rises by 100 (Round 1).

Students think a new equilibrium has occurred at 1300 $(\text{because } Y = C + I + G = 1300)$. But I point out that 1300 cannot be equilibrium. Because household income has gone up by 100 (*Flow 3*), C will rise by 80 (given the MPC of 0.8), so GDP will rise by 80 (Round 2). This 80 again returns to the Household, which spends another 64 dollars (80 x 0.8). So, C goes up by 64, and Y also goes up by 64 (Round 3). Finally, I explain that the process will end when GDP rises by 500 (because KM = 5, and 100 x 5 = 500).

The above various iterative values are shown in Figure 7, up to the third round. Figures in the parentheses represent the relevant round.

Classroom Activity

After I develop the interactive model, I ask the students to look at the completed chart (Figure 7) and explain which flows/values have been affected by the change of G and by how much.

6. Sample of GDPFC Based Questions for In-class Activities and Homework Assignments

In problems 1-3, MPC is not needed (trade balance is assumed).

1. Make a completed GDPFC showing an equilibrium GDP of 800 and a balanced budget.
2. Make a completed GDPFC showing an equilibrium GDP of 800 and a budget surplus/deficit of 100.
3. Prove that *Leakages* equal *Injections* in a closed economy.

In problems 4 and 5, MPC is needed (trade balance is assumed).

4. Suppose MPC is 0.75 and autonomous consumption is 100. Complete an equilibrium GDPFC. Suppose *G* increases by 25. Make a new GDPFC letting GDP increase because of the multiplier. Compare the new values with the values of the original GDP.
5. Make a completed GDPFC showing equilibrium GDP of 1200. Suppose *G* increases by 100. Show a possible consequence in a modified GDPFC assuming MPC = 0.9.

In the following problems, MPC is not needed and trade should not be in balance.

6. Make a completed GDPFC showing equilibrium GDP of 800 and a budget surplus/deficit of 100 and a trade surplus/deficit of 50.
7. Make a completed GDPFC with an equilibrium GDP of 1600 with imbalances in both trade and budget. Prove that $NS = I + NX$.
8. Prove that *Leakages* equal *Injections* in an open economy.

7. Conclusion

In biology, the movement of blood to and from the heart is illustrated using a chart. In physics, the gravitational pull between the earth, sun, and the moon is shown by drawing these bodies and the lines in between. A geography professor does not just describe the ocean currents between two places but uses a chart to do so. The goal of the GDPFC is to create a similar experience in certain areas of economics instruction. I have found the GDPFC model to be a highly valuable teaching tool and I have used it repeatedly in various courses. Students appreciate it as they can vividly visualize theoretical concepts of economics and also learn from simulations and problem-solving.

I hope that someday this GDPFC can be used in various schools and colleges when teaching relevant topics in economics. When actual data are used in the GDPFC, students get familiar with the basic macroeconomic features of the country. There are many other ways that this model can be used, and professors using this chart may modify it to suit their preferences (e.g., a line can be drawn between firms and government to include indirect business taxes). Finally, I have not assumed that government produces any goods or services. But we can easily include government production by entering some values in the chart for *Flow 7* and making a few other changes. I have done this in some upper-level courses. If any reader is interested, I would be happy to send him or her how I have accommodated government production into the model.

References

Arnold, R. A. 2019. *Macroeconomics* (13th ed.). Cengage.

Baltgailis, J. 2019. The issues of increasing the effectiveness of teaching comparative economics. *Insights into Regional Development, 1*(3), 190-199. DOI: 10.9770/ird.2019.1.3(1)

Baumol, W. J., Blinder, A. S., & Solow, J. L. 2020. *Macroeconomics: Principles and policy* (14th ed.). Cengage.

Buckles, S., & Hoyt, G. M. 2006. Using active learning techniques in large lecture classes. In W. E. Becker, M. Watts, & S. R. Becker. (Eds.), *Teaching economics: More alternatives to chalk and talk*. Edward Elgar, pp. 75-84.

Elmslie, B. T., & Tebaldi, E. 2010. Teaching economic growth theory with data. *The Journal of Economic Education, 41*(2), 110-124. DOI: 10.1080/00220481003617244

Goeree, J. K., & Holt, C.A. 1999. Employment and prices in a simple macroeconomy. *Southern Economic Journal, 65*(3), 637-647. DOI: 10.1002/j.2325-8012.1999.tb00184.x

Gwartney, J. D., Stroup, R. L., Sobel, R. S., & Macpherson, D. A. 2022. *Macroeconomics private and public choice* (17th ed.). Cengage.

Halliday, S. D., Makler, C., McKee, D., & Papadopoulou, A. 2024. Improving student comprehension through interactive model visualization. *International Review of Economics Education, 47*, 1-16. DOI: 10.1016/j.iree.2024.100296

Hazlett, D., & Hill, C. D. 2003. Calculating the candy price index: A classroom inflation experiment. *The Journal of Economic Education, 34*(3), 214-223. DOI: 10.1080/00220480309595216

Krugman, P., & Wells, R. (2006). *Macroeconomics.* Worth Publishers.

Luccasen, R. A., Hammock, M., & Thomas, M. K. 2011. Teaching macroeconomic principles using animated cartoons. *The American Economist, 56*(1), 38-47. DOI: 10.1177/056943451105600106

Mankiw, N. G. (2016). *Macroeconomics* (9th ed.). Worth Publishers.

Maximova, A., Muchiri, S., & Paraschiv M. 2023. A stroll down the dollar street: Teaching per-capita GDP using internationally comparable photographs. *Journal of Economics Teaching,* 87-113. DOI: 10.58311/jeconteach/178c166014597b60b1f4b7463ef0d55842b8996b

Neveu, A. R. 2020. Reimagining the introductory material in teaching money creation and monetary policy. *The Journal of Economic Education, 51*(3-4), 297-316. DOI: 10.1080/00220485.2020.1804505

Ruediger, S., & Batova, T. 2020. The candy price index and the gumball domestic product. *Journal of Economics Teaching,* 1-16. DOI: 10.58311/jeconteach/9b66ac6f03a5733bc1b0815a4fd37f98a308085d

Taylor, J. B. 2000. Teaching modern macroeconomics at the principles level. *AEA Papers and Proceedings, 90*(2), 90-94. DOI: 10.1257/aer.90.2.90

Tucker, I. B. 2018. *Macroeconomics for today* (10th ed.). Cengage.

Wolla, S. 2018. The textbook treatment of net exports: Will the uninformed reader understand? *Journal of Economics Teaching*, 232-253. DOI: 10.58311/jeconteach/9d595fc79391cbcc3a669af-7c6eb5af0f70b5869

Appendix A: Explanation of Why Positive *NX* Equals Capital Outflow (i.e., Negative *Flow 24*), and Vice Versa

This is a confusing concept. On the surface, it appears that with a positive export of goods, money (i.e., capital) will flow into the exporting country making a prima facie case for positive capital inflow. However, in macroeconomic trade accounting, exports are considered capital outflow. This apparent contradiction is resolved below:

For every dollar of goods produced as finished goods for the GDP, an equal dollar of income is produced for the household. Goods stay in the product market and the parallel money ("GDP money") stays in the households. When households or governments do not use some of this "GDP money" to buy finished goods, the unsold goods stay in the product market and an equal amount of "GDP money" stays unused. This "GDP money" is then saved in the financial sector through *Flow 21* or *Flow 23*. Thus, for every dollar of unsold goods in the product market, an equal amount of "GDP money" stays stuck in the financial sector. Ideally, this "GDP money" in the financial sector should be borrowed by the firms (*Flow 22*) to purchase capital goods (*Flow 5*). When these unsold goods are sold to foreign buyers, we also send the "GDP money" (i.e., potential capital) to them to pay for those goods in our product market. (In return, foreign buyers send to the financial sector an equal amount in their currency as an IOU). Hence, we see that with exports we also export "GDP money," or capital (implying *Capital Outflow* or negative *Flow 24*).

By reversing the argument from exports to imports, we can explain why imports are synonymous with capital inflow.