JOURNAL OF ECONOMICS TEACHING

The Candy Price Index and the Gumball Domestic Product

The "Candy Price Index" by Hazlett and Hill (2003) introduces students to the biases of the Consumer Price Index (CPI). This paper extends their assignment to also calculate real wages, real interest rates, real and nominal Gross Domestic Product (GDP), and the GDP deflator. Thus, it is well suited to complete the sequence of classes on measuring macroeconomic activity. In addition, the assignment provides insight into the differences between the GDP deflator and the CPI that result from their equations and not the basket of goods. Thus, this activity is a worthwhile starting point to discuss the differences between the CPI and GDP deflator.

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1. Introduction

Measuring inflation is one of the key topics of Principles of Macroeconomic classes. In these classes, students usually get exposed to two kinds of inflation measures: the Consumer Price Index (CPI) and the Gross Domestic Product (GDP) deflator. Unfortunately, not much information is provided in the textbooks about how the two measures differ aside from the range of goods and services included in each. No Principles textbook offers students the possibility to discover the computational differences between the two measures.

The classroom assignment presented in this article, "The Candy Price Index and the Gumball Domestic Product," provides a great starting point for discussing the differences between these two inflation measures, as well as changes made to these measures in the last decades. In addition, this article fills a void in the literature as there are no publications available that deal with the simple measurement of real GDP, nominal GDP, and the GDP deflator in educational settings. No undergraduate introductory level textbook has discussed the "new" way real GDP is calculated since 1996 (Kliesen, 1996). This "new" way, the chain-price index calculation of real GDP, is usually not introduced until the intermediate-level macroeconomic classes, and even in those textbooks it is neither commonly found nor discussed in detail. Our classroom assignment is a way to introduce the "new" way to calculate the real GDP that can be easily followed by students in introductory-level classes.

Our assignment is an extension of the "Candy Price Index"—the CPI assignment by Hazlett and Hill (2003 (henceforth HH). While HH use their assignment to focus on substitution, quality, and new goods bias, we offer a way to show how the different calculation methods for GDP deflator and CPI lead to different results. Furthermore, the first inflation measure that students get to know in a Principles of Macroeconomics class is the GDP deflator (80% of the top five books and 60% of the top 20 books – based on sales ranks provided by Amazon, Cengage, and Pearson). The number one selling Principles textbook by Greg Mankiw introduces the GDP deflator and inflation in Chapter 10 and the CPI and inflation in Chapter 11 (Mankiw, 2014). As such, students might consider the GDP deflator by default the more important and commonly used measure to calculate inflation. Our assignment allows them to consider the pros and cons of both.

In what follows, Section 2 surveys the relevant literature; Section 3 describes the assignment; and Section 4 provides an overview of students' responses to the assignment and concluding remarks.

2. Literature Review

Classroom activities based on games and experiments as an effective element of the economics classroom go back to the first such teaching tool proposed by Chamberlin (1948). Since then, the literature has evolved dramatically and experiments and games have become a commonly used teaching tool in economics. While some (e.g., Cardell et al., 1996; Greene, 2014; Emerson & Taylor, 2004) could not confirm improvements, numerous others (e.g., Dickie, 2006; Durham, McKinnon, & Schulman, 2007; Cartwright & Stepanova, 2012; Rousu et al., 2015; and Yandell, 2004) find that experiments and games in the economics classroom improve some learning outcomes.

Despite the long history of running experiment and game activities in the economics classroom, the number of such activities related to macroeconomics and specifically the calculation of real GDP, nominal GDP, and the GDP deflator is small (see Brauer & Delemeester,

2001; updated in 2007 for an overview).[1] There are only four articles that provide activities related to the calculation of GDP. Goeree and Holt (1999) describe a GDP-related game but this game is built around a circular-flow approach and offers no insights into the differences between real and nominal GDP. While Hazlett (1999) presents a game that includes several teaching points about real and nominal values (including GDP), this game has a focus on inflation and uncertainty and does not lend itself to explaining GDP and the GDP deflator. While real and nominal values are also at the core of the game proposed by Holleran, Taylor, and Santopietro (2006), the game is more focused on the money-inflation relationship than on GDP. Finally, O'Sullivan and Steven (1998) provide another GDP-related game, but in the game the GDP is focused on a production function approach, and the game deals extensively with costs and profits and thus, it is not a good starting point to discuss the GDP and GDP deflator.

Although there are currently no sources that discuss the calculation of the GDP deflator in the classroom context, the Candy Price Index assignment presented by HH can be extended from its focus on CPI to cover the GDP deflator. The assignment described by HH builds on six rounds of candy purchasing to introduce students to the topic of inflation. HH show how the assignment can be used to provide very specific examples of new product bias, quality bias, and substitution bias. The assignment starts with the entire class receiving the assignment sheet that outlines budget and candy prices for all available periods and then shopping for candy in the base period to determine the basket for a typical student. Once the representative consumption basket for the base period is established and shared with the students, students can determine how much they would purchase in each following period and calculate the CPI and, consequently, the economy-wide inflation rate. Variation in prices and variation in product availability allow the instructor to discuss the biases in the calculation of the CPI. After completing this assignment, students get a working knowledge of base periods, product baskets, and inflation equations.

3. The Candy Price Index and the Gumball Domestic Product[2]

A. Foundations of the Assignment

The main difference between GDP deflator and CPI is the different kinds of products and expenditure categories that are included in the GDP deflator when it is calculated at the economy level (Church, 2016). However, while both CPI and GDP deflator calculate inflation, each measure leads to different results, even if the products included in them are identical. Hence, the choice of which measure to use depends on one's purpose (Church, 2016), and it is very important to call students' attention to this issue.

This issue involves the biases that both CPI and GDP deflator are prone to. The CPI uses a fixed basket of goods and services as weights for the prices in the economy and follows the approach of a Laspeyres Price Index. The Bureau of Labor Statistics (Church, 2016) states that the way the CPI is currently calculated using the Laspeyres formula introduces "consumer substitution bias" into the CPI due to the inability to use real-time updates of consumer behavior. This means that the CPI does not account for the possibility that consumers will switch to substitutes, shop in outlets, or bargain hunt when the prices of products increase.

The real GDP is the output produced in the economy valued at prices of the base period. The nominal GDP is the output produced in the economy valued at current prices. Thus, the ratio of the two measures, the GDP deflator, follows the general approach of a Paasche Price Index

[1]A literature search for publications since 2007 did not yield any additional findings complete handouts available at sruediger.com.

[2]See the appendix for a detailed step-by-step guide to the assignment.

(this is the old method to calculate GDP deflator and is still the only way it is taught in Principles textbooks). Calculated this way, the GDP deflator reacts more quickly to the introduction of new products into the marketplace and in such a way overstates the biases (as compared to understating the biases in the case of CPI).

The "new" approach to calculating real GDP, the Fisher Index, addresses these shortcomings by using the geometric mean of Laspeyres and Paasche Indexes. This gives the "new" real GDP the ability to respond more quickly to any bias issues (Pakko, 1997; Hausman, 1999). The Bureau of Economic Analysis switched to using a Fisher ideal index formula to calculate real GDP in 1996 (see appendix for an explanation of the equation). However, the "new" way to calculate the real GDP is not taught in Principles textbooks. In addition, currently only one paper on teaching economics exists that offers activities to calculate the Fisher Ideal Price Index (Cahill, 2003).

B. Description of the Assignment

Our assignment, the Candy Price Index and the Gumball Domestic Product, builds on four rounds of candy purchasing. Because of the additional level of calculations beyond CPI, we suggest reducing the length of the assignment to four periods compared to the six periods suggested by HH. Removing two periods still allows for good coverage of biases but gives students additional time to calculate the real and nominal GDP and the GDP deflator.

The assignment starts with students going candy shopping during all four periods of the assignment. Either before the shopping starts or after the conclusion of the shopping, the instructor needs to set the base period; we recommend using the first period as the base period to make the assignment easier for the students, but additional complexity can be achieved by picking later periods.[3] Different from the assignment set-up by HH, here we can skip the calculation of a separate base period because the GDP calculations make it necessary to collect economy-wide shopping data for each period of the game.

Following the original idea by HH, we suggest allowing students a budget of $0.30 to make later calculations easier. Once the entire class has had time to shop for their desired candy products, we collect the shopping amounts for each student using a classroom response system. We ask one question per candy per round with the answer options ranging from 0 to 6 (this needs to be adjusted if you work with a budget different than $0.30). Prices for the three kinds of candy are 5, 10, and 15 cents and the total budget for consumption is thirty cents, thus students purchase quantities ranging from 0 to 6.[4] The instructor calculates a simple weighted average for each of the three candy categories to establish the shopping basket for all periods (see handouts in the appendix) and shares that information with the students. The calculation of the weighted average per period is where our assignment differs the most from the HH version. In the assignment by HH, students were asked to record their individual consumption levels for each period but were never asked to share that information with the instructor. Using the weighted average shopping basket for each period, students in our activity are able to calculate CPI, nominal, real GDP, and GDP deflator. The instructor should prepare a spreadsheet before class that automatically calculates the representative basket for the base period and the CPI, GDP, and inflation rates for all following periods. The calculation should be followed by a whole-class discussion to achieve the maximum effect.

[3]The assignment can be easily extended in the following way: round 1: pick period 1 as the base period and calculate everything together with the students as a big group exercise; round 2: change the base period and assign students to redo all the calculations. In this way students can see the dependency of the index on the base period.

[4]A fourth kind of candy is available in Rounds 3 and 4 to introduce a discussion about the new goods bias.

For instructors who want to cover the "new" way of calculating real GDP, we suggest splitting the class into two groups. Group 1 gets to calculate the CPI and GDP deflator (using the "old" equation for real GDP) using period 1 as the base year. Group 2 gets to calculate the CPI and GDP deflator (using the "old" equation for real GDP) using period 2 as the base year. Once both groups are done, the inflation rates can be compared (they will be different) and used as a starting point to discuss the benefits of the Fisher Ideal Price Index and the new chain-weighted calculation of the GDP. Once the discussion is completed, students should calculate real GDP using the new method and compare the old and new method results. (We offer an additional worksheet for the new way to calculate the real GDP in the appendix.)

C. Key Contributions of the Assignment

In "the Candy Price Index and the Gumball Domestic Product" assignment, the difference between the CPI and GDP deflator is nicely illustrated by the price changes of Skittles and Gumballs between periods 1 and 2. Skittles initially start out at 10 cents, while Gumballs cost 5 cents in period 1. In the next period, the price of Skittles drops to 5 cents and the price of Gumballs rises to 10 cents. Each time we used the assignment in the classroom, students purchased more Skittles and less Gumballs in period 2 compared to period 1. The Laspeyres Index used to calculate the CPI cannot capture this change in consumption behavior and thus tends to overstate inflation; the Paasche Index used to calculate real GDP tends to understate inflation. The new approach uses a geometric average of Laspeyres and Paasche Indexes and is thus likely to be more accurate than each index individually (Pakko, 1997). We do not introduce any economic assignment beyond basic consumption and thus there is no difference in the inclusion of products between the GDP deflator and the CPI. Yet, we get different numbers. Therefore, this is an important teaching point that was not part of the activity by HH.

In the activity presented here, we can illustrate the difference between the CPI and the GDP deflator solely based on the different weights assigned to different products between the two measures. The difference between the two measures in our activity is particularly pronounced because the price fluctuations we introduce in each period are not proportional for all the products.

D. Comments and Advice for Conducting the Activity

Given that we are running this activity in a mass lecture, counting raised hands as suggested by HH is difficult. We recommend using a classroom response system to collect the shopping information, but we do not recommend running the entire activity (answers for CPI, inflation, GDP, etc.) through the same classroom response system. While using a classroom response for all questions and not just the shopping data collection significantly reduces grading time, it also increases the amount of set-up cost required in the classroom and the level of stress students experience.

A classroom response system requires all students to work through the questions at the same pace. Yet, forcing everybody to work at the same pace has proven too difficult and caused, in some instances, a lot of noise in the classroom and rejection of the activity altogether. Thus, we recommend running the final part of the activity (i.e., the calculations) on paper, as initially suggested by HH. For a mass lecture, we also suggest providing an opportunity for students before class to practice the equations for the CPI, nominal GDP, real GDP, GDP deflator, and inflation rate, as well as having at least one teaching assistant available in the classroom. Furthermore, instructors should be prepared to walk around and help students get started with the basic calculations. With careful preparation, we were able to run this assignment in

classrooms of 265 and 379 students covering about 50 minutes of class time.

We also found that concluding the assignment with a whole-class discussion is very productive. Literature shows that including discussions and reflections after the conclusion of the activities helps. Cartwright and Stepanova (2012) find that achievement gains from experiments are greatest when students have to write a report about the assignment. Greene (2014) shows that classes with active discussions have the best exam performance. Holt (1999) also reiterates the importance of reflecting on the experiment using a discussion, because it "enhances the effectiveness of the Socratic method" (p.603), as opposed to traditional lectures and creates "a special kind of teaching/learning environment" (p.603). Following those results, we would recommend having an extensive discussion or reflective writing assignments at the end of the assignment presented in this paper (see also Olmsted and Ruediger (2013) about the benefits of reflective writing in economics).

Finally, it is worthwhile to allow students to work in groups of four or five. The benefits of group work for this assignment are additional learning effects from peer-instruction and less grading.

To improve students' buy-in, we award them with the candy they purchased. However, given that we have run this assignment in classes of 265 and more students, one needs to be concerned with the cost of the assignment. We propose the following solutions: 1) randomly select only one period for which candy is given out at the end of the assignment (see also HH for the same solution), and 2) randomly select only a certain number of students to receive the candy (this process needs to be made as transparent as possible to maintain student buy-in). Finally, we suggest that the candy be paid out in a subsequent class period to avoid having to purchase large amounts of candy in advance.

E. Assignment Follow-up: Calculating Real Wages and Real Interest Rates

In our adaptation of the assignment, we were very concerned with the real-life value of the gained insights. Learning about the different forms of biases that exist when calculating the CPI and the GDP deflator has an important value for the students, but our assignment can provide additional, helpful follow-up.

Students often struggle with differentiating between nominal and real wages, as well as nominal and real interest rates. Yet, distinguishing between nominal and real wages and nominal and real interest rates is one of the most important learning outcomes of a Principles of Macroeconomics class. When students decide about for long-term loans or specific products to use for saving, their knowledge about real and nominal interest rates is key to them making sound financial decisions. Furthermore, as soon as students graduate from college, they are confronted with a real wage and purchasing power analysis. Many students will have to compare different places to live and adjust nominal wage offerings to the local cost of living to know their true purchasing power (or real wage) in each location.

Our assignment provides an important learning opportunity beyond the CPI and GDP—and beyond the boundaries of the classroom. When students find themselves in future situations where it becomes important to differentiate between nominal and real variables, they will be able to draw parallels to the assignment presented here. Instructors should make time at the end of the assignment or during the next class period to ask the following (or a similar) set of questions:

- Consider the inflation rate between periods 3 and 4. By what percent would nominal

wages have to have changed on average between periods 3 and 4 for consumers' purchasing power to have stayed constant?
- Consider the Consumer Price Index value in periods 2 and 3. If you earned $50 per hour in period 2, how would your hourly salary have to have changed so that your purchasing power (real wage) would have been the same in Period 3?
- Consider the inflation rate between periods 2 and 3. By what percent would nominal interest rates have to have changed on average between periods 2 and 3 for real interest rates to have stayed constant?

In our experience, adding these questions to the end of the assignment allows students to make better connections between the learned material and real-life applications of the material.

4. Conclusion

In this paper, we introduce an active learning assignment that allows instructors to teach the construction of price indices and inflation rates. It is based on the paper by HH but enhances their approach by discussing how to avoid biases in price indices and what adjustments have recently been made by the Bureau of Labor Statistics to reduce the number of biases in the CPI and by the Bureau of Economic Analysis to reduce the number of biases in the real GDP calculation. With this assignment, students gain the important insight of why economists typically monitor both the GDP deflator and CPI.

The assignment can easily be extended to talk about nominal and real wages and nominal and real interest rates, as illustrated here. However, it has multiple additional applications. This assignment can illustrate the difference between the personally experienced price changes and the reported price changes at the market level. This assignment can be a fun introduction to a discussion about differences in price measurement between different US government agencies. Instructors can also use it to discuss the differences in the CPI and Personal Consumption Expenditure and the ways that these differences could lead to different monetary policy solutions. In addition, the assignment can be used to talk about cost of living adjustments in Social Security payments and the ways that different choices of price indices and other adjustments lead to different payout levels.

The overall response of students to the assignment has been positive. Students report that they prefer the assignment over regular lectures, that the assignment prepares them better for exams, and that the assignment is fun. Furthermore, students report that they appreciated the opportunity to engage in peer-instruction during the assignment and recommend that more such activities should be used during classes.

Overall, we show that "the Candy Price Index and the Gumball Domestic Product" assignment fills a void in the active learning literature, gives students important lessons about the different ways to measure inflation, and provides important real-life insights.

References

Brauer, J., & Delemeester, G. (2001). Games economists play: A survey of non-computerized classroom games for college economics. *Journal of Economic Surveys, 15*(2), 221-236.

Cahill, M. B. (2003). Teaching chain-weight real GDP measures. *The Journal of Economic Education, 34*(3), 224-234.

Cardell, N. S., Fort, R., Joerding, W., Inaba, F., Lamoreaux, D., Rosenman, R., Stromsdorfer, E., & Bartlett, R. (1996). Laboratory-based experimental and demonstration initiatives in teaching undergraduate economics. *The American Economic Review, 86*(2), 454-459.

Cartwright, E., & Stepanova, A. (2012). What do students learn from a classroom experiment: Not much, unless they write a report on it. *The Journal of Economic Education, 43*(1), 48-57.

Chamberlin, Edward H. (1948). An experimental imperfect market. *Journal of Political Economy 56*(2), 95-108.

Church, J. D. (2016). Comparing the consumer price index with the gross domestic product price index and gross domestic product implicit price deflator. *Monthly Labor Review,* U.S. Bureau of Labor Statistics, March 2016. Retrieved from https://doi.org/10.21916/mlr.2016.13

Dickie, M. (2006). Do classroom experiments increase learning in introductory microeconomics? T*he Journal of Economic Education, 37*(3), 267-288.

Durham, Y., McKinnon, T., & Schulman, C. (2007). Classroom experiments: Not just fun and games. *Economic Inquiry, 45*(1), 162-178.

Emerson, T. L., & Taylor, B. A. (2004). Comparing student achievement across experimental and lecture-oriented sections of a principles of microeconomics course. Southern Economic Journal, 70(3), 672-693.

Goeree, J. K., & Holt, C. A. (1999). Employment and prices in a simple macroeconomy. *Southern Economic Journal, 65*(3), 637-647.

Green, A. (2014). The classroom as policy laboratory: Using a classroom simulation to experience macroeconomic policy. [Unpublished manuscript.] Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2213334

Hausman, J. (1999). Cellular telephone, new products, and the CPI. *Journal of Business & Economic Statistics, 17*(2), 188-194.

Hazlett, D. (1999). Economic experiments in the classroom. Reading, MA: Addison Wesley Longman.

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

Holleran, P., Taylor, B., & Santopietro, G. D. (2006). Does active learning improve student performance? Results of a quantity theory game. [Unpublished manuscript.] Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=951244

Holt, C. A. (1999). Teaching economics with classroom experiments: A s
ymposium. *Southern Economic Journal, 65*(3), 603-610.

Kliesen, K. L. (1996). Chained, rested and ready: the new and improved GDP. *Regional Economist,* St. Louis Federal Reserve Bank, 10-11.

Mankiw, N. G. (2014). *Principles of macroeconomics (7th edition)*. Stamford, CT: Cengage Learning.

Olmsted, J., & Ruediger, S. (2013). Using reflection papers in principles of macroeconomics classes. *Journal of Economics and Economic Education Research, 14*(1), 85.

O'Sullivan, A., & Steven, S. M. (1998). Economics. Prentice Hall

Pakko, M. R. (1997). The business cycle and chain-weighted GDP: Has our perspective changed? *Federal Reserve Bank of St. Louis Review, 79*(5), 39.

Rousu, M. C., Corrigan, J. R., Harris, D., Hayter, J. K., Houser, S., Lafrancois, B. A., & Hoffer, A. (2015). Do monetary incentives matter in classroom experiments? Effects on course performance. The *Journal of Economic Education, 46*(4), 341-349.

Yandell, D. S. (2004). Effects of classroom experiments and integration on student learning and satisfaction. *Journal of Economics and Economic Education Research, 5*(3), 17.

Appendix A - Instructions for the Candy Price Index Assignment (Version 1)

For each of the periods listed below, you have $0.30 in credit to spend how you choose on any combination of the candies listed. The prices of the candies vary from period to period. Make your choices with regard to these prices, spending no more or less than thirty cents in each period. Note that in every period you have the option of buying Twix, Skittles, and Gumballs. However, in periods 3 and 4, you also have the option of buying miniature Snickers bars. You should assume that the Snickers bars are not actually invented until period 3. Please make your choices for all periods now (adapted from HH (2003)).

At the end of this assignment, I will roll a die to determine for which period I will provide candy. This period will also be our base period for the calculation of the CPI.

Please record your personal consumption spending here.

Now, please start "purchasing" your candy for each of the four periods and record your purchases in the table and using the classroom response system.

Period 1

Candy	Price	Amount
Twix	5 cents	
Skittles	10 cents	
Gumballs	5 cents	

Period 2

Candy	Price	Amount
Twix	5 cents	
Skittles	5 cents	
Gumballs	10 cents	

Period 3

Candy	Price	Amount
Twix	5 cents	
Skittles	10 cents	
Gumballs	10 cents	
Snickers	15 cents	

Period 4

Candy	Price	Amount
Twix	10 cents	
Skittles	10 cents	
Gumballs	5 cents	
Snickers	10 cents	

Aggregate Consumption (wait to fill in information until data collection is complete)

We will now determine as a class what amounts of candy a typical student bought in each period.

Period 1			Period 2		
Candy	Price	Amount	Candy	Price	Amount
Twix	5 cents		Twix	5 cents	
Skittles	10 cents		Skittles	5 cents	
Gumballs	5 cents		Gumballs	10 cents	

Period 3			Period 4		
Candy	Price	Amount	Candy	Price	Amount
Twix	5 cents		Twix	10 cents	
Skittles	10 cents		Skittles	10 cents	
Gumballs	10 cents		Gum-balls	5 cents	
Snickers	15 cents		Snickers	10 cents	

Calculations

Calculate the cost of the Basket in the base period and provide your answer here:

Cost of the Basket in the Base Period = _____

You will now calculate the Candy Price Index for each of the periods for the entire economy in the assignment.

You can use this space for your calculations but please record your answers using classroom response system

CPI in Period 1 = _____ X 100 =

CPI in Period 2 = _____ X 100 =

CPI in Period 3 = _____ X 100 =

CPI in Period 4 = _____ X 100 =

You will now calculate inflation rates for the entire economy using the Candy Price Index.

You can use this space for your calculations but please record your answers using the classroom response system

Inflation Rate between Period 1 and Period 2 =

Inflation Rate between Period 2 and Period 3 =

Inflation Rate between Period 3 and Period 4 =

Using the information for aggregate spending for each of the products in periods 1 – 4, please go ahead and calculate the nominal GDP and real GDP for each period for the entire economy. You can use this space for your calculations but please record your answers using the classroom response system.

Nominal GDP = P(current period)Q(current period)

Nominal GDP in Period 1 = _____ X 100 =

Nominal GDP in Period 2 = _____ X 100 =

Nominal GDP in Period 3 = _____ X 100 =

Nominal GDP in Period 4 = _____ X 100 =

Real GDP = P(base period)Q(current period)

Real GDP in Period 1 = _____ X 100 =

Real GDP in Period 2 = _____ X 100 =

Real GDP in Period 3 = _____ X 100 =

Real GDP in Period 4 = _____ X 100 =

You will now calculate the GDP deflator for each of the periods using nominal and real GDP. You can use this space for your calculations but please record your answers using the classroom response system.

GDP deflator = 100(nominal GDP/real GDP)

GDP deflator in Period 1 = _____ X 100 =

GDP deflator in Period 2 = _____ X 100 =

GDP deflator in Period 3 = _____ X 100 =

GDP deflator in Period 4 = _____ X 100 =

You will now calculate inflation rates for the entire economy using the GDP deflator.

You can use this space for your calculations but please record your answers using the classroom response system.

Inflation Rate Between Period 1 and Period 2 =

Inflation Rate Between Period 2 and Period 3 =

Inflation Rate Between Period 3 and Period 4 =

Fisher Price Index Sheet for Version 2 of the game

Example for year 2 as base year: real GDP = nom GDP in year 2

Laspeyres (PL) = (Pyr1 x Qyr2) / (Pyr1 x Qyr1) – evaluate quantity changes at prices of the previous year

Paasche (PP) = (Pyr2 x Qyr2) / (Pyr2 x Qyr1) – evaluate quantity changes at prices of the current year

Fisher = sqrt(PL x PP)

You will now calculate the Candy Price index for each period for the entire economy using all 3 methods.

You can use this space for your calculations but please record your answers using the classroom response system.

Laspeyres Price Index Period 2,1 =

Paasche Price Index Period 2,1 =

Fisher Price Index Period 2,1 =

Laspeyres Price Index Period 3,2 =

Paasche Price Index Period 3,2 =

Fisher Price Index Period 3,2 =

Laspeyres Price Index Period 4,3 =

Paasche Price Index Period 4,3 =

Fisher Price Index Period 4,3 =

You will now calculate Real GDP using the information for aggregate spending for all the product in period 1 – 4 and the Fisher Price Index.

You can use this space for your calculations but please record your answers using the classroom response system.

Base Year: real GDP = nominal GDP

Real GDP Period 2 = Real GDP Period 1 x Fisher Price Index 2,1

Real GDP in Period 1 = _____ X 100 =

Real GDP in Period 2 = _____ X 100 =

Real GDP in Period 3 = _____ X 100 =

Real GDP in Period 4 = _____ X 100 =

Appendix B – Step-by-Step Description of the Assignment (Version 1)

1. Students purchase candy for each period of the game and the instructor collects the data for the candy purchases after the conclusion of each period.

2. The instructor selects the base period, determines the consumption basket for the typical student (representative consumer), and shares the information with the students.

3. Once the students have the information for the typical student (representative consumer) they can get started calculating CPI, inflation based on CPI, real GDP, nominal GDP, GDP deflator, and inflation based on the GDP deflator. The instructor should also calculate the results to then be able to share the correct results with the students. Ideally, the instructor will have a spreadsheet prepared that automatically generates the results based on the raw data collected in the classroom.

4. The instructor shares the correct results with the students. At this point, the instructor can either review the correct results in detail or tell students to start working on the "advanced" questions about real wages, real interest rates, purchasing power adjustments, etc.

5. Conclude the assignment with a reflective assignment (e.g. one-minute paper) about the main lessons learned and relevance of those lessons to the students' lives.

Version 2 – Fisher price index version

1. Students purchase candy for each period of the game and the instructor collects the data for the candy purchases after the conclusion of each period.

2. The instructor splits the class into two groups: group 1 uses period 1 as the base year; group 2 uses period 2 as the base year. Once the groups are established the instructor determines the consumption basket for the typical student (representative consumer) for each group and shares the information with the students.

3. Once the students have the information for the typical student (representative consumer) they can get started calculating CPI, inflation based on CPI, real GDP (old way), nominal GDP, GDP deflator, and inflation based on GDP deflator. The instructor should also calculate the results to then be able to share the correct results with the students. Ideally, the instructor will have a spreadsheet prepared that automatically generates the results based on the raw data collected in the classroom. Once students are done with the calculation groups 1 and 2 should start sharing their results.

4. The instructor shares the correct results with the students and starts the discussion about the difference between the different price indices used for real GDP and CPI and introduces the Fisher Price Index. At this point the instructor can either review the correct results in detail or tell students to start working on the "advanced" questions about real wages, real interest rates, purchasing power adjustments, etc.

5. Conclude the assignment with a reflective assignment (e.g. one-minute paper) about the main lessons learned and relevance of those lessons to the students' lives.

Appendix C – Differences between CPI and GDP deflator

Figure 1 shows that the GDP deflator (GDP implicit price deflator) has systematically remained below the Consumer Price Index for All Urban Consumers (CPI-U) over time (2 percent annually for the GDP price index and implicit price deflator versus 2.4 percent annually for the CPI-U). The difference in the two measures is in part because the CPI-U employs a Laspeyres aggregation while the GDP deflator employs a Fisher ideal aggregation (Church, 2016)

Laspeyres:

PL = (ptq0)/(p0q0) (This compares the fixed basket of goods q0 for the old and new prices.)

Pasche:

PP = (ptqt)/(p0qt) (This compares the price of the new basket of goods to old and new prices – today's basket at yesterday's prices)

Fisher:

PF = sqrt(PP*PL)

"The Fisher ideal formula is the geometric mean of a Laspeyres index and a Paasche index. In the Laspeyres index calculation, price relatives are weighted by quantity in a base period (i.e., some point in time in the past). In the Paasche index calculation, price relatives are weighted by quantity in the current period. In the case of price indexes, the Fisher ideal index allows for the measurement of real-time changes in quantity." (Church, 2016)

Figure 1. GDP Deflator and CPI-U