NOMINAL AND REAL INCOME IN A REAL DOLLAR STORE

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ABSTRACT

In this paper, the distinction between nominal and real income is highlighted by positing the existence of an imaginary "real dollar store." In this store, all items are sold at a price of one dollar in the base year and the price of each is indexed to the cost of living. Hence, such concepts as "real income" and "real rate of interest" can be illustrated in physical terms in a way that lacks the ambiguity that comes with the term "dollar of the base year."

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Introduction

One of the most important things for beginning students to learn and understand in the principles of macroeconomics course is the difference between nominal income and real income. Nominal income, or money income, is the measure of income that is most familiar to lay persons – the one that is measured in terms of money. Real income is that measure of income that is based on the quantity of goods and services that can be purchased with money income. The measurement of real income, however, is one that is fraught with difficulty. If one were to make a list of all of the goods and services that people purchase and boil it down into a single number as a measure real income, the aggregation process would involve adding apples and oranges, which we are taught in kindergarten is improper. We would have to employ what economists call "real dollars," even though, as Kenneth Boulding said in his presidential address to the American Economic Association in 1968, a real dollar is a "strictly imaginary" one. And yet to measure real income, which is the most familiar metric of the state of a society's aggregate well-being and economic development, we are forced to use "real dollars."

The most familiar way that economists measure real income is with market baskets. In measuring real income using the consumer price index, for example, a fixed market basket is used. The problem with measuring real income in this way is that when the student computes real income in terms of "dollars of the base year" by dividing nominal income by the CPI, they have no intuitive feel for what the "correct answer" in terms of base year dollars really means.

We introduce another way of measuring real income, one that is associated with an imaginary institution called the "real dollar store," below. In a real dollar store, each physical unit of an item costs one dollar in the base year. In every other year, the price of each item is $\$1*(1+i)^t$ where i is the rate of inflation and t is the number of years since the base year. Hence, if we divide nominal income by the price of each item in the real dollar store, we obtain actual physical quantities of something that is familiar to the student, not some hypothetical or imaginary dollar amount.

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In order to compare this approach with the traditional way of measuring real income in macroeconomics textbooks, we normalize the value of a Laspeyres fixed market basket to $100 in the base year. In using an index like the CPI to generate real income in the traditional way, the computation of the CPI is not only simplified, but division by the CPI provides a measure of income called "basket income." If we then multiply the number of baskets that we can buy with nominal income in any given period by $100, we obtain the standard measure of real income in terms of "dollars of the base year." This measure of real income is then compared to the measure obtained from the real dollar store.

The Real Dollar Store

The first way to approach the concept of real income is to begin with someone whose annual nominal income is, say, $30,000 in the base year. This economic agent can purchase 30,000 physical items in the real dollar store where each item costs $1. Since actual dollar stores sell a wide variety of items from pencils to screw drivers to legal pads to cans of food, it is easy for a student to imagine this.

We now present the students with the following problems.

1. Suppose that our economic agent gets a 6% raise. Assume that the inflation rate is zero.
a) *What is the new nominal income?*
b) *What is the new real income?*

ANSWER: Nominal income rises to $30,000*1.06 = $31,800. All prices are still $1.00 and, since the inflation rate is assumed to be zero, the agent can purchase $31,800/$1.00 = 31,800 physical items. Hence, the new real income is 31,800 physical items. Real income rises by 6%.

2. Suppose that our economic agent gets a 6% raise with the inflation rate being 6%. What is real income now?

ANSWER: The nominal salary is still $31,800 as a result of the 6% raise, but the 6% inflation results in each item in the real dollar store having a price of $1.06. Real income, as measured by the number of items that can be purchased, is $31,800/$1.06= 30,000 items, the same as before. Thus, there is no change in real income. The agent's standard of living is unchanged. The percentage change in real income is 6% - 6% or 0%. The raise is simply a cost of living raise. Thus, the percentage change in real income is equal to the percentage increase in income minus the rate of inflation.

3. Now suppose that our economic agent gets a 6% raise and that the inflation rate is 8%. What is real income?

ANSWER: The nominal salary is still $31,800 as a result of the 6% raise, but every item in the store has a price of $1.08. The total number of items that can be purchased is $31,800/ $1.08 = 29,444 items. Thus, even though the agent is receiving a larger paycheck in terms of dollars, the amount that can be purchased has fallen from 30,000 items to 29,444, or a 2% drop. Again, the percentage change in real income is 6% - 8% or -2%. The 6% raise in nominal

income represents a 2% reduction in real income, because the rate of inflation is greater than the rise in nominal income.

Nominal Versus Real Rates Of Interest

The difference between nominal rates of interest and real rates of interest is also easy to imagine in the real dollar store.

. Suppose that the nominal rate of interest is 6% and that the rate of inflation is also 6%. Assume that the agent has $100 in the base year. If one saves the $100 in the base year for a period of one year, then in the year following, the saver will receive principle plus interest equal to $106. The real reward for savings is equal to zero percent since in both the base year and the year following, the saver can only purchase $100/$1.00 or $106/$1.06 or 100 items.

4. What is the real rate of interest if the nominal rate is 6% and the inflation rate is 2%?

ANSWER: If the rate of inflation is 2%, then each item in the real dollar store will cost $1.02. Thus the principle plus interest of $106 will enable the saver to purchase $106/$1.02 or approximately 104 items. Since the saver could have purchased 100 items in the base year, the real reward is not six real items but four real items. The real rate of interest is 4%

5.Finally, what is the real rate of interest if the nominal rate of interest is 6% while the rate of inflation is 8%.

ANSWER: Now, the saver is obviously a loser in real terms. The $106 dollars in the following year only buys $106/$1.08 or approximately 98 items. Since the saver could have purchased 100 items in the base year, there is no incentive for the agent to save. The real rate of interest is 6%-8% or -2%.

One advantage of the real dollar store example is that it discourages the tendency of students to engage in a subtraction exercise whenever they confront a real rate of interest and an inflation rate. When told that a lender demands a real rate of interest of 3% when the inflation rate is 2%, many students, even the best of them, often choose 1% as the nominal rate of interest. This paradigm forces them to think rather than to answer real interest rate questions on automatic pilot.

Basket Income: The Standard Approach

The standard approach to the consumer price index involves computing the value of a fixed market basket in a base year and dividing the value of the items in that basket in any given period by the value of the basket in the base year. That ratio is then multiplied by 100 to construct the CPI.

In the fifth edition of O'Sullivan, Sheffrin, and Perez's *Macroeconomics* principles text, for example, it is assumed that a fixed basket costs $200 in the base year of 1992. If that very same basket costs $250 in 2004, then the CPI is ($200/$200)*100= 100.0 in 1992 and ($250/$200)*100= 125.0 in 2004. The text then presents an example that asks how much nominal income is needed in 2004 to have the same standard of living as would have been provided by $300 in 1992. The answer is given as $300*(125/100) = $375. (Alternatively,

($375/125)*100 = $300). In my 35 years of teaching experience, I have found that examples of this type rarely result in student knowledge that persists beyond the final exam.

Here is another way to present the standard approach to the computations of the CPI and real income using the CPI. Consider an economy in which the standard market basket purchased by consumers contains 50 pounds of chicken to eat and 25 togas to wear. Assume that in the base year the price of chicken is $1 a pound and the price of togas is $2 per toga. Ask the students what the price of the basket is and they should answer $100. In a sample of principles of macro texts, the value of the basket in the base year is usually anything but $100. Of course, in reality the CPI market basket will not have a value of $100 in the base year and in that sense what follows is not "realistic." There are, however, some pedagogical benefits from normalizing the basket to have a $100 value.

The class is then asked how many of these baskets a consumer can buy in the base year if they have $200 of nominal income. The reply is a quick "2 baskets." I then tell them that in the year following the base year, the price of chicken rises to $1.05 per pound, the price of togas rises from $2 to $2.02, and the consumer's income rises from $200 per week to $206 per week. I then ask them how many baskets the consumer can purchase. The answer again is again two baskets because the standard market basket now costs $103. At this point, I tell them that the consumer price index is 100.0 in the base year and 103.0 in the year following the base year. These are the values that one obtains from following the standard textbook approach to computing the CPI. The CPI is thus the dollar value of the standard basket over time.

Finally, I tell them that in the following year nominal income rises to $213, the price of chicken rises to $1.08, and the price of togas rises to $2.10. Once again, I ask them how many baskets of 50 pounds of chicken and 25 togas the consumer can purchase with the $213 of money income now that the standard market basket costs $106.50. The answer again is a quick "2 baskets."

Students pick this example up very quickly. I then tell my students that if one consults data on real income, one never sees real income reported as "basket income." Instead, nominal income is divided by the CPI with the decimal point moved two places to the left. Hence, one evaluates for each example $200/1.00, $2.06/1.03, and 213/1.065, all of which are $200 dollars in the base year. There are always some puzzled looks when presented with this information.

To be sure, the number is the same whether we measure real income with basket income or the standard approach to CPI computation . I then ask them how much 2 baskets cost in the base year? Their reply is $200. At this point, the student understands that dividing nominal income by a price index with the decimal point moved over two places to the left in any given year is a measure of real income in terms of *dollars of the base year*.

Of course, there is not much difference between the "basket income" approach and the real dollar store approach to teaching real income. One can think of a real dollar store selling baskets costing $100 with each basket containing 100 items that each cost $1 in the base year. Or, one can think of an item in a real dollar store as a basket of one item.

Nevertheless, most students, unlike trained economists, do not think in terms of market baskets. Almost everyone, except people whose sense of pride prevents them from entering such a store due to concerns about being seen in one, has personal experience with making an actual purchase in such an establishment. Whether one thinks of baskets, or items in a dollar store each of which costs the same amount, real income is income in terms of commodities purchased rather than dollars, however defined.

Conclusion

Are real dollar stores hypothetical? Perhaps not. Of late, stores like *Dollar General* and *Five Below* have been selling their wares for more than one dollar. But at *Dollar Tree,* nearly all items cost $1 and at the *99 Cents Only* store, nearly all items sell for ninety-nine cents. While there are no actual "real dollar stores" where *all* prices are exactly indexed to the cost of living, I have found that such a store is a useful teaching device to introduce students to the distinction between real and nominal variables. For those who insist on using the traditional approach to computing the CPI and real CPI income, students are very sympathetic to the version of the traditional approach demonstrated here.

References

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