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Income and Substitution Effects: A Rejoinder to Professor Joseph Salerno

Karl-Friedrich Israel*

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Abstract: Professor Joseph Salerno (2019) has commented on my recent reconstruction of the income effect from a causal-realist perspective (Israel, 2018b). In this rejoinder, I clarify my position and show that the main points of criticism in Salerno's response are unfounded. In particular, I show that my argument does not involve a claim of greater "realism of assumptions" and it by no means contradicts the law of demand. Moreover, I work out in more detail the similarities and differences of my approach to the standard neoclassical decomposition of income and substitution effects. I show that my approach is closer to the Slutsky decomposition as opposed to the Hicks decomposition.

1. INTRODUCTION

Starting from Professor Salerno's (2018) refutation of the income effect, I have recently argued that the income effect should not be discarded. Rather, the neoclassical theory of the income effect can

* Karl-Friedrich Israel (israel@wifa.uni-leipzig.de) is senior researcher at the Institute for Economic Policy at Leipzig University, Germany. The author would like to thank Kristoffer Hansen, Dr. Tate Fegley and Professor Guido Hülsmann for fruitful discussions and some very helpful comments on an earlier version of this rejoinder.

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be reconstructed along causal-realist lines (Israel, 2018b). Salerno (2019) has honored my paper with a critique, which provides a welcome opportunity to clarify my position.

This rejoinder is structured as follows. Section 2 contains a brief exposition of the standard microeconomic analysis of income and substitution effects. This will highlight the backdrop against which our debate arose. Section 3 contains a discussion of the causal-realist point of view on demand analysis. Here I discuss the assumptions underlying the imaginary construct of the demand curve and show to what extent the causal-realist approach differs from standard neoclassical analysis. In section 4, I proceed to clarify the meaning of realism in economic analysis and argue that my proposed solution by no means runs into a contradiction with the infamous law of demand, as Salerno claims. I conclude in section 5.

2. THE STANDARD MICROECONOMIC ANALYSIS OF INCOME AND SUBSTITUTION EFFECTS

In modern neoclassical microeconomics consumer behavior is typically modeled by means of mathematical utility functions and budget constraints. In the standard scenario a consumer chooses between quantities of different goods, $x_1, x_2, \dots, x_n$, as a function of their unit prices, $p_1, p_2, \dots, p_n$, and the individual's available income or budget, $\bar{y}$. Given the utility function, u, consumer choice is thus described as a maximization problem with a side constraint:

$$\max_{x_1, x_2, \dots, x_n} u(x_1, x_2, \dots, x_n) \text{ given that: } \sum_{i=1}^{n} p_i x_i \leq \bar{y}.$$

Solving this maximization problem yields the so-called Marshallian demand functions (also called *primal demand*) for the various goods:

$$x_k^M(p_1, p_2, \dots, p_n, \bar{y}) \quad \forall k \in [|1, n|].$$

In the above optimization problem, the consumer chooses the optimal bundle of goods, that is, the bundle that maximizes the utility function, under the constraint that monetary expenses do not exceed the available budget.

An alternative way of formalizing consumer choice is the following:

$$\min_{x_1,x_2,\ldots,x_n} \sum_{i=1}^{n} p_i x_i \text{ given that: } u(x_1, x_2, \ldots, x_n) = \bar{u},$$

where $\bar{u}$ is a given level of want satisfaction or utility. In this version the optimal bundle that the consumer chooses corresponds to the cheapest bundle that yields this given level of utility. Instead of maximizing utility given the costs (i.e. the budget), the consumer is minimizing costs given a certain level of utility. The solution to this minimization problem yields the so-called Hicksian demand functions (also called *dual demand*):

$$x_i^H(p_1, p_2, \ldots, p_n, \bar{u}) \quad \forall i \in [|1, n|].$$

The conceptual difference between the Marshallian and the Hicksian demand functions is straightforward. Marshallian demand keeps nominal income $\bar{y}$ (i.e. the budget) constant, whereas Hicksian demand keeps real income $\bar{u}$ (i.e. the level of want satisfaction or utility) constant. As a result, the Marshallian demand captures both income and substitution effects, whereas Hicksian demand only captures the substitution effect. To be more precise, it captures the *Hicks-substitution effect* as opposed to the *Slutsky-substitution effect*. The latter can be analyzed on the basis of the Marshallian demand function, if the initial nominal budget is adjusted for any given price change, such that the optimal bundle, which would have been chosen at the initial price and the initial budget, just remains affordable at the new price and the adjusted budget. This yields the so-called income-compensated Marshallian demand function.[1]

Let us consider a simple example to push the standard analysis closer to where we want to go with it. We consider a case with two goods, one of which is money. This has some analytical convenience as the money price of money is always 1, that is, one US dollar costs one US dollar and one euro costs one euro. In standard terminology, such a good is referred to as the numéraire good. It is also convenient to include money in the two goods example, because it makes the example somewhat more general. The demand for money can be seen as a placeholder for all the other goods that the

[1] A detailed and very accessible exposition can be found in Varian (2010, chapter 8). We will illustrate the difference below.

consumer might want to buy, while we focus on the demand for one specific good. Let x_1 be that specific good. Its unit price is p_1. The other good, x_2, is money. Hence, $p_2 = 1$. We assume a standard utility function of the Cobb-Douglas form: $u(x_1, x_2) = x_1^{\alpha} x_2^{1-\alpha}$. For the sake of simplicity, let us say that $\alpha = 0.5$. The Marshallian optimization problem is thus:

$$\max_{x_1, x_2} \sqrt{x_1 x_2} \text{ given that: } p_1 x_1 + x_2 \leq \bar{y}.$$

Solving the optimization problem yields the following Marshallian demand functions:[2]

$$x_1^M(p_1, \bar{y}) = \frac{\bar{y}}{2p_1}; x_2^M(\bar{y}) = \frac{\bar{y}}{2}.$$

Assume that the budget is $\bar{y} = 100$ and $p_1 = 5$. The quantities demanded would be $x_1^M(5{,}100) = 10$ and $x_2^M(100) = 50$. The attained level of utility is $u(10{,}50) = \sqrt{500}$.

In contrast, the Hicksian optimization problem is:

$$\min_{x_1, x_2} p_1 x_1 + x_2 \text{ given that: } u(x_1, x_2) = \sqrt{x_1 x_2} = \bar{u}.$$

Solving the optimization problem yields the following Hicksian demand function:[3]

$$x_1^H(p_1, \bar{u}) = \frac{\bar{u}}{\sqrt{p_1}}; x_2^H(p_1, \bar{u}) = \sqrt{p_1}\bar{u}.$$

For the same level of utility as attained in the Marshallian example, $\bar{u} = \sqrt{500}$, and the same price, $p_1 = 5$, we obtain exactly the same quantities demanded: $x_1^H\left(5, \sqrt{500}\right) = 10$ and $x_2^H\left(5, \sqrt{500}\right) = 50$. However, for any other price p_1, given the budget $\bar{y} = 100$ in the Marshallian case and given the utility

[2] The Cobb-Douglas utility function leads to the particularity that the demand for one good does not depend on the price of the other. Moreover, in our example, the price of x_2 does not change, so that the demand for x_2 does only depend on the available budget. We would interpret that demand as a reservation demand for money (Rothbard 2009, 756): in this case, half of the available budget will be kept $(0.5\bar{y})$.

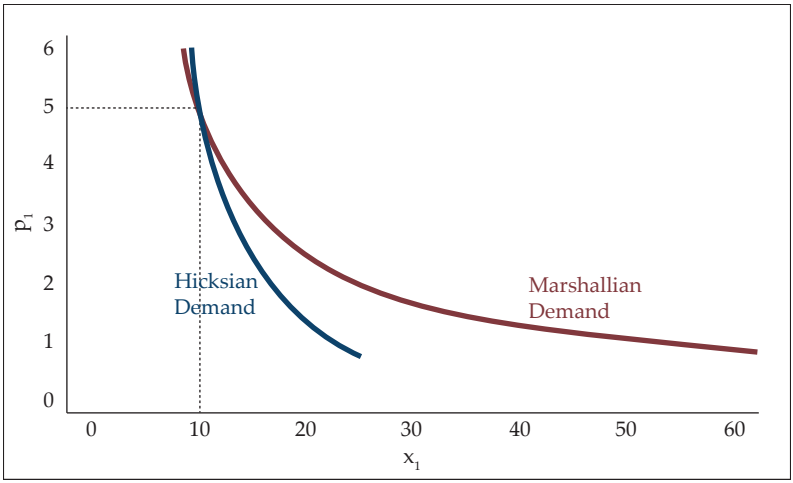
[3] In the Hicksian case, the demand for the numéraire good does depend on the price of the other good, because it is a type of income-compensated demand function.

level $\bar{u} = \sqrt{500}$ in the Hicksian case, the quantities demanded of x_1 are different:

$$x_1^M(p_1) = \frac{50}{p_1} \; ; \; x_1^H(p_1) = \sqrt{\frac{500}{p_1}}.$$

The two functions are plotted in Figure 1.

Figure 1. The uncompensated Marshallian demand curve and the compensated Hicksian demand curve

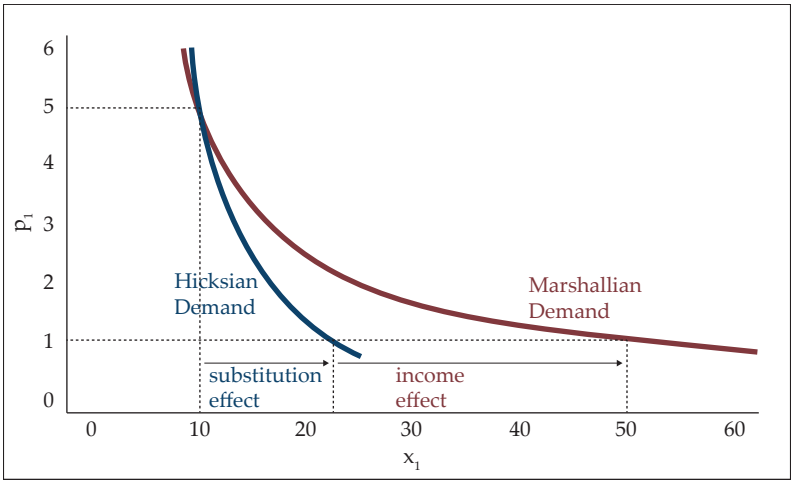


Let us now consider the effect of a price change from $p_1 = 5$ to $p_1 = 1$. The Marshallian demand at the new price is $x_1^M(1) = 50$ and the Hicksian demand is $x_1^H(1) = \sqrt{500} \approx 22.4$, which is much smaller. This is because *Hicksian demand only captures the Hicks-substitution effect* (in this case: $\Delta x_1^{HS} = x_1^H(1) - x_1^H(5) \approx 12.4$) and *not the income effect*. Marshallian demand captures both. The income effect of the price drop is positive because the good is normal (and not inferior).[4] The Hicks-income effect in this example is thus $\Delta x_1^{HI} = x_1^M(1) - x_1^H(1) \approx 27.6$. The overall effect of the price drop, as captured by the uncompensated Marshallian

[4] Cobb-Douglas utility functions always lead to normal goods.

demand function, is the sum of the substitution and income effects: $\Delta x_1 = x_1^M(1) - x_1^M(5) = \Delta x_1^{HI} + \Delta x_1^{HS} = 40$. Figure 2 illustrates the example.

Figure 2. The Hicks-substitution and income effects



The second standard version of distinguishing substitution and income effects is based on the income-compensated Marshallian demand function (this is the Slutsky approach). It is constructed in the following way. We take the same point of departure, namely, $\bar{y} = 100$ and $p_1 = 5$. Marshallian demand is $x_1^M(5{,}100) = 10$. This means that the consumer buys 10 units of good x_1 and keeps 50 money units in the cash balance. Any price change will now be compensated with respect to this reference bundle, in such a way that the consumer is able to acquire exactly the same bundle ($x_1 = 10, x_2 = 50$). If the price drops from $p_1 = 5$ to $p_1' = 4$, the consumer would need only 40 money units (instead of 50) to buy $x_1 = 10$. Hence, the compensated budget is $\bar{y}^c = 90$ (instead of $\bar{y} = 100$). In general, for any given price change, $\Delta p_1 = p_1' - 5$, the compensated budget is $\bar{y}^c = 100 + 10\Delta p_1$. The compensated Marshallian demand curve at the new price p_1' is thus:

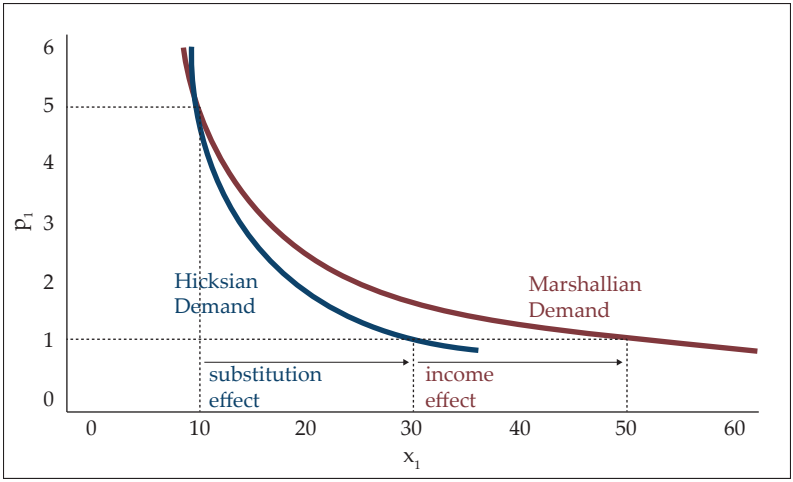
$$x_1^{M^c}(p_{1'}) = x_1^M(p_1', \bar{y}^c) = \frac{100 + 10(p_1' - 5)}{2p_1'} = \frac{25}{p_1'} + 5\,.$$

For the same price drop, from $p_1 = 5$ to $p_1' = 1$, the income-compensated Marshallian demand function yields a different result from the Hicksian demand function:

$x_1^{M^c}(1) = 30$ as opposed to $x_1^H(1) \approx 22.4$.

The difference is that *Hicksian demand keeps the level of utility constant, while income-compensated Marshallian demand keeps the purchasing power constant*, in the sense that exactly the same bundle (and no unit more) could be bought at the new price with the compensated budget. The substitution effect on the basis of the income-compensated Marshallian demand function, the so-called Slutsky-substitution effect, is $\Delta x_1^{SS} = x_1^{M^c}(1) - x_1^M(5) = 20$. The corresponding income effect is of the same size: $\Delta x_1^{SI} = x_1^M(1) - x_1^{M^c}(1) = 20$. The overall effect is again $\Delta x_1 = \Delta x_1^{SI} + \Delta x_1^{SS} = 40$. Figure 3 illustrates the second way of decomposing income and substitution effects.

Figure 3. The Slutsky-substitution and income effects



This should suffice as a refresher on standard neoclassical microeconomics. In the next section, I will contrast these two approaches with causal-realist demand analysis.

3. THE DEMAND CURVE AND ITS UNDERLYING ASSUMPTIONS FROM A CAUSAL-REALIST PERSPECTIVE

Many economists in the Austrian or causal-realist tradition criticize standard microeconomics for its overly formal and mathematical style. This formal criticism is rooted in a number of conceptual disagreements. Indeed, how useful is it to describe consumer preferences by means of continuous and differentiable mathematical functions and assume infinitely divisible goods? At what point do standard microeconomists sneak in cardinal as opposed to ordinal utility? Is the theoretical concept of indifference helpful in explaining consumer choice?

For an economist who accepts Rothbard's (2011, 304–06; 2009, 302–11) criticism of indifference analysis, it is easy to see why the Hicks-substitution and income effects are likely to be rejected. They squarely rely on the concept of indifference as the level of utility is held constant in the derivation of the Hicksian demand function.[5] But regardless of our stance on indifference,[6] the rationale for the Hicksian decomposition is straightforward: A lower unit price for any good is always preferred to a higher unit price for that good, so the "level of utility" increases when a price decreases. In that sense real income increases. The problems concerning indifference arise when we keep the level of utility constant in order to compensate for this increase in real income.

In contrast, the Slutsky decomposition based on the distinction between uncompensated and compensated Marshallian demand does not in principle rely on the concept of indifference and can avoid any other queries that one might have with the idea of keeping the level of utility constant as the price for a good changes. In fact, it is precisely the Slutsky decomposition that is in many ways very similar, albeit not identical, to my proposed reconstruction of a causal-realist income or rather wealth effect (Israel 2018b).

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[5] See also Block (1980), Hülsmann (1999) and Hoppe (2005) for rebuttals to Nozick (1977) and Caplan (1999) on indifference analysis.

[6] See for example O'Neill (2010) for a detailed discussion and defense of the concept of indifference from an Austrian perspective.

Let us briefly revisit that reconstruction. I had been drawn to the subject by Professor Salerno's (2018) paper, in which he had argued that the income effect of neoclassical microeconomics is merely an "illusion" (p. 35) stemming from a misapprehension of demand curves. The structure of Salerno's argument was as follows:

1. In order to construct a demand curve, we have to hold constant a) the buyer's value scale; b) the prices of all other goods; c) the buyer's stock of money balances; and d) the purchasing power of money.
2. Given a price change along the constructed demand curve the quantity demanded of the good changes.
3. The change in demand must be interpreted entirely as a substitution effect, because the purchasing power of money is necessarily held constant when working with a given demand curve. Hence, there can be no "purchasing power effect" or in standard terminology "income effect."

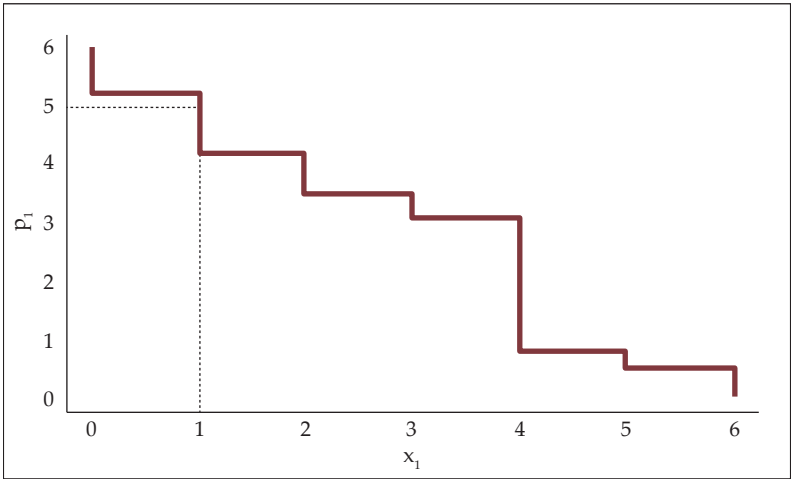
The tension lies in the fact that there can be no price change along the demand curve, when at the same time the prices of all other goods (assumption b) and the purchasing power of money (assumption d) have to remain constant (Israel 2018a).

My suggested solution to resolve this tension is the following. A demand curve gives us the hypothetical quantities demanded of a good at different unit prices expressed in terms of money. Hence, the construction of a demand curve requires a value ranking of definite amounts of money kept (not spent) against definite quantities of the good in question acquired (bought). The subjective evaluation of money and the subjective evaluation of the good in question have to be presupposed. They have to be given and held constant for the analysis. Now, there is not much to be said about the subjective evaluation of the good to be bought. It is just what it is. However, when it comes to money, we can go a little further.

There are essentially two options: Money at a consumer's disposal can either be spent on the good in question (option 1), or not (option 2). The value judgments that come into play are again the subjective evaluation of the good in question (option 1), about which nothing else can be said, and the subjective evaluation of the next best alternative to spending money on the good in question (option 2).

This led me to argue that we have to hold constant the *opportunity cost of spending a given sum of money on the good in question*. And I went as far as to argue that "we cannot boil this assumption further down" (Israel 2018b, 382). But why should we, anyway? It suffices to construct a demand schedule for some good x_1 given its unit price p_1 as shown in Figure 4.[7]

Figure 4. Discrete demand function



And here we come to the first serious point of criticism raised by Salerno (2019). He does not seem to believe that my assumption is sufficient and laments my "strange reluctance to clarify the assumptions [I use] in deriving the demand curve." This, he claims, "is inconsistent with causal-realist analysis" (p. 584). So, Salerno makes it seem as if it is an established causal-realist tradition to spell out the determinants of subjective value and the precise empirical conditions under which subjective evaluations remain constant. But is it really? Of course not. Subjective value or subjective preferences are always assumed as the starting point of the analysis. That is precisely the point of *subjectivism*.

[7] I abstain from a detailed exposition here. Any potential shortcomings in my earlier attempt can safely be ignored with a little goodwill. I proceed directly to the crucial issues that are disputed. Only notice that the demand schedule is a step function which is thought to reflect the discrete nature of human choice.

This is not to say that we cannot make additional assumptions when constructing a demand curve that illustrates the relationship between the money price per unit and the quantity demanded of a certain good by a given hypothetical consumer. We can invoke all kinds of assumptions about changing side constraints. Specifically, we can make assumptions about what exactly happens when we shift the unit price along the constructed demand curve. For example, we could assume that prices of other goods change in just the way Salerno (2019) wants in his comment on my critique. But to give another and somewhat unorthodox example: We could assume that for any price change of 1 money unit along the demand curve, the air temperature changes by 10 °F in the opposite direction, that is, if the price falls by 3 (2, 1) money units, the temperature increases by 30 (20, 10) °F and so on. If we were to analyze beer consumption as in the example of my initial article (Israel 2018b), this additional assumption would lead undoubtedly[8] to a flatter demand curve, that is, a larger increase in beer consumption for any given price drop than would occur without this additional assumption. A keen-witted microeconomist might then move on to construct the *temperature-compensated demand curve* in order to get rid of the bogus *temperature effect*, which is indeed merely an illusion that emerges by design.

Now, this example raises the question of what additional assumptions are analytically helpful and what assumptions are entertaining shenanigans at best. A reasonable starting point is to make as few and weak additional assumptions as possible and to keep all independent variables constant in order to gain a clear view on the one chain of cause and effect that we are interested in, namely, the effects of an exogenous price change along a given demand curve. This means that we invoke the classical *ceteris paribus* clause simply for the sake of analytical clarity. This means that we hold all variables constant that we cannot causally link to the exogenous price change under consideration. As an analytical point of departure, this implies that we hold all other money prices constant (and indeed the air temperature)—unless and until we

[8] Trigger-alert: I do assume that the subjective preferences of the beer drinker are such that higher air temperature increases the want satisfaction derived from drinking beer relative to the opportunity costs of spending money on beer. This is not to say that subjective preferences change, but simply that the side constraints change and hence the same subjective preferences manifest themselves differently in action.

can establish a causal connection to them—and this might well be possible under certain conditions (although I am not sure about the air temperature). We do not, however, assume these variables to change independently, precisely because we intend to isolate one chain of cause and effect, before embedding it into the whole picture. The latter, as Salerno rightfully points out by reference to the interdependence between markets for specific goods and the overall market for money balances, is of course the ultimate purpose of any serious economic analysis.

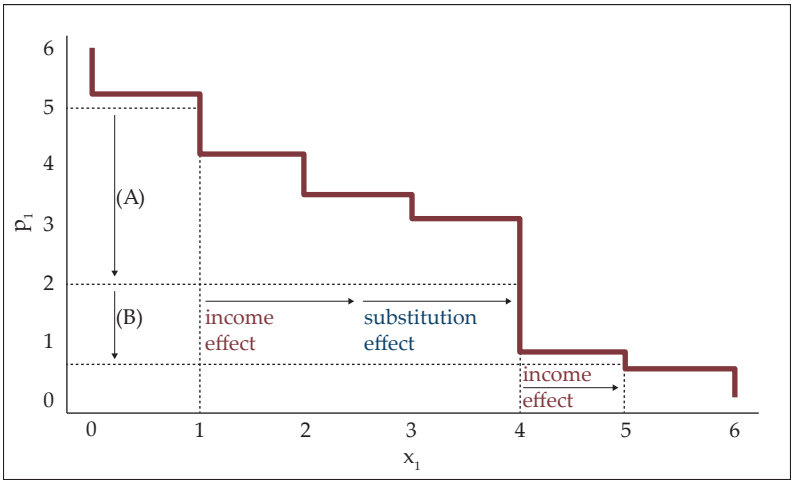
In order to briefly revisit my reconstruction of the income effect, let us take the reference point $p_1 = 5$ and $x_1 = 1$ on the demand schedule shown in Figure 4. Let us suppose that the price falls to $p_1' = 2$. The quantity demanded at this price would be $x_1' = 4$. The overall effect is thus $\Delta x_1 = 3$, that is, consumption increases by 3 units. It costs 6 money units to pay for the three additional units of the good, but the consumer also saves 3 money units on the first ($\Delta p_1 = p_1' - p_1 = 2 - 5 = -3$).[9] Hence, half of the expenses for the additional units are covered by what I called the *wealth effect* of the price change. The other half requires a genuine substitution in terms of a lower cash balance and/or lower money expenses for other goods. Hence, my suggested decomposition leads to a wealth effect of $\Delta x_1^W = 1.5$ and a substitution effect of $\Delta x_1^W = 1.5$ (overall $\Delta x_1 = \Delta x_1^W + \Delta x_1^S = 3$).

The analysis changes to some extent when we pick a price-inelastic segment of the demand schedule. Let us take $p_1 = 2$ and $x_1 = 4$ as the reference point. If the price falls to $p_1' = 0.60$, consumption would increase by one unit, $\Delta x_1 = 1$. The additional unit costs merely 0.60, but the individual saves 1.40 on each of the first four units ($(p_1' - p_1)x_1 = -5.60$). The expenses for the additional unit can entirely be financed out of the wealth effect. There is no genuine substitution necessary to make the additional consumption possible. To the contrary, the individual can afford the additional unit and has a higher cash balance and/or can spend more money on other goods and services. Hence, the entire effect can be interpreted as a wealth effect. *This led me to argue that the wealth effect so understood, far from*

[9] At this point one may recognize the similarity to the Slutsky decomposition. The 3 money units saved correspond to the income adjustment that would be made to derive the income-compensated Marshallian demand.

being an illusion, is indeed more general than the substitution effect. The latter *only* comes into play on price-elastic segments of the demand curve. The two price changes discussed are illustrated in Figure 5.

Figure 5. The reconstructed wealth effect with genuine substitution over a price-elastic segment of the demand curve (A) and the reconstructed wealth effect without substitution over a price-inelastic segment of the demand curve (B)



This should suffice as a summary of my suggested reconstruction of a type of income effect within a causal-realist framework. Salerno's (2019, 581) "simple and obvious solution that is ready to hand" to solve the tension that I have identified is indeed very different and, as he himself points out, very similar to Friedman's (1949) version of the income-compensated Marshallian demand curve. Salerno explains: "it is necessary only to restrict my second *ceteris paribus* assumption to the prices of closely related goods and to interpret the fourth assumption as implying that the general prices of all other goods move inversely to the price of the good in question so as to offset the change in the value of money entailed by the initial price change."[10]

[10] Remember Salerno's initial assumptions were that we have to hold constant a) the buyer's value scale; b) the prices of all other goods; c) the buyer's stock of money balances; and d) the purchasing power of money.

Of course, as pointed out above, one can make such an adjustment of assumptions, but ultimately it is nothing but an acknowledgment that the "income," "wealth," "purchasing power" effect, or whatever one may want to call it, does exist. Salerno is simply assuming it away and then proclaims it to be gone. However, the fact that it can be assumed away does not in any way prove it to be an illusion. Quite to the contrary, the fact that it has to be assumed away proves it to be there. *The whole purpose of adjusting the assumptions in just the way Salerno does is to construct a compensated demand function*. The impetus for doing so does not seem to be very different from the one in standard neoclassical microeconomics: illustrating the *law of demand* by abstracting from the income effect and potential Giffen behavior. In order to do so, Hicks holds the level of utility constant and Slutsky holds the purchasing power constant by adjusting the nominal budget. And Salerno holds the purchasing power constant by changing other prices accordingly. These are three different ways to analyze the very same phenomenon. All of them, implicitly or explicitly, recognize that this phenomenon plays a role in consumer choice.

Salerno further criticizes my approach for ignoring the interdependence between one particular market and other markets. In particular, he argues that in assuming all other prices to remain constant, I ignore the fact that a change along the demand curve for a given good entails a disturbance of the overall market for money. He writes:

> In Israel's analysis, therefore, a variation of the price of the good along the demand curve involves a disturbance in the market for money balances. If the price of the good in question falls, it does so because either: 1. There has been an increase in the reservation demand for money on the part of other buyers who increased their cash balances by reducing the market demand for the good; or 2. The overall supply of money in the economy has contracted with a particular incidence on those who were former purchasers and who reduce their demand for the good. (Salerno 2019, 585)

First of all, it is surprising that Salerno does not mention a third and most intuitive possible cause of a price reduction along a given demand curve, namely, a general increase in supply of the good in question, because of increased production or diminished reservation demand for that good. But more importantly, it is perfectly clear that changes on the market for the one good in question have repercussions on other markets. To analyze them would be the next step.

Consider again the above price drop along a price-elastic segment of the demand curve (part "(A)" in Figure 5). Let us suppose that the cause is indeed a general increase in supply. The portion of the increased demand that is labeled substitution effect can be financed either out of a reduction of the cash balance or a reduction of demand for other goods. To the extent that it is financed out of a reduction in the cash balance, the individual has decreased the *reservation demand* for money and accordingly increased the *exchange supply* of money, both of which is perfectly in line with the presumption that the price of money, understood as the overall purchasing power of money, has increased as a result of the downward shift in the price along the demand curve for the good in question. To the extent that the substitution is financed out of a reduction in demand for other goods, there will be, as a mediate effect of the initial price change, a downward pressure on the money prices for those other goods. In this way the increase in the purchasing power of money may propagate to other markets. This downward pressure on prices may be interpreted as a reduction in *exchange demand* for money on the part of the sellers of the respective goods, which is again perfectly in line with the presumption that the overall purchasing power of money has increased.

We can further explicate the effects of the price change under certain additional assumptions. Assume, for example, that there are important complementary goods to the good in question. A reduction of the price for the latter will entail an increase in demand for those complementary goods. This will tend to push up their prices. On the other hand, if there are important substitutes to the good in question, any genuine substitution in consumer choice will occur primarily with respect to those substitutes. Demand for them will decrease and their prices will tend to fall more strongly than others.

Consider now the above price drop along a price-inelastic segment of the demand curve (part "(B)" in Figure 5). The increased consumption does in that case not require a sacrifice in terms of either a reduced cash balance or a reduced demand for other goods. To the contrary, the consumer can either increase the cash balance or the demand for other goods. To the extent that the consumer increases the demand for other goods, their prices will be pushed upward, which counterbalances the initial increase in the purchasing power of money. This may also be interpreted as an increase in the *exchange supply* of money, which is in line with the

presumption that the price of money, i.e. its purchasing power, has increased due to the initial price drop.

This brief exposition, I hope, illustrates the potential of this approach to elucidate the interdependencies of the various partial markets for goods and services as well as the overall market for money. It is precisely because this approach does not abstract from purchasing power, income or wealth effects, as Salerno does, that it lends itself nicely to a *general* analysis of all pricing effects. It allows to analyze all the dynamics and interdependencies of real-world market pricing, which is the declared goal of the causal-realist approach (Salerno 2007).

4. CAUSAL-REALISM AND THE LAW OF DEMAND

There is a related issue that merits further consideration. Professor Salerno repeatedly chides my argument for misplaced realism, for example, when he laments a "single-minded quest for greater realism" (p. 586), a "zeal for realism" (p. 590), and a "misleading and self-defeating quest for realism" (p. 594) in my analysis. He seems to think that I claim a greater "realism of assumptions" in support of my argument and against his own. But this is not the case.

At no point did I claim that my *ceteris paribus* assumptions are realistic in the sense that they manifest themselves exactly like this in the real world. Nor did I characterize my demand curve as "something directly intuited from raw experience." When Salerno makes that claim he quotes the following part of one of the sentences in the conclusion of my initial article in order to create the impression that I was referring to the demand curve as such being: "…an easy and direct illustration of a very real phenomenon that most people intuitively understand, namely, that consumers are made better off when a given good can be acquired at a lower money price" (Israel 2018b, 396). But here I was not at all referring to the *demand curve as such*, but to my *approach* to the income effect. And the purpose of the whole analysis was indeed to illustrate a real phenomenon—something that is not simply an illusion. This does not mean that every tool used in the analysis has to be something *real* in the sense that it is observable, measurable or manifested in the external world.

Salerno (2019) explains at length, quoting Wicksteed and Mises, that demand curves are abstract theoretical tools—and I could not agree more. Of course they are. If anything, only one single point of

a demand curve ever is revealed in the real world, namely, when an individual decides to buy a certain quantity of a good at a given price at a given time in a given place. We know that in any such case there is a counterfactual scenario in which the quantity would have been different depending on the price to be paid. For one thing, we know that the quantity would be zero if the price was only high enough. What the demand curve then does for us is to illustrate a *range of counterfactual scenarios* that helps us to think through the implications of changing between those counterfactuals, and ultimately to understand consumer choice and the market pricing process better.[11]

Salerno (2019, 590–91) argues that a demand curve is "a heuristic device" whose primary purpose is "to elucidate the operation of the law of marginal utility in the pricing process by tracing out the effect of a change of price on the quantity demanded, while all other factors influencing the amount of the good purchased are impounded in the *ceteris paribus* clause." The purpose of constructing demand curves according to Salerno is thus to illustrate the operation of the law of demand. He moves on to argue that my own reconstruction ends up in a denial of the *law of demand*. And this brings us to the most important point of criticism in Salerno's comment.

For Salerno, a demand curve by its very nature is income-compensated, because the *overall* purchasing power has to be held constant as the price changes along the demand curve, otherwise the underlying value scale would be distorted. Salerno makes of course an important point. It seems to be obvious that a bonus payment of $10,000 or winning $10 million in a lottery revolutionize a given preference scale. A synchronous and proportional decrease of all money prices would have an equivalent effect. Inferior goods might be substituted by superior goods, because the opportunity costs of expanding the required sum of money to buy the superior good have decreased and having the superior good makes the inferior good obsolete. The latter may drop out of the preference ranking entirely. The former may enter the preference ranking. Moreover, a preference ranking will not necessarily remain constant when only one money price changes. This is easy to see. A person may intrinsically value a Scotch more highly than a bourbon. However, when the Scotch costs twice as much, the person may not reveal

[11] For a discussion of counterfactual laws in economic theory see Hülsmann (2003).

that preference in action, even though his budget might suffice to buy the Scotch. Given their respective money prices, the bourbon is preferred. If the bourbon were as expensive as the Scotch, the Scotch would be preferred, or no whiskey would be bought at all. In short, a preference ranking is not independent of money prices.

However, from the outset we have a very different situation. At no time have we explicitly considered a value ranking that involves more than two goods, for example, two whiskeys and money. We have only considered a preference ranking of two goods, namely, money balances and quantities of some specific good.[12] The individual has a certain budget in terms of money and decides how much of the budget to exchange against the good as a function of its money price. *The real question that is disputed is the following: Can this scenario be captured in one stable preference ranking, in which everything else is held constant, or do we have to adjust other money prices so as to prevent the revolution of the preference ranking*? The salient point of my argument was that we do not. All the effects of a changing money price on the demand for the good in question can be captured in the initial ranking, all other things held constant. However, if one wants to construct an example with a Giffen good, one would have to write the preference ranking down in a slightly different way.[13]

The next critical point raised by Salerno is that this means that a demand curve could have upward sloping segments. In other words, there could be Giffen behavior, which in his eyes contradicts the *law of demand*. Does it? If I understand Professor Salerno correctly, he holds that the law of demand *means* that any income-compensated demand curve is always downward sloping. I do not disagree. Indeed, it is pointless to disagree with a definition as long as it has any meaning at all, which is here the case. But my paper had a more general scope. I have constructed demand curves in a more general setting, including demand curves that are not income-compensated. This does not affect in the least the law of demand in Professor Salerno's definition. The question of whether this law holds or not is independent of the argument presented in my paper.

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[12] Again, the money balances can be interpreted as a placeholder for the demand for other goods, but this is not made explicit in the ranking.

[13] Instead of ranking quantities of money directly against quantities of the good in question, one would have to rank bundles including both money and the good in question.

What then about Giffen goods? It is not quite clear where Professor Salerno sees the contradiction between them and the law of demand. Is it the possibility of Giffen goods as such, or the idea of an upward sloping demand curve? That is, would he deny the existence of Giffen goods altogether, or would he argue that Giffen goods can exist, but there cannot be upward sloping demand curves, because demand curves always and everywhere have to be income-compensated?[14] I believe the latter describes his position more accurately. According to him, the whole point of constructing a demand curve is to illustrate the law of demand, and then indeed a demand curve needs to be income-compensated and downward-sloping. But why should that be the only purpose of analyzing demand curves? After all, we want to understand the real market pricing process, and if this is the goal, we should not abstract from the very real income effect.

5. CONCLUSION

Whatever the deficiencies of neoclassical price theory, it can hardly be denied that something similar to the neoclassical income effect does indeed exist and is not merely an illusion. I have proposed a way of incorporating this element of the real world into causal-realist price theory. My demonstration is similar to the Slutsky decomposition of income and substitution effects, in the sense that it takes account of the same hypothetical income compensation underlying the income-compensated Marshallian demand curve. But it is fundamentally different in the sense that it abstains from postulating what the demand would have been if the hypothetical income compensation had actually taken place. In my reconstruction, the wealth (or income) effect becomes the more general of the two effects. A genuine substitution *only* emerges along price-elastic segments of the demand curve.

[14] Notice that I actually have not taken a stance on whether or not Giffen goods are possible. I believe the question is rather complicated. Salerno makes it seem as if I have assumed that demand curves always have to be downward sloping, but, strictly speaking, I did not make such a claim. It just so happened that I picked an example with a downward sloping demand curve. And indeed, I believe this to reflect the general rule, and I feel inclined to regard Giffen goods as extreme exceptions, if they exist at all. But frankly, I do not know. In principle, they might exist.

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