

Hume's specie-flow mechanism and the 16th century price revolution

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Abstract: Though in Hume's epistemological theory only induction leads to discovery in matters of fact, because of the poor data Hume analyzes the balance of trade by reasoning from assumptions. Hume's potential explanation of why trade deficits have not depleted any country of its money is backed by the details of a case study, the price revolution of the 16th century, which supports half his conclusions, what happens when the money supply increases. Hume's attention to realistic hypotheses and the adjustment process remain relevant today.

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I. Introduction

In *An Enquiry Concerning Human Understanding*, first published in 1748, David Hume establishes a distinction between “relations of ideas” and “matters of fact”. Relations of ideas can be discovered by reasoning, but matters of fact can only be discovered by experience. This leads to a strict divide between deductive and inductive methods in formal and empirical sciences.

* The views are personal. I learned a lot from lively discussions with my students, among which I recall the remarks by Guillermo Simunovic on the necessary character of Hume's conclusions, and by María Sol Zambón on the 16th century price revolution as supporting evidence. I appreciate conversations with Ignacio Armando, Horacio Caraballo, Alejandro Corbacho, Ricardo Crespo, Celeste González and Daniel Heymann, and comments by Jorge Ávila, Daniel Lema and Juan Negri in a seminar at Ucema.

On the other hand, in his essay “On the balance of trade”, published in 1752 as part of the *Political Discourses*, Hume resorts to a “general argument” because of the poor data. Hume’s actual practice contradicts his theory of induction, but fits in nicely with what Mill (1836) describes as the only method of discovery possible in the moral sciences, that of reasoning from assumed hypothesis, due to the impossibility of experimentation to make inferences based on direct evidence.

Hume (1752) does present a case study, the price revolution of the 16th century. Among all the potential explanations one could imagine, this episode where there is a sudden increase in the quantity of money lends plausibility to his general argument because all the lines of his general argument, the specie-flow mechanism, are at work.

The next section briefly presents Hume’s epistemological views. Section III presents and formalizes his general argument on the specie-flow mechanism. Section IV describes the evidence that backs this potential explanation. Section V concludes.

II. Hume’s theory of induction in empirical sciences

According to Hume (1748), Section IV, while relations of ideas like the Pythagorean theorem can be discovered by reasoning, matters of fact can only be discovered by experience of relations of cause and effect:

I shall venture to affirm, as a general proposition, which admits of no exception, that the knowledge of this relation [of cause and effect] is not, in any instance, attained by reasonings a priori; but arises entirely from experience, when we find, that any particular objects are constantly conjoined with each other.

For Hume, in the empirical regularities studied with the aid of “mixed mathematics” [i.e., applied, as opposed to pure, mathematics], “abstract reasonings are employed, either to assist experience in the discovery of these laws, or to determine their influence in particular instances”, but “the discovery of the law itself is owing merely to experience, and all the abstract reasoning in the world would never lead us one step towards the knowledge of it”.

Hume (1748) goes on to stress the need of repeated experimentation, where experimentation may include plain observation according to another of his texts:¹

It is only after a long course of uniform experiments in any kind, that we attain a firm reliance and security with regard to a particular event. Now where is that process of reasoning, which, from one instance, draws a conclusion, so different from that which it infers from a hundred instances, that are nowise different from that single one? ...I cannot find, I cannot imagine any such reasoning.

III. Hume’s thought experiment

A. The general argument

In Hume (1752), since the data on the balance of trade are very incomplete and support all kinds of theories, he turns instead to a celebrated argument contained in four short paragraphs:

¹ Hume states in the Introduction to his 1739 *A Treatise on Human Nature* that, unlike natural philosophy, in moral philosophy “We must therefore glean up our experiments in this science from a cautious observation of human life, and take them as they appear in the common course of the world”. Cf. Rotwein (1957), p. xxvii.

In short, this apprehension of the wrong balance of trade, appears of such a nature, that it discovers itself, wherever one is out of humour with the ministry, or is in low spirits; and as it can never be refuted by a particular detail of all the exports, which counterbalance the imports, it may here be proper to form a general argument, that may prove the impossibility of this event, as long as we preserve our people and our industry.

Suppose four-fifths of all the money in Britain to be annihilated in one night ... Must not the price of all labour and commodities sink in proportion, and every thing be sold as cheap as they were in those [past] ages? What nation could then dispute with us in any foreign market, or pretend to navigate or to sell manufactures at the same price, which to us would afford sufficient profit? In how little time, therefore, must this bring back the money which we had lost, and raise us to the level of all the neighbouring nations? Where, after we have arrived, we immediately lose the advantage of the cheapness of labour and commodities; and the farther flowing in of money is stopped by our fulness and repletion.

Again, suppose, that all the money of Britain were multiplied fivefold in a night, must not the contrary effect follow? ...

Now, it is evident, that the same causes, which would correct these exorbitant inequalities, were they to happen miraculously, must prevent their happening in the common course of nature, and must for ever, in all neighbouring nations, preserve money nearly proportionable to the art and industry of each nation.

B. The necessary character of Hume's conclusions

To settle the debate on the balance of trade, Hume (1752) does not center his general argument on an inductive argument, but rather on a thought experiment. He derives a very strong conclusion: 'the same causes ... must *for ever* [italics added], in all neighbouring nations, preserve money nearly proportionable to the art and industry of each nation'.

When Hume confidently asserts that the same causes always produce the same effects, these necessary relations cannot apply to a set of contingent empirical regularities, which is the way Hume (1748) describes matters of fact. They can only apply to the hypothetical world Hume (1752) constructs. Hume (1752) is in fact formulating what Hume (1748) describes as relations of ideas.

C. The hypotheses behind the general argument

There are three hypotheses behind Hume's general argument, the specie-flow mechanism. His insight is to combine two hypotheses already found in mercantilist writings, completing them with the quantity theory of money.²

The first hypothesis is clearly articulated by Mun in his 1664 work, *England's Treasure by Forraign Trade, or The Ballance of our Forraign Trade is the Rule of our Treasure*, and is sometimes taken as the maxim of mercantilism:

² Wennerlind (2008) analyzes precursors to Hume's specie-flow mechanism. Paganelli (2006) places Hume's theory of an endogenous money supply that adapts to demand within pre-modern monetary views.

(i) *A positive balance of trade (i.e., more exports than imports) increases the quantity of money, a negative balance of trade diminishes it.*

The second hypothesis about how price competitiveness leads to a trade surplus is related to the prevailing views in the mercantilist literature on the convenience of cheap labour for stimulating exports (cf. Rotwein 1957, p. xv):

(ii) *Buyers purchase goods where they are cheapest.*

The third hypothesis, as first formulated by Martín de Azpilcueta in 1556, and Jean Bodin in 1568, was that the influx of silver from the Americas led to a decrease of the purchasing power of money (Munro 2007).³ Hume's formulation is that:

(iii) *The stock of money is proportional to the trade, industry and people of each nation.*

D. A formalization of the general argument

These three assumptions allow us to formulate the specie-flow mechanism under a fixed exchange rate (the gold standard) in a small open economy. They lead to derive the conclusion that, in the long run, the law of one price holds, so the money stock ends up distributed among countries in proportion to the real volume of transactions.

³ At the time, the stock of money was constituted by gold and silver. Munro (2007) mentions that negotiable credit instruments, which functioned as paper money, were starting to emerge.

Hypotheses (i)-(iii) are formalized as equations (1)-(3) in continuous time. First, the trade balance NX , given by net exports, i.e., exports minus imports, affects the supply of money M :

$$\dot{M}(t) = NX(t) \tag{1}$$

Second, competitiveness depends on the relation between home prices P and international prices P^* , determining the trade balance NX . With a linear constant $\theta > 0$, the less competitive a country is, the smaller the net exports. The long-run equilibrium counterpart of this proposition is the law of one price:

$$NX(t) = -\theta(P(t) - P^*) \tag{2}$$

Third, money supply always equals money demand, which is given by the nominal volume of transactions, home prices P time real transactions T , and a constant of proportionality k :

$$M(t) = kP(t)T \tag{3}$$

This is a small open economy that takes international prices P^* as given, since Hume ignores the effects of internal monetary changes on the world price level. All prices are quoted in specie, and there is no distinction between tradable and non-tradable goods. Hume makes equation (1) part of a mechanism where monetary imbalances are corrected through trade. Equation (2) is a principle of arbitrage among

goods. In equation (3), money demand responds to the transactions motive. Given that the real amount of transactions T and the velocity of circulation $1/k$ are implicitly treated as exogenous, this implies that prices change in proportion to money.

These three equations imply that internal adjustment is instantaneous and external adjustment is gradual. If external adjustment were instantaneous, the law of one price would never be violated in equation (2).⁴ In contrast to the standard interpretation, Cesarano (1998) asserts that for Hume the law of one price holds in the short run. We disagree. Not only is the standard interpretation backed by Hume's (1752) paragraph on the inflow of American silver in the 16th century that follows his general argument, the passages that Cesarano (1998) quotes to support his position can be offered an alternative interpretation, that money supply always equals money demand.

In a nice paper, Humphrey (1981) shows how Smith does not follow Hume in regard to gradual external adjustment, treating the economy as a small open price-taking economy where the law of one price always holds. If there is an excess supply of money, this is instantly corrected through direct spending (real balance) effects. This latter position is a direct forerunner of the monetary approach to the balance of payments where monetary imbalances are corrected by capital movements.

On the other hand, Berdell (1995) develops a model where there is both gradual external and internal adjustment. Berdell (1995) does not consider the specific case of the specie-flow mechanism in "On the balance of trade", where home prices adjust instantaneously, but rather a more general case where they adjust gradually. He combines this with the output and employment dynamics in "Of money", where Hume focuses on the real effects of money in the intermediate interval where money

⁴ Indeed, in the discrete time version trade imbalances must affect the money stock with a one-period lag in equation (1) for the adjustment to be gradual rather than instantaneous. Hume acknowledges the possibility of instantaneous adjustment in a letter to Oswald (Rotwein 1957, pp. lvi-lvii).

increases stimulate industry, and money decreases depress it. Berdell (1995) finds that, with hysteresis in labour force participation rates, these real effects may be permanent.

As to the thought experiment itself, start from an equilibrium position where the law of one price holds, so $P(0) = P^*$ and $M(0) = kP^*T$. If the quantity of money jumps exogenously to $M'(0)$, instantaneous internal adjustment leads to

$$P'(0) = \frac{1}{kT} M'(0). \quad (4)$$

Equations (1) and (2) imply that external adjustment is gradual,

$$\dot{M}(t) = -\theta(P(t) - P^*), \quad (5)$$

as in Berdell's (1995) first equation, based in turn on Waterman (1988).

Differentiation of equation (3) implies a special case of Berdell's (1995) second equation where adjustment of home prices is gradual (also based on Waterman 1988):

$$\dot{P}(t) = \frac{1}{kT} \dot{M}(t). \quad (6)$$

After the initial monetary shock, equations (5) and (6) imply that

$$P(t) = P^* + C e^{-\frac{\theta}{kT}t}, \quad (7)$$

where the constant C depends on initial monetary conditions: $C = \frac{M'(0)}{kT} - P^*$.

Stability requires $\theta > 0$, and convergence is always monotonic. In the long run prices and the stock of money return to the initial situation, and the trade balance is zero.

IV. The evidence for the general argument

A. The facts that back the hypotheses

Despite Hume's (1752) complaints about the lack of comprehensive balance of payments data, the first hypothesis about the balance of trade basically boils down to an accounting identity if there are no international capital movements. Later Ricardo (1817) sets the distinctive characteristic of the theory of foreign trade as the lack of labor and capital mobility among countries.^{5,6}

The second hypothesis about arbitrage is basically treated by Samuelson (1980), p. 143, as a tautology when he complains that the specie-flow mechanism "is vitiated by the *fact* [italics added] that the same good must have the same price everywhere in a competitive world without transport costs". More to the point, arbitrage is a transparent consequence of the maximization-of-returns hypothesis, for which Friedman (1953) considers there is a lot of indirect evidence after being repeatedly and successfully applied on innumerable occasions without being contradicted.

⁵ For Ricardo (1817), chapter VII, foreign trade basically boils down to barter according to comparative advantage. The specie-flow mechanism then determines how the stock of money is distributed among countries.

⁶ This is an idealization, but when Adam Smith (1776), Book IV, chapter III, points out that what is relevant is not a wrong balance of trade, even if a nation imports more than it exports for half a century, and contracts increasing debts with other nations –as long as its wealth increases in greater proportion through capital accumulation–, he gives "our North American colonies" as an example. During that period, British investment could hardly be considered foreign investment.

The third hypothesis faces the most serious empirical challenges. Hume lacks macroeconomic data on the stock of money or on nominal transactions, so it is impossible to have any direct evidence on his hypothesis that money is always proportional to nominal transactions. This flatly contradicts his theory of discovery in empirical sciences. As Coleman (1996) points out, this contradiction between the official and the actual methodology holds more generally for Enlightenment authors.

B. The empirical motivation for Hume's potential explanation

Hume's hypotheses can be seen as a potential explanation. What motivates Hume' (1752) is an empirical regularity, that no country is being drained of its gold and silver despite the prevailing fears about a natural tendency of an excess of imports over exports. To explain these facts that are surprising in the face of the existing beliefs, Hume builds a general argument.

This general argument fits the mould of Peirce's abductive inference. For Peirce (1903), "abduction" is another name for guessing or forming hunches: "The surprising fact, C, is observed; but if A were true, C would be a matter of course. Hence, there is reason to suspect that A is true." Abduction is a potential explanation.⁷ If what is being posited is true, the existing facts can be explained. This is quite different from the deductive-nomological model of scientific explanation where the predictions are deductively derived from known facts and laws (Klimovsky 1994, chapter 15).

⁷ In Peirce's *Lectures on Pragmatism* delivered at Harvard in 1903, "Deduction proves that something *must* be; Induction shows that something *actually is* operative; Abduction merely suggests that something *may be*." Santaella (2004) discusses the evolution of Peirce's thought. In his early writings, Peirce adds abduction as a third form of argument besides deduction and induction, where induction refers to arguments from a random sample to the population (a probable inference), and deduction to arguments from the population to a random sample (a necessary inference). In his later writings, the three become successive phases of inquiry: abduction generates possible hypotheses to account for a surprising phenomenon, deduction clarifies the necessary predictive consequences, and induction tests the predictions against the data.

Friedman (1953) closes his article on positive economics by saying that progress requires not only the testing and elaboration of existing hypotheses, but the construction of new ones, “a creative act of inspiration, intuition, invention; its essence is the vision of something new in familiar material”, a process which can be promoted by maxim and example. This applies to Hume’s contribution: the combination of old materials to explain new facts, introducing the quantity theory of money to the debate on the balance of trade in the mercantilist literature.

By its nature, a shortcoming of abduction is that other arguments may also explain the same facts. Like the case of overprotective parents who don’t let their kid ride a bike, and answer their kid’s complaint that he never gets hurt with an “Of course, darling, because we never let you do dangerous things”, since this was not an era of free trade, a mercantilist counterargument to Hume could be that existing state of affairs was precisely due to the prevailing restraints on imports.⁸

Crespo, Heymann and Tohmé (2009) distinguish between a weak version of abduction, which is purely heuristic and only offers a potential explanation, and a strong version, Inference to the Best Explanation. In that direction, a way to justify the inference is to find positive evidence that makes the argument plausible. We turn to this now.

C. A case study in Hume

Despite the fact that in his epistemological work Hume states that in matters of fact learning is only based on repeated experience with a long series of observations that

⁸ What is needed to empirically discriminate between the two theories is a country with no trade restraints. Smith (1776), in Book IV, Chapter III, Part II of the *Wealth of Nations*, argues that the country that most approaches free trade, Holland, indeed derives its great wealth from foreign trade.

conform to the same pattern and allow to establish an empirical regularity, his general argument follows instead the details of one particular historical event, the 16th century price revolution:

Can one imagine, that it had ever been possible, by any laws, or even by any art or industry, to have kept all the money in Spain, which the galleons have brought from the Indies? Or that all commodities could be sold in France for a tenth of the price which they would yield on the other side of the Pyrenees, without finding their way thither, and draining from their immense treasure?

This paragraph comes just after his general argument quoted above. In this historical illustration, all the hypothesis of his previous thought experiment are at work: there is an exogenous increase in the quantity of money, which is linked to a rise in prices (hypothesis iii), so by arbitrage there is a trade deficit (hypothesis ii), that in turn leads to an outflow of money (hypothesis i). This case study provides a justification for the specie-flow mechanism posited in his explanation.

As to the actual facts, Hamilton (1935) provides the classic study of how the influx of American treasure was indeed the main determinant of the price rise in Spain during the 1540-1600 period, though he cannot offer direct evidence on the quantity theory of money because he does not have data on the stock of money. Inflation actually started around 1520, before the arrival of great quantities of American silver, something explained by an earlier German and Central European silver mining boom; the silver-based price index in Spain rose from 99 to 321 between 1511-15 and 1596-1600, continuing to slowly creep up to 343 in 1646-50, almost a 3.5 fold rise over the whole period (cf. review in Munro 2007).

Munro (2007) stresses that this price revolution was a unique historical experience. While inflation had been frequent in European economic history, this event was exceptional both in its persistence (ca. 1520 to ca. 1650), and in its international character, with price increases that spread all over Europe, and perhaps the world.

Incidentally, the 16th century price revolution only supports half of Hume's thought experiment, namely, what happens if the stock of money expands tremendously. As to the other half, Friedman and Schwartz (1963) provide, in chapter 7 of what Rockoff (2000) calls an impressive array of case studies in monetary history, a landmark analysis of a crisis where the money supply contracted sharply, the Great Depression.⁹

D. Realistic assumptions

Hume's assertions are perhaps intended to be a bit stronger than mere hypotheses. Consider Hume's second hypothesis about arbitrage. It is a specific instance of the principle of self-interest, which is formulated in Hume's (1742) essay "Of the rise and progress of the arts and sciences" in the following terms: "Avarice, or the desire for gain, is an universal passion, which operates at all times, in all places, and upon all persons". Hume treats self-interest as a determinate cause because it operates regularly on a great number, in contrast to passions like love of knowledge which are subject to private whim and operate on few persons. Though Mill (1836) considers that the definition of a man in economics as someone who desires to possess wealth is arbitrary, just as the definition of a line in geometry as something with length but

⁹ The Great Depression is in the context of a convertible paper currency. Eichengreen (1992) studies how the limits the gold standard placed on monetary policy contributed to its severity.

without breadth, he none the less shares Hume's confidence in its empirical validity. Mill's justification is introspection.¹⁰

Interestingly, Mill (1836) derives a conclusion opposite to Hume (1748) from the principle of self-interest: economics is an abstract science like geometry whose method is to reason from assumptions, not from facts.¹¹ For Mill (1836), the conclusions of economic reasoning are completely valid only in the abstract. Conclusions are true in the concrete once proper allowances are made for disturbing causes that may have been *overlooked*, so the empirical validity of a theory has to be ascertained in each particular instance.

Schabas (2008), p. 165, emphasizes Hume's propensity to provide empirical support for his theoretical claims; in this connection, she mentions Hume's dislike of the physiocrats because of their unrealistic assumptions.¹² Schabas (2008, pp. 167-168) notes that the use of the adverb "nearly" in the last paragraph of the general argument indicates that Hume (1752) is aware that other factors are at work in the actual world. For her, Hume seeks to isolate certain tendencies in the hypothetical world of his monetary thought experiment; money is only neutral in this hypothetical world because Hume's conceptual objective is to explain the behavior of the balance of trade, unlike his objective in "Of money".

¹⁰ According to Dow (2009), though introspection also provides a distinctive source of evidence for Hume, because of imperfect recall Hume regards historical knowledge, and third party observation, as more reliable.

¹¹ Mill (1836) calls this method "a priori", not in reference to pure deduction, as is usual, but rather to a broader process that involves experience and reasoning, a mixed method of induction and deduction.

¹² Rotwein (1957), p. cx, points to the abundant historical material in Hume. It is paradoxical that Hume has as heirs Ricardo and the Classical economists, who are criticized for using abstract deduction instead of induction based on observation (Gide and Rist 1909, Book IV, Chapter I). Coleman (1996) traces this back to Hume's, and particularly Dugald Stewart's, methodology, which blurs the distinction between theory and fact by identifying general principles not with hypotheses but rather with plain facts from everyday life.

The realistic nature of assumptions has been the subject of heated controversies in economics. Though Friedman's (1953) main assertion is that theories must be solely tested by their predictions, he adds that realistic assumptions are irrelevant, or even the wrong approach to building economic models, a statement that seems at odds with the nature of his own work. However, Mäki (2009) is able to find a realist interpretation of Friedman (1953), linking it to a long tradition in economics that goes back to Mill and his contemporaries of viewing models as partial but potentially true descriptions of causally significant mechanisms.¹³ From the remarks of Schabas (2008) above, one can add that this view is implicit in Hume (1752).

In regard to the observational traits in Hume's theories, Hayek (1963) draws a broader consequence, linking Hume's close attention to history, and cultural evolution, to an evolutionary tradition within the Enlightenment that recognizes the narrow bounds of human understanding.¹⁴ Hayek contrasts this to rational constructivism that arrives at truth from explicit premises, of which Bentham is an important example. Following Mills' insight that we reason from assumptions, the relevant distinction between both traditions might not be the use of explicit premises, but rather whether these hypothesis rely on careful observation or not. As Akerlof (2005) points out, instead of attempting to impose some pre-ordained order on nature, empirical examples help develop theories that recreate nature.¹⁵

¹³ Mäki (2009) remarks that if assumptions really do not matter, rather than attacking Chamberlin for striving to use more realistic assumptions to build a monopolistic competition model, Friedman (1953) should appeal to the superior predictive performance of perfect competition models. Mäki (2009) goes on to say that, in the study of the used car market, it is neither irrelevant nor virtuous to ignore that information is asymmetric.

¹⁴ Rotwein (1957) has a comprehensive discussion of Hume's economic psychology and the importance of habit and custom in behavior.

¹⁵ Akin to Hume's cautious observation, Akerlof (2005), pp. 1-4, argues for the incorporation of detailed information to build hypotheses using "our simple powers of observation", as well as using the ability of the trained economist to connect mere anecdote and experience to economic structure.

V. Conclusions

Hume's (1752) general argument is a forerunner of our use of economic theory as a box of tools. Hume joins mercantilist notions with the quantity theory of money to develop a powerful theory of the specie-flow mechanism, allowing him to derive a potential explanation that can address the contemporary fears about a wrong balance of trade.

What also stands out is that Hume is quite empirical in paying attention to the available facts, grounding his analysis on a paradigmatic event, the price revolution of the 16th century. This specific case study helps to develop general insights about the workings of the economy.¹⁶ To build good applied theory, one needs to tailor models to the relevant details of each case. Getting the assumptions right might be crucial, after all, in a discipline like economics where we so often reason abductively.

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¹⁶ Cesarano (2006) notes how, since the 1950s, the move of new economic historians away from the analysis of specific episodes has reduced the role of economic history in economic theorizing, as regards suggesting new hypothesis and widening research perspectives.

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