# THE PORTFOLIO THEORY AND POLICY (IN)EFFECTIVENESS: A REVISITATION

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| Abstract: | This article revisits the Portfolio Theory of Inflation (PTI), with a view to further articulating its findings and implications. The article adds to the micro-foundations of the PTI, framing more rigorously the role of global investors as international allocators of capital resources, and providing richer analysis of their interaction with macroeconomic policies at country level. The article explores how country credibility enters the capital allocation choice process of global investors and how global investor choices shape the space available to country policy making, determining the extent to which the effect of macro-policies dissipates into exchange rate depreciation and higher inflation. |

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THE PORTFOLIO THEORY OF INFLATION AND POLICY (IN)EFFECTIVENESS: A REVISITATION

1. INTRODUCTION

The forces of globalization demand that each country considers realistically how effective its macro-policies can be, given its own characteristics and circumstances. In my recent work on the Portfolio Theory of Inflation (PTI), I have analyzed how financial globalization affects the policy space available to authorities at country level – in many cases constraining it to the point of rendering expansionary macro-policies ineffective or even outright destabilizing.

The issue – one that is especially (though not exclusively) important for developing and emerging market economies – is that despite financial globalization, current macroeconomic policy modelling continues to rely on domestic representative agents and fails to recognize the role of global macroeconomic dynamics.

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1 I am hugely grateful to the anonymous referee of this journal for the very helpful comments and suggestions provided to me across the various draft revisions. I would not have been able to realize my intent to revisit, and improve on, my Portfolio Theory of Inflation, without being induced to ponder on and respond to her/his critical and yet very constructive remarks. I am not sure I was eventually able to have convinced him/her of the goodness of the approach I propose, but the quality of my article has benefitted greatly. My intellectual indebtedness goes to Willem Buiter and Charles Wyplosz for inspiring me on the importance of intertemporal consistency in the analysis of macroeconomic policy choices and credibility as a factor determining macro-policy effectiveness. Obviously, I remain the only responsible for the opinions expressed in the article and for any remaining errors. As always, I also want to thank my wife Ornella for her unremitting support.

2 See Bossone (2019, 2020a, b).

3 The expression "policy space" here refers to the margin of action policymakers can use to conduct expansionary fiscal and monetary policy actions before these actions threaten the sustainability of public sector liabilities and/or before measures become necessary to ensure such sustainability, and eventually undoing the initial policy actions.
Global investors play in determining the value at which public sector liabilities (money and debt) trade in the markets, and their decisive impact on policy effectiveness. This is true both in mainstream modelling practices, where representative agents comprise domestic households, firms, and policymakers, who choose optimal actions out of feasible sets of resource allocation options, as well as in heterodox approaches – take the extreme example of Modern Money Theory (MMT) – where government prints all the money it needs to finance full-employment public spending and its money is always in demand. In both cases, domestic agents are believed to be sovereign.④

In fact, they are not, when they act in highly financially integrated (globalized) economies, especially where wealth is largely concentrated, and financial investments are managed by global operators holding or trading significant shares of these liabilities, and where more generally the accumulated stocks of financial wealth are not intended for local use and must be protected by risk of denomination. Here, the value of public sector liabilities (both those denominated in domestic and foreign currency) is determined by the expectations and trading activity of global investors (whose capital is at risk of high expected or actual depreciation) and shapes the space available for government policy. The power of global investors to determine the value of public sector liabilities affect, in turn, the non-financial private sector.

These actors must be brought to the center of macro-analysis if one wants to understand how policies work in the global financial context and predict their impact on the real economy. This has become even more compelling with the rising importance of the bond market as a major source of external finance for many countries and the recent increase in debt issuance following low interest rates.

④ For relevant references on MMT, see Wray (2015).
This article revisits the PTI as originally defined in my previous work, with a view to further articulating its findings and implications. In particular, after re-reading my previous work on the topic, I have noted mistakes and incompleteness, as well as areas for improvements (all duly noted below), and since I am confident that the PTI breaks new ground and its results still obtain after resolving the original shortcomings, I have decided to revisit its framework, adding to its the micro-foundations of the PTI model of the economy, modelling framing more rigorously the portfolio choices of global investors the policy constraints more rigorously, and in the process also correcting for the some errors contained in the previous original formulation, as detailed below) and providing richer analysis of their effects on inflation process triggered by policy shocks under certain conditions.

This article explores additional dimensions of how capital allocations by global investors interact with government macro-policies. It further studies how country credibility enters the capital allocation choice process of global investors and how global investor choices shape the space available to country policy making, determining the extent to which the effect of macro-policies dissipates into exchange rate depreciation higher inflation.

In the following, Section 2 discusses in great depth the role of global investors in today’s internationally highly financially integrated economies, and how this role shapes the policy space available to countries, based on the credibility they attribute to them. Section 3 integrates the micro side of the PTI model of the economy, using asset utility analysis, and derives optimal inter-temporal and intra-temporal rules for portfolio allocations by a representative global investor. Section 4 evaluates the new results from the revisited model on the dynamics of exchange rate and inflation following macro-policy shocks. Section 5 concludes the article.
2. THE KEY ROLE OF GLOBAL INVESTORS

Unlike conventional domestic (local) representative agents, global investors wield major market power by acting as "marginal" investors and exercise the largest influence on the pricing of market trades.\(^5\)

Global investors are not necessarily foreign agents. They could be resident persons, domestic subsidiaries of foreign entities, or foreign subjects operating in a country through domestic correspondent agents or dealers. What matters is that they act on investment decisions moving from a global perspective, which transcends local interests and inclinations.

Global investors mobilize far larger resources, and process far greater information, than typically smaller agents operating locally. They can also trade at much lower costs than local agents. Most importantly, unlike local agents, they are free from "home bias" and, even when they reside in (or operate from) a country, they hardly use more than a modest fraction of their managed wealth (if at all) to finance local consumption. They do not optimize consumption; they only seek to maximize utility from financial wealth by managing financial wealth. Global investors are not interested in the stability of the countries where they invest, if not to protect the value of their investment, and, unlike local agents, they do not participate in the cost of stabilizing the economy when stabilization is undertaken, while they stand ready to rush for the exit from country investments (moving their capital elsewhere) when stability prospects are under threat.

Global investors are not interested in the evolution of domestic price inflation or unemployment other than to draw indications on the credibility and stability of the country policy framework and use global price indexes or international reserve currency basket indicators as deflators to calculate the real value of relevant financial variables and as benchmarks; rather, they are keen to estimate the exposure

\(^5\) For a study on the marginal investor and a review of the marginal investor in the finance literature, see Bartholdy and Kate (2004) and references therein reported, and see more recently Chen and Lei (2015).
of domestic denominated investments to protect their local investment from market and foreign exchange risks and the risk of issuer default. (see Section 4.1 to appreciate the importance of this aspect). For instance, faced with the prospects of a government issuing liabilities in excess of what would keep their external value stable, global investors require higher premia to be paid on those liabilities and can replace them for alternative foreign liabilities at a much more rapid pace, lower cost and larger scale than local domestic agents can possibly do.

True, local agents keep demanding the domestic currency for transaction and tax payment purposes, but their demand might not be enough to prevent the currency from depreciating, as the value of their money would be set at the margin by global investors. The latter would determine the price and quantity of the money held and used by locals. Similarly, while local agents operating in relatively closed or segmented financial markets accept and hold public debt issues at convenient terms for the issuing government, global investors are much more risk-sensitive and set prices accordingly, possibly at less favorable terms for the issuing government and under much stronger exit threats that condition debt issuances. Importantly, in integrated international financial markets, global investors can move financial capital across markets and countries in real time and at negligible transactions costs.

With high uncertainty, the price of liabilities considered to be less safe than others decline, and vice versa. And if the credibility of a country is (rightly or wrongly) reputed by global the investors to be weak or weakening, the expansion of the country’s public sector liabilities causes them to lose (internal and external) value, irrespective of their currency of denomination. Government debt and money are discussed in turn.

**Government debt**

While debt contracts are stipulated in nominal terms, they are claims on real resources, and those who buy them do want to recover the full real value of the money invested in them (inclusive of interest income). In the case of global investors, contracts expressed in domestic currency would have to at
least earn (net of risk) returns at par with the foreign reference, high-hierarchy currencies (e.g., reserve currencies) – the ultimate claims on world real resources serving as benchmarks. Repayments in instruments that depreciate vis-à-vis the benchmarks, and whose depreciation is not compensated by adequate returns, do not constitute default legally but are economically equivalent to it.

Were it not so, a government could always snatch what would look like a "free lunch" by borrowing in domestic currency, which it can (in principle) print in unlimited amounts. In fact, this "free lunch" would correspond to rent extraction from borrowers, and government can extract rents when borrowers are small, uninformed and with limited investment management capacity, or when they operate in segmented or captive capital markets with limited alternative investment opportunities. Conversely, on the other hand, the "free lunch" is no longer feasible possible when the economy is globalized and its liabilities trade in the international financial markets; here, global investors evaluate the debt repayment capacity of the economy borrowers (in real resource terms) and set prices for those liabilities that reflect that capacity (which is obviously the same whether contracts are written in domestic or foreign currencies), and will try to protect their assets against the risk of not being repaid in real terms – a point that proves critical for the PTI.

Money

The fact that governments may in principle print infinite amounts of domestic currency does not alter - ex ante - the (real) losses that the investors expect from contracts that differ only for their currencies of denomination: contract terms are written so that the investors are indifferent between different currencies. That is, the contracts carry terms and conditions that protect the investors from risk of losses in all cases, whether this originates from the interruption of debt service or from debt repayment taking place in a depreciating currency. The debtor is the same, as well as its capacity to repay the debt (in real resources), and the same is therefore the risk faced by the investors. Furthermore, the lower the credibility of the issuing government, the higher the risk of currency depreciation and, therefore, the
higher the interest premium required by the investors for purchasing and holding its liabilities expressed in that currency.

The story is the same if government resorted to permanent monetary financing of the deficit (à la MMT). In a globalized economy, with large concentration of wealth and active global investment, the money injected in the economy through public spending, and eventually accumulated by wealth holders, companies, and intermediaries, would shift to alternative domestic and foreign assets. This happens normally, as growing portfolios are continuously diversified, and especially when wealth holders and investment managers feared an unorderly growth of the money stock.

No government is truly sovereign in a globalized world, and every government is subject to an intertemporal budget constraint (IBC) – although, of course, not all governments are born equal and not all IBCs are equally binding (see below).

**Government IBC: Endogenous, Elastic, Inescapable**

Under the IBC, governments must commit intertemporally to generating enough real resources to fulfil their financial obligations to the investors. From the investor standpoint, a government issuing debt liabilities must be regarded as capable to return the full real value of its future debt obligations (plus interest). The IBC must hold identically irrespective of the currency of denomination of the liabilities, since otherwise the investors would arbitrage away from government liabilities that would not return at least the same (net of risk) value in the best available alternative investment option expressed in a higher-hierarchy currency.

Regarding the objection that a government enjoying monetary sovereignty does not face an IBC, since it can always print all the money it needs to pay for its future obligations, it should be noted that global investors are guided by what they perceive to be the credibility of the issuing government: if they anticipate an undisciplined fiscal and monetary policy conduct, they bid down the value of the money issued and influence the markets to a point where the demand for the money (and the assets
denominated in that money) would shrivel, thereby affecting the government’s IBC: their power is their ability to "walk away" rapidly and costlessly from a country investment, and without any commitment to the country or any special purpose to continue to operate in it (unlike local agents). In globalized economies, it is often not the case that all the money printed is demanded at an unchanged price.

Every government – even if it issues its own currency – faces an IBC whose elasticity is endogenous to global investor decisions. Here, the concept of elasticity captures two complementary aspects: first, given the endogeneity of the IBC to global investor decisions (see Section 3), different levels of credibility attributed to a given country determine over time determine a tighter or less tight constraint on government policy action; second, countries with stronger credibility benefit from more flexible IBCs, in the sense that their government enjoys a softer constraint (for instance, by being allowed by the markets to run larger deficits without being penalized with lower asset price valuations), while harder constraints would bind countries with weaker credibility.6

A government that is reputed capable to satisfy its IBC would be perceived as credible by the markets, and vice versa. The stronger its credibility, the higher the elasticity of its IBC and the greater the market’s readiness to absorb larger amounts of its liabilities at the given price. On the other hand, with weaker credibility, the prospects of the government raising sufficient resources to repay its future obligations would be perceived as more uncertain, and the resulting tighter IBC would cause the price of its liabilities to fall. Further erosion of credibility might even lead global investors to no longer buy

6 The words "tighter" and "less stringent" should not be confused with "harder" and "softer" as they apply to the concept of budget constraint. While harder and softer refer to the extent to which a budget constraint is truly binding on an agent, tighter and less stringent refer to the quantitative limit imposed by a budget constraint on an agent (e.g., how high or low the limit on the budget deficit is set relative, say, to GDP); a hard constraint may become less stringent but could still remain hard. Thus, in the case of a government, tighter and less stringent they reflect indicate set how much space overall is available to the government for its policy actions.
or hold the government liabilities (both debt and money) and to shift their portfolios toward foreign
assets, thus limiting the space available for active macro-policies.

3. The Model of the Economy

The open-economy model developed originally for the PTI is here reported in an improved
formulation. It consists of two interacting sides – a macro and a micro side – that are linked to each
other by the central role of a representative global investor, whose capital allocation choices are
fundamentally driven by country credibility perceptions. The two sides of the economy are considered
in turn.

The Macro Side

The PTI model’s macro section consists of two open and highly financially integrated country
economies D and F, where F is relatively large vis-à-vis D and acts as price setter in the international
markets for goods and services, and D is price taker. The bar signals policy variables that are decided
exogenously by country authorities. The issuance of government debt bonds $B_j$ in country $j$, where
$j = D, F$, and their market value are tied to the country government’s IBC:

\[ \text{IBC}_{j} \]

7 Specifically, the areas where this article improves on the original formulation of the PTI include: i) the role of
global investors as links between the micro and macro side of the economy’s model, and hence between capital
allocation choices and a country’s macro-policy space; ii) the formalization of the global investor’s inter-
temporal and intra-temporal optimal plan; iii) the treatment of the asset utility function; iv) the separation
between the rate of time preference discount rate and the country credibility factor (which had originally been
conflated into one single term); v) the treatment of the risk of losses on assets; vi) the stock-flow consistency
between global investors’ capital allocation choices and public sector liabilities; vii) the structure of world price
indicators; viii) real output growth; ix) the policy objective function of the central bank; and ix) the
analysis of the exchange rate and inflation implications of macro-policies. Finally, some of the equations were
revised and errors and typos were corrected in some of the equations from the original formulation.
\begin{align*}
(1) \quad & P^B_{j,t} = P_t \sum_{\tau=1}^{\infty} \delta_t \beta_j \omega (\tilde{s}_t \tilde{b} + \Delta m_t \tilde{b} + \Delta g_t) \quad \text{with } 0 \leq \beta_j \leq 1 \\
(2) \quad & B_{j,t} = B_{j,t-1} + \Delta B_{j,t} \tilde{b} = B_{j,H,t} + B_{CB,j,t} \tilde{b} \\
(3) \quad & P_t = P_t (e_t \tilde{P}_t \tilde{E}_f) \quad \text{with } 0 \leq \alpha \leq 1 \\
(4) \quad & P_{f,t} = \Phi_D (e_t \tilde{P}_t \tilde{E}_f) \quad \text{with } 0 \leq \eta \leq 1; \quad \text{with } \eta \geq 0, \eta = 0, 1, \ldots \\
(5) \quad & \Phi_{D,t} = \Phi(\eta \phi_{D,t}) \quad \text{with } 0 < \phi < 1 \quad \text{with } \Phi_{\eta} > 0; \Phi \beta < 0 \\
(6) \quad & \Delta B_{j, CB,t} = \Delta M_{j,t} = M \left( i_{j,t}^{B_j} - i_{j,t} \right) \quad \text{with } M_{j,t} \geq 0 \\
(7) \quad & i_{j,t}^{B_j} = i_{j,t}^{B_j} + \eta (\tilde{p}_{D,t} - \tilde{p}_{D,t}) + (1 - \gamma) (X_{j,t} - \tilde{X}_{j,t}) \quad \text{with } 0 \leq \gamma \leq 1 \\
(8) \quad & X_{j,t} - X_{j,t}^* = X_{j,t} - X_{j,t}^* \quad \text{with } X_t < 0, X_t > 0 \quad \text{with } 0
(9) \quad & \Delta g_{j,t} = \Delta g_{j,t} = \tilde{g}_{j,t} \quad \text{with } \tilde{g}_{j,t} = \tilde{g}_{j,t} \quad \text{with } \tilde{g}_{j,t} < 0 \\

\end{align*}

Eq. (1) is the IBC of country j’s government, whereby the current market value of government bonds \( B \) must equal the present discounted value of future primary surpluses \( s_t \) and monetary financings \( \Delta m_t \) by the central bank (if any). In the equation: \( \delta \) is the time discount rate; \( P \) is the world price deflator used by global investors to gauge at any time the real value of their wealth; \( B \) is the number of nominal (interest-bearing) bonds issued by the government at a contractual value that is equal to 1 unit of money, and their market value is expressed as a ratio \( P^B \) to the bond’s contractual
value; all else being equal, this ratio changes directly with credibility factor $\beta_{j,t|\omega_t}$, a time-varying factor, conditional on information set $\omega_t$ available to the investors at time $t$, which acts as a scale factor that corrects the value of the IBC in the perception of the markets, based on the credibility that investors attribute to country $j$’s policy. This factor is key in the PTI context; it recognizes country credibility as a core aspect of international capital allocation in global financial markets; it plays a special role in linking the macro and micro dimensions of such allocations; and it is a realistic feature, since establishing ex ante the credibility of a government to determine its debt repayment capacity is an ordinary practice of international finance. That is why this factor deserves special attention (Box 1),

Box 1. Credibility Factor "$\beta$"

Credibility factor "$\beta$" condenses global investor views on the policy credibility of individual country economies. This factor can indifferently be thought of as an index that investors apply to the government IBC, which scaling its value up or down correspondingly, or as a probability measure that generates an expected value of the IBC, or else as a risk factor that adjusts the value of the IBC. All else equal, a lower $\beta_j$ reflects larger expected losses on government debt (either via higher inflation or default) and translates into a tighter IBC for $j$’s government, thus requiring larger (and possibly more frontloaded) fiscal efforts to sustain a given debt stock.

The information set $\omega_t$, at any time $t$, comprises all relevant information that global investors deem consider to be relevant to their decision-making process, and including using anything and everything that enables them investors to assess and determine the policy credibility of a country government (e.g., economic, political, and social factors, both internal and external to the country, which influence the achievability and sustainability of government’s specific policy commitments). New factors or events that raised the investors’ concerns that country $j$’s government might face future economic, political and social challenges (which

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8 This ratio generally varies between 0 and a value less than 1. Following the Global Financial Crises, however, cases were observed where the value of the ratio exceeded 1. These are cases where some assets (typically bonds issued by highly reputed governments) are considered by the markets to be especially safe, and trade at prices above their contractual value, thereby earning negative yields (see Why do investors buy negative yield bonds?, Financial Times, April 12, 2006). In such cases, private creditors of the issuing governments are de facto turned into private debtors.
would eventually induce the government to take such actions as defaulting on its future obligations, inflating its debt away, or even repudiating it) would be incorporated in a new information set $\omega_t$ and cause $\beta_j$ to fall ($\beta_j|\omega_t < \beta_j|\omega_0$), thus reducing the IBC elasticity accordingly. A fall of credibility might result in such a tightening of the IBC elasticity that investors would doubt the (economic, social, and political) sustainability of the future primary surpluses and/or debt monetization required by the tightened IBC, until such a point where they might even stop buying and holding the country’s debt altogether. This would cause the price of debt to collapse and, correspondingly, domestic interest rates to rise abnormally to levels where fiscal dominance would put pressure on the monetary authorities to monetize and inflate the debt away.

The relevant information set would also capture those developments (including, for instance, the evolution of local and/or global risks) that may induce investors to shift capital from lower-credible to higher-credible countries considered to be safer places for investment or issuers of safer liability instruments. In such instances, the credibility gap between countries (as perceived by the markets) may change and cause different dynamics of credibility factors and, hence, different IBC elasticities in different countries over time. All else equal, different IBC elasticities across countries are sufficient to make otherwise identical bonds imperfect substitutes of one another.

Total public debt, which equals the stock of government bonds inherited from the previous period plus any current new bond issuance, is held by representative global investor $H$ and the central bank $CB$ of the issuing country (Eq. (2)); both the central bank’s holdings of $B$ and the new debt issuances are policy variables decided, respectively, by the central bank and government.

World price index deflator $P_F$ (Eq. (3)) which is used by global investors to calculate the real value of relevant financial variables and is calculated as the weighted geometric mean of the general price level attaining in individual countries, $P_D$ and $P_F$, with weights proxying given by each the relative size of each country investment within the global investor’s portfolio's share in international trade (Eq. (3)), where $P_D$ is exogenous, and $P_F$ taken as exogenous. Country $D$’s price level $P_D$ is determined from the cost side by foreign price level $P_F$ via the nominal exchange rate $e$, and the exchange rate pass-through (ERPT) factor $\Phi$ and lag operator $L^{-n}$ (reflecting the speed of relative price adjustment to foreign price changes through a variable $n$ indicator) and from the demand side by the output gap (Eq. (4)), each with weight characterized by the openness of the economy to foreign trade. According to Eq. (5), ERPT factor $\Phi$ raises (structurally) with the degree of openness of
the economy, captured by a generic index, taken as given for each country, and declines with country credibility as higher credibility anchors inflation expectations and counteracts attenuates the impact bad effects on inflation caused by the ERPT effect.\footnote{For the literature on the ERPT and credibility, see references in Section 2 of Bossone (2019).}

Eq. (6) reflects summarizes the central bank’s decision policy rule whereby the central bank changes purchases or sells government bonds (and thus to issue money $M$ or to withdraw it from circulation by “printing” money $M$) as a result of the Taylor rule of Eq. (7) to stabilize the interest rate on government bonds around its “neutral” level value $i^*_N$, which is the interest rate that is consistent with zero inflation and zero output gap:\footnote{This what Blanchard (2016) has defined the “divine coincidence”, that is, the best rate that can be achieved by policy. Obviously, the central bank stabilization effort may succeed only if the total stock of government debt is given or correctly expected. This raises issues of policy coordination between monetary and fiscal policies, which will be only noted in this study, but not further elaborated.} the higher the target interest rate, the larger the amount of bonds purchased, and thus the larger the amount of money withdrawn from the economy interest rate differential, the larger the amount of bond purchases via money creation to bring it back to zero. Given the interest rate policy objective, as potential output grows over time (see below), the money supply accommodates such growth (all else being equal).

Equation (7) reflects the inverse relationship between bond prices and interest rates: reduced form Eq. (8.78) posits the real output gap (i.e., the difference between actual and potential output) to change a) negatively with the deviation of current interest rate from its neutral level, b) positively with the real exchange rate (assuming Marshall-Lerner condition), and c) positively with the fiscal deficit (assuming away full Ricardian equivalence), and assumes potential output to grow at gross rate $(1 + x)$.
It should be noted that debt-financed fiscal deficits (under a non-accommodative monetary policy) also would also affect the real output gap indirectly and with negatively due to their impact on through their crowding-out effect via on the interest rate, as via Eqs. (2) and the inverse relationship between the interest rate on bonds and bond prices (7); this effect is captured under relation a) above. While it is assumed, however, that the net effect of the fiscal deficits on output is would generally be positive, fiscal policy shocks enacted by weakly credible countries might be ineffective (as discussed below and in Bossone (2019)). Finally, Eq. (989) is the debt-financed fiscal deficit expressed in real terms where \( S \) is the nominal primary surplus.

The Micro Side

The PTI model’s micro section draws from the conventional portfolio balance approach to the exchange rate determination, reframed in the context of optimal intertemporal allocation choices by a representative global investor acting in internationally integrated financial markets and perceived by the markets as the representative "marginal" global investor—(see above). This agent pursues the objective of maximizes her financial wealth intertemporally (in utility terms), with a view to consuming it all at "the end of time" (if she is infinitely lived) or to pass it on to future global investors (if she is finitely lived), who will behave similarly across the infinite time horizon, as if they all worked for a company and a company purpose. Global investors, thus, act collectively as an intertemporal class of agents, which, who treat the assets in their portfolios as "vehicles" to the utility associated with the future streams of real resources to which they give access (Bossone, 2014). Their purpose is to agents may act both in their own interest and optimize and intermediate financial resources intertemporally

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11 This simplifying assumption is justified since the study focuses on aggregate demand and not on the real sources of output growth. Incorporating a properly structured dynamic supply function is a possible extension of PTI analysis.
from surplus agents to agents who are needing resources for investment or consumption—smoothing purposes.\textsuperscript{12}

Formally, representative global investor $H$ maximizes the intertemporal utility generated through wealth portfolio $W$:

$$U(W_{H,t}) = \max W \sum_t \mathbb{E}[U(W_{H,t})] = \max W \sum_t \mathbb{E} \left[ \delta_t^H u(W_{H,t}) \right]$$

$$\Omega \sum_t \Omega$$

$$W_{H,t} = M_{H,D,t} + e_t M_{H,F,t} + P_{B,t}^D B_{H,D,t} + e_t P_{B,t}^F B_{H,F,t} = M_{H,D,t} - R_{H,D,t} + e_t M_{H,F,t} - R_{H,F,t} + \Delta W_{H,t}$$

$$\Omega \sum_t \Omega$$

$$\sum_t P_{B,j,t} B_{H,j,t} + P_{B,j+1} B_{C,j,t} = P_{B,j,t} \sum_{t+1}^{\infty} \delta_t^j \beta_t^j \omega_t (s_{j,t} + \Delta m_t)$$

$$\lim_{t \to \infty} W_{H,t} = 0.$$
net divestments correspond to consumption decisions taken by agents who had previously invested in the portfolio of global investor $H$, and $R$ is the real rate of return on any asset $Q$ (here money $M$ or bonds $B$), which includes net of the risk of losses, and is calculated as $R^Q = (1 + i^Q)(1 + p^Q)(1 - p)(1 - l^Q)$, where $i^Q$ is the nominal own rate of return on asset $Q$, $p^Q$ is the rate of change of asset $Q$ price, $P^Q$, and $p$ is the rate of world price inflation, which also reflects the exchange rate variation between the currency of denomination of asset $Q$ and the currency chosen as benchmark; and $l^Q$ is especially important: it is the risk of losses from default on asset $Q$, as perceived by the global investors, which reflects the credibility that investors the latter attributes to the issuer of the asset (i.e., that is, it increases as credibility factor $\beta$ declines), and while any functional form could be assumed to link the two variables functionally, here the simplest possible form used here for convenience and without loss of generality is, $l^Q = 1 - \beta_j$, is considered for convenience and without loss of generality with maximum loss (i.e., $l^Q = 1$) for when $\beta_j = 0$ and no loss (i.e., $l^Q = 0$) for when $\beta_j = 1$. Importantly, as noted in Section 2, the risk of losses is the risk faced by the global investor of not being repaid what is due in real terms, either because of debtor default or because debt payments are made in an instrument that has lost (or is expected to lose) value with respect to the investor’s deflator benchmark indicator.

Eq. (1) is the investor’s instantaneous budget constraint, where only wealth inherited from the previous period and any new net investment can be allocated to domestic and foreign assets; notice that the term $\Delta W_{H,t-1}$ also incorporates any losses that may have materialized on past investments.

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13 In other words, these agents liquidate (part of) their investment to finance current consumption. If they divest funds to re-invest them, their net effect on global investor $H$’s portfolio is zero ($\Delta W_H = 0$). On the other hand, if agents invest more money, then this adds to the global investor $H$’s portfolio ($\Delta W_H > 0$).

14 If $P^Q$ is the price of a bond or a given stock, changes in $P^Q$ correspond to capital gains or losses on asset $Q$.

15 The introduction of the risk of loss is an innovation on my original assets-in-the-utility function approach.
According to From conditions relations (1212), the investor may hold non-negative quantities of each asset, and net changes to the investor’s wealth portfolio can be positive (as a result of investments), negative (as a result of divestments or losses from defaults), or zero (as a result of offsetting investments and divestments or of no investment and divestment activities). Eq. (132) requires that the aggregate demand for government bonds equal the aggregate supply of government bonds equal the demands outstanding by the investors and the central bank equal supply under the impending government IBC; this determines the policy space available to the central bank: given an expansionary monetary policy stance, if global investors deem it consistent with the stability of the external value of the debt they hold (based on the world price deflator \( P \), defined in Eq. (3)), they will allow for the policy to run its course, thus making it effective; otherwise, they will penalize it by bidding down the price of the debt and neutralizing the policy impact on real output (see Section 4.1). Finally, Eq. (14323) is the transversality condition consistent with the function of the "global investor" discussed at the outset of this section.

In this model, following my earlier work on assets (not only money) in the utility function (Bossone, 2014), assets are considered as vehicles to future consumption, each characterized by its own “speed” (readiness and cost to be liquidated) and “power” (capacity to store value and to accumulate wealth over time) vis-à-vis risk, uncertainty and changing market sentiment. At each point

16 Unlike what the anonymous reviewer has noted, Eq. (13) does not suffer from overdetermination of policy variables; it rather deliberately reflects a degree of indetermination, which can only be resolved within each specific country context, once investor expectations are known, based on their perceptions of country policy credibility of the country under consideration. This reflects the nature of the PTI, whose underlying approach, as I have noted in my previous works, is by choice—not mechanistic in that it derives the derivation of the inflationary and real output consequences of specific policy actions changes according to country circumstances: the very same policy actions would have different impacts hections—depending on different levels of country features, including most notably its policy credibility (as perceived by global investors).
in time, and across its life, any asset $Q$ delivers to its holder a level of utility that reflects the opportunity for the holder to liquidate the asset and to use its proceeds to finance consumption needs $C$ occurring with probability $\theta$. The utility of any asset $Q$ at date $t$ is calculated by summing over two terms: (i) the utility derived from converting the asset into consumption at the next date $t+1$ with probability $\theta_{t+1}$, and (ii) the utility from holding the asset further on with residual probability $(1 - \theta_{t+1})$. Notice that probabilities $\theta_{\tau}, \tau \in (1,\infty)$ are based on subjective judgments of asset holders and can change over time, also based on new information and changes in market sentiment. As can be shown in Appendix 1, substituting iteratively for $u(Q)$ at each forward date across the time horizon yields expression

\begin{equation}
\begin{aligned}
(14) (15) \quad u(Q_t) &= \mathbb{E}_t \left\{ \delta \sum_{T=t+1}^{\infty} \left[ \frac{P_{T}}{P_{t}} \right] \prod_{n=1}^{T-1} R_{n} \theta_{n} (1 - \theta_{n+1}) (1 - \xi_{n}) (1 - \sigma_{n}) \big| \omega_t \right\}.
\end{aligned}
\end{equation}

where $\xi$ and $\sigma$ are, respectively, the variable asset liquidation cost of and price volatility characterizing asset $Q$, and the expectations operator $\mathbb{E}$ incorporates changing market sentiments influenced by new information $\omega$.\footnote{Note that if asset $Q$ is cash (banknotes) or $M$, then $P_{Cash} = 1$, $\delta_{Cash} = 0$, $L_{Cash} = 0$, and $R_{Cash} = 0$. In fact, the introduction of a central bank digital currency for general purpose usage (that is, digital cash) would allow for $L_{Cash} \geq 0$, whereby the central bank would have the possibility of applying positive or negative interest rates on cash.}

While a simplified version of Eq. (14) is used in the following, its full expression reveals one of the key advantages of the approach, which makes all asset types and intertemporal consumption options mutually comparable in utility terms and treatable in an all-encompassing framework that can be used to derive optimal choices for capital allocation.

4. Results

Using Bellman’s equation to solve plan (10940)-(15434),
\[ U(W_{H,t}) = \text{Max}_W E_t \left[ \sum_{t=1}^{\infty} \delta_t u(W_{H,t}) \right] = V(W_{H,t}) = \text{Max}_W \left[ u(W_{H,t}) + \delta V(W_{H,t+1}) R_{t+1} \right], \]

where \( R \) is the vector of the real returns (net of the risk of losses) on the assets held in portfolio \( W \), which leads to the Euler equation

\[ u'(W_{H,t}) = \delta E_t \left[ u'(W_{H,t+n}) R_{t+n} \right], \]

which determines the optimal intertemporal path for wealth \( W \) managed by global investor \( H \), and

where, using following a simplified version of Eq. (15434), (with no liquidation cost, price volatility, and market sentiments), the LHS of Eq. (17656) can be expressed as:

\[ u'(W_{H,t}) = E_t \left[ \delta \sum_{t=1}^{\infty} u'(Q_{H,t} R_{H,t}) \Pi_{t=1}^{T-1} R_{H,t} \theta_T \left( 1 - \theta_{T-1} - \theta_{T-2} \right) \right] \omega_t = u'(Q_{H,t}), \]

with \( Q = M, B \).

Given the optimal time path of managed wealth \( W \), as determined by Eq. (17656), the optimal portfolio composition of global investor \( H \) at each date of the relevant time horizon must reflect optimal intra-date allocations of the wealth portfolio across the range of available assets. These allocations are derived by fulfilling the following two f.o.c.'s:

\[ u'(M_{H,D,t}) R_{M,D}^t = \frac{1}{e_C} u'(M_{H,F,t}) R_{M,F}^t = \frac{1}{p_D} u'(B_{H,D,t}) R_{B,D}^t = \frac{1}{e_{B,F}} u'(B_{H,F,t}) R_{B,F}^t = \lambda_t, \]

which requires equating the marginal utilities of \( M \) and \( B \) holdings, each weighted with its own price, and

\[ \lambda_t = \delta E_{H,t} R_{M,D}^{t+1} + \lambda_{t+1} = \delta E_{H,t} R_{B,D}^{t+1} + \lambda_{t+1} = \delta E_{H,t} R_{B,F}^{t+1} + \lambda_{t+1}, \]

which requires equalizing all rates of return on assets in real terms and net of default risk at each date and intertemporally.

Notice for completion that, since the global investor acts on behalf of its client wealth holders, optimality requires that the periodical divestments from its portfolio to finance consumption activities
(discussed earlier) generate, at the margin, the same utility that is generated by the assets held or acquired by the global investor.

Solving the model simultaneously for all demand and supply relations, under well-behaved investor preferences and optimal fiscal and monetary policies (that is, policies that are consistent with the government IBC), as well as with complete ERPT, instantaneous relative price adjustments to the exchange rate, and a given world price deflator- _P_ level of country _F_, optimal portfolio allocations \((M^*_H, B^*_H, M^*_F, B^*_F)\) attain at equilibrium asset prices \(P^*_D, P^*_F\), "natural" interest rates \(R^*_D, R^*_F\), and nominal exchange rate \(e^*_t\) consistent with a balanced (zero) real output gap. Critical to the existence of such general equilibrium position of the economy is that the stocks of money and debt required to ensure zero output gap are consistent with the government IBC. This reveals the relevance of the credibility factor \(\beta_j\) and its central role in linking the macro and micro sides of economies where capital resource allocations are determined by global investors.

For simplicity, but without loss of generality, assume utility to be \(u(W) = \ln(W)\). Dropping subscript \(H\) and solving Eq. (18767) for the equilibrium nominal exchange rate at date \(t\) obtain:

\[
(19)(20) \quad e^*_t = \frac{1}{M^*_D, M^*_F} + \frac{1}{P^*_D, P^*_F}.
\]

18 In force of the inverse relationship between bond prices and the interest rate on bonds, Eq. (7), equilibrium bond returns \(R^*_D\) and \(R^*_F\) are simultaneously determined with bond prices \(P^*_D\) and \(P^*_F\).
Transforming Eq. (2019) using natural logarithms, assuming $R_t^{M^*} = 0$, considering that, and
noting that $\ln R_t^B = \ln \{(1 + i^B)(1 - p^B)[1 + - (1 - \beta_i)]\} \approx i^B - p + (1 - \beta_i)$,\(^{19, 20}\) can change idiosyncratically across countries only if $\beta_i$ changes idiosyncratically, so that $\ln R_t^B = \ln (\beta_i) = \beta_i$, yield:

$$\varepsilon_t = (\bar{m}_{D,t} - \bar{m}_{F,t}) + (\bar{b}_{D,t} - \bar{b}_{F,t}) + (\bar{p}_{t}^{B_D} - \bar{p}_{t}^{B_F}) + \pm (\beta_F - \beta_D)\beta_D - \beta_D),$$

where the tilde indicates deviations of the variables from their steady-state values, and the deviations of money and bonds from their steady state proxy their respective net excess demand dynamics. Eq. (2101920) shows that the nominal exchange rate of domestic vs foreign assets, all else being equal, varies positively (i.e., depreciates) with:

i. the growth of the domestic net excess demands for money and bonds (relative to their foreign counterparts);

ii. the growth of domestic domestic bond prices (relative to their foreign counterparts);\(^{21}\) and

iii. the risk of losses on domestic bonds (relative to their foreign counterparts), as proxied by the credibility of the respective issuing countries; and

iv. the credibility of the domestic country relative to foreign counterparts.

\(^{19}\) Applying From TTaylor’s expansion, $\ln (1 + \chi) \equiv \chi = \frac{\chi^2}{2} + \frac{\chi^3}{3} + \frac{\chi^4}{4} + \ldots = \sum_{k=1}^{\infty} \frac{(\chi^k)}{k} = \chi \in (-1, 1]$. and $\lim_{n \to \infty} (R_n) \equiv \frac{\chi^2}{2} + \frac{\chi^3}{3} + \frac{\chi^4}{4} + \ldots = \sum_{k=1}^{\infty} \frac{(\chi^k)}{k} = 0$. for $\chi \in (0, 1)$ Thus, $\ln (1 + \chi) \approx \chi$.

\(^{20}\) Notice that the rate of change of the bond prices has been dropped from the calculation of the rate of return on the bonds, since the inverse relationship between the price of a bond and the interest rate on the bond makes one of the two variables redundant.

\(^{21}\) This follows from the bond remuneration becoming less attractive as the bond price increases (Eq. (7)).
Importantly, any persistent difference in country credibility, $\beta_F - \beta_D$, would have a persistent, and hence cumulative, effect on the exchange rate.

Log-linearizing and replacing Eqs. (6), (8), (9), and (21) into the log-linearized form of Eq. (4), assuming a fully accommodating monetary policy stance (i.e., $i_t^B = i_t^N$ (so that the interest rate differential $i_t^B - i_t^N$ remains unaltered), from Eq. (7)) and solving for domestic inflation, yield:

\[
\hat{\pi}_{D,t} = \frac{1}{1 + \Pi_X} \left\{ \phi(\cdot) + \Pi_X \left[ L \cdot e^{-t} - \Pi_X e^{t} \right] \left( \hat{m}_{D,t} - m_{F,t} \right) + (\hat{b}_{D,t} - \hat{b}_{F,t}) + (\hat{p}_{B,t} - \hat{p}_{F,t}) + (\beta_F - \beta_D) + (\beta_D - \beta_F) \right\},
\]

where $\Pi_X \leq 0$, $\Pi_X \geq 0$, $\Pi_X + \Pi_X \geq 0$, and the ERPT term has negative sign, except when the pass-through is complete (see Eq. (5)) and therefore $\phi(\cdot) = \ln 1 = 0$. Eq. (21) shows that, all else being equal, domestic inflation varies:

a. Positively with changes in the domestic monetary and financial stocks relative to the foreign benchmarks;

b. Positively with changes in domestic bond prices relative to the foreign benchmarks;

c. Negatively with the level of improvements in country credibility relative to the foreign benchmarks;

d. Positively with foreign inflation;

e. Positively with fiscal policy shocks.

Notice that due to the persistent effect of credibility on the exchange rate, noted above, a lower level of country credibility (relative to a benchmark country) would puts permanent pressure on inflation.
Importantly, global investor choices and the country’s macro-policies interact with each other, since any changes in the budget and its financing modalities bear changes in the stocks of $M$ and $B$ and trigger the allocative response by global investors, based on country credibility and considering that the latter changes as investors re-evaluate country policies when new information arrives.

As an application of Eq. (22.101), take the case of highly credible reserve currencies, like the US, the Eurozone, and Japan, following such critical events as the global financial crisis of 2007-9 and the Covid19 pandemic more recently. In all these cases, the demand for assets denominated in their currencies has exceeded even their fast-growing supply, causing $m < 0$ and $b < 0$ and thus weakening domestic inflation. This, in turn, has caused inflation to be low also in other (smaller) countries via Eq. (3).  

The term $\frac{1}{1 + \pi_d x_p + \pi_f x_b}$ of Eq. (22.101) suggests two considerations: first, the higher is the sensitivity of aggregate demand to the domestic price level (through the real exchange rate – Eq. (8.28)), the larger is its dampening effect on the inflation response to shocks from the variable on the RHS of Eq. (22.101), and vice versa; second, even with no dampening effect, due to, say, a large negative output gap, such that $\pi_d x_p = \pi_f x_e = 0$, demand policy shocks would still impact inflation through capital re-allocations by global investors and their effect on the exchange rate: with complete ERPT (i.e., $\phi(\cdot) = 0$ and instantaneous relative price adjustments to foreign prices (i.e., $L_p^{it} - n = L_p^{it} - \alpha = 1$), the occurrence enactment of positive and fully accommodated fiscal shocks (so that $\Pi^*_e - \Pi^*_d = 0$) would cause the nominal exchange rate to depreciate and to feed fully into domestic inflation, even at less than full employment output. Obviously, a complete ERPT is a limit case since, in general, economies  

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22 Notice here that, from the perspective of each reserve-issuing country, as the perspective focuses, in turn, on each reserve-issuing country, the subscripts $D$ and $F$ in Eq. (22.1) would be inverted, with the reserve-currency country being coming domestic ($D$) and the other countries being coming foreign ($F$).
(especially the larger ones) feature lower ERPT effects and, as recalled earlier, more credible countries tend to feature lower ERPT effects. Thus, such an effect on domestic inflation would be attenuated in the case of similar policy shocks occurring in a large, highly credible, reserve-issuing country, typically characterized by a low ERPT, the impact on domestic inflation would be attenuated.

4.1 Discussion

As regards the effects of monetary and fiscal policy shocks on real output (Eqs. (6), (7), (8), and (989)), despite the model revision, the analysis developed done in Bossone (2019) remains valid and will not be repeated here. Only In fact, an important -most critical- point that emerged from that analysis must be reiterated here. Considering Eq. (2210), expansionary policies that undermine the credibility of a country (in the perception of global investors) – say, because they threaten the future sustainability of public sector liabilities – translate into currency depreciation and higher inflation (thus, de facto fulfilling the prophecy), with inflation eventually neutralizing the positive effect of depreciation on real output, or even worse, if interest rates have to be adjusted to a point where they depress real output.

Eqs. (1) and (13) are critical, since critical in this regard. The former since it tells whether the weakening of credibility and its reflection on the IBC elasticity of the IBC are such as to threaten the sustainability of public sector liabilities and thus requires policy reversal for the country to prevent or to react to a financial crisis. On the other hand, As a result, the same policy can range from being fully effective to being totally ineffective (in terms of real output), depending on its impact on credibility as perceived by global investors: if ineffective, the policy impact will dissipate through currency depreciation, first, and higher inflation later (depending on the ERPT). Eq. (13) – which builds on Eq. (1) – determines the space for monetary policy governed by Eqs. (6)-(7). Here, the (independent) central bank decides the composition of the government liabilities in an attempt to target the interest rate; yet, the role of credibility factor $\beta$ is key in determining its actual policy space; if the central bank
tries to lower the interest rate to stimulate real output, it is either be the case that the central bank acts within the space granted by global investors, which would then make the targeted level of the interest rate consistent with investor expectations, or the central bank would be is seen as "trespassing" that space (which can likely to easily happen with a low or declining β), which would push investors to bid the price of the debt down, thereby tightening the IBC and, causing the interest rate to rise back to the original level or even higher, with a consequent negative impact and neutralizing (partly or fully) on the real output effect of the expansionary monetary policy. The higher the β, the larger the space available to the central bank to achieve its objectives, and vice versa. This can be appreciated would be seen more clearly by inspecting Eq. (13), where which, re-written reporting expanded expression of the world price deflator (Eq. (3)) in its denominator as

$$
\sum_{j,t} P_{B_{H,j,t}} + P_{B_{CB,j,t}} \delta P_{s_{Id,t}} (S_{Id,t} + \Delta m_{Id,t}) = \sum_{j,t} \delta P_{s_{Id,t}} (S_{Id,t} + \Delta m_{Id,t})
$$

The equation suggests that, as global investors fear that monetary policy threatens a devaluation of the currency (via Eq. (21)), thereby raising, as reflected by an increase of the world price deflator \( P \) (Eq. (3)), the real value of the government debt held by them would would decline (on the LHS of the equation Eq. (23)), and would be which would have to be mirrored by a proportional decline of the real value of the stream of the future debt repayments country’s credibility factor (on the RHS of the equation Eq. (23)). This implies that recovering the original real value of the debt would require greater sacrifices from the country (which might not even be sustainable). In addition, the attempts of the central bank to lower the interest rate would be offset by investor expectations reckoning considering the its lower level to be be unreasonable vis-à-vis its equilibrium value untenable.

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23 As noted in Section 2, this result points to the relevance of using world price indicators as deflators when operating from a global (as against local) investment perspective.
Notice that the inverted sequence of events could as well take place in reverse order and start from the RHS: also indeed materialize of Eq. (23): whereby the investors might perceive a deterioration of country credibility to deteriorate, first, this, which would tighten the government IBC, depreciate causes the currency to depreciate, and depress the real value of government debt to fall as a result.

Thus

As a result of these arguments, the same policy can range from being fully effective to being totally ineffective (in terms of real output), depending on its impact on credibility as perceived by global investors: if ineffective, the policy impact will dissipates into through-currency depreciation, first, and higher inflation later (depending on the ERPT).

Only fully credible governments can be in the "driving seat," since global markets grant them the policy space they want/need.

This discussion exemplifies the key role that country policy credibility, as proxied by factor $\beta$, plays in the PTI, whose main message is

Interestingly, therefore, global investors determine the relative (in)effectiveness of macro policies at the country level, and the point to be homed in here—which underpinnings the PTI—is about the endogeneity of the policy space available to national authorities: a country, as shaped by the global markets: the weaker the authorities in credibility of the country, the narrower their policy space — as determined by global investors — and the greater the contraction of such space due to policy choices that global investors believe will further weaken their authorities country’s credibility.
Additional considerations concern the exchange rate and thus deserve attention. The PTI suggests that, with high international financial integration and the central role of global investors as asset price setters, a persistently growing stock of public sector liabilities (money and debt) is sooner or later expected to exceed its optimal level, even if the economy is at less than full employment. This happens sooner, rather than later, in countries suffering from relatively weaker policy credibility, where the demand for assets denominated in domestic currency is at any time dominated by the demand for assets denominated in foreign currencies. The dominance of foreign asset preferences is even stronger where wealth is highly concentrated in the hands of a few holders and/or managed by professional investors, as both types of agents are highly sensitive to risks and react fast to changes in risk perceptions. The rationale for this is that, as public sector liabilities grow and circulate in the economy, they eventually accumulate in the financial portfolios of powerful market actors who, unlike the multitude of smaller local agents, are not interested in spending them in local goods and services, but rather diversify them across alternative assets (e.g., property, commodities, speculative financial securities, and foreign assets), acting in either their own interest (as wealth holders) or on behalf of wealth holders (as professional investors and portfolio managers).

Foreign assets tend to absorb larger portfolio shares, the higher the expected growth of money and/or public debt and the lower the credibility attributed by the markets to the national policy authorities. That is, even assuming that a larger money supply can be absorbed by a larger demand for transaction money balances (to be spent on additional output by local agents featuring a high average propensity to consume out of current income) and/or a larger demands for funds by the government, the prospects of persistently growing stocks of money and debt push global investors to substitute domestic with foreign assets (or, more broadly, with assets denominated in foreign currencies), thereby neutralizing the real (output) effect of the money supply: the excess supply of public sector liabilities incentivizes cross-currency arbitrage and triggers a depreciation of the nominal exchange rate until equality between excess asset supplies in real terms is re-established across countries. In the extreme,
no output effect follows, and the impact of liabilities growth dissipates entirely in nominal exchange rate devaluation (and inflation thereafter).

Notice that, all else being equal, the occurrence of excess liabilities growth is more likely to happen in countries with lower credibility, where the growth of money supply would not as easily be absorbed by an increasing demand for money, for the reasons discussed above.

With expectations incorporated into the model, anticipations of future nominal exchange rate devaluation do accelerate actual devaluation; and, with rational expectations, anticipations of currency devaluation fulfill themselves instantaneously. For instance, with expectations of unbounded money growth, as it would be the case with persistent monetization of fiscal deficits to pursue full employment (say, à la Modern Money Theory), the exchange rate would be in free fall in most countries – with the exclusion, perhaps, of reserve-issuing countries or countries with very strong policy credibility, where other mechanisms are triggered that can prevent stock imbalances from growing and expansionary macro-policies to be effective (Bossone, 2021b). Also, all else being equal, expectations of devaluation are stronger, the lower the credible of the country undertaking the fiscal-monetary expansion.

Finally, as noted (but it is worth re-emphasizing it here), the model predicts inflation nominal exchange rate changes to follow expansionary policies even at less than full employment output. These changes are fueled by expectations of "excess" public sector liabilities growth and the consequent currency depreciation driven by given perceptions of country low credibility, in spite of the negative output gap and yet they are de-linked from the expected impact of liabilities growth on price inflation (as the negative output gap makes the economy’s real resource constraint unbinding).

In other words, according to the PTI, inflation can be the consequence (and not necessarily the cause) of would follow (not cause) exchange rate depreciation following from due to EERPT effects and evolving independently of the economy’s level of resource employment levels in the economy (unlike in monetary theories of the exchange rate).
5. CONCLUSION

The forces of globalization demand that each country considers realistically how effective its macro-policies can be, given its own characteristics and circumstances. This is especially (though not exclusively) important for developing and emerging market economies. In fact, current macroeconomic policy modelling continues to rely on domestic representative agents and fails to recognize the role global investors play in determining the value at which public sector liabilities (money and debt) trade in the markets, and their decisive impact on policy effectiveness. Correcting for this shortcoming is what I have tried to do with my recent work on the Portfolio Theory of Inflation (PTI), cited earlier, where I have analyzed how financial globalization affects the policy space available at the national level – in many cases constraining it to the point of rendering expansionary macro-policies ineffective or even outright destabilizing.

This article has revisited the PTI as originally defined, further articulating its findings and implications. In particular, the article has added to the micro-foundations of the PTI model of the economy, framing more rigorously the role of global investors and their international capital allocation choices, and providing richer analysis of their effects on inflation. In the process, the revisitation also allowed to correct some errors contained in the previous work. The article has explored additional dimensions of how capital allocations by global investors interact with government macro-policies and impact nominal exchange rate and inflation. It has discussed in greater depth the role of global investors in today’s internationally highly financially integrated economies, showing how this role constrains or relaxes the policy space of the national authorities, depending on the credibility that global investors attribute to them, and has integrated the micro side of the PTI model of the economy using asset utility analysis developed in earlier work of mine. The revisited model has been employed to derive and evaluate new results on the dynamics of exchange rate and inflation following macro-policy shocks.
APPENDIX 1. DERIVATION OF THE ASSET UTILITY FUNCTION

The utility of asset $Q$ at date $t$ is calculated by summing over two terms: (i) the utility directly derived from converting the asset into consumption at the next date $t+1$ with probability $\theta_{t+1}$, and (ii) the utility indirectly derived from holding the asset further on with residual probability $(1 - \theta_{t+1})$, which in turn (iii) can be further decomposed as above at each future date. It can be shown that, substituting iteratively for $u(Q)$ at each forward date yields across the time horizon, the process generates the following series of expressions:

$$u(Q_t) = \delta E_t\left[ u \left( \frac{P_t^Q}{P_{t+1}} \right) R_{t+1}^Q \theta_{t+1} + u(Q_t)(1 - \theta_{t+1}) \right]$$

$$= E_t \left[ u \left( \frac{P_t^Q}{P_{t+1}} \right) \delta R_t^Q \theta_{t+1} + u \left( \frac{P_t^Q}{P_{t+2}} \right) \delta^2 R_t^Q + \theta_{t+2} + u(Q_t)(1 - \theta_{t+2}) \right] (1 - \theta_{t+1})$$

$$= E_t \left[ \left( \frac{P_t^Q}{P_{t+1}} \right) \delta R_t^Q \theta_{t+1} + \left( \frac{P_t^Q}{P_{t+2}} \right) \delta^2 R_t^Q + \theta_{t+2} + \left( \frac{P_t^Q}{P_{t+3}} \right) \delta^3 R_t^Q + \theta_{t+3} (1 - \theta_{t+2})(1 - \theta_{t+1}) \right]$$

$$= E_t \left[ \delta^T \sum_{T=t}^{\infty} u \left( \frac{P_t^Q}{P_T} \right) \prod_{n=t+1}^{T} R_n^Q \theta_T (1 - \theta_{T-1}) + u(Q_T) \prod_{T=t+1}^{\infty} (1 - \theta_T) \right].$$

and so on for each subsequent substitution of $u(Q_T)$, for each date until the end of the time horizon. Since wealth (and, therefore, every asset held in the portfolio) must be converted into consumption by the end of the time horizon, holdings of $Q$ vanish in the limit as $\lim_{T \to \infty} (1 - \theta_T) = 0$. Thus, summing over the agent’s infinite time horizon gives the utility of asset $Q$ at date $t$ as

$$u(Q_t) = E_t \left[ \delta^T \sum_{T=t}^{\infty} u \left( \frac{P_t^Q}{P_T} \right) \prod_{n=t+1}^{T} R_n^Q \theta_T (1 - \theta_{T-1}) \right].$$

The cost of asset liquidation

Liquidating assets may involve resource costs such as for information acquisition, search, evaluation and verification, legal and administrative requirements, bargaining and negotiations, etc. Depending on the efficiency of the financial system where asset trading takes place, as well as on the state of market mood, each
asset $Q$ requires its own minimum amount of time $\tau^*_Q$ (to be defined more precisely below) for its holder to be able to sell it at the ongoing market price $P^Q$, net of unit liquidation cost $q^* \in (0,1)$. If the agent is compelled to realize the asset within a time interval $\tau_Q \leq \tau^*_Q$, then she must be willing to accept a sale price lower than $(1 - q^*_Q)P^Q$, that is, the asset must sell at a price discount larger than the unit liquidation transaction cost under optimal timing ($q > q^*_Q$). The liquidity of asset $Q$ is therefore variable and endogenously determined, and can be modeled in terms of the following structure for asset liquidation cost

$$ q = q(\tau^*_Q / \tau) $$

where

a) if $0 \leq \tau^*_Q \leq \tau$, then, $q_Q = q^*_Q \geq 0$: the seller has enough time to liquidate $Q$ and pays only $q^*_Q$ for the transaction;

b) if $\tau^*_Q > \tau \geq 0$ then, $q_Q \geq q^*_Q$: the seller has not enough time and must sell $Q$ at a discount larger than the optimal unit transaction cost;

c) $\lim_{\tau^*_Q \geq \tau \to 0} q_Q = 1$: the discount increases with the time pressure on the seller to sell $Q$; and

d) if $\tau^*_Q = 0$, then, $q_Q = 0$: $Q$ is perfectly liquid (cash).

and where

$$ \tau^*_Q = \tau(\Psi^Q, \omega_Q) $$

that is, the minimum time interval required to sell $Q$ optimally decreases with structural variable $\Psi^Q$, which reflects the level of financial system efficiency in the trading of asset $Q$ (including such features as technology; market platform, legal, regulatory and supervisory infrastructure; etc.), and increases with $\omega_Q$, which captures the prevailing market mood for trading $Q$, with a high (low) $\omega_Q$ indicating the state of exuberance (pessimism) in the market for $Q$ as perceived by the agents (which is not discussed in this appendix, but is illustrated at length in Bossone (2014)).--Thus, greater (lower) efficiency of the financial infrastructure where $Q$ is traded and a “seller” (“buyer”) market would shorten (lengthen) $\tau^*_Q$ and lower (raise) $q$. Variable $\Psi$ is a subset of the agent’s perceived state of uncertainty, as discussed in Bossone (2014).
Since, at any time $T > t$, the expected utility lost to the liquidation of asset $Q_t$ inherited from time $t_t$, is a fraction $\xi_t$ of the expected utility from the consumption financed through the proceeds of $Q_t$,

$$
\xi_t = \frac{E_t[u(Q_t, P_t^Q, Q_t^P)]}{E_t[u(P_t^Q, Q_t^P)]},
$$

where $\xi_t = \xi(q_t)$, $\xi_t > 0$, $\xi(0) = 0$, $\xi(1) = 1$, indicating that $\xi_t$ decreases with improvements in market sentiment (and vice versa).

Then, Eq. (A2a) can then be rewritten as

$$
(A3)\quad u(Q_t) = E_t \left\{ \theta^T \sum_{t = 1}^{\infty} \frac{1}{\theta_t} \theta_t^{\frac{\kappa - 1}{\kappa}} R_{\theta_t}^Q (1 - \theta_{t-1}) (1 - \xi_t) \right\},
$$

which appears as Eq. (13) reported in the main text. In fact, three additional features could be incorporated to further qualify each asset’s performance as a vehicle of purchasing power: a variable asset liquidation cost (involved in the process of trading the asset or of transforming it into cash), the volatility of the asset value (i.e., the risk profile of the asset return), and market sentiment producing optimistic or pessimistic or neutral expectations, yielding Eq. (135) reported in the main text. Since these elements are not strictly relevant to the purpose of this study, they are not further analyzed here, and interested readers are referred to Bossone (2014).

References


Box 1. is an unnecessary and unilluminating detour.

Credibility is the core element of the PTI, and thus it is useful to provide readers with an explanation on the nature and role of this factor, as also suggested by readers of previous versions of the article. The box is one way of doing this in a dedicated space.

The information set \( \omega_t \) defined to include expectations of variables in time \( t + 1 \) is common knowledge. That is to say, the government will be aware of the costs of reneging on the equilibrium outcome of the game (There I go again!) played with the global investor. It will know that the price to be paid in the event is \( \beta_{t+1} \leq \beta_t \). If it chooses to do so it must be the case that it/society is better off by ‘cheating’, the payoffs calculated for all time to come and including the welfare of nonfinancial firms and workers.

The fact that a government knows the consequences of reneging on its future obligations does not necessarily imply that it can avoid situations where either it is forced to renege or finds it convenient to renege, as international experience shows.

Alternatively, while the information set is common knowledge, the expectations of global investors may diverge from those of the government, leading the former to draw conclusions on the future sustainability of government policies that are not necessarily shared by the government. Should this be the case, the government’s IBC would be tightened by investor decisions and the government would learn ex post about its narrower policy space, after observing the market reactions. It would then have to decide whether to adjust its future policy path (i.e., the stream of future primary surpluses and money supplies) and make it consistent with the \( \beta \) factor (e.g., Greece, or whether to reduce its dependence on capital markets and follow a different route (e.g., Argentina in the 2000s).

One could even assume that the government correctly predicts market reactions and adjusts its policies accordingly. Yet, this would not change the fact that the government would have to live with a tighter IBC.

Conversely, a government may stick to its actions and live with the consequences, irrespective of market reactions. The real world is indeed plenty of examples of countries that take policy decisions that are inconsistent with market expectations. Yet, they do so out of irrationality but because they pursue other objectives or because they are politically bound to do so.
<table>
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<th>COMMENT</th>
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<td>**[T]**he author suggests that the domestic government enjoys no such luxury. It is in the thrall of global investor interests. In that case, if $\beta_{t+1} \geq \beta_t$ for all $t$, why bring in beta at all?</td>
<td>I am not clear about this remark. Anyhow, certain governments do have such luxury, and if their credibility strengthens (in the eyes of the market), so does their policy space (as determined by the investors’ capital allocation decisions). Vice versa, of course, if their credibility weakens.</td>
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<td>In the terminology of the author why would a government choose a less-elastic IBC? Why would it not enjoy a good reputation year in and year out?</td>
<td>In fact, good reputation would be rewarded with more elastic (not less elastic) IBC. Anyway, governments do not choose their IBC (with very few exceptions in the world), and even less can they choose less-elastic IBCs. All governments are subject to exogenous IBCs. According to the PTI, governments of countries that are highly internationally financially integrated find themselves subject to IBCs whose elasticity may change according to decisions by global investors, based on credibility factor $\beta$. Moreover, governments in the real world do act under all sorts of external conditions and constraints (economic, political, societal), which seldom afford them full freedom to achieve and enjoy the reputation they wish, if not after undergoing significant and costly sacrifices. Should this not be the case, all governments would easily enjoy triple A status, which is not what is observed in real life. Not to mention, as noted, those cases where governments pursue policies that are obviously inconsistent with market expectations and credibility criteria. However, there are cases of governments that behave like the reviewer suggests: one clear example, out of very many, is the governments of Asian EMEs following the financial crisis of the late 1990s-early 2000s. And indeed, they have since been “rewarded” by markets with higher credibility marks and hence greater policy space (i.e., a more elastic IBC).</td>
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<td>I question the introduction of ERPT and the lag operator (at the end of the day on page 17 we have instantaneous price adjustment) as well as equation (5) (The meaning of the sign of the second derivative is unclear).</td>
<td>Point partly taken. Both aspects had been added for realistic purposes. The lag operator was eventually dropped as not necessary to the analysis. On the other hand, the ERPT was retained to reflect the fact that in real-world situations the effect is usually less than complete and varies across space and time. Also, and importantly, as the literature shows (see p. 11 and fn. 9), the ERPT is affected by credibility</td>
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<td>(besides other structural factors), which explains the sign of the second derivative.</td>
<td>Thus, the ERPT is another channel through which capital allocation decisions by global investors determine country policy space: due to a low or declining credibility factor $\beta$, expansionary macro-policy shocks dissipate into currency depreciation, first, and higher inflation later (with limited or no impact on output), and vice versa for countries with a high $\beta$.</td>
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<td>Thus, the ERPT is another channel through which capital allocation decisions by global investors determine country policy space: due to a low or declining credibility factor $\beta$, expansionary macro-policy shocks dissipate into currency depreciation, first, and higher inflation later (with limited or no impact on output), and vice versa for countries with a high $\beta$.</td>
<td>A complete ERPT is used in the PTI model only as a limit assumption (together with other limit assumptions) to derive some neat equilibrium solutions for asset portfolio allocations and prices, while it is recognized that less-than-complete effects usually hold in reality, with implications for the outcomes of Eq. (22) (see discussion on p. 20).</td>
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<td>With equation (6), the central bank is in the driver’s seat, with equation (1) it is the government. Refer to my earlier point about overdetermination of policy variables.</td>
<td>With equation (6), the central bank is in the driver’s seat, with equation (1) it is the government. Refer to my earlier point about overdetermination of policy variables. Point used to improve the framework. Only few governments can in fact be in the driving seat (only those with very high $\beta$). Under Eq. (1), and a low $\beta$, a government can only decide the level of its debt, while the market will judge the sustainability of the debt and will determine the price at which the debt trades. Under now revised Eqs. (6)-(7) the central bank determines the composition of government liabilities in an attempt to target the interest rate. Yet, again under a low $\beta$, the central bank might (and would likely) not succeed in its attempt. In particular, if $\beta$ is low and/or declining, the central bank may try to monetize all the debt it wishes but global investors would frustrate its attempts. The new Eq. (13), previously suppressed, has been recovered and used to define the central bank’s policy space. Its relevance is discussed both in the text illustrating it (p. 15) and in the new Section 4.1, where some important aspects are noted. There is no overdetermination of policy variables; rather there is some deliberate indetermination, which can be resolved once investor expectations are known. See the new fn. 16. The government only determines the overall debt level (not its price), while an independent central bank can change the debt composition and try to affect its price. However, in trying to do so—say, to lower the interest rate—it may act within the space...</td>
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<td>granted by global investors, which implies that the interest rate target it seeks to set is consistent with investor expectations, or it ends up “trespassing” that space (this can easily happen with a low β): in this case, the investors bid the price of the debt down, tighten the IBC, and cause the interest rate to rise back to its original level or even higher (thereby neutralizing the output effect of the expansionary monetary policy or even worse).</td>
<td>In the limit, only fully credible governments can be in the driving seat, since global markets grant them the policy space they want. This is the key role that credibility factor β plays in the PTI. The sense of these considerations is now reflected in the new Section 4.1.</td>
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<td>Equation (7) is a well-known definition and can be omitted.</td>
<td>Point taken. The equation has been dropped.</td>
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<td>An important clarification wrt equation (8) is sought. Does potential output grow at the rate 1 + x or does the deviation of actual from potential output grow at that rate?</td>
<td>As in the equation (now Eq. (7)) and in the explanatory text on p. 12, potential output grows at rate (1+x).</td>
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<td>What is the basis of the expectations operator in equation (10) in The Micro Side?</td>
<td>It is explained by the (ex ante) unknown realizations of future wealth and wealth components.</td>
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<td>Equation (14) is dizzying. With liquidation cost and price volatility slipped in (they are not part of the derivation in Appendix 1) only to be dropped along with market sentiments shortly after, once again I wondered at the point of its inclusion. The movement from equation (16) to (17) would be smooth without it.</td>
<td>Point taken. Only the variable liquidation cost of assets is retained, given its importance for differentiating among assets with different liquidity profiles. A full explanation of the nature of liquidation cost and how it enters the asset utility function is now reported in Appendix 1 (drawing from Bossone (2014)).</td>
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<td>Equations (17) and (18) turn out to be eternal verities which do not require this luggage.</td>
<td>I wouldn’t know how to represent them without this luggage.</td>
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<td>My eyes scanned the familiar tracks of the last paragraph on page 17 only to pause at the last line leading to page 18. I had lost track of the “credibility factor” βj. The author attempts to locate it in equation (19). It does not seem to be there but appears through a logarithmic transformation of the equation. As remarked in my first appraisal, take away the beta factor and the results 1., ii., iii., are pretty standard and a., b., c., d., can be derived through prettier means.</td>
<td>Point taken, and the new Credibility factor β shows up now in Eq. (13) and in the expression for the rate of return on government bonds (see p. 14). Factor β cannot be taken away from the PTI: it is a core element of the theory. Considering the need to retain it, I am not aware of any “prettier” way to derive the same results. As regards the results of the PTI, it should be noted that those derived and discussed in this revisitation...</td>
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<td>that equation (21).</td>
<td>of the PTI complement those derived in the original work, which focus on how global investor constrain country policy space based on the credibility factor (see below).</td>
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<td>In sum, borrowing the language of the author in 5. Conclusion, financial globalization does not act on the domestic policy space “constraining it to the point …” but constrains it to a point. “Global investors” do not “interact with government macro-policies” but determine them. Depressing but true perhaps.</td>
<td>The language in Section 5 (as well as in Section 1), refers, as indicated, to Bossone (2019), which shows that financial globalization does not constrain the domestic policy space “to a point”; it may constrain it to various degrees, including “to the point of rendering expansionary macro-policies ineffective or even destabilizing.” Again, it ultimately all depends on credibility factor $\beta$ of the countries considered; hence, the centrality of this factor in the PTI, as emphasized throughout this matrix and in the article itself.</td>
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