Economics
The Open-Access, Open-Assessment E-Journal
Vol. 13, 2019-33 | June 04, 2019 | http://dx.doi.org/10.5018/economics-ejournal.ja.2019-33

The portfolio theory of inflation and policy (in)effectiveness

Biagio Bossone

Abstract
The analysis of open macroeconomies typically assumes (implicitly or explicitly) that resource allocation decisions are taken by domestic agents. The Portfolio Theory of Inflation (PTI) developed in this study assumes that some critical allocation decisions are taken by global investors and investigates how such decisions affect the effectiveness of macroeconomic policy in open and highly financially integrated economies. The PTI adopts a modified version of the portfolio balance approach to exchange rate determination and incorporates optimal intertemporal choices from global investors who allocate resources internationally based, inter alia, on the perceived policy credibility of the national authorities and their policies. The PTI shows that when a country has low credibility and is heavily indebted, investors hold its economy to a tighter intertemporal budget constraint and policies aimed to stimulate output growth do in fact dissipate into currency depreciation and higher inflation, with limited or no impact on output. On the other hand, high credibility creates space for effective and non-inflationary macro policies with limited impact on nominal variables.

JEL E31 E4 E5 E62 F31 G15 H3
Keywords Credibility; exchange rate; financial integration; global investor; interest rate; intertemporal budget constraint; money, bonds and assets; pass-through

Authors
Biagio Bossone, Governance on Global Finance, The Group of Lecce, Lecce, Italy, biagio.bossone@gmail.com

Citation Biagio Bossone (2019). The portfolio theory of inflation and policy (in)effectiveness. *Economics: The Open-Access, Open-Assessment E-Journal*, 13 (2019-33): 1–25. http://dx.doi.org/10.5018/economics-ejournal.ja.2019-33

Received April 15, 2019 **Published as Economics Discussion Paper** March 11, 2019
Revised May 11, 2019 **Accepted** May 21, 2019 **Published** June 4, 2019

> "I used to think that if there was reincarnation, I wanted to come back as the president or the pope…But now I would like to come back as the bond market. You can intimidate everybody."
>
> James Carville[1]

1 Introduction

Is it true that floating exchange rates protect an economy from the consequences of "sudden stops" in capital flows, and grant its policymakers greater flexibility in both managing demand and sustaining public debt? Or that a country enjoys more fiscal space if it denominates its debt in its own currency? And even more so, if its debt is held by its residents (as opposed to nonresidents)? Should therefore countries that are part of a fixed exchange rate or currency union arrangement exit the arrangement in the expectation that it would give them more freeway to raise output and employment?

As is usual with most questions in the realm of economics, the answer to the above ones is, «it depends…». Answering them requires, first, to consider how open and financially integrated are the economies under investigation – in particular, whether their public liabilities trade in the global markets – and then to figure how credible their policy authorities, framework and institutions are in the eyes of the markets where their liabilities trade.

In recent contributions I argued that a fully financially integrated economy with large public debt and poor policy credibility (in the eyes of the market) would not stand to gain much in terms of shock insulation and policy autonomy from either issuing liabilities in its own (rather than a foreign) currency or adopting a flexible (rather than fixed) exchange rate regime (Bossone 2018, 2019a, 2019b). By extension, I concluded, a country with the above characteristics that is already part of a fixed exchange rate or monetary union arrangement would not benefit much, if at all, from exiting the arrangement unless and until it frees itself of its debt burden and adopts policies that the markets deem to be credible: in the interim to that point, and for a while, the country's space for expansionary macro policies would be rather limited (if not nihil).

Key to the above conclusion was the assumption of full integration of the economy into the global financial markets, where the adjective "full" means absence of market segmentations and frictions, implying that a single and global homogeneous market environment exists where residents and nonresidents act alike. Upon reflection, however, I realized that financial integration does not need to be "full" (as it is not, in reality) for the above implications to hold for any given country, and that a "high" degree of integration would in fact be sufficient to that extent, where "high" means that the public liabilities of the country are traded in the international financial markets and their prices are determined by investors who i) manage their portfolios taking a global perspective on local investment opportunities (in a sense that will be

[1] Lead strategist of the successful 1992 presidential campaign of then-Arkansas governor William J. Clinton.

defined below) and ii) are capable to shift capital in and out of the country in real time and at negligible transaction costs.

High financial integration thus understood causes relevant shares of domestic (private and public) assets and liabilities to be managed as global portfolios. Notice that this effect would be magnified by adding to high integration such realistic features as high incidence of institutional investment over domestic savings and large concentration of domestic wealth, since both confer greater relevance on factor i) above and its implications for resource allocation.

The strong initial assumption of full integration can therefore be relaxed, thus gaining in realism. As this study will show, market segmentations and frictions (such as, for instance, "home bias" factors) as well as the presence of unexploited opportunities from portfolio diversification, can all be admitted in the analysis without impairing its results, since what matters for the results to obtain is that the prices of a country's debt and currency be determined by global players acting as "marginal" investors (as defined in the finance literature – see Section 3) – this is what ultimately determines the space available for governments to use active macroeconomic policies effectively.

Consequently, if the policy authorities of the above poorly credible and highly indebted economy operating under a floating exchange rate regime were to use the macro levers actively, they would in fact cause capital to flee the country, the nominal exchange rate to depreciate, and domestic inflation to rise. Ultimately, they would be forced to reverse their course of action and manage the economy similarly to what they would have done, had they committed to maintaining a fixed exchange rate rule to start with.

This study will explore what looks like a new theory of inflation, which, as the study's title suggests, will be referred to as the "portfolio theory of inflation" (PTI) for reasons that will be explained below. According to the PTI, in a nutshell, investors operating in globally integrated financial markets allocate resources across national economies based on the latter's credibility. Thus, when investors deem a country's credibility to be low, the economy is tied to a tighter intertemporal budget constraint (IBC) and the issuance of public sector liabilities (in the form of money or debt under any currency denomination) aimed to stimulate output growth dissipates instead into domestic currency depreciation and higher inflation.[2] On the other hand, if the same expansionary action is undertaken by a highly credible government, a more flexible IBC allows output to expand with no dissipative effects on nominal variables.

The theory is therefore consistent with – and indeed explains – different economic outcomes deriving from similar policies adopted by different countries, on the basis of the different degrees of credibility that markets attribute to the policy authorities of each country and their action.

Moreover, much better than the prevailing theories of inflation, the PTI reflects the dominant role that global finance plays in defining the space available for national authorities of open and financially integrated economies to undertake active, effective and non-inflationary demand management policies. Indeed, the PTI may prove especially relevant to investigate the policy space of small and open economies, in particular those that are highly indebted, and to identify the circumstances where (and the reasons why) their active macro policies are

[2] The concepts of credibility and excess liabilities will be clarified in Section 3.

ineffective, irrespective of whether their liabilities are denominated in the domestic currency and their exchange rate is flexible.

This study is organized as follows. Section 2 relates the PTI to the existing relevant literature. Section 3 discusses the importance of financial integration and policy credibility in determining the effectiveness of the nominal exchange rate under specific economic circumstances, as a fundamental premise for the PTI. Section 4 postulates the PTI, provides a formal representation of the theory and discusses its main results. Section 5 considers the strengths of the PTI as a theory to explain inflation in contemporary economies. Section 6 concludes the study.

2 Relations with the literature

As the PTI rests essentially on two pillars, reference is made in this section to the research that is pertinent to each of the two pillars and to how the PTI relates to this research. The pillars are: i) the portfolio balance approach (PBA) to exchange rate determination, as modified to incorporate intertemporal choices from global investors, and ii) the relationship between policy credibility, exchange rate and inflation.

Consider the first pillar first. In the PTI, the exchange rate is determined as in the PBA,[3] where financial markets create demand for predetermined stock supplies of domestic and foreign assets (such as money and bonds), based on current wealth, and assets are imperfect substitutes. As the PBA, the PTI assumes that assets are part of the investor portfolios and that changes in asset supplies induce investors to re-balance their portfolios upon risk-return considerations, setting in motion an adjustment process that influences the exchange rate via demand changes for assets. The PTI moves beyond the PBA, however, in that it assumes a highly integrated world capital market driven by investors who act globally and allocate resources across countries based on intertemporal optimization criteria (see Sections 3 and 4). The PTI, also, gives prominence to governments' IBC as one essential determinant of the value of national public debts. Furthermore, the PTI model developed in this study encompasses a central role for money, both as a monetary policy tool and as one of the economy's assets.

In as much as the PTI relies on a micro-founded model with intertemporal decisions, it draws inspiration on the Modern Open Economy Macroeconomics (MOEM).[4] However, the PTI departs from the latter in some important respects. First, while the MOEM's main building block consists of individual countries acting as intertemporally optimizing home-resident agents, the PTI centers on the role of "global investors" as allocators of funds across countries. Second, and relatedly, whereas the MOEM's perspective is that of a country facing the rest of the world that generates external shocks to which the country economy adapts, and sometimes reacts to spillovers from shocks transmitted from the country (Trautwein, 2017), the PTI takes on the perspective of global investors and studies how the their portfolio choices determine exchange rate and inflation dynamics and how they affect the effectiveness of country

[3] For references, see Branson (1985) and Wang (2009).

[4] Obstfeld and Rogoff (1995, 1996).

macroeconomic policies in different country contexts. Finally, while the MOEM provides a grand analytical framework to evaluate all relevant aspects of open macroeconomies, the ambition of the PTI is confined to determining exchange rate and price level changes in open and highly financially integrated economies and to evaluating the effectiveness of their macro policies.

In sum, while the analysis of macro policy effectiveness typically assumes implicitly (as in the case of the PBA) or explicitly (as in the case of the MOEM) that resource allocation decisions are taken by domestic agents, the PTI assumes that, when countries are integrated in the global real and financial markets, critical resource allocation decisions are taken by international investors acting on a different (global) perspective, and uses this assumption to evaluate how these decisions affect macro policy effectiveness at the country level.

As regards the second pillar – on policy credibility, the exchange rate and inflation – the study falls within the strand of research on credibility opened by Agénor (1994) and Calvo and Végh (1991), and further developed by Calvo and Reinhart (2002) under their "fear of floating" conceptualization. Other relevant literature in this area of research is empirical in nature and covers both the analysis of the pass-through effect from the exchange rate to inflation and the relationship between policy credibility and the intensity of the exchange rate pass-through (ERPT). On the ERPT effect, in light of the importance given by this study to the openness and international integration of national economies, a relevant reference to mention is the work by Benigno and Faia (2016), which, based on US data, shows and measures the various channels through which globalization (especially in trade) has raised the degree of ERPT both in the short and the long run as a result of trade openness, greater competition, and the increasing share of foreign products sold domestically. Furthermore, in 2016 the central bank of Sweden found that, since 2014, inflation had shown a rising trend in the country and the depreciation of the krona that had taken place over the period was deemed to have contributed to this development (Sveriges Riksbank, 2016). More generally, however, as a study from the Bank for International Settlements has recently found, while the ERPT effect in emerging market economies has decreased following the 2008-09 financial crisis, the effect in advanced economies has remained relatively low and stable over time (Jašová et al., 2016). In Canada, where exchange rate movements do have a material impact on the prices of consumer goods, the ERPT effect has been shown to have only a transitory influence over the rate of inflation, since the long-run inflation expectations are anchored near the Bank of Canada's inflation target and thus play a mitigating role on the pass-through (Savoie-Chabot and Khan, 2015). This argument suggests, that policy credibility – ceteris paribus – weakens the link between the exchange rate and inflation.[5] This causal relationship seems to be supported by a number of studies. Aleem and

[5] While not all country studies on the ERPT effect may be reviewed here, some that cover emerging market economies are worth mentioning. Zelealem and Musila (2018) examine the temporal relationships between inflation and exchange rate changes, and their implications for the trade balance, and find that in the long run a real depreciation leads to an increase in inflation. Suleiman et al. (2018) estimate the quantitative effects of exchange rate depreciation on budget deficit and inflation in Nigeria and find that the impact of the exchange rate on inflation is positive, although it is not statistically significant. Also, a fairly substantial ERPT effect, although incomplete and slow, has been found for Egypt by Helmy et al. (2018), who attribute the reason for the incompleteness and slowness to the circumstance that the consumer price index in Egypt include a relatively large number of subsidized commodities and goods with administered prices.

Lahiani (2014) show that a lower ERPT is associated with a credible monetary policy aiming at controlling inflation and find evidence that the EPRT is higher in Latin American countries than in East Asian countries, where it has declined since the adoption of an inflation targeting monetary policy.[6] A similar result was observed by Edwards (2006) examining emerging market economies, and by Takhtamanova (2008) analyzing OECD countries. Carrière-Swallow et al. (2016) and Lopez-Villavicencio and Mignon (2016) identify strong links between the ERPT and the monetary policy regime's performance in delivering price stability in several emerging economies. This result is further corroborated by Kabundi and Mlachila (2018) for South Africa and by Winkelried (2014) for Peru. Looking at the Brazilian experience, Ferreira de Mendonça and Tostes (2014) find that not only monetary but also fiscal policy credibility matters for reducing the pass-through on inflation of market prices and inflation expectations.

Finally, the results of this study regarding the effectiveness of macroeconomic policies in relation to the credibility of the countries undertaking them are in line with the empirical findings by Calderón et al. (2004), based on a panel of 11 emerging market economies and time-series data for Chile. These findings show that the cyclical properties of macroeconomic policies depend critically on policy credibility, and support the conclusion that countries with higher credibility (as reflected by lower country risk levels) are able to conduct countercyclical fiscal and monetary policies, while countries with less credible policies fail to do so.

3 Financial integration, credibility and exchange rate (non)neutrality

The effectiveness of the exchange rate as an adjustment mechanism in a given country depends critically on three key variables (Bossone, 2018). These include the country's degree of financial integration into the global markets,[7] the size of its public debt (irrespective of currency denomination), and its level of policy credibility.[8] To see how these factors interact with each other, let's take a highly financially integrated country, suffering from weak policy credibility,

---

[6] In other words, the more credible the central bank, the quicker inflation returns to its steady-state level from before it suffered a shock.

[7] As generally understood, in a fully integrated financial market asset prices would be determined competitively, each country and institution operating in the market would be a price taker, and interest rates (net of risk premia) would be equalized everywhere across markets. Full integration would correspond to each asset being traded in a single global market. No frictions (e.g., home bias factors) would leave arbitrage opportunities unexploited by agents anywhere in the markets. The absence of frictions would be somewhat relaxed in the context of a "high" but not necessarily "full" degree of financial integration, as assumed in this study and as discussed in Section 1.

[8] Based on the approach introduced in macroeconomics by Backus and Driffil (1985a, 1985b), following the work of Kreps and Wilson (1982), this study defines "policy credibility" – as referred to a government – as the extent to which economic agents believe the government will carry out the macroeconomic policies it has promised to pursue. Importantly, this notion relates to both the will and ability of the government to deliver on its promise. Market judgments on policy credibility, thus, draw on a country's past policy track record, its resolve to pursue pre-announced policy commitments and targets, and the adherence of its policy framework to what markets consider to be sound financial stability criteria (such as, typically, low inflation, stable asset prices, high liquidity and solvency of financial institutions, low leverage of key sectors, etc.).

and assume that its policymakers adopt a floating exchange rate regime and commit to expanding public liabilities (debt and/or money) as much as necessary to stabilize output and employment at full capacity. With persistent expansion of the public liabilities, the policymakers would soon be faced with a dilemma:

- they may either be forced to set the interest rates on debt liabilities high enough to prevent the exchange rate from falling at levels that would make the liabilities unsustainable, or
- they may decide to monetize the debt as needed to keep interest rates low and to guarantee debt service.

Under the first option, the country would have to abandon its policy objective of stabilizing output to full-employment level, and the resulting endogeneity of the interest rate would, de facto, amount to bringing back through the window the fixed exchange policy that was thrown out of the door. Under the second option, the country would fail to achieve the objective anyway. In ex-ante (equilibrium) terms, and from the standpoint of the liabilities' holders, the two options are equivalent since the expected losses from the risk of debt default (as compensated ex ante by higher interest rate premia) would equal the expected losses from currency depreciation (a form of default of its own).

Indeed, if the liabilities consist of public debt denominated in a foreign currency, investors face the risk of the country defaulting on its debt obligations at some future date and thus protect their investments by requiring an appropriate premium on the debt interest rate. On the other hand, if debt is denominated in the domestic currency, investors are protected against the risk of default (since the issuer can always monetize the debt), yet they are exposed to the risk of future currency depreciation based on the authorities' commitment to unbounded debt monetization. Thus, all else equal, both options carry the same probability of triggering a contractionary sudden stop, and the flexibility of floating exchange rates plays no role in influencing the economy's real variables.

Globalization

A central assumption underpinning this conclusion is the country's high integration into the global financial markets, which tends to remove (but does not necessarily remove entirely) systematic differences between the intertemporal behavior of resident and nonresident agents and between their valuations of the country's liabilities, but most of all enable its public liabilities to be traded internationally. Under such condition, when faced with the prospects of the country issuing "excess" liabilities,[9] residents and nonresidents alike would replace at the

[9] The concept of "excess" liabilities may be understood in circumstances such as when public liabilities exceed the value of nominal aggregate output and both grow at the same rate, causing the difference between the two variables to grow indefinitely, beyond the point at which the holders of the liabilities might no longer be willing to absorb them, except perhaps at exorbitant (and yet unsustainable) interest rates. Holders would at some point start diversifying their portfolio into alternative assets, including those denominated in foreign currencies, and indeed very rapidly so in the event that the ratio were anticipated to grow fast. Notice that this would happen independently of increasing inflation expectations, and simply as a result of portfolio rebalancing effects. In fact, as will be explained below, higher inflation (and inflation expectations) could be the consequence, not the causing factor, of such portfolio rebalancing effects.

relevant margin *both* domestic debt *and* money holdings with foreign assets deemed to be safer stores of value. It should be emphasized that the concept of excess liabilities here refers to a sustained issuance of public liabilities by a poorly credible economy, not to the financing of short-run budgetary policies to address transitory output gaps (see the discussion of the "helicopter money" case in Section 4).[10]

This effect of high financial integration would be further reinforced if i) the incidence of institutional investment over total domestic savings were high and ii) the distribution of domestic wealth were largely unequal (or concentrated), since both features magnify the role of global investors (see below) in the price determination process of the traded liabilities. In particular, as exchange rates often diverge considerably and persistently from purchasing power parities, institutional investors and the owners of large wealth are typically more sensitive than small savers to the need to protect their assets not just from domestic inflation but also from losses due to exchange rate dynamics. Such investors optimize their portfolios by taking a more global view of asset risks and returns than small savers, and much more easily than small savers can (re)direct their investments across global markets. Since such investors would operate at the relevant margin, they would determine prices at which trades would be executed and set the benchmarks for other agents to determine their own allocations choices based on those prices (see Section 4).

It is often objected that resident and non-resident agents use different inflation rates to gauge their portfolio choices, with resident agents being primarily interested in protecting their wealth from the erosion due to domestic price increases and therefore being less responsive to foreign inflation. In fact, to the extent that prices are determined by marginal investors who manage their portfolios taking a global perspective and are able to transfer capital cross-border in real time and at negligible costs, asset values would be driven by the expected dynamics of international asset prices. In such circumstances, domestic inflation rates are determined by the exchange rate dynamics (rather than the contrary), and the more open is the economy and more flexible its prices, the greater is the transmission from the exchange rate to domestic prices (through the ERPT effect).

These global investors act as "marginal" investors, that is, those who trades at the margin and therefore have the most influence on the pricing of their trades.[11] Thus, in poorly credible and highly indebted economies higher inflation could materialize even at positive levels of the output gap as a reflection of the growth of public liabilities and their impact on the currency's exchange rate. In fact, with high financial integration, high incidence of institutional savings, and large concentration of wealth, the issuance of excess liabilities (as defined above) would first prompt a larger demand for domestic non-money assets (e.g., real estate) and then increasingly cause capital outflows.

Based on the above assumptions, thus, the policy space available to a country for expansionary measures grows narrower with its stock of liabilities – in whichever currency

[10] Of course, residents would still demand the domestic currency for transaction and tax payment purposes, but such demand might not be enough to prevent the currency from depreciating if people move large share of wealth out of it and into alternative assets (including foreign currency denominated ones).

[11] 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, and see more recently Chen and Lei (2015).

these are denominated – and is limited by the country's level of policy credibility. This conclusion is suggestive of a new theory of inflation grounded on the central role that global markets play, today, in determining prices in open and highly financially integrated economies as a result of their dynamic portfolio strategies. This theory is developed next.

4 The portfolio theory of inflation

The economy's model

The PTI developed in this section originates 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 "marginal" investor (see above). This agent pursues the objective of maximizing her financial wealth intertemporally, 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 as if they all worked for a company and for a company purpose. Global investors, thus, act collectively as an intertemporal class of agents who treat the assets in their portfolios as "vehicles" to the utility associated with the future streams of real resources to which they promise to give access. Their social purpose is to optimize and intermediate financial resources intertemporally from surplus agents to agents who needs them for investment or consumption-smoothing.

Importantly, in integrated international financial markets, global investors can move financial capital across markets and countries in real time and at negligible transactions costs.

Under the conditions discussed in Section 3 (high financial integration of the economy, high incidence of institutional investment, and large wealth concentration), the global investor is truly representative of the relevant investment community that national policy authorities need to consider when taking decisions. As is shown below, the peculiarity of the PTI is precisely the central role played by the global financial markets in shaping governments' IBC and in determining the effectiveness of their macro policies.

The model 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. 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:

(1) $P_t^B B_{j,t} = P_t \sum_{\tau=t}^{\infty} \left(\beta_{j,t}|_{\omega_t}\right)^t (s_{j,t} + \Delta m_{j,t})$ with $0 \leq \beta_j \leq 0$

(2) $B_{j,t} = B_{j,t-1} + \overline{\Delta B}_{j,t} = B_{j,H,t} + \bar{B}_{j,CB,t}$

(3) $P_t = P_{D,t}^{\alpha} (e_t \bar{P}_{F,t})^{1-\alpha}$ with $0 \leq \alpha \leq 1$

(4) $P_{D,t} = \Phi_D L_D^{-1}\left(e_t \bar{P}_{F,t}\right) + \Pi\left(X_{D,t} - X_{D,t}^*\right)$ with $\Pi' > 0$

(5) $\Phi_{D,t} = \Phi(\sigma_{D,t}, \beta_{D,t})$ with $\Phi_1 > 0, \Phi_2 < 0$; $\Phi_D \in (0,1)$

$$(6) \qquad \Delta B_{j,CB,t} = \Delta M_{j,t} = \mathrm{M}\left(i_t^{B_j} - i_N^{B_j}\right) \qquad \text{with } \mathrm{M}' > 0$$

$$(7) \qquad i_t^{B_j} = \iota^{-1}(P_t^{B_j}) \qquad \text{with } \iota^{-1\prime} < 0$$

$$(8) \qquad X_{j,t} - X_j^* = \mathrm{X}\left(i_t^{B_j} - i_N^{B_j}, \frac{e_{j,t}}{P_{j,t}}, \overline{\Delta g}_{j,t}\right) \qquad \text{with } \mathrm{X}_1 < 0, \mathrm{X}_2 > 0, \mathrm{X}_3 > 0$$

$$(9) \qquad \overline{\Delta g}_{j,t} = \frac{\overline{\Delta G}_{j,t}}{P_{j,t}} = \frac{\left(-\bar{S}_{j,t} + i_{t-1}^{B_j} B_{j,t-1}\right)}{P_{j,t}} = \frac{\overline{\Delta B}_{j,t}}{P_{j,t}} = \overline{\Delta b}_{j,t}.$$

Eq. (1) is the IBC of country *j*'s government and its central role in the PTI is discussed below; according to it, the current market value of government bonds *B* must equal the present discounted value of future primary surpluses and monetary financings. Specifically *B* is the number of (one-period) nominal (interest-bearing) bonds issued by the government at a contractual value that is equal to 1 unit of money, and P^B is the market value of one unit of bond *B* and is expressed as a ratio to the bond's contractual value;[12] s_t and Δm_t denote, respectively, the real value of the primary surpluses (taxes minus government spending excluding interest) and the real value of central bank money injections; $\beta_{j,t}|_{\omega_t}$ is a time-varying factor, conditional on information set ω_t available to investors at time *t*; it should be understood as a scale factor that *corrects* the value of the IBC in the perception of the markets and reflects the credibility that investors attribute to country *j*'s policy based on the current information available;[13] ceteris paribus, a lower β_j translates into a tighter IBC for *j*'s government and requires larger (and possibly more frontloaded) fiscal efforts to sustain a given debt stock.[14]

---

[12] This ratio generally varies between 0 and a value less than 1. Recently, however, following the Global Financial Crises, there have been cases where the value of the ratio has 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.

[13] Credibility factor $\beta_{j,t}|_{\omega_t}$ could indifferently be thought of as an index that applies to the IBC, scaling down or up its value correspondingly; a probability measure that generates an expected value of the IBC; or a risk factor that adjusts the value of the IBC.

[14] The information set ω_t comprises all the information that enables investors to assess and determine the policy credibility of a country government, and in particular all relevant 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 raise investors' concerns that country *j*'s government might face future challenges (which would eventually induce it to take such actions as defaulting on future obligations, inflating the debt away, or even repudiating it) would be incorporated in a new information set ω_t^1 and cause β_j to fall ($\beta_{j,t}|_{\omega_t'} < \beta_{j,t}|_{\omega_t}$) 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 required by the tightened the 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, interest rates to rise abnormally to a level where fiscal dominance puts pressure on the monetary authorities to monetize and inflate the debt away. The relevant information set would capture also those developments (including, for instance, the evolution of local 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, due to those developments, the credibility gap between countries (as perceived by the markets) may change and reflect different relative

This factor, thus, defines the "elasticity" of the IBC, as further discussion below.[15] Total public debt, equal to the stock of government bonds inherited from the previous period plus any current new bond issuance, is held by investors *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.[16]

In Eq. (1), *P* is the world price deflator used by global investors to gauge at any time the real value of their wealth and is calculated as the weighted geometric mean of the general price level attaining in individual countries, $P_D$and P_F, with weights given by each country's share in international trade (Eq. (3)), where P_F is 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, the ERTP factor Φ and lag operator L^{-1} (reflecting the speed of relative price adjustment to foreign price changes) and from the demand side by the output gap (Eq. (4)). According to Eq. (5), ERPT factor Φ raises (structurally) with the openness of the economy and declines with country credibility – higher credibility anchors inflation expectations and counteracts the effect on inflation caused by the ERPT factor (see Section 2).

Eq. (6) summarizes the central bank's policy rule whereby the central bank purchases government bonds (by "printing" money *M*) in an attempt to stabilize the interest rate on government bonds around its "neutral" value $i_N^{B_j}$; the latter is the interest rate that is consistent with zero inflation and zero output gap.[17]

Equation (7) reflects the inverse relationship between bond prices and interest rates; reduced form Eq. (8) posits the real output gap to change i) negatively with the deviation of current interest rate from its neutral level, ii) positively with the real exchange rate (assuming Marshall-Lerner condition), and iii) positively with the fiscal deficit (assuming away full Ricardian equivalence);[18] and Eq. (9) is the debt-financed fiscal deficit expressed in real terms where S is the nominal primary surplus.

The representative global investor *H* maximizes the intertemporal utility indirectly derived from wealth *W:*

$$(10) \qquad U(W_H) = Max_W \; E_t \left[\sum_{t=\tau}^{\infty} \left(\beta_{H,j,t}|_{\omega_t}\right)^t u\left(W_{H,t}\right) \right]$$

s. t.

dynamics of credibility factor $\beta_{j,t}|_{\omega_t}$for different countries over time. The role of the "credibility gap" will be analyzed in Section 4 and Appendix 1.

15 All else equal, different IBC elasticities across countries would be sufficient to make otherwise identical bonds imperfect substitutes of one another.

16 The bar over variables indicates that the variables are determined exogenously to the model.

17 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.

18 It should be noted that debt-financed fiscal deficits would also affect the real output gap indirectly and with positive sign via their effect on the interest rate via Eq.'s. (2) and (7)). This effect would be captured under relation i).

$$(11) \quad W_{H,t} = M_{H,D,t} + M_{H,F,t} + P_t^{B_D} B_{H,D,t} + e_t P_t^{B_F} B_{H,F,t} = y_{H,t} + M_{H,D,t-1} + M_{H,F,t-1} + P_t^{B_D} B_{H,D,t-1}\left(1 + i_{D,t-1}^{B}\right) + e_t P_t^{B_F} B_{H,F,t-1}\left(1 + i_{F,t-1}^{B}\right)$$

$$(12) \quad M_{H,D}, M_{H,F}, B_{H,D}, B_{H,F} \geq 0$$

and transversality condition

$$(13) \quad \sum_{t=0}^{\infty}\left(\beta_{H,D,t}\right)^t (M_{H,D,t} + M_{H,F,t} + P_t^{B_D} B_{H,D,t} + e_t P_t^{B_F} B_{H,F,t} - y_\tau) = 0,$$[19]

where $u(\cdot)$ is a strictly quasi concave, time-separable, and well-behaved utility function; E_t is the expectations operator at time *t;* and y_H is the investor *H*'s income.

The intertemporal budget constraint

It is important to wholly understand the central role of the IBC (Eq. (1)) for the PTI. With high integration of financial markets and the global nature of investors, liability issuers must commit intertemporally to generating enough real resources to fulfill their financial obligations to the investors. The IBC reflects the constraint that, whatever paths or rules government chooses to set for current and future surpluses, the present discounted value of future surpluses must at least be equal to the value of the liabilities outstanding. From the point of view of the investors, the issuing government must prove capable *and* willing to return the full value of its future debt obligations expressed in terms of foreign (reference) currencies and global inflation, and the IBC must hold identically irrespective of the currency of denomination of the liabilities (for the reasons discussed in Section 2).

Regarding the objection that a government enjoying monetary sovereignty does not face an IBC since it can always print all the money needed to pay for its future obligations, the PTI response is that investors guided by what they perceive to be weak credibility of the policy regime and institutions of the issuing government may bid down the value of the money and orientate the markets, even to a point where their demand for the money and any assets denominated in that money will shrivel, thereby imposing an IBC on government. Every government – whether it does or does not issue the currency of the country – faces an IBC. The elasticity of the IBC may vary, but an IBC will always be there.

A government that consistently proved capable and willing to satisfy Eq. (1) would be perceived as credible by the markets, and vice versa. The stronger its credibility (a high β), the higher the "elasticity" of its IBC and the greater the market's readiness to absorb larger amounts of its liabilities. On the other hand, with weaker credibility (a low β), the prospects of it being capable and willing to raise sufficient future resources to repay its obligations would be perceived as more uncertain by the investors and the IBC would cause bond prices to fall; the further erosion of credibility might even lead investors to no longer buy or hold domestic bonds and to shift their portfolio preferences toward foreign assets.

[19] Aside from its importance for making the model consistent and solvable, the transversality condition of Eq. (12) reflects the role of the "global investor" discussed at the outset of this section.

Eq. (1) epitomizes the essence of the PTI developed in this study, in that the theory reflects the ultimate subjective nature of market perceptions (as expressed in the investors' expectations, conjectures, and conventional beliefs) that are relevant to evaluate the credibility of national economic policies and the confidence than can be placed on the country's policy regime and institutions.[20]

Solving the model represented by the above equations for the domestic price level expressed in logarithmic form (see Appendix 1) yields:

$$(14) \quad \tilde{p}_{D,t} \approx \phi(\cdot) + L^{-1}\{[(\beta_{F,t+1} - \beta_{D,t+1}) + (\tilde{m}_{D,t+1} - \tilde{m}_{F,t+1}) + (\tilde{b}_{D,t+1} - \tilde{b}_{F,t+1}) + (\tilde{\imath}_{t+1}^{B_F} - \tilde{\imath}_{t+1}^{B_D})) + \tilde{p}_{F,t}] + \pi_{D,t}(\cdot)\},$$

where the tilde indicates the percentage deviation of variables from their steady state (optimal) values. According to Eq. (14), for a given ERPT factor $\phi(\cdot)$ and zero net excess internal demand $\pi(\cdot) = 0$, domestic inflation varies directly with:

i. changes in country credibility gap, as perceived by the market and based on new information and re-evaluation of relevant economic data. Note that credibility affects inflation both directly (via the credibility gap) and indirectly through the pass-through factor (the higher domestic credibility, the lower the pass-through, and the lower the inflation rate);
ii. changes in the relative dynamics of domestic versus foreign money stocks;
iii. changes in the relative dynamics of domestic versus public debt;
iv. changes in the interest rates differential on government bonds, and
v. changes in the rate of foreign inflation.

Notice that the EPRT term in Eq. (14) has negative sign, except when the pass-through is complete and thus $\phi(\cdot) = ln1 = 0$. With complete pass-through, instantaneous relative price adjustment to foreign prices, and no change in the output gap, changes in the nominal exchange rate feed fully into domestic inflation (relative to foreign).

According to Eq. (14), inflation would be sensitive to whatever public liabilities are deemed to be in "excess" vis-à-vis relevant foreign economies, irrespective of their nature and denomination.

Interestingly, Eq. (14) can be used to show that international economic developments may induce investors to move capital to countries enjoying higher credibility (and are generally regarded as safe havens). In such situations, the credibility gap might actually widen with the consequence that the IBC of highest-credible countries becomes more elastic, their policy space for expansionary action increases and, all else equal, their rate of inflation declines, while the opposite happen to the lowest-credible countries. Notice in such cases that the credibility gap

[20] More goes into Eq. (1) than the mere evaluation of stock-flow consistency. To see this, consider that, ceteris paribus, the same level of public debt may correspond to very different spending and tax policies that a government may decide to adopt, with different implications for the fiscal multipliers and the economy's supply side. Different policies would impact differently the growth path of the economy and its capacity to generate future fiscal surpluses, thereby inducing the markets to assess differently the policy credibility of the authorities and to determine a different elasticity of the government IBC.

widens not because national authorities have necessarily changed their policy commitments, but because the information carried by the new developments induce the investors to search for better protection of their resources; this is sufficient for them to strengthen in their perception the credibility of the most credible countries at the expense of the others.[21]

Credibility and macro policies: discussion

The model above allows to evaluate the effects of active fiscal and monetary policies of a government essentially by analyzing how policy stimuli are financed and how the government's financing strategy is judged by the financial markets.

Assume country *D*'s highly indebted government engineers a persistent fiscal stimulus through the issuance of new domestic debt $\overline{\Delta b}_{\tau}^{D} > \overline{\Delta b}_{t}^{D}$, $\tau = t+1, \ldots t+n$, for an indefinite *n*, in an attempt to keep real output gap at zero (Eq. (8)). If its credibility is low (a low β_D), investors apply an inelastic IBC and require government to commit to attaining larger primary surpluses over the immediate future so as to keep bond prices from falling. In fact, for economies that already suffer from low credibility, the very intention of relaxing macro policies might be perceived by the markets as further weakening credibility, thus tightening the government IBC.[22] A tight(er) IBC makes the stimulus small and short-lived, if at all. Moreover, if the government does not (credibly) commit to attaining larger future primary surpluses (that is, $\beta_{D,t}|_{\omega_t^1} < \beta_{D,t}|_{\omega_t}$), based on the new information set ω_t^1), bond prices fall (Eq. (1)), as investors sell domestic bonds for foreign assets, leading to higher interest rates (Eq. (7)) and a contraction in the supply of money supply engineered by the central bank to accommodate higher rates and stymie currency depreciation. Substituting Eq.'s (1) and (2) into Eq. (7) and the resulting expression into Eq. (8), casting the exchange rate as an implicit function of credibility and the interest rate from Eq. (A5) in Appendix 1, differentiating totally and setting the resulting expression equal to zero, yield

$$(15) \quad \Delta X_{D,t} = X_{D,t} - X_{D,t-1} =$$

$$\mathrm{X}_1\left\{\left(\iota^{-1}\left(\frac{P_t\sum_{\tau=t}^{\infty}\left(\boldsymbol{\beta_{D,t}|_{\omega_t^1}}\right)^n(s_{D,t}+\Delta m_{D,t})}{B_{D,t-1}+\overline{\Delta B}_{D,t}}\right)-i_N^{B_D}\right)\Delta i_t^{B_D}+\left(\iota^{-1}\left(\frac{P_t\sum_{\tau=t}^{\infty}\left(\boldsymbol{\beta_{D,t}|_{\omega_t^1}}\right)^n(s_{D,t}+\Delta m_{D,t})}{B_{D,t-1}+\overline{\Delta B}_{D,t}}\right)-i_N^{B_D}\right)\boldsymbol{\Delta\beta_{D,t}}\right\}+$$

$$\mathrm{X}_2\left(\Delta\frac{e_{D,t}}{P_{D,t}}\boldsymbol{\beta_{D,t}|_{\omega_t^1}}+\frac{e_{D,t}}{P_{D,t}}\boldsymbol{\Delta\beta_{D,t}}\right)+X_3\,\overline{\Delta b}_{D,t}=0,$$

which shows that, based on the new information set, country *D*'s credibility could drop to a critical level $\beta_{D,t}|_{\omega_t^1}$ (marked in bold and red in Eq. (15)) that neutralizes the effect on real output from both the fiscal stimulus $\overline{\Delta b}_{D,t}$ and the real exchange rate depreciation $\Delta\frac{e_{D,t}}{P_{D,t}}$, such

[21] See also discussion in Footnote 17.

[22] An implication of this argument is the asymmetrical treatment by the markets of expansionary versus contractionary policies. Whereas the former would weaken credibility, thereby further limiting the policy space available to policymakers, the letter would strengthen credibility and thus enhance government's ability to affect real variables as desired. This issue of policy asymmetry will not be further pursued here.

that $\Delta X_{D,t} = 0$; yet, the fiscal stimulus would increase the nominal exchange rate and inflation via Eq. (14). The negative credibility effect might even have a net contractionary impact on output (Fig. 1a).

Consider now the central bank's decision to stimulate the economy by lowering the domestic policy rate (Eq. (7)) and committing to keep it low for a long period by supplying more money through periodic purchases of government bonds. From Eq.'s (1) and (6), the share

Figure 1b. Fiscal Impulse

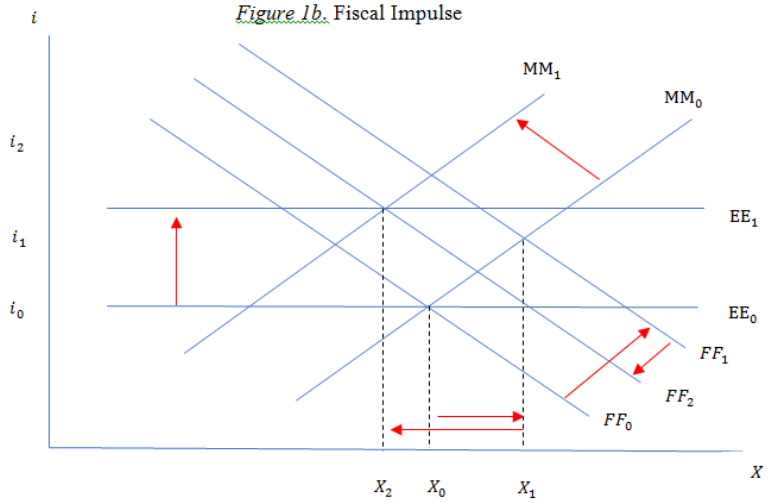
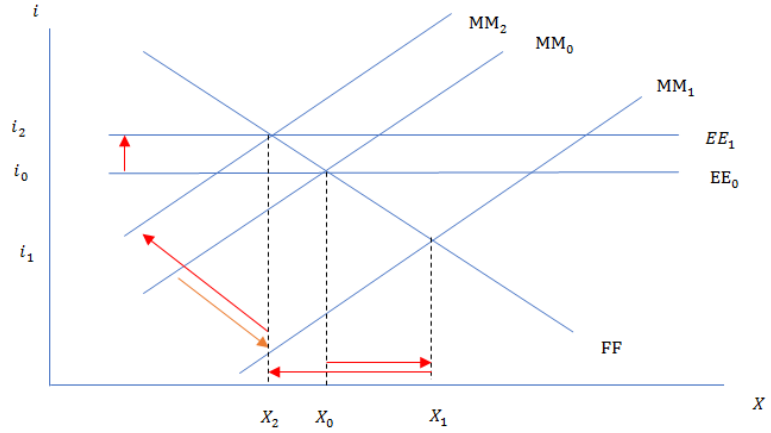


Figure 1a. Monetary Impulse



Note: Figures 1a and 1b: the curve MM is the locus of (*i*, *X*) pairs at which $\Delta b = 0$; the curve FF is the locus of (*i*, *X*) pairs at which $\Delta m = 0$; and the curve EE is the locus of (*i*, *X*) pairs at which $\Delta\left(\frac{e}{P}\right) = 0$. Fig. 1a portrays the case where the expansionary fiscal stimulus $\Delta b > 0$ is more than offset by effects of the drop in the level of policy credibility as perceived by the market. The fiscal authorities initially shift the FF curve rightward from $FF_0$to $FF_1$to a higher level of output, which is only partially dampened by a higher interest rate. However, the lack of credibility causes investors to sell off domestic bonds in exchange for foreign assets, and the monetary and fiscal authorities to adjust, respectively, the money and bond supply so as to keep balance in the bond and foreign exchange markets. As a result, the EE and MM curves shift, respectively, from EE_0 up to $EE_1$and from MM_0 backward to MM_1, and the FF curve moves somewhat backward to FF_2, all crossing each other at an interest rate that more than offsets the initial stimulus. Fig. 1b represents the case where the expansionary output effect of the monetary impulse $\Delta m > 0$ is more than offset by the effects of the drop in the level of policy credibility as perceived by the market. The monetary policy authorities initially shift the MM curve from MM_0 to MM_1 to a lower interest and exchange rate levels. The lack of credibility, however, causes investors to sell domestic bonds for foreign assets, causing the interest rate to rise and the currency to weaken. The EE curve shifts upward from EE_0 to EE_1 and the monetary authorities must shrink the money supply as necessary to restore equilibrium in the bond and foreign exchange markets . As a result, the adjustment might be such as to even more than offset the initial stimulus.

of domestic bonds held by the central bank increases (at an unchanged level of total outstanding government debt); correspondingly, global investors reallocate their portfolio toward foreign bonds since the marginal utility of the money balances they have received in exchange for selling the bonds to the central banks has declined, as shows Eq. (A5) in Appendix 1.[23] The latter equation also shows that, ceteris paribus, portfolio compositions featuring higher shares of foreign assets relative to domestic assets determine a higher nominal exchange rate. While the nominal exchange rate depreciation may in principle amplify the stimulus, the intensity and duration of its effect ultimately depend on the amplitude and speed of the real exchange rate adjustment process (Eq. (14)).

Short of the real exchange rate effect, the monetary stimulus is effective only to the extent that the central bank keeps the interest rate low (at or below its neutral level) for long enough. As experienced during the recent crisis, this policy encounters a limit at the zero (or effective) lower bound on the nominal interest rate; yet, until such limiting point is reached, the policy is generally effective.

However, the policy authorities must be mindful of the impact of credibility on the country's IBC. While high credibility raises the effectiveness of monetary policy, low credibility or the erosion of credibility in the eyes of the markets reduces it. This factor is particularly relevant for highly financially integrated and highly indebted countries, especially if their capacity to sustain a low interest rate policy is doubted by the markets. This would be the case if persistently low interest rates rendered the economy's public debt unattractive to investors or if the excess money balances injected by the central bank to purchase (monetize) the outstanding debt were used to buy speculative assets and assets denominated in foreign currencies. In this case, the authorities would have to undo the stimulus and raise the interest rate so as to halt exchange rate depreciation, otherwise depreciation and inflation would go unchecked. Reusing Eq. (15), after setting $\Delta \frac{e_{D,t}}{P_{D,t}} = 0$ and $\overline{\Delta b}_{D,H,t} = 0$, gives

$$(16) \quad \Delta X_{D,t} = X_{D,t} - X_{D,t-1} =$$

$$\mathrm{X}_1 \left\{ \left(\iota^{-1} \left(\frac{\sum_{\tau=t}^{\infty} \left(\boldsymbol{\beta_{D,t}}|_{\omega_t^1} \right)^n \left(s_{D,t} + \frac{\overline{\Delta M}_{D,t}}{P_t} \right)}{B_{D,t-1} + \overline{\Delta B}_{D,t}} \right) - i_N^{B_D} \right) \Delta i_t^{B_D} + \right.$$

$$\left. \left(\iota^{-1} \left(\frac{\sum_{\tau=t}^{\infty} \left(\boldsymbol{\beta_{D,t}}|_{\omega_t^1} \right)^n \left(s_{D,t} + \frac{\overline{\Delta M}_{D,t}}{P_t} \right)}{B_{D,t-1} + \overline{\Delta B}_{D,t}} \right) - i_N^{D} \right) \Delta \boldsymbol{\beta_{D,t}} \right\} = 0$$

which again shows that, based on the new information set, if country *D*'s credibility drops to a critical level $\beta_{D,t}|_{\omega_t^1}$ (marked in bold and red in Eq. (16)) that neutralizes the effect of the monetary stimulus $\overline{\Delta m}_{D,t}$ on the nominal interest rate, $\Delta \iota^{-1}(\cdot) = 0$, and hence on real output, while the largest part of the effect would dissipate into nominal exchange rate depreciation and

[23] This is due to the fact that they now hold domestic money balances in excess with respect to optimal balances.

higher inflation via Eq. (14).[24] The negative credibility effect might even have a net contractionary impact on output (Fig. 1b).

Finally, if the central bank and government coordinated their acts and engineered a monetary financing of new debt issuance aimed to support a fiscal stimulus $\left(\overline{\Delta b}_{D,CB,t} = \overline{\Delta m}_{D,t}\right)$ large enough to keep $i_t^{B_D} - i_N^{B_D} = const$ (a.k.a. "helicopter money"), by totally differentiating Eq. (8) the change in the real output gap would be given by

$$(17) \quad \Delta X_{D,t} = X_{D,t} - X_{D,t-1} = X_1\left(i_t^{B_D} - i_N^{B_D}\right)\Delta i_t^{B_D} + X_2\left(\frac{e_{D,t}}{P_{D,t}}\right)\Delta\frac{e_{D,t}}{P_{D,t}} + X_3\,\overline{\Delta bm}_{D,t} = X_3\,\overline{\Delta m}_{D,t},$$

since $\Delta i_t^{B_D} = 0$ by construction and $\Delta e_{D,t} = 0$ with full pass-through from Eq. (14). Eq. (17) shows that, by keeping the interest rate differential constant, no negative effects retrofit on real output; as a result, the fiscal-monetary impulse is unencumbered and the policy program can be calibrated to stabilize real output at full capacity without causing inflationary pressure. This result is consistent with Buiter's (2016) conclusion that *«helicopter money always works»* However, the monetary authorities should always consider the impact of their action on the exchange rate. If the stimulus were temporary, and the pass-through less than complete, the nominal exchange depreciation that would follow the temporary excess supply of money (Eq. (14)) would amplify the stimulus (Eq. (8)). On the other hand, under a persistent monetary financing of the fiscal deficits, the ongoing excess money creation would affect the nominal exchange rate and the inflation rate, causing credibility to drop, the ERPT effect to increase (Eq. (5)), and the exchange rate and inflation to further rise (Eq. (14)). Thus, while policy coordination may achieve the best result possible, it is not by itself sufficient for the country to gain credibility in the eyes of the market. In fact, the prospects of a persistent excess money creation policy would weaken credibility in the eyes of the markets.

The analysis of the two cases above shows that the effectiveness of macroeconomic policies depends on the level of government policy credibility as perceived by the markets. In particular, at lower level of credibility, the policy space available to the policy authorities for expansionary measures may be very limited, nihil or event negative, even in the context of floating exchange rates.

In particular, Eq.'s (14)–(17) point to the relevance of a) credibility for policy effectiveness and price dynamics in a context where economies are open and highly financially integrated in the global markets, and b) the dissipation of the policy effects into inflation. Policy credibility creates space for active, effective and non-inflationary macro policies. The abuse of such space, however, dissipates the policy effects into exchange rate depreciation and higher inflation. Inflation is the measure of the dissipative effect.

As will be discussed in the next section, there is no mechanical correspondence between changes in government liabilities (money and/or debt), the exchange rate, inflation and real output. The correspondence is country specific as it depends on the country's credibility as

[24] For full neutralization to be possible, that is, for $\Delta X_{D,t} = 0$, the decline in credibility must offset the impact that the monetary stimulus exerts through the change in the price of bond *B* (represented by the term in parentheses of the expression for $\Delta\iota^{-1}(\cdot)$), so that $\Delta\iota^{-1}(\cdot) = 0$.

perceived by the markets and may change depending on the government efforts (or lack thereof) to gain credibility in the eyes of the markets.

5 Why is a new theory of inflation needed?

Prevailing macroeconomic theories have been unsuccessful at explaining inflation in contemporary economies. Old Monetarism as well as the New Classical school have proven unable to account for how the massive and persistent money injections that were engineered in advanced economies during the Great Recession have largely failed to rekindle inflation. Similarly, New Keynesianism has been unable to explain the very slow motion of low-interest rate policies to deliver on the inflation targets promised by central banks (Palley, 2019), and in fact it has been caught in flagrant contradiction between its policy prescriptions and its inherent theoretical Neo-Fisherian structure, which should have led to opposite policy prescriptions (see Cochrane, 2017).[25]

More recently, the Fiscal Theory of the Price Level (FTPL) has re-asserted itself as a sufficient theory to explain the price level as being determined by government debt and fiscal policy alone, with monetary policy playing at best an indirect role. Originally developed in the early 1990s, the FTPL has made a comeback in recent years; yet, upon rigorous analysis, it has been shown to be internally inconsistent in supporting its conclusion that the general price level takes on the value required to ensure that the real contractual value of the outstanding stock of nominal (non-monetary) public debt is always equal to the present discounted value of the current and future real primary surpluses and monetary financings of the State.[26]

What these theories leave out of the picture is how policy effectiveness may change and affect inflation in response to investors' diverse attitude toward different countries in a world of highly open and financially integrated economies where global financial markets play a dominant role in driving resource allocation across national boundaries, based on the perceived policy credibility of each country. Where credibility is low, the space available for using active demand management policies is limited and the most likely result of such policies is currency depreciation and inflation, with limited or no gains on the real variables of interest (output and resource employment).

There is, therefore, a need for a theory that can explain the ineffectiveness of macroeconomic policies, and their inflationary consequences, taking into account the global financial context that has become dominant nowadays. Two critical features make the PTI developed in this study especially fit as a theory of inflation in today's global context. One is that, according to the PTI, there is nothing mechanical about the transmission channel running from government liabilities to inflation dynamics. The transmission rests fundamentally on the

---

[25] See also the discussions by J. Hendrickson in *In Defense of Neo-Fisherism* The Everyday Economist, October 17, 2014 https://everydayecon.wordpress.com/2014/10/17/in-defense-of-neo-fisherism/, and in *New Keynesian Failure*, The Everyday Economist, August 20, 2015 https://everydayecon.wordpress.com/2015/08/20/the-new-keynesian-failure/.

[26] See Buiter (2017) and Buiter and Sibert (2018) for a comprehensive review of the relevant literature, and for the analysis of the anomalies and inconsistencies of the FTPL.

role of financial market expectations, perceptions, and conventional beliefs – as revealed by global investors through their portfolio choices – regarding the policy credibility of a country and the future sustainability of its liabilities. To illustrate the point through an example, a country that would expand its public liabilities to finance new output and employment, all else being equal, could be successful in its attempt (thus ending up with higher output at low inflation) or unsuccessful (thus ending up with higher inflation and limited or no change in real variables), depending on how the credibility of the country's authorities and policy institutions as perceived by the market. Whereas the country's liabilities would be deemed to be intertemporally sustainable in the former case, they would be regarded as not sustainable in the latter, thus leading investors to very different portfolio allocation choices in each case. According to the PTI, in either event the market is central in determining the elasticity of the country's IBC, and while investors may be assumed to act rationally (grounding their portfolio choices on the best knowledge available), the explanatory power of the theory does not require them to be necessarily right in their judgments – the theory simply predicts that whatever investors decide does ultimately determine the outcome of the country' policies.

The other feature is that, according to the PTI, the effect of public liabilities on inflation is not direct but it is mediated by the exchange rate. Investor portfolio choices impact, first, the exchange rate of the domestic currency as a relative price of the assets that are traded internationally and influence domestic inflation once the changes in the exchange rate are transmitted to domestic prices via the passed-through and relative price adjustment mechanisms. In the PTI, therefore, the financial and trade sectors, both domestic and external, interact strongly with each other, reflecting the degree of integration of the economies into the global (real and financial) markets. The different speeds at which such markets process the information are critical for the transmission of the price signals to proceed from the financial assets to the goods and services exchanged in the economy, and back into the real value of the assets supplied to the markets and those held by the investors.

An important implication of the two critical features just discussed is that the PTI may explain how identical policies may attain different outcomes in different countries. For instance, active demand management policies in poorly credible countries may fail to stimulate output and might instead cause inflation to rise (even in the presence of large output gaps) and capital to flee the economy due to an inelastic IBC and unanchored inflation expectations; on the other hand, in highly reputed countries with more elastic IBC (as determined by global market preferences) and strongly anchored expectations, the same policies may achieve the desired results in terms of output and real resource use, with limited or no dissipative effect on the exchange rate and inflation.

6 Conclusion

The analysis of open macroeconomies typically assumes (implicitly or explicitly) that resource allocation decisions are taken by domestic agents. The Portfolio Theory of Inflation (PTI) developed in this study has assumed that some critical allocation decisions are taken by global investors and investigates how such decisions affect the effectiveness of macroeconomic policy

in open and highly financial integrated economies. Based on this assumption, the PTI has investigated the central role of global financial markets in determining the effectiveness of macroeconomic policy in open and highly financially integrated economies. Using a modified version of the portfolio balance approach to exchange rate determination, the PTI builds on the role of global financial investors as agents acting as intertemporal and international resource allocators and operating in a highly integrated world market space where they can move capital across countries quickly and at negligible cost.

According to the PTI, domestic inflation varies directly with the country's credibility gap and with changes in the relative dynamics of domestic versus foreign money and public debt stocks, the interest rate differential, and foreign inflation. Also, the PTI predicts that monetary and fiscal policies can be effective if the country undertaking them enjoys strong credibility (in the eyes of the markets), while they are less effective or ineffective, and eventually dissipate into currency depreciation and higher inflation, if the country undertaking them is deemed poorly credible. The PTI, therefore, can explain how identical policies may have different economic outcomes in different countries.

The PTI also suggests that coordination between monetary and fiscal policies is necessary but not sufficient for a country to gain credibility in the eyes of the market.

More broadly, as a theory of policy (in)effectiveness, the PTI points to a general strategic and yet practical conclusion. A country that intends to maintain or recover space for the active use of the macroeconomic policy levers may pursue one of two alternative options – one desirable, the other one not quite so. The undesirable option would be for the country to isolate itself from the international financial markets and adopt a degree of domestic financial repression that would force its residents to hold all the liabilities (money and debt) that it issues. The superior option would be for the country to integrate itself in the global financial system but, also, to carefully prevent its stock of liabilities from growing inordinately large (in other words, it should keep the public debt low), thus avoiding having to surrender its policy sovereignty to the financial markets.

Finally, better than prevailing theories of inflation, the PTI can reflect the dominant role of global finance in defining the space available for national authorities of open and financially integrated economies to undertake active, effective and non-inflationary demand management policies.

Acknowledgement I would like to thank the two anonymous referees of this study, who provided me with very valuable comments and suggestions on earlier versions of it. I also would like to thank Larry Summers for his thought-provoking comments on issues relating to the topic of the study, Charles Wyplosz for his helpful insights at an earlier stage of my reflection on it, and Antonio Fatas for inspiring my consideration of policy effectiveness under floating exchange rates. I am intellectually indebted to the work of Willem Buiter, more than the references to his publications by themselves reveal. Obviously, I am the only responsible for the views expressed in the study and for any remaining errors. Finally, I am grateful to my wife Ornella for her unremitting support.

Appendix 1. Solution of the Economy's Model

Using the Bellman's equation to solve plan (10)–(13) in the main text,

(A1) $V(y_{H,t}, W_{H,t}) = Max\left[u(W_{H,t}) + \beta V(y_{H,t+1}, W_{H,t+1})\gamma'_{t+1}R'_{t+1}\right]$,

where $R'$is the vector of real income growth rates, real interest rates and loss ratios for all bonds, leads to the Euler equation

(A2) $u'(W_{H,t}) = \left(\beta_{H,j,t}|_{\omega_t}\right)^n E_t\left[u'(W_{H,t+n})\gamma'_{H,t+n}R'_{t+n}\right]$,

which determines the optimal intertemporal path for wealth *W*. For a given *W* in each period, then, investor *H*'s optimal portfolio corresponds to the optimal intra-date allocation of *W* across the various assets available, and is derived by equating the marginal utilities of *M* and *B* holdings, each weighted with the price of each:

(A3) $u'\left(M_{H,D,t}\right) = u'\left(M_{H,F,t}\right) = \frac{1}{P_t^{B_D}}u'\left(B_{H,D,t}\right) = \frac{1}{e_t P_t^{B_F}}u'\left(B_{H,F,t}\right)$.

Solving the model simultaneously for all demand and supply relations, under well-behaved investor preferences and optimal fiscal and monetary policies, and with complete ERPT, instantaneous relative price adjustment to the exchange rate, and a given price level of country *F*, optimal portfolio allocations $\left(M^*_{H,D}, M^*_{H,F}B^*_{H,D}, B^*_{H,F}\right)$ attain at equilibrium asset prices $P_t^{B_D*}, P_t^{B_{F*}} = 1$ (since bonds trade at their contractual value), interest rates $i_{t+n}^{B_j*} = i_N^{B_j}$ (equal to their neutral level), and exchange rate e_t^*, where the real output gap is balanced and the domestic and world price levels (expressed in units of the domestic currency) are each equal to $e_t^* P_{F,t}^*$. In fact, the closure of the output gap depends ultimately on the optimality and effectiveness of both fiscal and monetary policies, and optimality calls into question the issue of coordination between fiscal and monetary policies. While policy effectiveness will be discussed in the next subsection, optimality will not be further elaborated in this study.

Assuming $u(W) = \ln(W)$, using Euler equation (A2), replacing $M_{H,D}, M_{H,F}, B_{H,D}$, and $B_{H,F}$ with their respective real values all expressed in the domestic currency,[27] simplifying and replacing the solution of Eq. (A2) into Eq. (A3), yield equilibrium relationship

(A4) $\frac{\left(\beta_{H,D,t}|_{\omega_t}\right)^n(1-p^*_{t+n})^n}{M^*_{H,D,t+n,}} = \frac{\left(\beta_{H,F,t}|_{\omega_t}\right)^n(1-p^*_{t+n})^n}{e_t^* M^*_{H,F,t+n}} = \frac{\left(\beta_{H,D,t}|_{\omega_t}\right)^n\left(1+i_{t+n}^{B_D*}\right)^n(1-p^*_{t+n})^n}{B^*_{H,D,t+n}} =$

$\frac{\left(\beta_{H,F,t}|_{\omega_t}\right)^n\left(1+i_{t+n}^{F*}\right)^n(1-p^*_{t+n})^n}{e_t^* B^*_{H,F,t+n}}$,

[27] These are given by what these assets can actually buy to their holders at world market prices, that is, $\frac{\beta eM}{P}$and $\frac{\beta eBP^B}{P}$, where $e = 1$ for M_D and B_D. For the analysis and formal derivation of the utility of money and other assets, see Bossone (2014).

where *p* is the world rate of inflation used by the global investors to gauge the real value of their wealth. Re-expressing Eq. (A4) in terms of the equilibrium nominal exchange rate at time t and dropping the subscript *H* give

$$\text{(A5)} \qquad e_t^* = \frac{\beta_{F,t|\omega_t}}{\beta_{D,t|\omega_t}} \frac{\left[\frac{1}{M^*_{F,t+1}} + \frac{1}{B^*_{F,t+,1}} E_t\left(1+i_{t+1}^{B_{F*}}\right)\right]}{\left[\frac{1}{M^*_{D,t+1}} + \frac{1}{B^*_{D,t+1}} E_t\left(1+i_{t+1}^{B_{D*}}\right)\right]}.$$

Note from Eq. (A4) that a low β_D relative to β_F causes investors to hold relatively less optimal amounts of domestic money and bonds, and note from Eq. (A5) that a larger "credibility gap" of economy *D* versus *F* (proxied by $\frac{\beta_F}{\beta_D} > 1$) determines, ceteris paribus, a higher equilibrium nominal exchange rate *e* of currency *D* versus *F*.

Finally, transforming Eq.'s (4) in the main text and (A5) using natural logarithms, substituting Eq. (A5) into Eq. (4) in the main text, applying Taylor's expansion to derive the equality $\ln(1+i) \approx i$,[28] and solving for the rate of domestic inflation, yield:

$$\text{(A6)} \qquad \tilde{p}_{D,t} \approx \phi(\cdot) + L^{-1}\{\left[\left(\beta_{F,t+1} - \beta_{D,t+1}\right) + \left(\tilde{m}_{D,t+1} - \tilde{m}_{F,t+1}\right) + \left(\tilde{b}_{D,t+1} - \tilde{b}_{F,t+1}\right) + \left(\tilde{\imath}_{t+1}^{B_F} - \tilde{\imath}_{t+1}^{B_D}\right)\right) + \tilde{p}_{F,t}\right] + \pi_{D,t}(\cdot)\},$$

which is reported as Eq. (14) in the main text.

---

28 From Taylor's expansion, $\ln(1+i) = i - \frac{i^2}{2} + \frac{i^3}{3} - \frac{i^4}{4} + \frac{i^5}{5} - \cdots = \sum_{n=1}^{\infty}(-1)^{n+1}\frac{i}{n}$, $\forall\, i \in (-1, 1]$, and $\lim_{n\to\infty}(R_n) = -\frac{i^2}{2} + \frac{i^3}{3} - \frac{i^4}{4} + \frac{i^5}{5} - \cdots = \frac{(-1)^n}{(1+\xi)^{n+1}}\frac{(i)^{n+1}}{(n+1)!} = 0$, $\forall\, \xi \in (0, i)$, and $\forall i \in (-1, 1]$. Thus, $\ln(1+i) \approx i$.

References

Agénor, P. R. (1994). Credibility and exchange rate management in developing countries. *Journal of Development Economics* 45(1): 1–16. https://doi.org/10.1016/0304-3878(94)90056-6

Aleem, A., and A. Lahiani (2014). Monetary policy credibility and exchange rate pass-through: Some evidence from emerging countries. *Economic Modelling* 43(C): 21–29. https://doi.org/10.1016/j.econmod.2014.06.020

Backus, D, and E. J. Driffill (1985a). Inflation and reputation. *American Economic Review* 75(June): 530–538. https://www.jstor.org/stable/1814819

Backus, D, and E. J. Driffill (1985b). Expectation and policy credibility following a change in regime. *Review of Economic Studies* 52(2): 211–221. https://www.jstor.org/stable/2297617

Bartholdy, J., and B. Kate (2004). Testing for multiple types of marginal investor in ex-day pricing. *Multinational Finance Journal* 8(3/4): 173–209. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2625108

Benigno, P., and E. Faia (2016). Globalization, pass-through, and inflation dynamics. *International Journal of Central Banking*, *International Journal of Central Banking* 12(4): 263–306, December. https://www.ijcb.org/journal/ijcb16q4a7.pdf

Blanchard, O. (2016). The US Phillips curve: Back to the 60s? Policy Brief No. PB16-1, Peterson Institute for International Economics, January. https://piie.com/publications/policy-briefs/us-phillips-curve-back-60s

Bossone, B. (2014). Secular stagnation. Economics Discussion Papers, No 2014-47, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2014-47

Bossone, B. (2018). The exchange rate as a 'veil'. *World Economics* 19(2, April–June9: 105–119. https://www.worldeconomics.com/Journal/Papers/Exchange%20Rates%20as%20a%20%E2%80%98Veil%E2%80%99%20.details?ID=708

Bossone, B. (2019a). Floating or Fixed? Credibility makes the difference. *Economia e Politica*, March 19. https://www.economiaepolitica.it/2019-anno-11-n-17-sem-1/exchange-rates-floating-or-fixed-credibility-makes-the-difference/

Bossone, B. (2019b). Which exchange rate regime? Credibility and exchange rate neutrality. Economonitor, 26 March. https://moneymaven.io/economonitor/financial-markets/which-exchange-rate-regime-credibility-and-exchange-rate-neutrality-CEdqwRcXV0eh24mjpOxZpw/

Branson, W. H. (1985). The dynamic interaction of exchange rates and trade flows. NBER Working Paper Series, Working Paper No. 1780, National Bureau of Economic Research, Cambridge, Mass., December. https://www.nber.org/papers/w1780

Buiter, W. H. (2016). The simple analytics of helicopter money: Why it works — always. *Economics: The Open-Access, Open-Assessment E-Journal*, 8 (2014-28): 1–45 (Version 3). http://dx.doi.org/10.5018/economics-ejournal.ja.2014-28

Buiter, W. H. (2017). The fallacy of the fiscal theory of the price level – once more. Columbia/SIPA, Center for Development Economics and Policy, CDEP-CGEG Working Paper Series, No. 37, March. https://cdep.sipa.columbia.edu/sites/default/files/cdep/WP37Buiter.pdf

Buiter, W. H., and A. C. Sibert (2018). The fallacy of the fiscal theory of the price level – one last time. *Economics: The Open-Access, Open-Assessment E-Journal*, 12 (2018-48): 1–56. http://dx.doi.org/10.5018/economics-ejournal.ja.2018-48

Calderón, C., R. Duncan, and K. Schmidt-Hebbel (2004). The role of credibility in the cyclical properties of macroeconomic policies in emerging economies. *Review of World Economics* 140(4): 613–633. https://link.springer.com/article/10.1007/BF02659617

Calvo, G., and C. M., Reinhart (2002). Fear of floating. *The Quarterly Journal of Economics* 117, No. 2 (May), 379–408. https://www.jstor.org/stable/2696430

Calvo, C., and C. Végh (1991). Exchange-rate-based stabilization under imperfect credibility. IMF Working Papers, WP 1991/77, International Monetary Fund, August. https://www.imf.org/en/Publications/WP/Issues/2016/12/30/Exchange-Rate-Based-Stabilization-under-Imperfect-Credibility-956

Carrière-Swallow, Y., B. Gruss, N. E. Magud, and F. Valencia (2016). Monetary policy credibility and exchange rate pass-through. IMF Working Paper WP/16/240, International Monetary Fund. https://www.imf.org/external/pubs/ft/wp/2016/wp16240.pdf

Chen, Z. and Z., Lei (2015). Back to the beginning: Does investor diversification affect the firm's cost of equity? 9 October, available at SSRN: https://ssrn.com/abstract=2538386 or http://dx.doi.org/10.2139/ssrn.2538386

Cochrane, J. H. (2017). Michelson-Morley, Fisher, and Occam: The radical implications of stable quiet inflation at the zero bound. *NBER Macroeconomics Annual* 32(1). https://www.journals.uchicago.edu/doi/abs/10.1086/696050?journalCode=ma

Edwards, S. (2006). The relationship between exchange rates and inflation targeting revisited. NBER Working Paper Series, Working Paper 12163, National Bureau of Economic Research. https://www.nber.org/papers/w12163

Ferreira de Mendonça. H., and F. Tostes (2015). The Effect of Monetary and Fiscal Credibility on Exchange Rate Pass-Through in an Emerging Economy. *Open Economies Review* 26(4), 787–816. https://link.springer.com/article/10.1007/s11079-014-9339-3

Ferreira de Mendonça, H., and B. Pires Tiberto (2017). Effect of credibility and exchange rate pass-through on inflation: An assessment for developing countries. *International Review of Economics and Finance* 50(July): 196–244. https://doi.org/10.1016/j.iref.2017.03.027

Helmy, O., M. Fayed, and K. Hussien (2018). Exchange rate pass-through to inflation in Egypt: A structural VAR approach. *Review of Economics and Political Science* 3(2): 2–19. https://www.emeraldinsight.com/doi/full/10.1108/REPS-07-2018-001

Jašová, M., R. Moessner, and E. Takáts (2016). Exchange rate passthrough: What has changed since the crisis? BIS Working Papers No 583, Bank for International Settlements, September. https://www.bis.org/publ/work583.htm

Kabundi, A. and M., Mlachila (2018). Monetary policy credibility and exchange rate pass-through in South Africa. South African Reserve Bank, WP/18/04, August. https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/8690/WP1804.pdf

Kreps, D., and R. Wilson (1982). Reputation and imperfect information. *Journal of Economic Theory* 27(2): 253–279. https://doi.org/10.1016/0022-0531(82)90030-8

Lopez-Villavicencio, A., and V. Mignon (2016). Exchange rate pass-through in emerging countries: Do the inflation environment, monetary policy regime and institutional quality matter? CEPII Working Paper No 2016-07, April. http://www.cepii.fr/PDF_PUB/wp/2016/wp2016-07.pdf

Obstfeld, M., and K. Rogoff (1995). Exchange rate dynamics redux. *Journal of Political Economy* 103(June): 624–660. https://www.jstor.org/stable/2138701

Obstfeld, M., and K. Rogoff (1996). *Foundations of international macroeconomics*. Cambridge, Mass.: MIT Press.

Palley, T. I. (2019). The fallacy of the natural rate of interest and zero lower bound economics: Why negative interest rates may not remedy Keynesian unemployment. *Review of Keynesian Economics* (April): 151–170. https://doi.org/10.4337/roke.2019.02.03

Savoie-Chabot, L., and M. Khan (2015). Exchange rate pass-through to consumer prices: Theory and recent evidence. Bank of Canada Discussion Paper 2015-9, October. https://www.bankofcanada.ca/wp-content/uploads/2015/10/dp2015-91.pdf

Sveriges Riksbank (2016). The impact of the exchange rate on inflation. Monetary Policy Report, December.

Suleiman S., A. Alexander, and M. Olure-Bank (2018). An econometric analysis of the nexus of exchange rate, inflation and budget deficit: Case of Nigeria 1981–2016. *Journal of World Economic Research* 7(1): 1–13. https://doi.org/10.11648/j.jwer.20180701.11

Takhtamanova, Y. (2008). Understanding changes in exchange rate pass-through. Journal of Macroeconomics 32(4): 1118–1130. https://doi.org/10.1016/j.jmacro.2010.04.004

Trautwein, H. M. (2017). Some international aspects of business cycles: Neisser, Haberler and modern open economy macroeconomics. *Journal of the History of Economic Thought* 39(special issue 1, March): 47–67. https://doi.org/10.1017/S1053837216001036

Wang, P. (2009). The portfolio balance approach to exchange rate determination. in: *The Economics of Foreign Exchange and Global Finance*. Springer, Berlin, Heidelberg.

Winkelried, D. (2014). Exchange rate pass-through and inflation targeting in Peru. *Empirical Economics* 46(4): 1181–1196. https://link.springer.com/article/10.1007/s00181-013-0715-4

Zelealem, Y., and J. Musila, (2018). The dynamics of inflation, exchange rates and the trade balance in a small economy: The case of Uganda. *International Journal of Development Issues* 17(2): 246–264. https://doi.org/10.1108/IJDI-12-2017-0209