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Michael B. Devereux
Rui Lu
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Juanyi (Jenny) Xu

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**ABSTRACT**

This paper proposes a concept of a global currency and introduces a "global currency pricing" (GCP) specification into a standard N-country open economy macroeconomic model. A global currency is defined as a virtual unit of account that is exclusively used for international trade invoicing and is formed as a basket of individual currencies, similar to the existing SDR. We describe the pattern of exchange rate pass-through and real allocations under a global currency and derive optimal monetary policies under each specification. We show there is a unique welfare optimal composition of a global currency that weights currencies according to their importance in international trade. A striking implication is that under this global currency design, the monetary policy of each country should be concerned solely with domestic shocks. No country should have more than a 50 percent weight in an optimal global currency. The optimal configuration of the global currency applies whether or not there is international policy cooperation. Applying the model to a sample of 20 world countries and currencies, we find that all countries can gain in welfare from a shift out of dollar currency pricing (DCP) to GCP.

Michael B. Devereux
University of British Columbia
Department of Economics
and NBER
mbdevereux@gmail.com

Rui Lu
The Chinese University of
Hong Kong (CUHK)
rui.lu@link.cuhk.edu.hk

Kang Shi
The Chinese University of
Hong Kong (CUHK)
Department of Economics
kangshi@cuhk.edu.hk

Juanyi (Jenny) Xu
Hong Kong University of Science
and Technology (HKUST)
jennyxu@ust.hk

# 1 Introduction

The world has at least 180 independent currencies, but it is well understood that the global financial and trading system relies on a small number of currencies for facilitating international transactions in goods and assets. By far the most important currency is the US dollar. Specifically the dollar is the invoicing currency for well over 50% of global trade, with the euro coming in second place, and with a substantially smaller share. The dominance of the US dollar in trade pricing has significant implications for exchange rate pass-through, international macro transmission, and the stance of monetary policy. But US dollar dominance is not guaranteed to last indefinitely. A constant theme of recent academic and policy related writing has been the possible decline in the influence of the US dollar, and the search for alternative currencies or payment mechanisms that would replace the dollar. [1]

Our paper contributes to this literature by analyzing a composite currency that would be used as a benchmark for international trade pricing. We refer to this as Global Currency Pricing (GCP), and we define a global currency as one in which all country's invoice their exports in this currency denomination. In our definition, the global currency is a weighted basket of individual country currencies, in the same way that the IMF's Special Drawing Rights (SDR) represents a basket of a small number of major currencies. Unlike the SDR however, we don't think of the Global Currency as a separate issued currency, but rather as a unit of account that is used to denominate all international transactions.[2]

We incorporate the global currency into an open economy New Keynesian model as in (Galí, 2018) where countries are subject to idiosyncratic productivity shocks. The basic structure of our model is very standard. There is a large number ($N$) of countries of varying size. In each country there is a tradable composite good and a non-tradable good. The results are initially developed with a static version of the model, but we use a one-period version of Calvo pricing, where a fraction of firms have to set prices in advance and the complementary fraction can adjust their price ex-post after the realization of productivity shocks (Mukhin, 2022). Consumers in each country have preferences defined over all traded goods and supply labor. The static model is deliberately kept minimal so that we can conduct the analysis analytically and all our results can be obtained as simple closed form expressions. GCP pricing differs from traditional invoicing methods like PCP, LCP, and DCP in terms of exchange rate pass-through, equilibrium allocations, and welfare. In addition, critically, GCP pricing influences the design of monetary policy at the country level when each individual country's exchange rate floats against the global currency.

The main focus of the paper is then to ask, if all countries were to adopt a global currency for trade pricing, how should this currency be constructed? Given that the global currency represents a basket of individual country currencies, what should be the share of each currency in the basket? What would this

[1] See, e.g. Jiang et al. (2025)

[2] The potential of a composite currency use in international trade has been suggested by Brunnermeier et al. (2021) and Carney (2019) among others. A more recent suggestion has been to construct a stablecoin as a basket of currencies. This is explored in Giudici et al. (2022).

imply for optimal monetary policies of each country within the global currency basket? A principal result of our paper is to establish that there is a unique composition of a global currency which maximizes world welfare. The optimal country share can be summarized in a simple formula. The optimal share of a given country $i$ in the global currency basket of $N$ countries is

$$\alpha_i^* = \frac{n_i(1-n_i)}{\sum_{j=1}^{N} n_j(1-n_j)}$$

where $n_i$ is the share of country $i$ in world output, and $\sum_i^N n_i = 1$. This formula reflects the importance of each country in international trade, rather than country size alone. In fact, we find that the optimal composition of a global currency should underweight relatively large countries and overweight relatively small countries. Moreover, no country should hold more than a 50 percent share in the optimal GCP basket.

A remarkable feature of the global currency is that if it is designed in this way, each country can set its monetary policy to focus on domestic shocks alone, and ignore its own role in the international system. If each country ensures an efficient response to domestic disturbances, the composition of the global currency itself ensures an efficient global response. Effectively, the optimal global currency basket adds another degree of freedom to the international currency mix, and achieves the maximum global welfare, conditional on one currency being used as a unit of account for all international trade. Strikingly, given an optimal currency composition as described by this basket, each country would follow a monetary policy identical to the policy that is optimal under traditional producer currency pricing (PCP). In other words, in the terms coined by Obstfeld and Rogoff (2002), each country would pursue a purely 'self-oriented' monetary policy.

Our analysis of optimal monetary policy under global currency pricing encompasses both cooperative and non-cooperative policy environments. The above optimal GC formula applies exactly to the case of cooperative policy making. But we show that under almost all empirically relevant calibrations, the results carry over very closely under non-cooperative policy.

The model allows a straightforward welfare comparison across all alternative pricing paradigms, when policy is chosen optimally conditional on the currency of pricing. In the baseline model, PCP welfare dominates all other pricing practices. This follows trivially due to the well-known 'divine coincidence'. With each country setting goods prices in its own currency, optimal monetary policy can eliminate 'currency misalignment'. But GCP represents the welfare maximizing outcome in the case where one currency (or currency basket) is chosen as the pricing currency for all traded goods. An optimally defined GCP welfare-dominates the present system of Dominant (Dollar) Currency Pricing for all countries.

Furthermore, in an extension of the basic model, allowing for monetary or financial shocks, we find that GCP may dominate all other pricing policies in welfare terms, even that of PCP. We assume that these shocks cannot be directly offset by a monetary policy rule. In this case, the divine coincidence breaks down, and while PCP allows each monetary authority to respond optimally to country specific productivity shocks, the inability to offset velocity shocks means that the shock must be fully absorbed within each country. But with GCP, these shocks are diversified away by the composition of the global currency basket. As a result, there is a trade-off in welfare terms between the efficient elimination of real shocks (which cause currency misalignment) under PCP and the stabilizing of monetary shocks offered by the global currency.

We then present a dynamic extension of the model calibrated to twenty of the worlds largest countries, allowing for both productivity and monetary/financial shocks. Using this extended model, we can compare welfare under DCP to one where a currency basket follows the IMF's SDR composition but also one which follows the theoretically optimal GC composition. The welfare consequences depend on whether monetary policy is determined cooperatively or non-cooperatively. Under cooperative policy making we find that the non-US SDR countries may lose from a switch from DCP to an SDR basket, as they must divert their monetary policy away from domestic objectives. But when we compare DCP to the optimal GCP composition based on our model, we find that all countries gain, whatever is the monetary policy framework. A key result from this empirical application is that the optimal composition of GCP even in the presence of multiple shocks is very close to that presented in the above formula.

A natural question to ask is if GCP has such advantages, why do we not see such a currency basket in practice? While the institutional design of asset market structure is beyond the scope of our paper, we note that the use of a currency basket for trade invoicing is subject to the same network externalities that supports the US dollar as the principal currency in world trade. But in an Appendix we establish the conditions under which, given that a global currency is launched, firms would endogenously switch from setting prices in dollars (DCP) towards the use of the global currency (GCP). In a similar way to other literature in this area, we show that this possibility depends on the presence of strategic complementarity in firm pricing behaviour as well as multiple types of shocks.

## 1.1 Related Literature

Our paper is part of the large literature on the currency of export pricing. In this literature, three fundamental price specifications often discussed are PCP, LCP and DCP. Devereux and Engel (2003) underscore the importance of distinguishing between PCP and LCP in shaping optimal monetary policies in open economies. However, in their model, firms' pricing decisions were considered exogenous, so Devereux et al. (2004) and Bacchetta and van Wincoop (2005) incorporate the micro-level decision of firms determining invoice prices into a general equilibrium model. Subsequently, numerous studies demonstrate the impact of invoicing patterns on exchange rate pass-through (De Gregorio et al., 2024; Gopinath et al., 2010) and monetary policy transmission (Cook and Patel, 2023; Goldberg and Tille, 2009; Zhang, 2022). In addition, there are extensive studies exploring the determinants of firms' invoicing currency choices, such as exchange rate fluctuations and exchange rate regime (Goldberg and Tille, 2016), market share (Devereux et al., 2015), hedging costs (Berthou et al., 2022; Lyonnet et al., 2022; Novy, 2006), imported input reliance (Chung, 2016), input-output linkages and complementarity (Amiti et al., 2022; Gopinath and Stein, 2021). Our model closely aligns with Mukhin (2022), which uses a general equilibrium model with price stickiness to show that the dollar's dominance as an invoicing currency arises from the U.S.'s large economy advantage and the dollar's stability as an anchor currency.

More generally, there is an extensive literature on the role of the US dollar in both trade, investment, and financing. In international trade, dollar invoicing, or DCP, also referred to as the dominant currency paradigm, is extensively discussed in Gopinath and Itskhoki (2022). In the realms of financing and investment, dollar assets also have become the leading assets (Maggiori et al., 2020) due to their unique convenience yield (Jiang et al., 2021; 2024). Firms opt to issue dollar-denominated debt because it offers low interest rates (Salomao and Varela, 2022), robust liquidity (Coppola et al., 2023), stable pricing (Bocola and Lorenzoni, 2020; Drenik et al., 2022), and complements the dollar demand of other agents (Chahrour and Valchev, 2022). Investors prefer dollar assets for their strong liquidity (Engel and Wu, 2023), high safety (He et al., 2019), and countercyclical insurance properties (Hassan, 2013; Hassan and Zhang, 2021; Maggiori, 2017). The dominant role of the dollar in international trade and finance is often referred to as an 'exorbitant privilege,' which has profound implications for the global economy (Gourinchas and Rey, 2022). The U.S. may uses its market power to issue government bonds (Choi et al., 2023), often seen as safe assets and bought extensively by investors at low interest rates (Blanchard, 2019; Caramp and Singh, 2023), enabling the U.S. to sustain what some describe as Ponzi-like financial practices (Brunnermeier et al., 2024). In addition, the dollar is at the centre of the global financial cycle (Miranda-Agrippino and Rey, 2020; Obstfeld and Zhou, 2022), with U.S. interest rate hikes negatively affecting other economic systems.

Our paper is directed at a more narrow issue than the above literature. Still, to the extent that a GC offers a possible alternative to dollar invoicing, it is related to recent discussions about reducing dependency on the dollar. Recent studies have focused on the internationalization of other currencies, such as the RMB, exploring measures like establishing central bank swap lines (Bahaj and Reis, 2020), gradually liberalizing financial accounts (Clayton et al., 2024), supporting cross-border financial rescues (Horn et al., 2023), and initiating multi-country central bank digital currencies (BISpaper, 2022). Our paper explores an approach to undermine the dominance of a single currency by proposing a basket of currencies as the invoicing standard in the international trade.

Another relevant paper is Giudici et al. (2022). They investigate the advantages of a stablecoin pegged to a basket of currencies. They construct optimal empirical weights which minimize the variability of the basket based stablecoin. They show that basket-based stablecoins are less volatile than single-currency stablecoins, offering better value preservation during crises. Our paper differs in that we take a fully theoretical perspective within a general equilibrium model. In addition, as noted above, we do not propose a new currency as such, but rather the GCP as a unit of account for trade invoicing.

The structure of the paper is as follows: Section 2 introduces the benchmark model, which incorporates exogenous global currency pricing. Section 2.2 describes the model equilibrium for given monetary policy. Section 3 investigates the nature of optimal monetary policy with 3.1 focusing on cooperative policy and the optimal design of an international currency, while 3.2 focuses on non-cooperative policy. Section 4 extends the analysis to both productivity shocks and monetary/financial shocks. Section 5 extends the model to a dynamic setting and provides a quantitative calibration. Section 6 provides some conclusions.

# 2 A Simple Model

Our model follows the basic New Keynesian Open Economy (NKOE) framework, where price stickiness enables the effectiveness of monetary policy. In order to obtain a clear closed-form solution for welfare analysis, we make many simplified assumptions in the baseline model, including log utility functions, linear labor disutility, a Cobb-Douglas aggregator, complete financial markets, no intermediate goods, and one-period Calvo price setting.

## 2.1 Environment

There are $N$ countries with asymmetric sizes, where in country $i$ there exists a continuum of $n_i$ households and a continuum of $n_i$ monopolistically competitive firms producing different varieties. Normalize so that $\sum_{i=1}^{N} n_i = 1$, where country 1 represents the US. This framework allows us to replicate various models in the NKOE literature. For $N \to \infty$ and $n_i \to 0$, the model aligns with frameworks such as Gali and Monacelli (2005, 2008), assuming all countries are small open economies; for $N = 2$ and $n_1 + n_2 = 1$, it mirrors economies akin to Clarida et al. (2002), featuring only two major economies; and for $n_1 \to 0$ and $n_2 \to 1$, country 1 stands as a standalone small open economy like De Paoli (2009). Each country has its own fiat currency, and the exchange rate between currency $i$ and currency $j$ is denoted by $\mathcal{E}_{ijt}$, where an increase indicates a depreciation of currency $i$.

The asymmetry between countries arises not only from differences in size but also from an uneven international pricing system. We introduce a unit of account we call Global Currency, which is comprises a basket of currencies from different countries. Let $\mathcal{E}_{igt}$ denote the price of the global currency in terms of currency $i$. The composition of the global currency is represented as $(\mathcal{E}_{1gt})^{\alpha_1}(\mathcal{E}_{2gt})^{\alpha_2}\cdots(\mathcal{E}_{Ngt})^{\alpha_N} = 1$ with $\sum_{i=1}^{N} \alpha_N = 1$. Dominant currency pricing (DCP), as defined by Gopinath and Itskhoki (2022) represents a special case where the global currency is exclusively composed of the dollar, namely $\alpha_1 = 1$. It's easy to show that the exchange rate between currency $i$ and global currency $g$ is determined by:

$$\mathcal{E}_{igt} = (\mathcal{E}_{i1t})^{\alpha_1}(\mathcal{E}_{i2t})^{\alpha_2}\cdots(\mathcal{E}_{iNt})^{\alpha_N}.$$

Thus, $\alpha_i$ represents the share of currency $i$ within the global currency basket. For instance, when $\alpha_i = 1$, we have $\mathcal{E}_{igt} = 1$, indicating that the global currency is entirely constituted by currency $i$.

### 2.1.1 Households

**Preferences.** In country $i$, the representative household obtain funds by providing labor $L_{it}$, investing in state contingent bonds, and receiving profits from firms, which they use for consumption bundle $C_{it}$ and payment of lump-sum taxes $T_{it}$. The household's utility function is

$$\mathbb{E}\sum_{t=0}^{\infty}\beta^t\left(\ln C_{it}-L_{it}\right).$$

The household's optimal labor supply satisfies $W_{it}=P_{it}C_{it}$. The stochastic discount factor between period $t-1$ and $t$ is given by $Q_{it}=\beta(P_{it-1}C_{it-1})/(P_{it}C_{it})$.

**Consumption bundles.** Representative households in country $i$ simultaneously consume both domestic and foreign goods, with a home bias $v$ capturing the preference for domestically produced goods, which can also be interpreted as a preference for non-tradable goods. Country $i$'s consumption bundle $C_{it}$ consists of the non-tradable goods bundle $C_{Nit}$ and the tradable goods bundle $C_{Tit}$ through the Cobb-Douglas aggregator. Therefore, the consumption aggregator and the consumption price index (CPI) for region $i$ are given as:

$$C_{it}=\frac{C_{Nit}^{v}C_{Tit}^{1-v}}{v^v(1-v)^{1-v}},\qquad P_{it}=P_{Nit}^{v}P_{Tit}^{1-v},$$

where non-tradable goods bundle $C_{Nit}$ and price index $P_{Nit}$ are defined by

$$C_{Nit}=\left(n_i^{-\frac{1}{\varepsilon}}\int_0^{n_i}C_{Nit}(\omega)^{\frac{\varepsilon-1}{\varepsilon}}d\omega\right)^{\frac{\varepsilon}{\varepsilon-1}},\quad P_{Nit}=\left(\frac{1}{n_i}\int_0^{n_i}P_{Nit}(\omega)^{1-\varepsilon}d\omega\right)^{\frac{1}{1-\varepsilon}}.$$

The tradable goods consumption bundle $C_{Tit}$ is composed of the consumption baskets from country $i\in\{1,...,N\}$ by the Cobb-Douglas aggregator:

$$C_{Tit}=\Pi_{j=1}^{N}\left(\frac{C_{jit}}{n_j}\right)^{n_j},\quad P_{Ti}=\Pi_{j=1}^{N}(P_{jit})^{n_j},$$

where $P_{jit}$ is the price of tradable goods from country $j$ to country $i$ denominated in currency $i$. Notice that the tradable goods bundle $C_{jit}$ and price index $P_{jit}$ are adjusted by $n_j$, since there is only a continuum of $n_j$ monopolistically competitive firms in country $j$. Larger countries produce more goods and thus hold a larger share in tradable goods.

The tradable goods bundle $C_{jit}$ and price index $P_{jit}$ are defined by

$$C_{jit}=\left(n_j^{-\frac{1}{\varepsilon}}\int_0^{n_j}C_{jit}(\omega)^{\frac{\varepsilon-1}{\varepsilon}}d\omega\right)^{\frac{\varepsilon}{\varepsilon-1}},\quad P_{jit}=\left(\frac{1}{n_j}\int_0^{n_j}P_{jit}(\omega)^{1-\varepsilon}d\omega\right)^{\frac{1}{1-\varepsilon}},$$

where $\varepsilon>1$ represents the elasticity of substitution between varieties.

**Complete Markets.** We focus on the simplest complete markets setup, where there are state-contingent bonds traded in each period, thus satisfying the risk-sharing condition:

$$\mathcal{E}_{ijt}=\eta_{ij}\frac{P_{it}C_{it}}{P_{jt}C_{jt}}.\tag{2.1}$$

Since log utility is used in our model, we have $\eta_{ij}=1$ in equilibrium. [3]

[3] The proof can be found in the appendix of Devereux and Engel (2003).

### 2.1.2 Firms

Following Mukhin (2022), our model employs a one-period version of Calvo (1983) price setting to characterize price stickiness. Specifically, in each period $t$, a fraction $\theta$ of firms can only set goods prices at the beginning of each period $t$, while the remaining fraction $1-\theta$ can adjust prices after the realization of all shocks. This assumption bridges between one-period in advance (e.g., Obstfeld and Rogoff, 1995, 1998) and standard Calvo price setting (e.g., Clarida et al., 2000). The advantage is that $\theta$ quantifies the degree of price stickiness, but because prices are sticky for only one period, the measure of preset prices is independent of its history.[4]

In the baseline model, we abstract from intermediate goods, and assume production functions are linear in labor, so that marginal cost for non-tradable and tradable firms in country $j$ is simply $MC_{jt} = W_{jt}/Z_{jt}$. The profit function of $\theta$ proportion of the sticky-price firm $\omega$ producing non-tradable goods in country $j$ is:

$$\max_{\bar{P}_{Njt}(\omega)} E_{t-1}\left\{Q_{jt}\left[\left(\bar{P}_{Njt}(\omega)-(1-\tau_{jt})MC_{jt}\right)\left(n_j Y_{Njt}(\omega)\right)\right]\right\},$$

A tradable firm $\omega$ in country $j$ sets two different prices for the domestic and foreign markets, $P_{jjt}(\omega)$ and $P^G_{j-jt}(\omega)$, denominated in currency $j$ and the global currency respectively. The optimization problem for the sticky GCP firm is therefore:

$$\max_{\bar{P}_{jjt}(\omega)} E_{t-1}\left\{Q_{jt}\left[\left(\bar{P}_{jjt}(\omega)-(1-\tau_{jt})MC_{jt}\right)\left(n_j Y_{jjt}(\omega)\right)\right]\right\},$$

$$\max_{\bar{P}^G_{j-jt}(\omega)} E_{t-1}\left\{Q_{jt}\left[\left(\mathcal{E}_{jgt}\bar{P}^G_{j-jt}(\omega)-(1-\tau_{jt})MC_{jt}\right)\left(\sum_{i\neq j} n_i Y_{jit}(\omega)\right)\right]\right\},$$

We multiply $Y_{jit}(\omega)$ by $n_i$ since there is a continuum of $n_i$ households in country $i$, meaning that larger countries have a higher demand for variety $\omega$.

To eliminate the monopolistic distortion in equilibrium, we assume that $\tau_{jt} = 1/\varepsilon$ is an exogenous subsidy provided by the government. Hence, the price set by the firm at the beginning of period $t$ is:

$$\bar{P}_{Njt} = \frac{E_{t-1}\left(Q_{jt}MC_{jt}(P_{Njt})^{\varepsilon}Y_{Njt}\right)}{E_{t-1}\left(Q_{jt}(P_{Njt})^{\varepsilon}Y_{Njt}\right)},$$

$$\bar{P}_{jjt} = \frac{E_{t-1}\left(Q_{jt}MC_{jt}(P_{jjt})^{\varepsilon}Y_{jjt}\right)}{E_{t-1}\left(Q_{jt}(P_{jjt})^{\varepsilon}Y_{jjt}\right)},$$

$$\bar{P}^G_{j-jt} = \frac{E_{t-1}\left(Q_{jt}MC_{jt}(P^G_{j-jt})^{\varepsilon}\left(\sum_{i\neq j} n_i Y_{jit}\right)\right)}{E_{t-1}\left(Q_{jt}\mathcal{E}_{jgt}(P^G_{j-jt})^{\varepsilon}\left(\sum_{i\neq j} n_i Y_{jit}\right)\right)}.$$

Additionally, there is a proportion of $1-\theta$ firms that set prices flexibly as follows:

$$\tilde{P}_{Njt} = MC_{jt}, \quad \tilde{P}_{jjt} = MC_{jt}, \quad \tilde{P}^G_{j-jt} = MC_{jt}\mathcal{E}_{gjt}.$$

In equilibrium, the price for non-tradables is given by $(P_{Njt})^{1-\varepsilon} = \theta(\bar{P}_{Njt})^{1-\varepsilon} + (1-\theta)(\tilde{P}_{Njt})^{1-\varepsilon}$, and similarly for $P_{jjt}$ and $P^G_{j-jt}$.

[4] The baseline model, which uses one-period Calvo pricing, can be simplified into a one-period static model. Since we will extend the model to standard Calvo pricing in an extension, we maintain a dynamic framework in the baseline model.

### 2.1.3 Monetary Policy

Following some money-in-utility models or cash-in-advance models, we assume the money demand in country $i$ satisfies $M_{it} = P_{it}C_{it}$. In the discussion below, the money supply $M_{it}$ will be treated as a policy instrument, with a committed central bank selecting it in response to various exogenous productivity shocks.

### 2.1.4 Equilibrium Conditions

**Definition of Equilibrium.** Given the stochastic process of the external productivity shocks $Z_{it}$ (assumed common for both tradable and non-tradable goods production) and monetary policies $M_{it}$, the competitive equilibrium satisfies (a) households optimally choose consumption, state-contingent assets, and labor supply; (b) firms maximize profits; (c) goods and labor markets clear as follows:

$$n_j L_{jt} = \frac{1}{Z_{jt}} n_j C_{Njt} \Delta_{Njt} + \frac{1}{Z_{jt}} n_j C_{jjt} \Delta_{jjt} + \frac{1}{Z_{jt}} \sum_{i \neq j} n_i C_{jit} \Delta^G_{j-jt}, \tag{2.2}$$

where $\Delta_{Njt} = \frac{1}{n_j}\int_0^{n_j} (\frac{P_{Njt}(\omega)}{P_{Njt}})^{-\varepsilon} d\omega$, $\Delta_{jjt} = \frac{1}{n_j}\int_0^{n_j} (\frac{P_{jjt}(\omega)}{P_{jjt}})^{-\varepsilon} d\omega$, and $\Delta^G_{j-jt} = \frac{1}{n_j}\int_0^{n_j} (\frac{P^G_{j-jt}(\omega)}{P^G_{j-jt}})^{-\varepsilon} d\omega$ is the price dispersion term. The market clearing condition indicates that labor in country $j$ is used for the production of domestic non-tradable goods $C_{Njt}$ and tradable goods consumed domestically $C_{jjt}$ and exported abroad $C_{jit}$. The appendix outlines the equilibrium system and first-order logarithmic linearization for PCP, LCP, DCP, and GCP.

## 2.2 Equilibrium

We use lowercase $y_{ijt}$ denote the log deviation from the steady state $\ln Y_{ijt} - \ln Y_{ij,ss}$.[5] Log productivity shocks $z_{it}$ are assumed to follow a normal distribution $N(0, \sigma^2_{iz})$, and the shocks between countries are independent. For the money supply shock $m_{it}$, if treated as exogenous, its mean is also assumed to follow normal distribution. When the committed central bank actively implements monetary policy, $m_{it}$ becomes a linear function of other shocks, ensuring that $E_{t-1}m_{it} = 0$ also. We further define the size-weighted global shock as $x_t = \sum_{i=1}^N n_i x_{it}$ for shocks $x_{it} \in \{z_{it}, m_{it}, mc_{it}\}$.

### 2.2.1 Exchange Rate Pass-Through

**Exchange Rate.** Under the assumption of complete markets, the bilateral exchange rate $e_{ijt}$ can be considered exogenous shocks due to the risk sharing condition equation (2.1.1):

$$e_{ijt} = m_{it} - m_{jt}.$$

This implies that the exchange rate between two countries depends only on their relative money supply.

We further define a virtual money supply $m_{gt} = \sum_{i=1}^N \alpha_i m_{it}$, which is a weighted average of each country's money supply based on their share in the global currency basket. It is as if there exists a virtual

[5]With the one-period Calvo pricing setting, we can also define the log deviation as $y_{ijt} = \ln Y_{ijt} - E_{t-1}\ln Y_{ijt}$, avoiding the need to assume expectations satisfying $E_{t-1}x_t = 0$.

country $g$ in the economy, whose money supply depends on the monetary policy of the countries in the global currency basket, and the exchange rate between currency $i$ and the global currency $g$ is:

$$e_{igt} = \sum_{j=1}^{N} (\alpha_j e_{ijt}) = m_{it} - m_{gt}.$$

The depreciation of currency $i$ relative to the global currency $g$ depends on whether country $i$'s money supply exceeds that of the virtual country $g$. When $\alpha_1 = 1$, meaning the global currency is entirely composed of the dollar, this virtual country $g$ can be considered as the United States/country 1.

**Exchange Rate Pass-Through.** Under the four pricing paradigms, the currency $i$ price of tradable goods exported from country $j$ to country $i$, $p_{jit}$, is given by:

$$\begin{aligned}
PCP &: p_{jit} = (1-\theta) mc_{jt} + e_{ijt};\\
LCP &: p_{jit} = (1-\theta) mc_{jt} + (1-\theta) e_{ijt};\\
DCP &: p_{jit} = (1-\theta) mc_{jt} + (1-\theta) e_{ijt} + \theta e_{i1t};\\
GCP &: p_{jit} = (1-\theta) mc_{jt} + (1-\theta) e_{ijt} + \theta \sum_{k=1}^{N} \alpha_k e_{ikt}.
\end{aligned}$$

The above equations show how the exchange rate is transmitted to consumer prices. It is only when prices are sticky, i.e., $\theta \neq 0$, that the different pricing assumptions make a difference. When $\theta = 1$, the pass-through of exchange rates to prices varies significantly: Under PCP, there is complete pass-through of exchange rates from other countries; under LCP, there is no pass-through; under DCP, there is complete pass-through of the dollar exchange rate; and under GCP, each country's currency $k$ passes through to prices $p_{jit}$ in proportion to $\alpha_k$.

### 2.2.2 Allocation Deviation

**Efficient allocation.** Since our model uses taxes to eliminate the distortion from monopolistic competition the flexible price equilibrium is efficient (Woodford and Walsh, 2005, Galí, 2008). We use a tilde, $\tilde{y}_{ijt}$, to denote the log deviation of the efficient allocation from the steady state, $\ln \tilde{Y}_{ijt} - \ln Y_{ij,ss}$, where $\tilde{Y}_{ijt}$ is the efficient allocation. Thus, we have:

$$\tilde{c}_{it} = \tilde{y}_{it} = v z_{it} + (1-v) z_t, \quad \tilde{c}_{Nit} = z_{it}, \quad \tilde{c}_{Tit} = z_t, \quad \tilde{c}_{jit} = z_{jt}.$$

For the first-best allocation, consumption is fully determined by productivity shocks.

**Consumption deviation.** When nominal rigidity distorts the economy, monetary policy can influence the equilibrium allocation. Following Itskhoki and Mukhin (2023), we describe the equilibrium by its log deviation from the first-best allocation. The non-tradable consumption $c_{Nit}$ and domestic tradable consumption $c_{iit}$ in country $i$ depend on $m_{it}$, as both goods are priced in currency $i$:

$$c_{Nit} - \tilde{c}_{Nit} = c_{iit} - \tilde{c}_{iit} = \theta(m_{it} - z_{it}); \tag{2.3}$$

However, international trade is more complex, depending on the pricing paradigm, as households' consumption depends on the money supply of the currency in which those goods are priced:

$$\begin{aligned} PCP &: c_{jit} - \tilde{c}_{jit} = \theta(m_{jt} - z_{jt}); \\ LCP &: c_{jit} - \tilde{c}_{jit} = \theta(m_{it} - z_{jt}); \\ DCP &: c_{jit} - \tilde{c}_{jit} = \theta(m_{1t} - z_{jt}); \\ GCP &: c_{jit} - \tilde{c}_{jit} = \theta(m_{gt} - z_{jt}). \end{aligned} \tag{2.4}$$

For PCP, LCP, DCP, and GCP, the deviation $c_{jit} - \tilde{c}_{jit}$ depends on its pricing currency, specifically $m_{jt}$, $m_{it}$, $m_{1t}$, and $m_{gt}$. As is later discussed, this currency misalignment leads to inconsistencies in monetary policy objectives when addressing external shocks.

# 3 Optimal Monetary Policy

In this section, two versions of optimal monetary policy under different pricing regimes are discussed. Section 3.1 examines the case where countries are willing to cooperate to maximize global welfare, while Section 3.2 focuses on a Nash equilibrium where monetary policies are designed to maximize each country's own utility.

## 3.1 Cooperative Monetary Policy

We examine the differences in optimal monetary policy under the four pricing paradigms in a cooperative setting. The Appendix shows that the global loss function may be expressed as follows:

$$\delta\, \mathbb{E}\left( v \sum_{i=1}^{N} n_i (c_{Nit} - \tilde{c}_{Nit})^2 + (1-v) \sum_{i=1}^{N} n_i^2 (c_{iit} - \tilde{c}_{iit})^2 + (1-v) \sum_{i=1}^{N} \sum_{j \neq i} n_i n_j (c_{jit} - \tilde{c}_{jit})^2 \right), \tag{3.1}$$

where $\delta = (\varepsilon(1-\theta)+\theta)/(2\theta)$ is a constant related to the degree of price stickiness $\theta$. The separation between the second and third terms inside the parentheses emphasizes that domestically produced and imported traded goods may be priced in different currencies. Substituting the consumption deviations, i.e. equation (2.4), under PCP, LCP, DCP, and GCP into equation (3.1), we obtain the global loss function. We define the common component $\mathcal{L}^c$ to the loss function which prevails across all specifications as:

$$\mathcal{L}^c = \underbrace{v \sum_{i=1}^{N} n_i (m_{it} - z_{it})^2}_{\text{related to } (c_{Nit} - \tilde{c}_{Nit})^2} + \underbrace{(1-v) \sum_{i=1}^{N} n_i^2 (m_{it} - z_{it})^2}_{\text{related to } (c_{iit} - \tilde{c}_{iit})^2}$$

The common component to all welfare losses is associated with domestic shocks that affect the non-traded consumption sector and domestic traded goods consumption equally. For losses associated with consumption of foreign tradable goods however, the global loss function differs depending on the pricing specification. We illustrate the global loss function for the four different pricing specifications as follows:

$$PCP : \kappa\, \mathbb{E}\left( \mathcal{L}^c + (1-v) \sum_{i=1}^{N} \sum_{j \neq i} n_i n_j (m_{jt} - z_{jt})^2 \right), \tag{3.2}$$

$$LCP : \kappa\, \mathbb{E}\left(\mathcal{L}^c + (1-v)\sum_{i=1}^{N}\sum_{j\neq i} n_i n_j (m_{it} - z_{jt})^2\right), \tag{3.3}$$

$$DCP : \kappa\, \mathbb{E}\left(\mathcal{L}^c + (1-v)\sum_{i=1}^{N}\sum_{j\neq i} n_i n_j (m_{1t} - z_{jt})^2\right), \tag{3.4}$$

$$GCP : \kappa\, \mathbb{E}\left(\mathcal{L}^c + (1-v)\sum_{i=1}^{N}\sum_{j\neq i} n_i n_j (m_{gt} - z_{jt})^2\right), \tag{3.5}$$

where $\kappa = \theta(\varepsilon(1-\theta)+\theta)/2$ is a constant. We consider committed monetary policy, meaning that at the beginning of the period, the policy maker commits to making $m_{it}$ a linear function of all shocks to minimize global losses. The occurrence of idiosyncratic shocks means that each country experiences different domestic shocks, with $z_{it} \neq z_{jt}$. If the global economy faced identical shocks, i.e., $z_t = z_{it} = z_{jt}$ for $\forall i, j$, then all four pricing paradigms could achieve an efficient allocation, provided that $m_{it} = z_t$ for $\forall i$. However, due to the existence of various shocks, the outcome deviates from the efficient allocation.

Equations (3.2) to (3.5) show that the key distortion in terms of welfare losses is the currency misalignment caused by LCP, DCP, and GCP pricing paradigms. Then it follows that the optimal monetary policy will depend on the various degrees of misalignment. We present the optimal policies in turn.

**Producer currency pricing.** The optimal monetary policy under PCP can be treated as the efficient benchmark, which is the open economy version of the 'divine coincidence' (Blanchard and Galí, 2007). We slightly rearrange the global welfare equation in equation (3.2) as:

$$PCP : \kappa\, \mathbb{E}\left(\underbrace{v\sum_{i=1}^{N} n_i (m_{it} - z_{it})^2 + (1-v)\sum_{i=1}^{N} n_i^2 (m_{it} - z_{it})^2}_{\mathcal{L}^c,\quad \text{related to } (c_{Nit}-\tilde{c}_{Nit})^2 \text{ and } (c_{iit}-\tilde{c}_{iit})^2} + \underbrace{(1-v)\sum_{i=1}^{N}\sum_{j\neq i} n_i n_j (m_{it} - z_{it})^2}_{\text{related to } (c_{ijt}-\tilde{c}_{ijt})^2}\right). \tag{3.6}$$

Under PCP, country $i$'s monetary policy $m_{it}$ influences three parts: ① country $i$'s non-tradable goods $(c_{Nit} - \tilde{c}_{Nit})^2$, ② country $i$'s domestic tradable goods $(c_{iit} - \tilde{c}_{iit})^2$,and ③ country $i$'s exports $(c_{ijt} - \tilde{c}_{ijt})^2$. The first two terms are part of the common component $\mathcal{L}^c$, while the third is specific to PCP pricing. All three require the monetary policy $m_{it}$ to target the productivity shock $z_{it}$. Therefore, the optimal monetary policy $m_{it} = z_{it}$ achieves the efficient allocation in both the non-tradable allocation and tradable allocation.

**Local currency pricing.** Under LCP, there is currency misalignment, and the global loss function is repeated below as follows:

$$LCP : \kappa\, \mathbb{E}\left(\underbrace{v\sum_{i=1}^{N} n_i (m_{it} - z_{it})^2 + (1-v)\sum_{i=1}^{N} n_i^2 (m_{it} - z_{it})^2}_{\mathcal{L}^c,\quad \text{related to } (c_{Nit}-\tilde{c}_{Nit})^2 \text{ and } (c_{iit}-\tilde{c}_{iit})^2} + \underbrace{(1-v)\sum_{i=1}^{N}\sum_{j\neq i} n_i n_j (m_{it} - z_{jt})^2}_{\text{related to } (c_{jit}-\tilde{c}_{jit})^2}\right). \tag{3.7}$$

Under LCP, country $i$'s monetary policy again $m_{it}$ influences three parts: the two parts of the common component $\mathcal{L}^c$, and the third part, representing country $i$'s imports $(c_{jit} - \tilde{c}_{jit})^2$. The first two terms are the same as under PCP, requiring $m_{it}$ to target the domestic productivity shock $z_{it}$. However, the third part of the loss function requires $m_{it}$ to target all foreign productivity shock $z_{jt}$ for $\forall j$, since the consumption of country $i$'s households' import consumption of good $j$ is influenced by country $i$'s monetary policy. Thus, country $i$'s optimal monetary policy must balance the trade-off between domestic and foreign productivity shocks:

$$\begin{aligned} m_{it}^{opt,cL} &= \frac{vn_i}{\Delta_i^{cL}} z_{it} + \frac{(1-v)n_i^2}{\Delta_i^{cL}} z_{it} + \sum_{j \neq i} \left( \frac{(1-v)n_i n_j}{\Delta_i^{cL}} z_{jt} \right) \\ &= v z_{it} + (1-v) n_i z_{it} + (1-v) (\sum_{j \neq i} n_j z_{jt}), \end{aligned} \tag{3.8}$$

where $\Delta_i^{cL} = vn_i + (1-v)n_i^2 + (1-v)\sum_{j\neq i} n_i n_j$ is the sum of the weights. A policy maker in country $i$ aiming to maximize global welfare must assign weights of $v$, $(1-v)n_i$, and $(1-v)n_j$ to non-tradable goods, domestic tradable goods, and foreign tradable goods from country $j$, respectively. And the monetary policy of country $i$ will allocate a larger share to bigger countries.

**Dollar currency pricing.** In DCP, country 1 (the U.S.) and other countries exhibit asymmetry in their monetary policies. By slightly rearranging the equation (3.4), we have

$$DCP : \kappa\, \mathbb{E} \left( \underbrace{v \sum_{i=1}^{N} n_i (m_{it} - z_{it})^2 + (1-v) \sum_{i=1}^{N} n_i^2 (m_{it} - z_{it})^2}_{\mathcal{L}^c, \quad \text{related to } (c_{Nit} - \tilde{c}_{Nit})^2 \text{ and } (c_{iit} - \tilde{c}_{iit})^2} + \underbrace{(1-v) \sum_{i=1}^{N} n_i (1-n_i)(m_{1t} - z_{it})^2}_{\text{related to } (c_{ijt} - \tilde{c}_{ijt})^2} \right). \tag{3.9}$$

We first examine the monetary policies of country $i$, $i \neq 1$. Clearly, country $i$'s monetary policy $m_{it}$ only influences $\mathcal{L}^c$, namely country $i$'s non-tradable goods and domestic tradable goods, and both of which require the monetary policy $m_{it}$ to target $z_{it}$. The third term is completely unrelated to the country $i$'s monetary policy $m_{it}$, since country $i$'s monetary policy cannot influence international trade. Thus, the monetary policy of non-U.S. countries only needs to ensure that non-tradable goods and domestic tradable goods reach their efficient levels:

$$m_{it}^{opt,cD} = \frac{vn_i}{\Delta_i^{cD}} z_{it} + \frac{(1-v)n_i^2}{\Delta_i^{cD}} z_{it} = z_{it} \quad \text{for } i \neq 1, \tag{3.10}$$

where $\Delta_i^{cD} = vn_i + (1-v)n_i^2$ is the sum of the weights. Hence for the non-DCP countries, the optimal policy is simply to target domestic productivity shocks, as in the PCP case.

The monetary policy of country 1 can influence four parts: ① country 1's non-tradable goods $(c_{N1t} - \tilde{c}_{N1t})^2$, ② country 1's domestic tradable goods $(c_{11t} - \tilde{c}_{11t})^2$, ③ country 1's exports $(c_{1jt} - \tilde{c}_{1jt})^2$, and ④ country $i$'s $(i \neq 1)$ exports $(c_{ijt} - \tilde{c}_{ijt})^2$. The first three parts require $m_{1t}$ to target $z_{1t}$, while the fourth part requires $m_{1t}$ to target the productivity shocks of other countries, $z_{it}$. Thus we have

$$m_{1t}^{opt,cD} = \frac{vn_1}{\Delta_1^{cD}} z_{1t} + \frac{(1-v)n_1^2}{\Delta_1^{cD}} z_{1t} + \frac{(1-v)n_1(1-n_1)}{\Delta_1^{cD}} z_{1t} + (1-v) \sum_{j \neq 1} \left( \frac{n_j(1-n_j)}{\Delta_1^{cD}} z_{jt} \right), \tag{3.11}$$

where $\Delta_1^{cD} = vn_1 + (1-v)n_1^2 + (1-v)n_1(1-n_1) + (1-v)\sum_{j\neq 1} n_j(1-n_j)$. In a cooperative outcome, U.S. monetary policy takes on the role of managing global exports, leading to multiple objectives for U.S. monetary policy. In contrast, the monetary policies of other countries only need to target their own domestic productivity shocks.

**Crypto currency pricing.** Before discussing GCP, it is useful to define a hypothetical arrangement we refer to as cryptocurrency currency pricing. Imagine that in addition to the $N$ national fiat currencies, there exists a cryptocurrency with a money supply $m_{ct}$ that is independent of all other currencies. Assume that all imports and exports for all $N$ countries are priced in cryptocurrency, while domestic consumption does not use cryptocurrency for pricing. We emphasize that this currency is not meant to be real, but is defined simply to help exposit the optimal policy under GCP. The global welfare function under CCP is:

$$CCP : \kappa\, \mathbb{E}\left( \underbrace{v\sum_{i=1}^{N} n_i(m_{it}-z_{it})^2 + (1-v)\sum_{i=1}^{N} n_i^2(m_{it}-z_{it})^2}_{\mathcal{L}^c,\quad \text{related to } (c_{Nit}-\tilde{c}_{Nit})^2 \text{ and } (c_{iit}-\tilde{c}_{iit})^2} + \underbrace{(1-v)\sum_{i=1}^{N} n_i(1-n_i)(m_{ct}-z_{it})^2}_{\text{related to } (c_{ijt}-\tilde{c}_{ijt})^2} \right). \quad (3.12)$$

Under CCP, it is obvious that country $i$'s monetary policy satisfies

$$m_{it}^{opt,cC} = \frac{vn_i}{\Delta_i^{cC}} z_{it} + \frac{(1-v)n_i^2}{\Delta_i^{cC}} z_{it} = z_{it} \quad \text{for } \forall i$$

where $\Delta_i^{cC} = vn_i + (1-v)n_i^2$. The monetary policy $m_{it}$ only affects the common component of the global loss function $\mathcal{L}^c$. Hence the consumption of non-tradable goods and domestic tradable goods in each country reaches the efficient level.

By contrast, the cryptocurrency issuer must instead weight the productivity shocks across all countries to balance the asymmetric productivity shocks as follows:

$$m_{ct}^{opt,cC} = \sum_{i=1}^{N} \left( \frac{n_i(1-n_i)}{\sum_{j=1}^{N} n_j(1-n_j)} z_{it} \right). \quad (3.13)$$

The term $n_i(1-n_i)$ is a measure of country $i$'s international trade importance, serving as an index that captures both country $i$'s export share $n_i$ and import share $1-n_i$. Both extremely large and extremely small countries are likely to be overlooked, as large countries are less reliant on import consumption, while small countries' export production is too negligible to have a significant impact, resulting in a relatively small trade importance index $n_i(1-n_i)$.

We introduce CCP because it represents a fictional pricing paradigm whose welfare lies between that of PCP and GCP. This would be the optimal allocation achievable when one separate currency is used as the invoicing currency, and gives national monetary policies independence to target domestic shocks. Welfare under CCP is strictly inferior to that under PCP because PCP achieves the optimal allocation in all three areas: non-tradable goods, domestic tradable goods, and foreign tradable goods, whereas CCP can only achieve the full optimum in the first two areas. CCP is no worse than GCP, as it can be viewed as the optimal allocation achievable when only one currency is used as the international trade invoicing currency. In other words, under DCP and GCP, the economy is constrained by having only $N$ monetary policy instruments to address shocks, whereas CCP provides $N+1$ instruments. Consequently, CCP represents the upper bound of GCP in terms of policy effectiveness.

**Global currency pricing.** Now we focus on the optimal monetary policy under GCP. The global loss function under GCP is given by:

$$GCP: \kappa\, \mathbb{E}\left( \underbrace{v\sum_{i=1}^{N} n_i(m_{it}-z_{it})^2 + (1-v)\sum_{i=1}^{N} n_i^2(m_{it}-z_{it})^2}_{\mathcal{L}^c,\quad \text{related to } (c_{Nit}-\tilde{c}_{Nit})^2 \text{ and } (c_{iit}-\tilde{c}_{iit})^2} + \underbrace{(1-v)\sum_{i=1}^{N}\left(n_i(1-n_i)\left(\sum_{j=1}^{N}\alpha_j m_{jt} - z_{it}\right)^2\right)}_{\text{related to } (c_{ijt}-\tilde{c}_{ijt})^2} \right). \tag{3.14}$$

The final term in the loss function captures the fact that under GCP, to the extent that it forms part of the global currency basket, each country's monetary policy influences both its exports, captured by the $n_i$ coefficient, and its imports, captured by the $1-n_i$ coefficient. In this case, optimal monetary policy becomes more complex because the marginal effect of $m_{it}$ is no longer linear.

However, under GCP the optimal monetary policy can be characterized indirectly by the following expressions:

$$\begin{aligned} m_{it}^{opt,cG} &= z_{it} + \frac{a(1-v)\alpha_i}{vn_i + (1-v)n_i^2}(m_{ct}^{opt,cC} - m_{gt}^{opt,cG}), \\ m_{gt}^{opt,cG} &= \frac{\sum_{i=1}^{N}\alpha_i z_i + ab(1-v)m_{ct}^{opt,cC}}{1+ab(1-v)}, \end{aligned} \tag{3.15}$$

where $a = \sum_{i=1}^{N} n_i(1-n_i)$ and $b = \sum_{i=1}^{N}(\alpha_i^2/(vn_i + (1-v)n_i^2))$ . Country $i$'s optimal monetary policy essentially involves balancing two objectives: one is to maintain the efficiency of its own non-tradable and domestic tradable consumption, which requires $m_{it}$ to reach $z_{it}$; the other is to ensure that global trade reaches the level of CCP, necessitating $m_{gt}$ to converge to $m_{ct}^{opt,cC}$ as shown in equation (3.13). To achieve the latter objective, currencies within the global currency basket must ignore to some degree their domestic consumption efficiency $(c_{Nit} - \tilde{c}_{Nit})^2$ and $(c_{iit} - \tilde{c}_{iit})^2$ in pursuit of this global trade alignment.

Despite the complex form of equation (3.15), the variable $m_{gt}^{opt,cG}$ is the same for all $N$ countries. This highlights two important points: first, currencies with a larger share ($\alpha_i \uparrow$) in the global currency basket deviate more from $z_{it}$ compared to those with smaller shares. If currency $i$ is not included in the global currency basket, i.e., $\alpha_i = 0$, then $m_{it}^{opt,cG} = z_{it}$, since currency $i$ only needs to address deviations in non-tradable goods and domestic tradable goods. Secondly, larger countries ($n_i \uparrow$) deviate less from $z_{it}$ compared to smaller countries from equation (3.15). This is because, for large countries, domestic consumption constitutes a significant portion of global welfare.

These results point to a positive externality of the global currency under the cooperative policy: all countries share the same objective of making $m_{gt}$ target $m_{ct}^{opt,cC}$ to achieve the optimal allocation for international trade $(c_{ijt} - \tilde{c}_{ijt})^2$. To obtain this goal, currencies in the global currency basket must sacrifice domestic consumption $(c_{Nit} - \tilde{c}_{Nit})^2$ and $(c_{iit} - \tilde{c}_{iit})^2$ to better coordinate trade allocations. Currencies not in the global currency basket or those with smaller shares can allow their monetary policies to focus more on achieving efficient $\mathcal{L}^c$.

**Optimal global currency design.** As we've shown, in a cooperative equilibrium, an arbitrary composition of the global currency involves some countries deviating from fully offsetting domestic shocks in order to contribute to the global good. This requirement can be avoided by an appropriately designed global currency.

**Proposition 1** *The optimal global currency design under a cooperative game involves the participation of every country in the global currency, with country i's share $\alpha_i$ determined such that it satisfies:*

$$\alpha_i^* = \frac{n_i(1-n_i)}{\sum_{j=1}^{N} n_j(1-n_j)}.$$

*Under the optimal global currency design, country i's optimal monetary policy $m_{it}^{opt,cG}$ and global currency supply $m_{gt}^{opt,cG}$ is equal to:*

$$\begin{aligned} m_{it}^{opt,cG} &= z_{it}, \\ m_{gt}^{opt,cG} &= \sum_{i=1}^{N} \left( \frac{n_i(1-n_i)}{\sum_{j=1}^{N} n_j(1-n_j)} z_{it} \right), \end{aligned}$$

*which implies that the optimal global currency design replicates the allocation in cryptocurrency currency pricing as equation (3.13).*

Under cooperative policy, the optimal global currency design $(\alpha_1^*, ..., \alpha_N^*)$ has two key features: first, all countries are included in the global currency basket; second, the weight of country $i$ in the global currency basket is determined by its trade importance index, weighted by $n_i(1-n_i)$. Including all $N$ countries in the global currency provides more monetary policy tools, facilitating cooperation to drive $m_{gt}$ closer to $m_{ct}^{opt,cC}$, and thereby reducing the need to sacrifice domestic consumption. Furthermore, it is optimal to weight each country by its trade importance index $n_i(1-n_i)$ to exploit the positive externalities existing in the global currency pricing, giving countries with a greater trade importance index the incentive to steer $m_{gt}$ towards the optimal level. We note also that this weighting scheme tends to underweight larger countries and overweight smaller countries, relative to their share in world GDP.

Proposition 1 also demonstrates that under this global currency design, GCP replicates the allocation of CCP. Countries' domestic consumption, $\mathcal{L}^c$, reaches the efficient level since $m_{it} = z_{it}$, while the import consumption $(c_{ijt} - \tilde{c}_{ijt})^2$ achieves the optimal scenario achievable when only a single currency is used as the trade invoicing currency. Remarkably, the optimal GCP basket then effectively replicates the allocation where there is an independent additional currency used solely for trade invoicing, chosen optimally to minimize misalignment in traded goods prices. Thus, in the cooperative equilibrium, a well-designed GCP can achieve an equilibrium allocation that reaches the theoretical upper bound, which corresponds to CCP.

One notable feature of Proposition 1 is that it puts a limit on the size of any country's share in the global basket currency. In particular we can state the following:

**Corollary 1** *The maximum share that any single country can hold in an optimal global currency basket is* $1/2$*, given cooperative monetary policies are implemented by all countries.*

This follows immediately from the definition of the optimal shares in Proposition 1.

A more important implication of Proposition 1 is that it the optimal currency basket eliminates the need for any country to sacrifice its domestic objectives related to inefficient consumption of domestic non-traded or domestically produced traded goods. In effect there is a conditional "Global Divine Coincidence" in that if the global currency is designed as in Proposition 1, each country can focus solely on its share of the common component of the loss function $\mathcal{L}_i^c$ while at the same time the component related to international trade is minimized subject to the constraints of a basket currency. This suggests an approach to decentralizing the allocation under GCP as follows:

**Corollary 2** *If the global currency basket is constructed as in Proposition 1, the optimal allocation under CCP can be achieved in a decentralized (non-cooperative) equilibrium if each country* $i$ *chooses its monetary policy to minimize:*

$$\mathbb{E}(\mathcal{L}_i^c) = \mathbb{E}\left( \underbrace{v(m_{it} - z_{it})^2}_{\textit{related to } (c_{Nit} - \tilde{c}_{Nit})^2} + \underbrace{(1-v)n_i(m_{it} - z_{it})^2}_{\textit{related to } (c_{iit} - \tilde{c}_{iit})^2} \right)$$

*where* $\mathcal{L}_i^c = v(m_{it} - z_{it})^2 + (1-v)n_i(m_{it} - z_{it})^2$ *represents the part of the common component of the global loss specific to country* $i$*, with* $\mathcal{L}^c = \sum_{i=1}^{N} n_i \mathcal{L}_i^c$*.*

The intuition behind this corollary is clear. If each country minimizes its domestic loss, then the global currency basket will reflect the required response from each country to minimize the losses from international trade. [6]

Section A.4 of the Online Appendix analyzes a specific two country example of the optimal monetary policy with GCP. There it is shown that the optimal share of each country in the global currency is half, and from a global welfare point of view, the worst outcome would be to give the larger country the full share of the global currency.

[6] Note that the condition required for Corollary 2 will in general be binding. As noted below, in general in a non-cooperative game each country will take account of its influence on international trade losses.

### 3.2 Non-cooperative Monetary Policy

We now turn to the case where monetary policy is set independently by each government to maximize own country welfare. In the non-cooperative equilibrium with commitment, each country's central bank announces $m_{it}$ in advance as a function of shocks, aiming to minimize its domestic expected loss function. Appendix A 3.2 shows that country $i$'s loss function can be expressed as:

$$\mathbb{E}\left(l_{it} - \tilde{l}_{it}\right) = \delta\ \mathbb{E}\left(v(c_{Nit} - \tilde{c}_{Nit})^2 + (1-v)n_i(c_{iit} - \tilde{c}_{iit})^2 + (1-v)\sum_{j\neq i} n_j(c_{jit} - \tilde{c}_{jit})^2\right). \tag{3.16}$$

Each country's expected loss function consists of three components: non-tradable consumption $(c_{Nit} - \tilde{c}_{Nit})^2$, domestic tradable consumption $(c_{iit} - \tilde{c}_{iit})^2$, and import consumption deviation $(c_{jit} - \tilde{c}_{jit})^2$. Thus, country $i$'s expected loss function under the four specifications is:

$$PCP : \kappa\ \mathbb{E}\ \left(\mathcal{L}_i^c + (1-v)\sum_{j\neq i} n_j(m_{jt} - z_{jt})^2\right); \tag{3.17}$$

$$LCP : \kappa\ \mathbb{E}\ \left(\mathcal{L}_i^c + (1-v)\sum_{j\neq i} n_j(m_{it} - z_{jt})^2\right); \tag{3.18}$$

$$DCP : \kappa\ \mathbb{E}\ \left(\mathcal{L}_i^c + (1-v)\sum_{j\neq i} n_j(m_{1t} - z_{jt})^2\right); \tag{3.19}$$

$$GCP : \kappa\ \mathbb{E}\ \left(\mathcal{L}_i^c + (1-v)\sum_{j\neq i} n_j(m_{gt} - z_{jt})^2\right). \tag{3.20}$$

where $\mathcal{L}_i^c = v(m_{it} - z_{it})^2 + (1-v)n_i(m_{it} - z_{it})^2$, as defined in Corollary 2 denotes country $i$'s domestic welfare loss from $(c_{Nit} - \tilde{c}_{Nit})^2$ and $(c_{iit} - \tilde{c}_{iit})^2$. Compared to equations (3.2) to (3.5), in the Nash case, country $i$ disregards two key considerations under cooperation: first, the externalities of monetary policy, as country $i$ does not account for the impact of $m_{it}$ on other countries' consumption, i.e. $(c_{ijt} - \tilde{c}_{ijt})^2$; and second, its relative share in global welfare is $n_i$, but in the Nash case, it weights its own loss fully.

We now analyze the optimal monetary policy under each pricing paradigm and compare them to the outcome under cooperation.

**Producer currency pricing.** From equation (3.17), it can be observed that country $i$'s monetary policy can only influence its' domestic loss $\mathcal{L}_i^c$. The optimal policy requires country $i$'s monetary policy to target $z_{it}$, so that:

$$m_{it}^{opt,nP} = \frac{v}{\Delta_i^{nP}} z_{it} + \frac{(1-v)n_i}{\Delta_i^{nP}} z_{it} = z_{it},$$

where the superscript "$nP$" represents "Nash game" and "PCP", and $\Delta_i^{nP} = v + (1-v)n_i$ is the sum of the weights. In fact this is the same as in the cooperative case. [7]

[7]Although it may seem that both the cooperative and uncooperative outcomes under PCP implement the same monetary policy $m_{it} = z_{it}$ to achieve the same allocation, this is merely a coincidence. In fact, under PCP, the non-cooperative problem

**Local currency pricing.** From equation (3.18), we can see that the optimal monetary policy under LCP in the Nash equilibrium is exactly the same as in the cooperative case, as shown in equation (3.8). Additionally, there are no monetary policy externalities under LCP, since each country's loss function depends solely on its own policy response.

**Dollar currency pricing.** In DCP, country 1 and the other countries are asymmetric. For non-U.S. country $i$, the welfare loss from import consumption $(c_{jit} - \tilde{c}_{jit})^2$, is beyond the influence of country $i$'s policy. Therefore, just as in the cooperative problem, i.e. equation (3.10), country $i$'s optimal monetary policy is $m_{it}^{opt,nD} = z_{it}$ for $i \neq 1$, ensuring domestic loss $\mathcal{L}_i^c$ reach the efficient level.

Compared to the cooperative equilibrium, country 1's monetary policy in the uncooperative equilibrium only takes into account of three components: ① country 1's non-tradable goods $(c_{N1t} - \tilde{c}_{N1t})^2$, ② country 1's domestic tradable goods $(c_{11t} - \tilde{c}_{11t})^2$, and ③ country 1's imports $(c_{i1t} - \tilde{c}_{i1t})^2$ for $i \neq 1$. The first two require $m_{1t}$ to target $z_{1t}$, while the last one requires it to target $z_{it}$. Thus, country 1's optimal uncooperative monetary policy is given by:

$$m_{1t}^{opt,nD} = \frac{v}{\Delta_1^{nD}} z_{1t} + \frac{(1-v)n_1}{\Delta_1^{nD}} z_{1t} + (1-v) \sum_{j \neq 1} \left( \frac{n_j}{\Delta_1^{nD}} z_{jt} \right), \tag{3.21}$$

where $\Delta_1^{nD} = v + (1-v)n_1 + (1-v)\Sigma_{j\neq 1} n_j$ is the sum of weights. When $v = 0, N = 2$, equation (3.21) is same as the optimal monetary policy in Devereux et al. (2007).

By comparing equation (3.11) and equation (3.21), we observe that country 1's monetary policy $m_{1t}$ in the non-cooperative equilibrium deviates in two significant ways compared with the cooperative equilibrium. First, in the non-cooperative equilibrium, country 1 does not consider how its monetary policy affects other countries' consumption through its exports, thereby ignoring the impact of $m_{1t}$ on $(c_{1jt} - \tilde{c}_{1jt})^2$. Second, the weights assigned to productivity shocks across countries are not optimal. In equation (3.11), country 1 would assign a weight of $\frac{n_j(1-n_j)}{\Delta_1^{cD}}$ to the productivity shock $z_{jt}$ of country $j$. However, in the non-cooperative outcome, this weight is reduced to $n_j$, indicating that country 1 only considers the impact of other countries' productivity on its own import consumption, while neglecting the share of each country's welfare in overall global welfare.

**Crypto currency pricing.** The cryptocurrency measure in the non-cooperative game must be defined separately for each country. That is defined as the optimal policy for each country if it had control of a currency solely used for international trade invoicing. The loss function in this case for country $i$ would be

$$CCP : \kappa \, \mathbb{E} \left( \mathcal{L}_i^c + (1-v) \sum_{j \neq i} n_j (m_{ct} - z_{jt})^2 \right). \tag{3.22}$$

involves monetary policy externalities. As seen from equation (3.6), $m_{it}$ affects foreign imports $(c_{ijt} - \tilde{c}_{ijt})^2$, but in the non-cooperative game, the central bank $i$ does not consider this because it is home imports $(c_{jit} - \tilde{c}_{jit})^2$, rather than home exports $(c_{ijt} - \tilde{c}_{ijt})^2$, that enter country $i$'s utility function. For example, if a country's non-tradable goods shock and tradable goods shock were different, i.e., $z_{it}^N \neq z_{it}$, then the optimal monetary policy under PCP under the non-cooperative outcome would differ from that in the cooperative outcome.

The cryptocurrency issuer, aim to maximize the country $i$'s welfare, will not take country $i$'s productivity shock $z_{it}$ into account when determining the cryptocurrency supply, as it does not affect country $i$'s imported consumption $(c_{jit} - \tilde{c}_{jit})^2$. The optimal monetary policy set by the hypothetical cryptocurrency issuer in country $i$ would be:

$$m_{cit}^{opt,nC} = \frac{1}{1-n_i} \sum_{j \neq i} (n_j z_{jt}), \tag{3.23}$$

where $m_{cit}^{opt,nC}$ represents the optimal cryptocurrency supply if cryptocurrency is issued by country $i$. Mathematically, $m_{cit}^{opt,nC}$, reflects the optimal supply of the pricing currency that maximize country $i$'s welfare from import consumption $(c_{jit} - \tilde{c}_{jit})^2$ when there is only one currency used for international trade invoicing.

**Global currency pricing.** As shown in equation (3.20), under GCP, if country $i$ is included in the global currency basket, its monetary policy can influence three terms: ① country $i$'s non-tradable goods $(c_{Nit} - \tilde{c}_{Nit})^2$, ② country $i$'s domestic tradable goods $(c_{iit} - \tilde{c}_{iit})^2$, and ③ country $i$'s import consumption $(c_{jit} - \tilde{c}_{jit})^2$. Compared to the cooperative game, country $i$ doesn't consider the impact of $m_{it}$ on its export.

The optimal monetary policy for country $i$ under GCP is as follows:

$$\begin{aligned} m_{it}^{opt,nG} &= z_{it} + \frac{\alpha_i(1-v)(1-n_i)}{v+(1-v)n_i}\left(m_{cit}^{opt,nC} - m_{gt}^{opt,nG}\right), \\ m_{gt}^{opt,nG} &= \frac{\sum_{i=1}^{N}\left(\alpha_i z_{it} + \frac{\alpha_i^2(1-v)(1-n_i)}{v+(1-v)n_i} m_{cit}^{opt,nC}\right)}{1+\sum_{i=1}^{N}\left(\frac{\alpha_i^2(1-v)(1-n_i)}{v+(1-v)n_i}\right)}. \end{aligned} \tag{3.24}$$

Equation (3.24) indicates that country $i$'s monetary policy $m_{it}$ aims to balance two objectives: the first is targeting $z_{it}$ to ensure that domestic loss, $\mathcal{L}_i^c$, reaches the efficient level; the second is to adjust the global currency supply $m_{gt}$ to be closer to $m_{cit}^{opt,nC}$ in order to optimize country $i$'s import consumption $(c_{jit} - \tilde{c}_{jit})^2$. Notice that, in contrast to the cooperative game, different countries have distinct goals since $m_{cit}^{opt,nC} \neq m_{cjt}^{opt,nC}$ if $i \neq j$, so country $i$'s preference for global currency supply is different as shown in equation (3.24).

Therefore, the positive externality of the global currency that we identified in the cooperative game does not hold in the non-cooperative equilibrium. In the cooperative equilibrium, all countries share a joint trade allocation goal, i.e. $m_{ct}^{opt,cC}$. By contrast there is negative externality of the global currency under the non-cooperative game: each country pursues its own trade allocation goal, $m_{cit}^{opt,nC}$, which varies across countries. The inconsistency in each country's policy goal $m_{cit}^{opt,nC}$ results in negative externalities since countries neglect the effects of their monetary policies on exports.

**Optimal global currency design.** Given that each country has a different goal for the composition of the global currency, it is not possible to analytically characterize the composition of the global currency what maximizes world welfare under the assumption that all countries behave non-cooperatively. However, we can numerically compute welfare optimal shares for different cases under non-cooperative policy-making. Our numerical simulations indicate that the optimal allocations under cooperative and non-cooperative policies converge when home bias $v$ is empirically relevant. Figure 1 demonstrates the convergence of country 1's optimal weight ($\alpha_1$) under cooperative and non-cooperative policies in a special case with $v = 0.4$, $N = 5$, and and equal country sizes for countries 2 to 5. Our simulations confirm this convergence holds more generally for randomly distributed country sizes when $v = 0.4$.

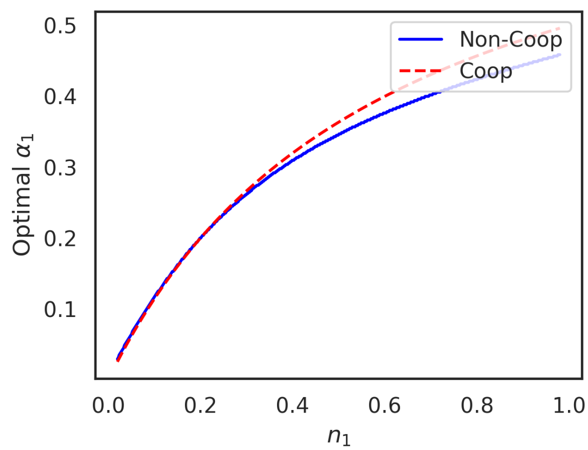


Figure 1: Optimal alpha under cooperative and non-cooperative policies

*Note: Figure 1 considers a five-country case ($N = 5$) with i.i.d. productivity shocks, where countries 2-5 have identical sizes ($n_2 = \cdots = n_5$) and home bias $v = 0.4$. The blue curve traces country 1's optimal global currency weight ($\alpha_1$) under non-cooperative policies as its size varies, while the red curve shows the corresponding cooperative policy scenario.*

The economic intuition is straightforward: when home bias $v$ is sufficiently large, monetary policies in both cooperative and non-cooperative regimes become predominantly self-oriented, resulting in modest differences in optimal policy responses. This result is consistent with Obstfeld and Rogoff (2002)'s minimal coordination gains finding. While subsequent research (Canzoneri et al., 2005; Benigno and Benigno, 2006; Bodenstein et al., 2025) has identified potential larger coordination benefits via sector-specific technology shocks or global imbalances, our baseline model — which abstracts from these features — naturally reproduces the earlier convergence result.

## 3.3 Policy implementation

Due to the static nature of the model, the implementation of monetary policy is characterized as a money supply rule. In standard New Keynesian models, we are used to thinking of policy as a target rule for stabilizing an inflation index. But the optimal policy rules, outlined above is isomorphic to a rule which stabilizes different price indices. Table 1 outlines the different indices corresponding to optimal policies under different pricing strategies. For instance, in the cooperative or Nash case under PCP, the optimal rule stabilizes the Producer Price Index (PPI), while under LCP it is the Consumer Price Index (CPI) that is stabilized. Under DCP and GCP, the price index generally differs between cooperative and Nash cases, and is not described either by the PPI or CPI. In the dynamic model described below, an optimal monetary policy targets an inflation rate rather than a price index. The Appendix provides further description of this Table.

Table 1: The price targeting rule of country $i$ under various pricing paradigms, $i \in \{1, 2, ..., N\}$

| Pricing Paradigm | Cooperative Game | Nash game |
|---|---|---|
| PCP | PPI | PPI |
| LCP | CPI | CPI |
| DCP | The currency $i$ price of all goods priced in currency $i$ and consumed **globally** | The currency $i$ price of all goods priced in currency $i$ and consumed **by country** $i$ |
| CCP | The currency $i$ price of all goods priced in currency $i$ | The currency $i$ price of all goods priced in currency $i$ |
| GCP | The currency $i$ price of all goods priced in currency $i$ + $\alpha_i$ × the global currency price of all goods priced in global currency and consumed **globally** | The currency $i$ price of all goods priced in currency $i$ + $\alpha_i$ × the global currency price of all goods priced in global currency and consumed **by country** $i$ |

# 4 Extensions: Monetary Shocks

We now consider a scenario where each country faces additional exogenous shocks to its monetary policy, denoted as $\boldsymbol{\mu}_t = (\mu_{1t}, \cdots, \mu_{Nt})'$, such as velocity shocks, which are beyond the control of the monetary authority. The central bank in country $i$ commits to implement the monetary policy equation $m_{it} = a_{i1}z_{1t} + \ldots + a_{iN}z_{Nt}$, but the actual monetary supply turns out to be:

$$m_{it} = a_{i1}z_{1t} + \ldots + a_{iN}z_{Nt} + \mu_{it}, \tag{4.1}$$

where $\mu_{it}$ represents an unexpected monetary shock in country $i$. Central banks choose monetary policy parameters $\boldsymbol{a} = [a_{ij}]_{i,j=1}^{N}$ at the beginning of each period and adhere to this commitment after all shocks occur, but they cannot respond to $\boldsymbol{\mu}_t$. The velocity shocks introduce a level of uncertainty, highlighting the central bank's inability to fully control the monetary supply. [8]

We further assume that productivity shocks $\boldsymbol{z}_t = (z_{1t}, \cdots, z_{Nt})'$ and velocity shocks $\boldsymbol{\mu}_t = (\mu_{1t}, \cdots, \mu_{Nt})'$ are orthogonal both internally and between each other, with variances given by $\boldsymbol{\sigma}_z^2 = (\sigma_{1z}^2, \cdots, \sigma_{Nz}^2)'$ and $\boldsymbol{\sigma}_\mu^2 = (\sigma_{1\mu}^2, \cdots, \sigma_{N\mu}^2)'$.

[8] In a more general model, we could think of $\mu_{it}$ as representing a country-specific financial shock which affects the spread between policy rates and domestic borrowing rates.

## 4.1 Global Currency Pricing

We now consider the case of GCP in the extended model. The central bank in country $i$ can select $(a_{i1}, \ldots, a_{iN})$ in equation (4.1). Thus, the global currency supply $m_{gt}$ is given by

$$m_{gt} = \sum_{i=1}^{N} \sum_{j=1}^{N} \alpha_i a_{ij} z_{jt} + \sum_{i=1}^{N} \alpha_i \mu_{it}.$$

Since the global currency is a composite of $N$ fiat currencies, its supply is influenced by global monetary shocks $\boldsymbol{\mu}_t$, weighted by each country's share $\alpha_i$ in the global currency basket. Unlike single-currency pricing paradigms such as PCP, LCP, and DCP, where exports from one country to another are impacted by the monetary policies of individual countries, GCP offers a stability advantage due to its diversified structure.

### 4.1.1 Global Loss Function

When considering unresponsive monetary shocks, there are two types of distortions in the economy: one arises from currency misalignment discussed in Section 3, and the other results from uncontrollable monetary volatility that prevent monetary policy from fully responding to productivity shocks. The orthogonality between the shocks allows us to easily decompose the global loss function into two parts for any monetary policy rules $\boldsymbol{a} = [a_{ij}]_{i,j=1}^{N}$ and any global currency design $\boldsymbol{\alpha}$:

$$L^G = \underbrace{\boldsymbol{\chi}_z^G(v, \boldsymbol{n}, \boldsymbol{\alpha}, \boldsymbol{a})' \boldsymbol{\sigma}_z^2}_{\text{currency misalignment}} + \underbrace{\boldsymbol{\chi}_\mu^G(v, \boldsymbol{n}, \boldsymbol{\alpha})' \boldsymbol{\sigma}_\mu^2}_{\text{monetary volatility}}, \tag{4.2}$$

where the column vectors $\boldsymbol{\chi}_z^G$ and $\boldsymbol{\chi}_\mu^G$, functions of $(v, \boldsymbol{n}, \boldsymbol{\alpha}, \boldsymbol{a})$ and $(v, \boldsymbol{n}, \boldsymbol{\alpha})$ respectively, describe the impact of productivity and velocity shocks on welfare. Global losses stem from two main distortions, currency misalignment and monetary volatility. The monetary policy rule $\boldsymbol{a} = [a_{ij}]_{i,j=1}^{N}$ can only mitigate currency misalignment but cannot address monetary volatility, as the velocity shocks $\boldsymbol{\mu}_t$ are unresponsive in the setup.

**Currency misalignment.** Note that in equation (4.2), the selection of the monetary policy rule $\boldsymbol{a} = [a_{ij}]_{i,j=1}^{N}$ impacts only $\boldsymbol{\chi}_z^G$ and does not affect $\boldsymbol{\chi}_\mu^G$. When committing to a monetary policy, the government does not need to account for potential future monetary shocks $\boldsymbol{\sigma}_\mu^2$. Thus, when countries implement cooperative monetary policies to maximize global welfare, the money supply is same as the baseline model but now incorporating the velocity shock $u_{it}$, slightly rearranged below:

$$\begin{aligned} m_{it}^{opt,cG} &= z_{it} - \frac{(1-v)\alpha_i}{vn_i + (1-v)n_i^2}\, x_t + u_{it}, \\ x_t &= \frac{\sum_{i=1}^{N} \left( n_i(1-n_i) \left( \sum_{j=1}^{N} (\alpha_j z_{jt}) - z_{it} \right) \right)}{1 + (1-v) \left( \sum_{i=1}^{N} n_i(1-n_i) \right) \left( \sum_{i=1}^{N} \left( \frac{\alpha_i^2}{vn_i + (1-v)n_i^2} \right) \right)}. \end{aligned} \tag{4.3}$$

Due to the separability of productivity shocks and monetary shocks as shown in equation (4.2), the analysis concerning $\boldsymbol{\chi}_z^G(v, \boldsymbol{n}, \boldsymbol{\alpha}, \boldsymbol{a})' \boldsymbol{\sigma}_z^2$ is identical to the baseline model. Monetary authorities continue to follow optimal policies under GCP to offset domestic and international productivity shocks.

**Monetary volatility.** We provide the expression for the welfare loss from monetary volatility $\boldsymbol{\chi}_{\mu}^{G}(v,\boldsymbol{n},\boldsymbol{\alpha})'\boldsymbol{\sigma}_{\mu}^{2}$ in equation (4.2):

$$\boldsymbol{\chi}_{\mu}^{G}(v,\boldsymbol{n},\boldsymbol{\alpha})'\boldsymbol{\sigma}_{\mu}^{2}=v\left(\sum_{i=1}^{N}n_i\sigma_{iu}^2\right)+(1-v)\left(\sum_{i=1}^{N}n_i^2\sigma_{iu}^2\right)+(1-v)\left(\sum_{i=1}^{N}n_i(1-n_i)\right)\left(\sum_{i=1}^{N}\alpha_i^2\sigma_{iu}^2\right). \quad (4.4)$$

The negative effects of uncontrollable velocity shocks also consist of three parts: deviations in non-tradable consumption, domestic tradable consumption, and international trade. The underlying intuition is analogous: given that the nontradable goods and domestically produced tradable goods of country $i$ are priced in currency $i$ for any pricing paradigm, the first two terms of equation (4.4) capture the effects stemming from the volatility of currency $i$. Conversely, for imports and exports priced in a global currency, the volatility of each country's currency will be transmitted at a proportion represented by $\alpha_i$.

The final/third term in the RHS of equation (4.4) highlights why GCP differs from other single-currency pricing paradigms like PCP, LCP, and DCP. Because GCP is composed of multiple currencies, it can significantly mitigate the negative effects of monetary volatility in international trade. The impact of monetary shocks on international trade, represented as $\sum_{i=1}^{N}\alpha_i^2\sigma_{iu}^2$, depends on the share of each currency in the basket. The global currency gains stability from being composed of a diverse basket of currencies.

### 4.1.2 Optimal Global Currency Design

The global loss function, as outlined in equation (4.2), demonstrates that the design of the global currency, $\boldsymbol{\alpha}$, influences welfare through two channels: currency misalignment and monetary volatility. Based on this, we propose the following:

**Proposition 2** *For any country sizes set $\boldsymbol{n}$, variance set $(\boldsymbol{\sigma}_z^2,\boldsymbol{\sigma}_\mu^2)$, we find that:*

*(1) Suppose the government commit to the optimal cooperative monetary policy rule $\boldsymbol{a}=[a_{ij}]_{i,j=1}^{N}$ as equation (4.3). The optimal global currency design $\boldsymbol{\alpha}$ to minimize currency misalignment, as defined by $\boldsymbol{\chi}_z^G(v,\boldsymbol{n},\boldsymbol{\alpha},\boldsymbol{a})$, is given by:*

$$\alpha_i=\frac{n_i(1-n_i)}{\sum_{j=1}^{N}n_j(1-n_j)}.$$

*(2) For any monetary policy rule $\boldsymbol{a}=[a_{ij}]_{i,j=1}^{N}$, the optimal global currency design $\boldsymbol{\alpha}$ to minimize monetary volatility, as captured by $\boldsymbol{\chi}_{\mu}^{G}(v,\boldsymbol{n},\boldsymbol{\alpha})$, is given by:*

$$\alpha_i=\frac{1/\sigma_{i\mu}^2}{\sum_{j=1}^{N}(1/\sigma_{j\mu}^2)}.$$

*The relative volatility of productivity shocks $\boldsymbol{\sigma}_z^2$ and monetary shocks $\boldsymbol{\sigma}_\mu^2$ determines how the optimal global currency design $\boldsymbol{\alpha}$ should be structured.*

This Proposition extends Proposition 1 in the baseline model.[9] It illustrates that when exists other non-responsive shocks $\boldsymbol{\mu}_t$, the optimal design of a global currency $\boldsymbol{\alpha}$ needs to account for the variability of

[9] It is not possible generally to analytically characterize the optimal GC shares in the presence of both productivity and monetary shocks. Section 5 below computes the optimal GC shares in the dynamic model for our multi-country quantitative model.

velocity shocks across countries. We can improve welfare by giving more stable currencies a larger share in the global currency basket.

## 4.2 Welfare Ranking

In this section, we compare how welfare performance varies under optimal cooperative monetary policy across different pricing paradigms: PCP, LCP, DCP, and GCP. This means that in the pricing paradigm $X$, where $X \in \{P, L, D, G\}$, the monetary policy adheres to the optimal strategy defined for that paradigm, similar to the baseline model, but with the inclusion of the monetary shock $\mu_{it}$. For simplicity, we assume that the shock variances are the same across all countries, meaning $\sigma_{iz}^2 \equiv \sigma_z^2$ and $\sigma_{i\mu}^2 \equiv \sigma_\mu^2$. In the pricing paradigm $X$, the global loss function can also be decomposed into two parts:

$$L^{cX}(v, \boldsymbol{n}) = \underbrace{\chi_z^{cX}(v, \boldsymbol{n})\sigma_z^2}_{\text{currency misalignment}} + \underbrace{\chi_\mu^{cX}(v, \boldsymbol{n})\sigma_\mu^2}_{\text{monetary volatility}}, \qquad X \in \{P, L, D, G\},$$

where $\chi_z^{cX}(v, \boldsymbol{n})$ and $\chi_\mu^{cX}(v, \boldsymbol{n})$ represent the losses from currency misalignment and monetary volatility under a cooperative policy within pricing paradigm $X$, respectively, while $L^{cX}(v, \boldsymbol{n})$ represents the total loss. There are the following differences in welfare outcomes across the four pricing paradigms:

**Proposition 3** *If countries implement a cooperative monetary policy, then for any set of country sizes $\boldsymbol{n}$, we have:*

*(1) In terms of reducing currency misalignment, we find that $PCP \succeq GCP \succeq DCP \succeq LCP$, with global currency designed as $\alpha_i^* = n_i(1-n_i)/\sum_{j=1}^N n_j(1-n_j)$ under GCP. Mathematically, it means:*

$$0 = \chi_z^{cP}(v, \boldsymbol{n}) \leq \chi_z^{cG}(v, \boldsymbol{n}, \boldsymbol{\alpha})|_{\alpha_i = \alpha_i^*} \leq \chi_z^{cD}(v, \boldsymbol{n}) \leq \chi_z^{cL}(v, \boldsymbol{n}).$$

*(2) In terms of reducing monetary volatility, we find that $GCP \succeq PCP = DCP = LCP$. Mathematically, it means for any global currency design $\boldsymbol{\alpha}$:*

$$0 \leq \chi_\mu^{cG}(v, \boldsymbol{n}, \boldsymbol{\alpha}) \leq \chi_\mu^{cP}(v, \boldsymbol{n}) = \chi_\mu^{cD}(v, \boldsymbol{n}) = \chi_\mu^{cL}(v, \boldsymbol{n}).$$

The expressions for $\chi_z^{cX}(v, \boldsymbol{n})$ and $\chi_\mu^{cX}(v, \boldsymbol{n})$ are provided in the appendix. The proposition shows that PCP effectively addresses currency misalignment, whereas GCP excels at reducing the negative impacts of monetary volatility. DCP and LCP, however, do not offer significant benefits in either aspect.

PCP and GCP each have advantages in mitigating productivity and velocity shocks respectively, thus we can make the following corollary:

**Corollary 3** *Suppose $\alpha_i^* = n_i(1-n_i)/\sum_{j=1}^N n_j(1-n_j)$, for any set of country sizes $\boldsymbol{n}$, there exists a cut-off point that satisfies:*

*(1) if $\sigma_u^2/\sigma_z^2 < 1$, in term of global welfare, we have $PCP \succeq GCP \succeq DCP \succeq LCP$. Mathematically, it means:*

$$L^{cP}(v, \boldsymbol{n}) \leq L^{cG}(v, \boldsymbol{n}, \boldsymbol{\alpha})|_{\alpha_i = \alpha_i^*} \leq L^{cD}(v, \boldsymbol{n}) \leq L^{cL}(v, \boldsymbol{n}).$$

*(2) if $\sigma_u^2/\sigma_z^2 > 1$, in term of global welfare, we have $GCP \succeq PCP \succeq DCP \succeq LCP$. Mathematically, it means:*

$$L^{cG}(v, \boldsymbol{n}, \boldsymbol{\alpha})|_{\alpha_i=\alpha_i^*} \leq L^{cP}(v, \boldsymbol{n}) \leq L^{cD}(v, \boldsymbol{n}) \leq L^{cL}(v, \boldsymbol{n}).$$

Thus, $\sigma_u^2/\sigma_z^2 = 1$ serves as a cut-off point that determines whether PCP or GCP is more advantageous in achieving greater global welfare. Greater volatility in productivity shocks favors PCP, while greater volatility in monetary shocks benefits GCP.

# 5 Dynamic Model

We now extend the analysis to a dynamic model and develop a quantitative application based on data from 20 world economies. The baseline model uses one-period Calvo pricing to simplify monetary policy trade-offs, reducing it to a static framework. To capture dynamics with staggered prices, we move to a dynamic setting with Calvo pricing as in Clarida et al. (2002). The definition of equilibrium remains the same, except that firm's price-setting strategy changes to (e.g., for GCP):

$$\tilde{P}_{jjt} = \frac{E_t\left[\sum_{s=0}^{\infty} \theta^s Q_{jt,t+s} MC_{j,t+s} (P_{jj,t+s})^{\varepsilon} Y_{jj,t+s}\right]}{E_t\left[\sum_{s=0}^{\infty} \theta^s Q_{jt,t+s} (P_{jj,t+s})^{\varepsilon} Y_{jj,t+s}\right]},$$

$$\tilde{P}_{j-jt}^{G} = \frac{E_t\left[\sum_{s=0}^{\infty} \theta^s Q_{jt,t+s} MC_{j,t+s} (P_{j-j,t+s}^{G})^{\varepsilon} \left(\sum_{i\neq j} n_i Y_{ji,t+s}\right)\right]}{E_t\left[\sum_{s=0}^{\infty} \theta^s Q_{jt,t+s} \mathcal{E}_{jg,t+s} (P_{j-j,t+s}^{G})^{\varepsilon} \left(\sum_{i\neq j} n_i Y_{ji,t+s}\right)\right]},$$

where $Q_{jt,t+s} = \beta^s P_{jt} C_{jt}/(P_{j,t+s} C_{j,t+s})$ is the stochastic discount factor between period $t$ and $t+s$. And the price indices are now expressed in recursive form:

$$(P_{jjt})^{1-\varepsilon} = \theta (P_{jj,t-1})^{1-\varepsilon} + (1-\theta)(\tilde{P}_{jjt})^{1-\varepsilon},$$
$$(P_{j-jt}^{G})^{1-\varepsilon} = \theta (P_{j-j,t-1}^{G})^{1-\varepsilon} + (1-\theta)(\tilde{P}_{j-jt}^{G})^{1-\varepsilon}.$$

The country-specific productivity and monetary shocks follow the AR(1) process with correlation $(\eta_z, \eta_\mu)$:

$$z_{it} = \eta_z z_{i,t-1} + \epsilon_{it}^{z}, \qquad \mu_{it} = \eta_\mu \mu_{i,t-1} + \epsilon_{it}^{\mu}$$

where cross-country disturbance terms $\boldsymbol{\epsilon}_t^z$ and $\boldsymbol{\epsilon}_t^\mu$ follow normal distributions with zero mean. Productivity and monetary shocks are serially correlated internally but orthogonal to each other.

## 5.1 Optimal Policies

**Global loss function.** While the price stickiness setup changes from one-period Calvo to staggered pricing, the trade-off faced by monetary policy in the baseline model remains unchanged. We can still decompose the global welfare loss function into three parts: non-tradable goods distortion, domestic tradable goods distortion, and foreign tradable goods distortion, which corresponding directly to equation (3.1).

$$\mathbb{E}_0\left(\sum_{t=0}^{\infty}\beta^t(l_t-\tilde{l}_t)\right)=\mathbb{E}_0\sum_{t=0}^{\infty}\beta^t\left[\underbrace{\frac{1}{2}v\sum_{i=1}^{N}n_i\left(\frac{\varepsilon}{\tilde{\theta}}\pi_{Nit}^2+(c_{Nit}-\tilde{c}_{Nit})^2\right)}_{\text{related to }(m_{it}-z_{it})^2}+\underbrace{\frac{1}{2}(1-v)\sum_{i=1}^{N}n_i^2\left(\frac{\varepsilon}{\tilde{\theta}}\pi_{iit}^2+(c_{iit}-\tilde{c}_{iit})^2\right)}_{\text{related to }(m_{it}-z_{it})^2}\right.$$
$$\left.+\underbrace{\frac{1}{2}(1-v)\sum_{i=1}^{N}\sum_{j\neq i}n_in_j\left(\frac{\varepsilon}{\tilde{\theta}}(\pi_{jit}^X)^2+(c_{jit}-\tilde{c}_{jit})^2\right)}_{\text{related to }(m_{xt}-z_{jt})^2,\ x\in\{j,i,1,b,g\}}\right],$$

where $\pi_{jit}^X=p_{jit}^X-p_{ji,t-1}^X$ is the log inflation term and $\tilde{\theta}=(1-\beta\theta)(1-\theta)/\theta$ measure the degree of price stickiness. In the one-period version of Calvo, price dispersion is proportional to consumption deviation so the loss function simplifies to equation (3.1), whereas in the standard Calvo framework, it enters the loss function through inflation.

To eliminate the distortions in non-tradable and domestic tradable goods, monetary policy $m_{it}$ should target $z_{it}$, whereas eliminating the distortion in foreign tradable goods depends on the pricing paradigms. Under PCP, LCP, DCP, and GCP, the monetary policies $m_{jt}$, $m_{it}$, $m_{1t}$, and $m_{gt}$ need to target $z_{jt}$ for any country $j$. The policy trade-offs underlying equations (3.2) to (3.5) in the baseline model remain unchanged.

**Country loss function.** Similarly, we can decompose country loss into three components, each arising from non-tradable goods, domestic tradable goods, and foreign tradable goods.

$$\mathbb{E}_0\left(\sum_{t=0}^{\infty}\beta^t(l_{it}-\tilde{l}_{it})\right)=\mathbb{E}_0\sum_{t=0}^{\infty}\beta^t\left[\underbrace{\frac{1}{2}v\left(\frac{\varepsilon}{\tilde{\theta}}\pi_{Nit}^2+(c_{Nit}-\tilde{c}_{Nit})^2\right)}_{\text{related to }(m_{it}-z_{it})^2}+\underbrace{\frac{1}{2}(1-v)n_i\left(\frac{\varepsilon}{\tilde{\theta}}\pi_{iit}^2+(c_{iit}-\tilde{c}_{iit})^2\right)}_{\text{related to }(m_{it}-z_{it})^2}\right.$$
$$\left.+\underbrace{\frac{1}{2}(1-v)\sum_{j\neq i}n_j\left(\frac{\varepsilon}{\tilde{\theta}}(\pi_{jit}^X)^2+(c_{jit}-\tilde{c}_{jit})^2\right)}_{\text{related to }(m_{xt}-z_{jt})^2,\ x\in\{j,i,1,b,g\}}\right]. \tag{5.1}$$

The above country loss function can be seen as the dynamic environment version of equations (3.17) to (3.20). Compared to the global welfare function, each country focuses solely on its own consumption deviation and corresponding inflation, resulting in different weights.

**Policy implementation.** The optimal policy implementation rule in the baseline model, as shown in Table 1, remains unchanged, with the focus shifting from targeting prices to targeting inflation, which demonstrates the robustness of our baseline model. There exists the open economy version of the Divine Coincidence Phillips Curve, similar to Rubbo (2023), where targeting the corresponding inflation can eliminate the

Table 2: The inflation targeting rule of country $i$, $i \in \{1, 2, ..., N\}$

| Pricing Paradigm | Cooperative Game | Nash game |
|---|---|---|
| PCP | $\pi_{Nit} = \pi^P_{ijt} = v\pi_{Nit} + (1-v)\sum_{j=1}^{N} n_j \pi^P_{ijt} = 0$ | |
| LCP | $v\pi_{Nit} + (1-v)n_i\pi_{iit} + (1-v)\sum_{j\neq i}^{N} n_j \pi^L_{jit} = 0$ | |
| DCP | a special case of GCP | a special case of GCP |
| CCP | $v\pi_{Nit} + (1-v)n_i\pi_{iit} = 0$ | |
| GCP | $vn_i\pi_{Nit} + (1-v)n_i^2\pi_{iit}$ $+(1-v)\alpha_i\sum_{j=1}^{N}(n_j(1-n_j)\pi^G_{j-jt}) = 0$ | $v\pi_{Nit} + (1-v)n_i\pi_{iit}$ $+(1-v)\alpha_i\sum_{j\neq i}(n_j\pi^G_{j-jt}) = 0$ |

trade-off between output gaps and inflation. We summarize the operation of monetary policy under PCP, LCP, DCP, CCP, and GCP under staggered prices as follows:

A detailed proof can be found in the appendix. Table 2 corresponds directly to Table 1, presenting the optimal monetary policy implementation rules under various pricing paradigms. Thus, the key conclusions of the baseline model remain robust in the dynamic setting, evident in several aspects: both global and country welfare follow a similar decomposition, policymakers face analogous trade-offs in implementing monetary policy, and the optimal money supply $m_{it}^{opt}$ is consistent across both dynamic and static models (this is proved in the appendix). Furthermore, for all pricing paradigms, monetary policy implementation remains stable in the dynamic model, shifting from price targeting to inflation targeting. The effects of global currency design are also analogous, ensuring that with productivity shocks alone, Proposition 1 still holds under staggered pricing.

## 5.2 Calibration

Our aim here is to provide some empirical insight regarding the performance of traded goods pricing under GCP relative to the existing international order under DCP. It is not clear exactly how to provide a such a quantitative comparison of the two systems using contemporaneous international data. We pursue this in two stages. First we offer a partial analysis by comparing DCP to an alternative that uses the IMF's Special Drawing Rights (SDR) as a potential basket currency to be used for GCP. Second, in subsection 5.4 below, we compute optimal GCP currency weights implied directly by our model, and compare these to an SDR system.

Building on the dynamic analysis in Section 5.1, we calibrate the model for 20 representative economies to evaluate welfare implications of using the SDR as the invoicing currency in trade. Parameters are categorized as either global (drawn from existing literature) or country-specific (calibrated using national data). In the model, the one-period represents a quarter. Our key parameterizations include: home bias $v = 0.4$ to reflect consumer preference for domestic goods; substitution elasticity $\varepsilon = 8$, implying a pre-subsidy price markup of approximately 15%; discount factor $\beta = 0.99$ corresponds to an annual real interest rate of approximately 4%; price stickiness $\theta = 0.75$ captures firms adjust their prices once a year on average; and autocorrelation

Table 3: Calibrated country-specific parameter values

| Country Name | Country Code | $n$ | $\alpha^{SDR}$ | $\sigma_z^2$ | $\sigma_{\mu,a}^2$ | $\sigma_{\mu,b}^2$ |
|---|---|---|---|---|---|---|
| United States | USA | 0.2955 | 0.4338 | 0.0672 | 0.0078 | 0.0242 |
| Euro area | EMU | 0.1994 | 0.2931 | 0.0559 | 0.0044 | 0.0376 |
| China | CHN | 0.1473 | 0.1228 | 0.3439 | 0.0534 | 0.0241 |
| Japan | JPN | 0.0746 | 0.0759 | 0.0998 | 0.0347 | 0.0983 |
| United Kingdom | GBR | 0.0478 | 0.0744 | 0.1026 | 0.0130 | 0.0543 |
| India | IND | 0.0295 | 0 | 0.4777 | 0.1987 | 0.0424 |
| Brazil | BRA | 0.0282 | 0 | 0.4774 | 0.1828 | 0.2998 |
| Canada | CAN | 0.0252 | 0 | 0.1082 | 0.0095 | 0.0431 |
| Korea, Rep. | KOR | 0.0223 | 0 | 0.1486 | 0.0182 | 0.0731 |
| Russian Federation | RUS | 0.0217 | 0 | 2.0687 | 0.3522 | 0.2421 |
| Australia | AUS | 0.0211 | 0 | 0.1252 | 0.0080 | 0.1070 |
| Mexico | MEX | 0.0193 | 0 | 0.3132 | 0.0355 | 0.1129 |
| Indonesia | IDN | 0.0124 | 0 | 0.4421 | 0.2206 | 0.0650 |
| Turkiye | TUR | 0.0123 | 0 | 0.7303 | 1.5062 | 0.2422 |
| Switzerland | CHE | 0.0112 | 0 | 0.0715 | 0.0089 | 0.0387 |
| Sweden | SWE | 0.0081 | 0 | 0.1221 | 0.0152 | 0.0721 |
| Poland | POL | 0.0074 | 0 | 0.1592 | 0.0527 | 0.1247 |
| Thailand | THA | 0.0062 | 0 | 0.3051 | 0.0483 | 0.0264 |
| South Africa | ZAF | 0.0054 | 0 | 0.2298 | 0.1777 | 0.2301 |
| Denmark | DNK | 0.0051 | 0 | 0.1461 | 0.0100 | 0.0383 |

*Note: Table 3 summarizes the country-specific parameters for the 20 economies included in our analysis. Column 3 presents the economic size measure $n_i$, while Column 4 displays the currency share $\alpha_i^{SDR}$ within the SDR basket. Additionally, the diagonal elements of $\mathbf{\Sigma}_z$, represented by $\sigma_z^2$, indicate the variance of productivity shocks among economies. And $(\sigma_{\mu,a}^2, \sigma_{\mu,b}^2)$, the diagonal elements of $(\mathbf{\Sigma}_{\mu,a}, \mathbf{\Sigma}_{\mu,b})$, represent the variances of monetary shocks measured by price changes and exchange rate fluctuations respectively.*

coefficients $\eta_z = 0.95$ for productivity shocks and $\eta_\mu = 0.5$ for monetary shocks since productivity shocks exhibit strong persistence while monetary shocks are more short-lived.

Table 3 reports country-specific parameters calibrated using annual data from 2002 to 2020. The country size parameter $n_i$, which simultaneously denotes the mass of consumers and firms in economy $i$, is measured by its averaged GDP share relative to the global economy. The global currency basket weight $\alpha_i$ corresponds to the IMF's 2022-2027 SDR valuation cycle. We calibrate cross-country covariance matrices $\mathbf{\Sigma}_z$ and $\mathbf{\Sigma}_\mu$ for productivity and monetary shocks. The productivity shock covariance matrix $\mathbf{\Sigma}_z$ is calibrated using the covariance of quarterly GDP data across countries. Monetary shocks $\mu_{it}$ in our complete markets framework, where exchange rates satisfy $e_{ijt} = m_{it} - m_{jt}$, capture both price shocks from unexpected money supply and financial shocks from noisy cross-border asset transactions. Thus, we adopt quarterly CPI covariance matrix($\Sigma_{\mu,a}$) as our baseline specification for calibrating $\mathbf{\Sigma}_\mu$, while reporting exchange rate covariance matrix ($\Sigma_{\mu,b}$) to ensure robustness. Smets and Wouters (2007) estimate the standard deviations of productivity and monetary shocks for the United States as 0.45 and 0.24, respectively. We normalize the covariance matrices $\mathbf{\Sigma}_z$ and $\mathbf{\Sigma}_\mu$ by proportionally scaling them to ensure that the size-weighted shock variances across countries satisfy:

$$\frac{\sum_{i=1}^{N} n_i \sigma_{zi}^2}{\sum_{i=1}^{N} n_i \sigma_{\mu i}^2} = \frac{0.45^2}{0.24^2} \tag{5.2}$$

where $\sigma_{zi}^2$ and $\sigma_{\mu i}^2$ are the diagonal elements of $\mathbf{\Sigma}_z$ and $\mathbf{\Sigma}_\mu$, representing the variances of productivity and monetary shocks for country $i$, respectively. The last three columns of Table 3 report each country's productivity shock variance along with monetary shock variances calibrated using two methods.

### 5.3 Welfare Analysis under SDR Pricing

The welfare loss computation method follows Gali and Monacelli (2005) and Rubbo (2023). Economies experience period-0 productivity and monetary shocks, then we compute equilibrium impulse response functions as in Schmitt-Grohé and Uribe (2004) and record each country's welfare losses using equation (5.1). Final welfare loss outcomes are simulation averages over shock realizations preserving $\mathbf{\Sigma}_z$ and $\mathbf{\Sigma}_\mu$.

Figure 2 demonstrates the welfare loss across various countries under four pricing paradigms under cooperative monetary policies. Due to monetary shocks being relatively small compared to productivity shocks, PCP significantly outperforms the other pricing paradigms. LCP performs the worst; in countries with unstable monetary shocks, particularly emerging markets like Russia and Turkey, it brings huge negative impacts because import consumption is heavily affected by volatile domestic prices. DCP and GCP, as single-currency pricing specifications, yield welfare levels between those of PCP and LCP.

Table 4 records the percentage of welfare improvement of GCP compared to DCP under two monetary policies, allowing for both cooperative and non-cooperative monetary policy regimes. Based on their distinct roles in the international pricing system, we categorize the 20 countries into three groups: the United States,

Table 4: Relative welfare improvement of GCP (using SDR) compared to DCP

| | Cooperative policy | | | Non-cooperative policy | | |
|---|---|---|---|---|---|---|
| | $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$ | $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,b})$ | i.i.d. | $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$ | $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,b})$ | i.i.d. |
| United States | 16.954% | 17.596% | 35.959% | 12.405% | 13.162% | 31.797% |
| Euro area | -2.929% | -1.758% | -1.074% | 0.492% | 1.569% | 2.531% |
| China | -1.444% | 0.015% | 4.341% | 0.237% | 1.720% | 9.175% |
| Japan | -0.436% | 0.681% | 4.973% | 2.522% | 3.587% | 10.614% |
| United Kingdom | -3.022% | -1.708% | 3.576% | 2.318% | 3.464% | 10.846% |
| India | 0.933% | 2.361% | 6.431% | 2.030% | 3.571% | 11.292% |
| Brazil | 1.173% | 2.221% | 6.444% | 2.436% | 3.417% | 11.314% |
| Canada | 1.177% | 2.404% | 6.419% | 2.484% | 3.685% | 11.285% |
| Korea, Rep. | 1.090% | 2.285% | 6.437% | 2.360% | 3.511% | 11.303% |
| Russian Federation | 1.271% | 2.734% | 6.443% | 2.593% | 4.143% | 11.312% |
| Australia | 1.130% | 2.276% | 6.443% | 2.416% | 3.492% | 11.311% |
| Mexico | 1.102% | 2.284% | 6.431% | 2.360% | 3.489% | 11.296% |
| Indonesia | 0.999% | 2.366% | 6.422% | 2.148% | 3.617% | 11.278% |
| Turkiye | 0.639% | 2.267% | 6.407% | 1.371% | 3.484% | 11.259% |
| Switzerland | 1.125% | 2.372% | 6.414% | 2.414% | 3.638% | 11.267% |
| Sweden | 1.120% | 2.333% | 6.402% | 2.410% | 3.582% | 11.254% |
| Poland | 1.073% | 2.245% | 6.404% | 2.321% | 3.447% | 11.253% |
| Thailand | 1.085% | 2.381% | 6.405% | 2.339% | 3.645% | 11.253% |
| South Africa | 1.026% | 2.146% | 6.410% | 2.206% | 3.300% | 11.260% |
| Denmark | 1.136% | 2.391% | 6.414% | 2.436% | 3.668% | 11.269% |
| Dominant country (USA) | 16.954% | 17.596% | 35.959% | 12.405% | 13.162% | 31.797% |
| Four other SDR countries | -2.111% | -0.865% | 2.178% | 0.993% | 2.189% | 6.958% |
| Non-SDR countries | 1.064% | 2.343% | 6.428% | 2.264% | 3.585% | 11.290% |
| All countries | 5.051% | 6.122% | 15.677% | 5.000% | 6.102% | 16.718% |

*Note: Table 4 presents the percentage increase in welfare for using SDR compared to DCP across two monetary policies. Under each policy, the first two columns use the estimated shock covariance, specifically* $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$ *and* $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,b})$*. To eliminate the impact of shock differences between countries on welfare, the third column assumes i.i.d. shocks, with productivity and monetary shocks following* $\mathcal{N}(0, 0.45^2)$ *and* $\mathcal{N}(0, 0.24^2)$ *respectively. We group the 20 countries into three categories: (1) the USA (standalone), (2) four other SDR countries, and (3) 15 non-SDR countries, and compute their respective relative welfare gains using size-weighted averages.*

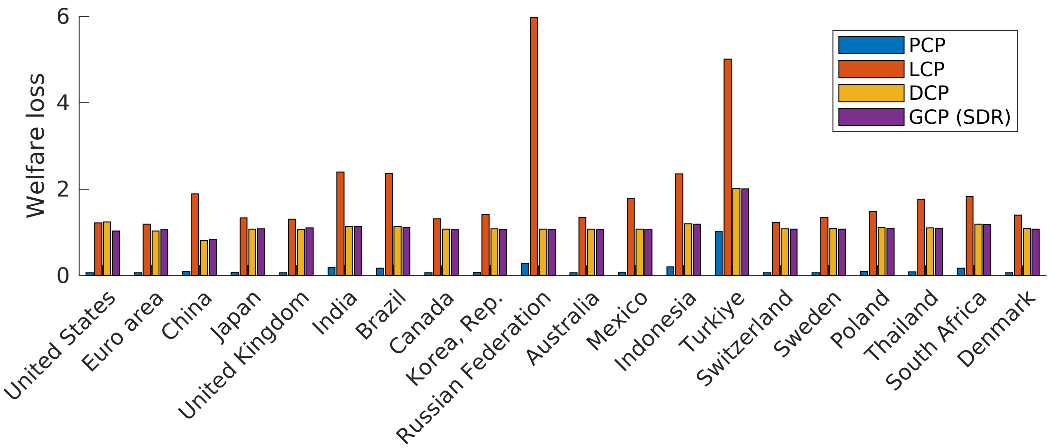


Figure 2: Calibrated countries' welfare loss under cooperation $(\Sigma_z, \Sigma_{\mu,a})$

*Note: Figure 2 shows 20 country's welfare loss under cooperative monetary policies. All countries commit to the optimal cooperative monetary policy to deal with productivity shocks while the money supply experience unexpected monetary shocks. The productivity shocks draw from $\mathbf{\Sigma}_z$ and monetary shocks draw from $\mathbf{\Sigma}_{\mu,a}$.*

four other SDR countries, and fifteen non-SDR economies. It is notable that the US gains far more than any of the other groups. This is because the use of the dollar in international pricing leads the US to skew its monetary policy away from offsetting domestic shocks in an efficient manner. In contrast, under SDR pricing, the monetary policies of the remaining four SDR countries become more oriented toward international trade adjustment at the expense of domestic stabilization. As a result, these four countries exhibit either welfare deterioration (in a cooperative equilibrium) or modest gains (under non-cooperation) relative to the DCP framework. The fifteen non-SDR countries, whose currencies are not used for trade invoicing under either pricing paradigm, continue to conduct monetary policy that efficiently stabilizes domestic shocks after adopting SDR pricing. The increased currency diversification in international trade pricing system provides additional welfare benefits, yielding positive – though much smaller than the U.S. – welfare gains across all fifteen economies.

## 5.4 Optimal Global Currency Design

While previous analyses assume an SDR-identical global currency composition, the SDR basket is not welfare-optimal. We therefore derive the quantitatively optimal currency basket design. Table 5 presents the results, showing four specifications: $(\alpha^{coop,a}, \alpha^{coop,b})$ for cooperative policies and $(\alpha^{non,a}, \alpha^{non,b})$ for non-cooperative policies, each calibrated under monetary shock structures $\mathbf{\Sigma}_{\mu,a}$ and $\mathbf{\Sigma}_{\mu,b}$ respectively. All four optimal configurations closely approximate $\alpha^*$ from Proposition 1. This similarity stems from two reasons: (1) the significantly higher volatility of productivity shocks relative to monetary shocks, as calibrated in equation (5.2), drives cooperative solutions to converge to $\alpha^*$ — the optimal global currency design derived exclusively under productivity shocks; (2) with a high home bias parameter of $v = 0.4$, monetary policies under both cooperative and non-cooperative regimes prioritize domestic stabilization to such a degree that

Table 5: Optimal global currency design

| Country Name | $\alpha^{SDR}$ | $\alpha^{*}$ | $\alpha^{coop,a}$ | $\alpha^{coop,b}$ | $\alpha^{non,a}$ | $\alpha^{non,b}$ |
|---|---|---|---|---|---|---|
| United States | 0.4338 | 0.2482 | 0.2555 | 0.2629 | 0.2433 | 0.2530 |
| Euro area | 0.2931 | 0.1903 | 0.1909 | 0.1974 | 0.1847 | 0.1893 |
| China | 0.1228 | 0.1498 | 0.1520 | 0.1534 | 0.1496 | 0.1515 |
| Japan | 0.0759 | 0.0823 | 0.0786 | 0.0800 | 0.0837 | 0.0842 |
| United Kingdom | 0.0744 | 0.0543 | 0.0489 | 0.0491 | 0.0526 | 0.0518 |
| India | 0 | 0.0341 | 0.0324 | 0.0349 | 0.0323 | 0.0351 |
| Brazil | 0 | 0.0327 | 0.0306 | 0.0304 | 0.0304 | 0.0303 |
| Canada | 0 | 0.0293 | 0.0352 | 0.0274 | 0.0377 | 0.0303 |
| Korea, Rep. | 0 | 0.0260 | 0.0230 | 0.0237 | 0.0244 | 0.0249 |
| Russian Federation | 0 | 0.0253 | 0.0246 | 0.0257 | 0.0247 | 0.0253 |
| Australia | 0 | 0.0247 | 0.0250 | 0.0222 | 0.0247 | 0.0224 |
| Mexico | 0 | 0.0226 | 0.0248 | 0.0230 | 0.0222 | 0.0218 |
| Indonesia | 0 | 0.0146 | 0.0133 | 0.0161 | 0.0128 | 0.0148 |
| Turkiye | 0 | 0.0145 | 0.0132 | 0.0133 | 0.0133 | 0.0136 |
| Switzerland | 0 | 0.0132 | 0.0150 | 0.0123 | 0.0183 | 0.0156 |
| Sweden | 0 | 0.0095 | 0.0096 | 0.0057 | 0.0118 | 0.0076 |
| Poland | 0 | 0.0088 | 0.0080 | 0.0024 | 0.0125 | 0.0074 |
| Thailand | 0 | 0.0073 | 0.0098 | 0.0071 | 0.0102 | 0.0077 |
| South Africa | 0 | 0.0064 | 0.0053 | 0.0050 | 0.0065 | 0.0055 |
| Denmark | 0 | 0.0061 | 0.0042 | 0.0078 | 0.0043 | 0.0077 |

*Note: Table 5 reports the weights for six different global currency designs. The first, $\alpha^{SDR}$, denotes an SDR-like global currency with weights corresponding to the IMF's 2022-2027 SDR valuation cycle. The second, $\alpha^{*}$, represents the global currency composition derived in Proposition 1. The subsequent four columns, $(\alpha^{coop,a}, \alpha^{coop,b}, \alpha^{non,a}, \alpha^{non,b})$, represent the optimal alpha calibrated under monetary shocks using $\mathbf{\Sigma}_{\mu,a}$ and $\mathbf{\Sigma}_{\mu,b}$ for cooperative and non-cooperative policies, respectively.*

their equilibrium outcomes converge.

Although the optimal global currency basket closely approximate $\alpha^{*}$ from Proposition 1, non-negligible deviations occur. For instance, under cooperative policy with $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$, more inflation-stable economies, e.g., the U.S., Eurozone, Canada, and Switzerland, exhibit slightly higher weights in $\alpha^{coop,a}$ than in $\alpha^{*}$. The Chinese case presents a more nuanced pattern: despite its higher monetary shock variance ($\sigma^2_{\mu,a} = 0.0534$ in Table 3), its $\alpha^{coop,a}$ weight also exceeds $\alpha^{*}$. This occurs because China's monetary shocks display negative correlations, providing valuable risk diversification, analogous to an insurance mechanism in the currency basket.

Table 6 compares the relative welfare improvement compared with DCP under three global currency arrangements — an SDR-like basket, the theoretical optimum from Proposition 1 when only productivity shock occurs ($\alpha^{*}$), and the quantitative optimal design ($\alpha^{coop,a}$) — for the case with cooperative monetary policy and shocks drawn from $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$. Quantitatively, the SDR yields a 5.051% welfare improvement over DCP, whereas the optimized $\alpha^{coop,a}$ achieves 8.510% gains. Under SDR pricing, the four non-U.S. SDR

Table 6: Relative welfare improvement compared with DCP under cooperation $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$

| | $\alpha^{SDR}$ | $\alpha^*$ | $\alpha^{coop,a}$ |
|---|---|---|---|
| Dominant country (USA) | 16.954% | 23.163% | 23.150% |
| Four other SDR countries | -2.111% | 0.981% | 0.989% |
| Non-SDR countries | 1.064% | 1.421% | 1.435% |
| All countries | 5.051% | 8.508% | 8.510% |

*Note: Table 6 quantifies the welfare gains of three alternative global currency designs—an SDR-like basket ($\alpha^{SDR}$), the theoretical optimum with only productivity shocks as shown in Proposition 1 ($\alpha^*$), and the calibrated optimal design ($\alpha^{coop,a}$)—relative to the DCP benchmark, assuming cooperative policies and shocks drawn from $(\mathbf{\Sigma}_z, \mathbf{\Sigma}_{\mu,a})$.*

countries bear responsibilities in maintaining the international pricing system, resulting in welfare losses for these economies. In contrast, the optimal allocation $\alpha^{coop,a}$ distributes these stabilization burdens across all participating countries, leading to universal welfare improvements — with particularly significant gains for the United States.

Another interesting quantitative implication of Table 6 is the difference in welfare between $\alpha^*$ and $\alpha^{coop,a}$ is minimal. Even though the introduction of monetary shocks lead the optimal global currency design to deviate from the theoretical value in Proposition 1, our simulation results show that the performance of the $\alpha^*$ defined in Proposition 1 is still quite good — particularly when compared to the quantitatively optimized $\alpha^{coop,a}$. More broadly, given the empirical challenges in measuring the degree of policy coordination and shock variances, our analysis demonstrates that while $\alpha^*$ may not be theoretically optimal under non-cooperative policies or monetary shocks, it remains a reasonably effective solution when accounting for both the greater volatility of productivity shocks and significant home bias in data.

# 6 Conclusion

This paper has explored the positive and normative consequences of a global currency which could replace the US dollar as the predominant invoicing currency for international trade. We derived the implications for exchange rate pass through and real allocations of the use of the global currency and compared this to existing invoicing assumptions used in the literature, such as PCP, LCP, or the more common DCP. Our key result is that there exists a unique composition of an optimal global currency which allows each country to focus purely on domestic objectives. This global currency composition replicates an outcome where there is a separate currency used for international trade invoicing completely independent from the monetary policies of the member countries. In an optimal global currency basket, the currency of all countries should be included, large countries should be underweighted, and no one country should have a share greater than 50 percent. While this optimal currency basket can be exactly described under global monetary cooperation, we found that the global welfare maximizing basket is almost identical even in the case of non-cooperative policy making.

We showed also that a global currency could welfare dominate any other pricing system in the presence of monetary or financial shocks. This is because the optimal currency basket effectively dilutes the effect of individual countries monetary or financial shocks on global allocations. Extending the model to a full dynamic environment and calibrating to 20 countries, we show the consequences of a switch from the current DCP system to a GCP using the IMF's SDR as a basket. In this case, we found that the US should gain, but other SDR members may lose, depending on whether policy making is made cooperatively or non-cooperatively. By contrast, moving from a DCP system to a GCP system using the optimal GCP basket based on our model allows all countries to gain, whether monetary policy is determined cooperatively or non-cooperatively.

An important unanswered question in the present paper is how a GCP pricing outcome could arise endogenously as an invoicing choice for firms in a world where network externalities lead to the continued dominance of dollar pricing. In online Appendix C we derive conditions under which the launch of a global currency could lead to an endogenous adoption at the level of individual firms. We leave a full analysis of this question as a subject for future research.

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