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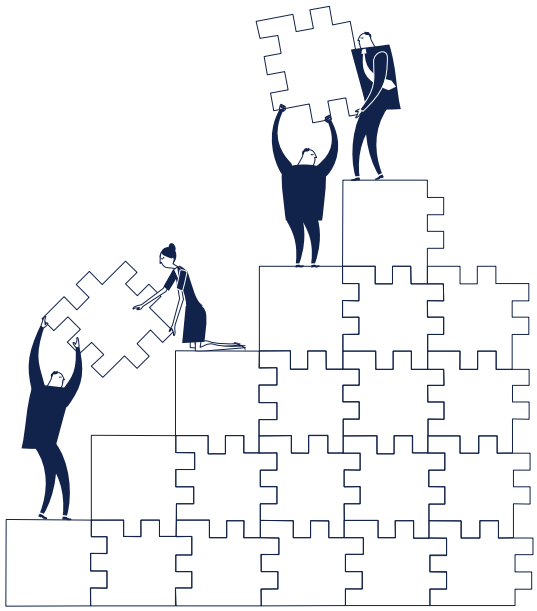

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Debt Restructuring for the Eurozone[1]

Dimitrios P. Tsomocos[2] and Xuan Wang[3]

Abstract: The Eurozone Debt Crisis has rekindled the debate on the nexus between currency areas and fiscal sovereigns. After the crisis, much of the intellectual and political debate has been on the benefit of a fiscal union, the idea of creating a common fiscal entity that is well equipped to make state-contingent cross-country transfers within the eurozone. Although the role of a benevolent fiscal union can in theory be welfare-improving for a currency union, it is understood that this is a highly politically constrained option, particularly in the Eurozone. Given this constraint, in this paper, we take the implausibility of fiscal union as given, and argue that debt restructuring can be a close substitute to a fiscal union, leading to welfare improvement. In contrast to a fiscal union that resorts to the government's *visible* hand to move nominal resources across countries, the debt restructuring plan designs the bankruptcy rules, but it allows the *invisible* hand of the markets to make the choice based on context-dependent incentives. Much of the insight in this paper originates from Goodhart, Peiris and Tsomocos (2018) and Wang (2019). The authors show that debt restructuring is particularly vital in currency unions and can lead to significant welfare improvement for both the debtor and the creditor, given a hard government budget constraint. A wider implication of this paper is that for the understanding of modern monetary and financial phenomena, particularly the viability of a currency union, we simply cannot ignore the interplay of liquidity and default.

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1 Introduction

The Eurozone Debt Crisis has rekindled the debate on the nexus between currency areas and fiscal sovereigns. Goodhart (1997, 1998) presents a wide range of historical evidence on the intertwining relationship between the monetary arm and the fiscal arm of the government. That is, very rarely were fiscal sovereigns and monetary authorities majorly decoupled. Shedding light on the creation of euro, Goodhart (1998) argues that the creation of common currency in Europe begs the question of what would constitute the common fiscal entity. In a similar spirit, but perhaps with a much more pessimistic tone, Friedman (1997) feared that the creation of a common currency in Europe would eventually lead to political disunity, the very situation that creating the euro were wishfully designed to avoid.

Perhaps, the euro crisis vindicated these author's arguments and concerns. After the crisis, much of the intellectual and political debate has been on the benefit of a fiscal union, the idea of creating a common fiscal entity that is well equipped to make state-contingent cross-country transfers within the eurozone. For example, in Farhi and Werning (2017), the authors build a small open economy model of a currency union, and they show even if financial markets within the currency union are highly sophisticated (i.e. markets are complete), with nominal rigidities present, privately optimal risk sharing fails to obtain in equilibrium. Therefore, a role naturally emerges for a fiscal union to implement constrained efficient state-contingent tax transfers within a currency union. In our view, the design of the series of state-contingent tax transfers at the core points to the creation of a union-wide safe assets, the design and implementation of which are more nuanced.

Although the role of a benevolent fiscal union can in theory be welfare-improving for a currency union, even if we suppose a fiscal union could turn out benevolent in reality, it is understood that this is a highly politically constrained option, particularly in the Eurozone. The presence of fiscal union is partially based on the US or China model. In the US, different states share the same US dollar, but a federal government is in place to make transfers across states if need be. Similarly, in China, different provinces differ in economic fundamentals, and labour is arguably much less mobile than that in the US or Europe, but the Chinese central government is in the position capable of making fiscal transfers across provinces. These institutional arrangements are difficult to implement in the Eurozone, for political, cultural, and historical reasons. Given this constraint, in this paper, we take the implausibility of fiscal union as given, and argue that debt restructuring can be a substitute to a fiscal union, leading to welfare improvement. In contrast to a fiscal union that resorts to the government's *visible* hand to move nominal resources across countries, the debt restructuring plan designs the bankruptcy rules, but it allows the *invisible* hand of the markets to make the choice based on context-dependent incentives (see Wang 2019).

There is an emerging body of literature that investigates debt restructuring in the context of currency union (see Adam and Grill 2017, Goodhart et al. 2018, Wang 2019). Much of the insight in this paper originates from Goodhart, Peiris and Tsomocos (2018) and Wang (2019). Conventionally, the debate on the costs and benefits of default and debt restructuring has primarily focused on the debtor, and the effects on the creditors have been largely ignored or assumed to be negative. However, in Goodhart et al. (2018), the authors build a structural model of Greece and Germany and show that debt

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restructuring for Greece can actually benefit both the debtor (Greece) and the creditor (Germany), given a hard government budget constraint. This is because debt forgiveness lowers the volatility of both German and Greek consumption whereas demanding higher recovery rates has the opposite effect. Under certain conditions, the authors demonstrate that the short-term loss of Germany being more forgiving on Greek debt restructuring would be matched by long-term higher returns from their remaining investments in Greece. This leads to an overall lower volatility of German consumption and welfare improves.

In a similar spirit, Wang (2019) provides a specific rationale why debt restructuring is particular vital in a currency union. Wang (2019) develops a two-country international finance model with uncertainty in a currency union. In this paper, four regimes are considered: (A) a currency union with no fiscal union and a harsh international bankruptcy code; (B) a currency union with a fiscal union and a harsh international bankruptcy code; (C) a currency union with no fiscal union and the tolerance of international debt restructuring; D) national currencies with no fiscal union and a harsh international bankruptcy code. The model shows the allocation efficiency, risk sharing and asset price dynamics in these four regimes and suggests that debt restructuring can *mostly* substitute fiscal union and is welfare-improving *particularly* in a currency union. To clearly illustrate the point that cross-country debt restructuring can compensate for the loss of credible floating exchange rate, the author abstracts away from moral hazard issues from national governments, such that the need for debt restructuring purely stems from the loss of credible floating exchange rate. In the following sections, we shall discuss the conceptual framework, intuition and rationale in more detail.

In Section 2, we review the theoretical argument for the benefit of default; Section 3 provides the conceptual framework of international finance with money and default that can be easily extended to analyse currency union issues. Using this conceptual framework, in Section 4 we discuss why debt restructuring is particularly important in a currency union. In Section 5, we explain how to design bankruptcy codes such that debt restructuring improves resource allocation and risk sharing in a currency union. Section 6 concludes.

2 The Role of Default for Welfare Improvement

Policy arena tends to associate default or debt restructuring with disequilibria and mis-allocation, and equally, academic literature traditionally tends to emphasise the *ex post* cost of default and the inefficiency associated with debt restructuring. However, this does not mean the welfare property of default and debt restructuring is not worth studying, nor does it mean default and debt restructuring are inconsistent with the orderly function of markets. As a matter of fact, in 'Default and Punishment in General Equilibrium' by Dubey, Geanakoplos and Shubik (2005), the authors prove in general equilibrium with incomplete markets, that under very general conditions, refined equilibrium with default always exists in the model, and under some conditions, default can be welfare-improving, despite its social cost.

The idea that default or debt restructuring could be welfare-enhancing despite its social cost may seem surprising, but the mechanism is well understood in the general equilibrium literature with incomplete markets. In Dubey et al. (2005), the authors

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illustrate with an example that features incomplete markets, and they show the tolerance for intermediate default leads to Pareto improvement. This is because default is a choice variable and with an intermediate penalty, it endogenises the asset payoffs. With incomplete markets, default increases the asset span and obtains greater risk sharing. In a similar spirit, Adam and Grill (2017) applies this insight to sovereign default in a currency union. The authors show that with idiosyncratic domestic production risk and non-contingent government debt, it is *ex ante* optimal to occasionally deviate from the legal repayment and default partially. Moreover, a careful quantitative analysis is conducted in this paper, suggesting the Greek debt restructuring in 2012 was not sufficient.

However, given the "diabolic" loop between the government debt and private debt (Brunnermeier et al. 2016) and the sophistication of financial markets to hedge risks, the assumption of non-contingent debt seems strong. In particular, as Kehoe and Pastorino (2017) suggest, if financial markets are complete, it is not clear why optimal risk sharing would not be attainable in a currency union. We argue even if the international financial markets in a currency union are highly sophisticated, i.e. a complete set of financial securities are available for trade vis-à-vis the number of states of uncertainty, optimal risk sharing does not obtain in a currency union in the presence of credit risks. Section 3 sets out the framework for understanding the underlying rational, and the theoretical proof can be found in Wang (2019) by relating endogenous credit risks with (the loss of) floating exchange rate.

3 International Finance with Money and Liquidity

To appreciate why debt restructuring is particularly vital in a currency union, one needs to understand the issuing process of fiat money and the exact relationship between money and credit. Although the benefit of entering the currency union (e.g. reducing transaction cost, removing exchange rate risks, controlling inflation) is well understood, the cost of joining the union seems downplayed. In this section, we start by looking at the relationship between money and credit, then detail the process of fiat money issuance via the banking sector, and then provide the theoretical argument for the nexus between currency areas and fiscal sovereigns. By understanding the nature of fiat money, we should be able to trace the root of the problem and see how the removal of a credible exchange rate can transfer credit risks into the banking sector at the national level.

3.1 Money, Credit and Banking

Modern monetary and banking system operate via fiat money. Fiat money, different from commodity money, is a special type of credit and does not serve direct utility values. Its supply, rather than being fixed or exogenous as in the commodity money case, can be elastic depending on the monetary policy rate and financial conditions. In practice, when a borrower applies for loans from a commercial bank, this commercial bank credits deposits to the borrower's bank account simultaneously. When deposits are withdrawn or moved across banks, then commercial banks swap safe assets with central bank reserves subject to a transaction cost, i.e. policy rate. The central bank acts

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as a settlement bank connecting all the private commercial banks, extending liquidity in its currency as the ultimate issuer of fiat money (see McLeay et al. Bank of England). This operational fact was extensively written about by early economists when the banking sector just started booming (see Macleod 1866, Wicksell 1906, Hahn 1920, Hawtrey 1919, Schumpeter 1934, 1954, Keynes 1931). What lies at the heart of this operation, i.e. fiat money issued against bank credit, is the IOU nature of money.

However, it is understood that many recent micro-founded monetary models abstract money completely away from banking and credit and that these models tend to have very limited scope to provide insight on the nominal forces and their impact on the real economy and debt crisis (see discussions in Tsomocos 2003, Piazzesi and Schneider 2018, Tsomocos and Wang 2019). Thus, to meaningfully model and provide the scope for policy in the context of the Eurozone Debt Crisis, we purposefully resort to the general equilibrium theory of money that has rigorously incorporated the credit nature of money (see Grandmont and Younes 1972 1973, Shubik and Wilson 1977, Dubey and Geanakoplos 2003b 2006, Drèze and Polemarchakis 2001, Tsomocos 2003). In this body of literature, money issued against an offsetting debt obligation whose repayment guarantees money's exit from the economic system is termed as *Inside Money*, and money clear of debt obligation is referred to as *Outside Money*. One insight from these works is that an important role for banks is to provide the value of fiat money (Dubey and Geanakoplos 1992). Extending this framework to an international finance model, both the value of fiat money and the exchange rate determination can be studied alongside banking. We view an international finance model that incorporates inside money and banking liquidity as a natural laboratory to study currency union debt sustainability and debt restructuring.

To the best of our knowledge, the seminal works that incorporates inside money and banking liquidity in an international finance framework are Geanakoplos and Tsomocos (2002), Tsomocos (2008) and Peiris and Tsomocos (2015), on which the currency union model in Wang (2019) is based. In 3.2, we summarise the key ingredients and insights of this suite of models. Sensible modifications of these models can establish a tractable analytical framework suited to investigate Eurozone debt restructuring (Section 4).

3.2 Modelling Framework

Key features

We synthesise the key features of Geanakoplos and Tsomocos (2002), Tsomocos (2008), Peiris and Tsomocos (2015) and Wang (2019). The summary is provided as follows.

- Inside money issued against bank credit

  Fiat money is the stipulated means of exchange in this economy, and inside money is issued against an offsetting bank credit which carries credit risks. Money also serves as a store of value and flows across and through budget

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constraints. Agents need to use fiat money for transactions, asset payoffs and loan repayment.

- Value of money, price of money, exchange rate, and interest rate

  Modelling inside and outside money in a general equilibrium with incomplete markets establishes equilibrium existence and achieves both real and nominal determinacy. In particular, without appealing to nominal rigidity, price level determinacy allows us to relate inflation to borrowers' credibility and bankruptcy procedure. The following definitions relating to money are coherently and precisely depicted in the model: 1) value of money refers to the inverse of price level, i.e. how much is a unit of money worth in terms of real goods. It is the relative price between money and goods; 2) price of money is the relative price between money and money itself. By Walras' Law, it is one; 3) exchange rate is the relative price between one type of money and another type of money; 4) interest rate is the relative price between bank credit and money.

- Idiosyncratic and aggregate risks

  Both idiosyncratic income risks and aggregate endowment risks can be captured because the model is general enough to include multiple types of goods and uncertainty relating to multiple types of endowments. These fundamental risks can translate into credit risks when borrowers evaluate the state-dependent marginal benefit of default and the marginal cost of default.

- Incomplete risk sharing and nominal assets

  There are multiple nominal assets available to hedge the risks, but the assets do not need to fully span the states of uncertainty. In the case when the assets do not fully span, markets are incomplete, giving rise to a non-trivial role for policy to improve welfare. Particularly, assets payoffs are in terms of fiat money, rather than consumption goods or goods bundles, and the monetary payoff eventually flows back to the banking sector to (partially) extinguish the loans. This is not only important for evaluating the bankruptcy conditions of the banking sector, but also key to appreciating the viability of a currency union. This is because asset payoffs are in terms of fiat money currencies, and the exchange rate or the removal of exchange rate between different currencies could alter asset span in the presence of credit risks, generating additional nominal and real effects.

- Inter-temporal decision for consumption smoothing

  The standard consumption smoothing can be carried out via money or nominal assets. The state prices or the Euler equation is thus affected by agent heterogeneity, liquidity premia and credit risk premia. The implication of financial intermediary, liquidity and default on asset pricing can be studied simultaneously.

- Endogenous default

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Strategic default is modelled a la Shubik and Wilson (1977) and Dubey et al. (2005). A default penalty parameter λ is assumed that can be interpreted as the harshness of the terms for debt restructuring. And the total cost of default is non-pecuniary and increases with the real value of the defaulted amount. Thus, the model produces the classic Fisherian debt deflation mechanism via money and default (Fisher 1933). In our view, this modelling approach is comprehensive enough to capture a wide range of default punishment that could go beyond direct market/credit exclusion and pecuniary costs. Indeed, as Wang (2019) argues, particularly in the case of currency union debt crisis, a harsh non-pecuniary default could result in austerity tax and internal devaluation. However, the cost of austerity tax and internal devaluation go beyond a direct pecuniary penalty because these costs are not a direct deadweight loss in the budget sets.

Basic Economic Environment

Geanakoplos and Tsomocos (2002), Tsomocos (2008), and Peiris and Tsomocos (2015) build a general framework for international finance models in which trade, monetary forces and financial frictions can be studied simultaneously. Here we describe a two-period general equilibrium with incomplete markets (GEI) augmented with money, liquidity and default to synthesise these three papers and to summarise the basic economic environment. There are multiple countries in this economy, and in each country, there are many households that can differ in their endowments and preferences. A variety of perishable goods are also modelled but they cannot be inventoried between periods. Each good is associated with a single country. Every good is assumed to be present in international trade, and no household has the null endowment of goods in any time period. In the second period, there are a finite number of states relating to households' endowment structure, and a set of nominal financial securities are available for trade in the first period for risk sharing.

Each country has a central bank to issue national currencies (inside money) against loans, and exchange rate can be determined via foreign exchange rate markets. Various frictions of the foreign exchange markets and exchange rate regimes (e.g. managed floating, currency board system, central bank sterilisation) can be incorporated to analyse their implications for economic allocation and asset prices. To model a currency union, Wang (2019) removes the foreign exchange markets and only models one central bank as the ultimate Lender of Last Resort in the open economy. Moreover, borrowers in this economy are subject to default penalties, and choose asset deliveries and loan repayments.

3.3 Main Insight

In this suite of models, we can prove equilibrium existence and determinacy (see the theorems in Geanakoplos and Tsomocos 2002 and Tsomocos 2008). Price-level determinacy obtains due to seigniorage transfer and/or default. Given that exchange rate is the relative price between different currencies, exchange rate is also determined in this suite of models due to seigniorage transfer and/or default.

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This is particularly important to our understanding of many modern monetary phenomena. To help pin down inflation determinacy in monetary and international finance modelling, we do not need sticky prices, *a priori* that exogenously decouples price stability from borrowing and default. However, a glimpse into a myriad of historical episodes of hyperinflation and currency crises can tell us that price stability and capital flight are sensitive to financial conditions, but not so much to exogenous inflexibility of adjusting goods prices and wages.

Another main result is the general non-neutrality of money and its implication for banking insolvency in a currency union. In this suite of models, the change of monetary policy alters both inflation, default risks and real allocation, and the reason is purely financial. This is because monetary policy rate serves as a transaction cost that enters agents' financing decision as a marginal cost of financing. A rise in monetary policy rate increases borrowing cost and the marginal cost of financing, which can stifle trade and production, and lead to a contraction of endogenous money supply. The fall in price level increases the debt burden, hence, the marginal cost of default, causing further default and non-performing loans, which may result in banking insolvency. This has second round effect to the borrowing cost in the economy because the term structure of the interest rate includes default risk premia and is likely to further drive up the borrowing cost.

Following this line of logic, monetary policy is naturally tied to the liquidity condition or even the solvency condition of the domestic banking system. In a currency union, a union-wide monetary policy is constrained from fulfilling the liquidity demand of various national-level banks. Therefore, it does not seem all that surprising that some national banks inevitably run into solvency issues in the currency union.

4 Why Debt Restructuring is Particularly Vital in Currency Unions

So far, the theory suggests that seigniorage transfer and/or default achieves price-level determinacy, money has value, and that exchange rate is determined in equilibrium. In this section we argue, once a regime such as currency union fixes the exchange rate to one at all times, this nominal friction will eventually bite the domestic banking system. Without debt restructuring, national government needs to resort to austerity tax and interval devaluation to bail out banks, giving rise to a divergent growth pattern within the currency union.

4.1 Seigniorage, Inflation and Credibility

To illustrate our points precisely, we use Equations (1) and (2) that are different versions of the Quantity Theory of Money obtained from the abovementioned suite of models. These equations could also help us understand the economic reason why some countries chose to join the Eurozone in the first place. Although the precise form of the expressions can vary depending on the specific structural assumptions, the gist remains.

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$$\sum_{\{h\in H\}}\sum_{\{l\in L\}} p_l q_l^h + \sum_{\{h\in H\}}\sum_{\{m\in S\}} \pi_m \theta_m^h = M + \sum_{\{h\in H\}} m^h \qquad (1)$$

$$\sum_{\{h\in H\}}\sum_{\{l\in L\}} p_l q_l^h + \sum_{\{h\in H\}}\sum_{\{m\in S\}} \pi_m \theta_m^h = M + \sum_{\{h\in H\}} d^h \qquad (2)$$

Equation (1) relates price-level determinacy and inflation dynamics to seigniorage transfer, which is the nexus with the fiscal sovereign. l indexes the type of perishable good that belongs to the set of all types of goods L, h indexes the household that belongs to the set of all households H, and m indexes the financial asset that belongs to the set of all financial assets S. p denotes the price of goods, q denotes the quantity of goods trade, π denotes asset prices, θ denotes asset positions. Particularly, M is the aggregate amount of inside money issued against bank credit. In modern monetary and banking architecture, central banks do not set M but decide on the policy rate. In the model, given the policy rate, M is endogenously determined in equilibrium. m^h is any monetary endowment or outside money held by household h and can be infinitesimally small. Along with inside money, it is used to facilitate transactions. The total amount of ϵ flows through the budget constraints and contributes to interest payment, and it eventually becomes the government's seigniorage.

The key to establishing price level determinacy is that the seigniorage collected by the government through interest rate payments are not reinjected to the economy in the same period. Thus, the government budget constraints need not be satisfied in very period and in this sense fiscal policy is non-Ricardian (Buiter 1991, Sims 1994). Indeed, as Goodhart (1997) argues, seigniorage can be considered as part of government's taxation plan, and as Shubik put it, it is the "institutionalised symbol of trust". In our view, seigniorage is the nexus between currency areas and fiscal sovereigns, supported by the empirical regularity that a well-functioning state has its own monetary power, despite the fact that the monetary authority and the fiscal authority are operationally separate. As Wang (2019) shows, part of the economic issue of a currency union is the split of seigniorage, as it is collected by a union-wide central bank, rather than by national central banks that could coordinate with their own national governments.

The difference between Equation (2) and Equation (1) is that Equation (2) replaces seigniorage with the aggregate default $\sum_{\{h\in H\}} d^h$. As Lin et al. (2016) prove, even without outside money, positive default in every state of the world on some long-term loan endogenously creates positive liquid wealth that supports positive interest rates and both nominal and real determinacy obtains. A non-Ricardian policy across loans markets allows the central bank to earn seigniorage to compensate for any losses. In other words, a credible and consistent bankruptcy procedure establishes the institutionalised symbol of trust of fiat money. The takeaway of this presentation of the Quantity Theory of Money is that price-level determinacy and inflation dynamics depends on aggregate default, and that a bankruptcy procedure that lacks consistency and credibility can lead to hyperinflation.

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To see the intuition, suppose a country over borrows either publicly or privately but lacks a credible bankruptcy procedure that does not tolerate a hard default and enforce debt discipline. The only way the country could achieve that is through further borrowing. As we have discussed, fiat money is issued against credit, and if the credit does not offset, then money accumulates in the system and leads to hyperinflation. In this sense, inflation is also sometimes referred to as 'soft default'. This takeaway is especially relevant to the currency union, because one of the most powerful arguments for some countries to join the Eurozone was to shield those countries from high inflation in their domestic economy.

4.2 Exchange Rates, Credit Risks, and Failing Banks

Nevertheless, history presents ample evidence that suggests entering a fixed exchange rate regime to tackle domestic inflation is merely delaying the issue and can cause severe currency crises. Similarly, we argue that using a currency union to shield countries from domestic inflation is also just a temporary solution and can lead to a severe "currency crisis", disguised as a debt crisis. An ancient Chinese idiom sums it up perfectly: it is better to teach fishing to someone than to give them fish. The cause of hyperinflation has deep institutional roots relating to bankruptcy and default penalty, solving hyperinflation would require implementing a consistent and credible bankruptcy procedure and enforcing debt discipline. However, solving it simply by fixing the exchange rate or removing the domestic currency altogether seems all too "easy", and more often than not, brutal force has its consequences.

So, what are the consequences? Suppose a country has limited capability for debt enforcement and the government also does not wish to see prevalent hard default. Inflation is a natural way to smooth hard default and digest the credit risks, but inflation brings its own set of social cost. To avoid the social cost of inflation, this country joins a currency union. When a negative income shock hits, this country will see a reduction in both exports and imports; however, given the credit risks in its domestic loans, the tendency to reduce export would be larger than the tendency to reduce imports, because when the negative income shock hits, the marginal benefit of default increases due to higher marginal utility of consumption, and households end up default more on the domestic loans. This implies that a negative income shock actually results in the country's current account deficit. In a hypothetical world of competitive floating exchange rate, the pressure of current account deficit would drive up the demand for foreign currency and lead to a depreciation of domestic currency, thus, the domestic debt burden decreases such that there is enough liquidity going around to repay domestic bank loans. The domestic banking system would have been fine. Now we are in the currency union world, the market-based currency depreciation is simply not an option, hence, domestic debt burden increases compared to the hypothetical case of floating exchange rate, leading to less liquidity to repay domestic loans. If the shock is big enough, a current account deficit can easily translate into a domestic banking crisis.

In short, both inflation and exchange rates are price mechanism to digest credit risks and smooth out hard default, and once these prices are constrained, the credit risks

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simply show up somewhere else in the economic system. In the currency union case, the credit risks are in essence "transferred" to the national banks. If we could take the liberty to use an analogy, a currency union for some member countries is isomorphic to going back to the "gold" standard, the supply of which is inelastic to its domestic fundamentals. And when the economy needs to grow and capital needs to accumulate, a gold standard is expected to witness a chain of default and banking insolvency.

The above narrative seems to fit well with the Eurozone Debt Crisis. Mindful of the high social cost of banking insolvency, national governments in the periphery countries have resorted to bailing out domestic banks but the sovereign instead take on the default stress. Given harsh bankruptcy terms for cross-country borrowing within the union, national governments are left with limited options except austerity measures and internal devaluation to pay back the debt.

In Wang (2019), this equilibrium is characterised in Regime (A), a currency union with no fiscal union and a harsh bankruptcy penalty for cross-country borrowing. In this Regime, the domestic banking system at the bad state runs into insolvency due to the loss of floating exchange rate in the presence of credit risks. And to avoid the high social cost of systemic bank failure, the national government levies tax to bailout the domestic banks. This bailout tax distorts the economic allocation, prices, and asset prices, and is equivalent to austerity measures that give rise to internal devaluation. To see this, Wang (2019) derives the following propositions.

- The bailout tax distorts the Fisher effect and causes the "internal devaluation" effect.

  That is, the domestic nominal interest rate is approximately equal to the real interest rate plus inflation premium adjusted by the bailout tax rate. Given the nominal interest rate, the higher the bailout tax rate is, the lower the inflation, and the real interest rate. In this regime of a currency union, credit risks and the viability of the national banking systems push down union-wide inflation and real interest rate, generating the "internal devaluation" effect.

- The bailout tax distorts allocation efficiency within state and risk sharing between countries.

  In this regime, with an intolerance of cross-country debt restructuring, the marginal rate of substitutions of domestic and foreign goods between countries within the same state of nature do not equate, as they are distorted by the bailout tax. Moreover, the marginal rate of substitutions across states do not equate, as the bailout tax prevents optimal risk sharing.

- The bailout tax affects asset prices through affecting the stochastic discount factor.

The implication of these analytical results is that the bailout tax generates fiscal austerity and internal devaluation for the periphery countries in the Eurozone and could drive the divergence of growth and financial risk profiles within the currency union. Hence, it is vital to use debt restructuring as one approach to alleviate the

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domestic banking stress in the Eurozone. In Section 5, we argue for the use of debt restructuring to remove the need for fiscal austerity and internal devaluation, and the result is welfare-enhancing via both prices and quantities.

5 Bankruptcy Codes and Credit Risks in a Currency Union

As we have argued, creating a currency union in Europe to shield member countries from domestic inflation problems is not solving the inflation problem at its root, and can eventually lead to a currency union "currency crisis", disguised as a "debt crisis" with fiscal implications. In the absence of fiscal union, one way to address this currency-debt crisis is to use capital markets to shoulder part of the default cost and relieve the banking system from insolvency. As Wang (2019) shows, the tolerance of cross-country partial default and debt restructuring can achieve this aim. In this sense, we are arguing for the benefit of default, in a similar spirit to Dubey et al. (2005) and Adam and Grill (2017). However, the one step forward of our argument and that of Wang (2019) is that the financial markets are assumed highly sophisticated. That is, for the international financial markets within the currency union, a complete set of financial securities is available for trade *ex ante*. Hence, the benefit of default in our argument stems purely from credit risks and the loss of exchange rate, a currency union specific friction, rather than *ex ante* market incompleteness.

Taking this argument one step further, Goodhart et al. (2018) incorporate non-trivial production sectors in a two-country dynamic stochastic general equilibrium model. Calibrating with the German and Greek data, the authors show that debt restructuring is not only beneficial for the debtor alone, but also conducive to the creditor's welfare improvement given a hard government budget constraint. This is because the short-term cost of debt restructuring for the creditor would be outweighed by the long-term benefit of maintaining investments in Greece, such that the Germany's consumption volatilities decrease.

5.1 Implications of Debt Restructuring in the Eurozone

With suitable lenient terms for cross-country debt restructuring within the currency union, the default stress on the domestic banking system can be much alleviated and instead, the financial markets absorb the credit risks that cannot be digested due to the loss of exchange rate. The punchline of our analysis is that debt restructuring can be a plausible way to compensate for the loss of credible exchange rates. Figure 1 illustrates one numerical result of Wang (2019). Country I resides in a currency union. vertical axis is the lifetime utility of the households in Country I consuming both foreign and domestic goods, minus the social cost of default (if any), and the horizontal axis is the increment of income shocks to the baseline calibration. The dotted line illustrates the numerical solution of the equilibrium when the currency union has a harsh bankruptcy procedure for cross-country borrowing and needs to resort to internal devaluation to render the system viable; the solid line shows the numerical solution of the equilibrium

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when the currency union allows for debt restructuring of cross-country borrowing. We can see that debt restructuring in a currency union can bring sizable welfare improvement. As Wang (2019) shows, this welfare improvement is Pareto improving in the currency union.

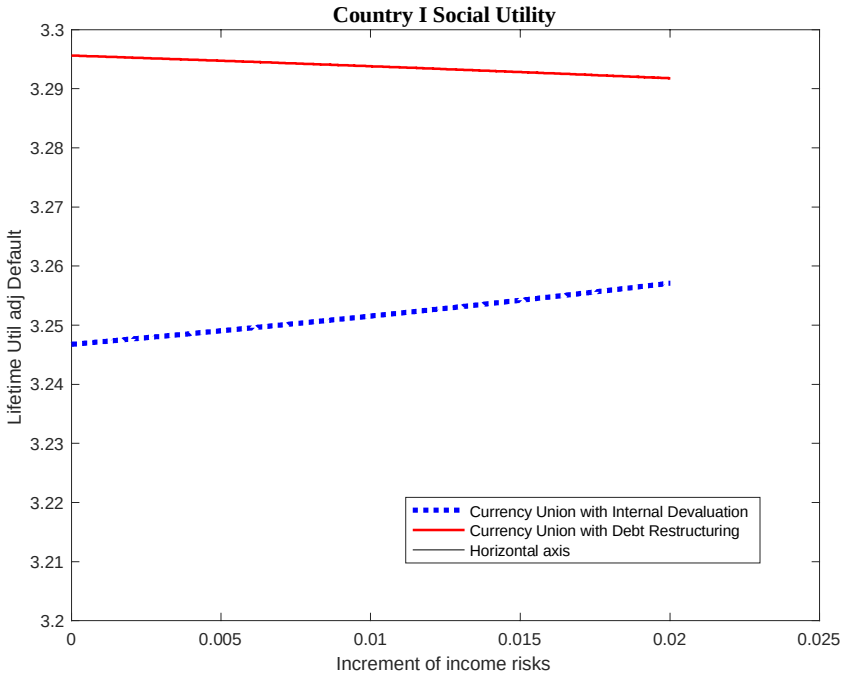

Figure 1: Social Utility with Internal Devaluation and with Debt Restructuring
Source: Wang (2019).

Analytically, the following propositions from Wang (2019) explain the driving force behind the welfare improvement.

- Debt restructuring for cross-country borrowing saves domestic banks.

  That is, financial markets have the capacity to absorb credit risks if debt restructuring is allowed, and it alleviates the default stress from the domestic banking system that would have otherwise failed. In other words, debt restructuring in a currency union removes the need for bailout tax and internal devaluation.

- Allocation efficiency and risk sharing both improve.

  In this regime, with cross-country debt restructuring, the marginal rate of substitutions of domestic and foreign goods between countries within the same state of nature are not distorted by the bailout tax. Moreover, the marginal rate of substitutions across states are not distorted by the bailout tax. Although Pareto optimality still does not obtain due to the positive borrowing cost and default premia, the distortion with debt restructuring is less than the case without.

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5.2 Implementation

A noteworthy advantage of debt restructuring of cross-country borrowing within the currency union is that it can leverage the invisible hand of the financial markets. Dubey et al. (2005) prove that orderly default on financial securities, in other words, the possibility of debt restructuring, is consistent with the existence of equilibrium and the orderly function of the markets. The intuition is that if the cost and the terms of debt restructuring are well understood by the markets, the markets will ask for a suitable credit risk premium of the underlying financial assets as a compensation. If the terms of debt restructuring are lenient, the default risk would increase, driving down the price of the asset, and if the price is low enough, there can be buyers. Indeed, Wang (2019) shows that with suitable terms of debt restructuring, the defaultable financial assets in the currency union are traded. Unlike the visible hand of a fiscal union that can move nominal resources between countries in the currency union, debt restructuring leaves the choice to the markets.

For Eurozone debt restructuring to work, i.e. compensating for the loss of a credible floating exchange, the terms of debt restructuring should be consistent and *ex ante* well understood by market participants. This requires a credible bankruptcy law for cross-country borrowing in the currency union, such that the market participants can properly price in the credit risks of the financial assets. Therefore, it is important to note that the debt restructuring we argue in this paper is not an *ex post* discretionary debt restructuring that few markets participants could rationally anticipate. Thus, the usual argument against debt restructuring that it is "unfair" to the lenders does not go through, because in our scenario, the credit risks are correctly priced in, and no one is forcing market participants to buy or sell the defaultable financial assets.

6 Conclusions

In this paper, we have argued for the role of debt restructuring in the Eurozone as a plausible way to compensate for the loss of exchange rates in the presence of credit risks. Debt restructuring is particularly relevant and vital in the Eurozone because the cross-country fiscal backstop is still highly incomplete, and a fully-fledged fiscal union is understood to be a politically constrained option. We start by reviewing the theoretical argument for the benefits of default and debt restructuring. We note that our argument needs not to reply on the incompleteness of the financial markets and that the need for debt restructuring purely stems from currency union specific frictions. Then we introduce a suite of international finance models with money and liquidity, suitable to structurally study the debt restructuring issue of a currency union. To appreciate that the Eurozone debt crisis is partially a disguised classic "currency crisis" due to fixing the exchange rate, we borrow the conceptual advance from the general equilibrium theory of money and default and emphasise the credit nature of fiat money and its interlinkages with the financial system. Then we relate credit risks to exchange rate and argue why debt restructuring is particularly vital for the Eurozone. Finally, we compare and contrast the scenarios with and without debt restructuring in the Eurozone.

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Much of the insight in this paper is based on the theoretical arguments in Goodhart et al. (2018) and Wang (2019). Going forward, it is of significance to extend Wang (2019) to a dynamic setting and calibrate it with the Eurozone data, allowing us to carefully evaluate the quantitative impact of debt restructuring in the Eurozone. A wider implication of this paper is that for the understanding of modern monetary and financial phenomena, particularly the viability of a currency union, we simply cannot ignore the credit nature of fiat money and the interplay of liquidity and default, which matter not only for price stability but also for financial stability, in both a closed economy and an open economy such as the Eurozone. For that, we owe it to the intellectual legacy from Keynes, Minsky, Shubik, and Grandmont and Younes.

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