Optimal Payment Area or Optimal Currency Area?

By Patrick Bolton and Haizhou Huang*

In this paper we employ the framework developed in Bolton and Huang (2018a) around the *Optimal Capital Structure of Nations* to revisit the classical theory of *Optimum Currency Areas* of Mundell (1961). In our (2018a) article we make an analogy between fiat money and corporate equity: Besides being a medium of exchange, fiat money is also a store of value that can be freely issued by the sovereign, just like corporate equity is a store of value that can be freely issued by a firm's owners. Of course, if too much money is printed or too much equity is issued the value of a unit of money or equity is eroded. There is thus a natural link between the concepts of inflation and equity dilution. The capital structure of a nation can be thought of as the ratio of fiat money (and fiat-money claims) to foreign-currency debt liabilities. Taking a leaf from the corporate finance literature, the question of the optimal capital structure of a nation can then be formulated as a tradeoff between inflation costs and expected default costs on foreign-currency debt.

Here we explain how the open-economy model in our (2018a) article can be generalized to a two-country setting in which the issue of the optimum currency area (OCA) can be examined. We provide a full and detailed analysis of the two-country model under respectively no monetary union and a monetary union in our (2018b) paper. Here we sketch out the key ideas of this analysis and how they relate to Mundell (1961) and the OCA literature it has spawned. Mundell's seminal paper, frames the question of the optimal number of currencies in terms of a tradeoff between lower transaction costs for international trade, and employment stability across countries: "Money is a convenience and this restricts the optimum number of currencies....If the world can be divided into regions within each of which there is factor mobility and between which there is factor immobility, then each of these regions should have a separate currency which fluctuates relative to all other currencies." [Mundell, 1961, pp 662-663] As Goodhart (1998) has observed, this analysis is framed in terms of transaction-cost minimization and entirely "ignores the 'political economy' factors that made currency areas coincident with countries in the first place...If the USSR were an optimal currency area before its break-up, it should have presumably remained so afterwards." [Goodhart, 1998, pp 420 and 423]

Why is money so narrowly tied to sovereignty? When is relinquishing monetary independence justifiable? These questions can be addressed by drawing a parallel with the theory of the firm. One of the main control rights shareholders have is the right to decide when to issue new shares. An arrangement whereby the firm's owners separate out this right and give it to another entity would be highly implausible in practice. The value of the option to issue new shares when the need arises is intimately tied to the value of ownership. Equally, the value of monetary sovereignty is the value of the financing available through "the printing press" in times of economic or political exigency.

But there is a negative externality to monetary sovereignty in a multi-country integrated economy such as the European Union (EU). The monetary history of the EU up to the creation of the Euro plainly illustrates the problem of keeping multiple currencies in an economically integrated union: a member country may be tempted to respond to an adverse economic shock by printing more money, thereby partially "exporting" the negative shock to other member countries. Indeed, by increasing money balances the country can (temporarily) increase the purchasing power of its households if the exchange rate does not instantaneously adjust to reflect

* Bolton: Columbia University, NBER and CEPR, New York, NY, pb2208@columbia.edu. Huang: China International Capital Corporation, CF40, SAIF, and PBCSF

the relative change in money supply. Only in the extreme situation of frictionless foreign currency markets does Hayek's (1978) International Financial Neutrality result obtain, whereby a change in money supply in one country does not affect the equilibrium allocation of goods in the other countries.

But before the introduction of the Euro, the exchange rates of member countries were constrained to remain within a tight band, first under the Currency Snake, and later under the Exchange Rate Mechanism (ERM). Both were arrangements aimed at reducing exchange transaction costs. However, these were unstable systems because member countries that printed more money could artificially boost the purchasing power of their residents until the time when the currency band was widened and the country was forced to devalue. What is more, this system built in an inflationary bias, because the best response of other countries could well be to also increase their money supply so as to undo the artificial increase in purchasing power that could not be immediately undone through an exchange rate adjustment.

The model we develop in Bolton and Huang (2018b) builds on this tradeoff between the benefits of monetary flexibility and the costs of strategic monetizations, to offer an alternative OCA theory to Mundell's transaction-costs minimization theory. The classical OCA theory five decades ago has provided the conceptual foundations for the formation of the euro-area in 1999 and the creation of the European Central Bank (ECB). However, the sovereign-debt crisis in the euro-area after the 2008 global financial crisis has starkly revealed the gaps in this theory. Our analysis attempts to fill in the monetary-sovereignty gap in OCA theory. We briefly describe the model before stating the main results.

A simple model

The model comprises two countries, A and B, each composed of two classes of agents, savers and workers, who live for two periods $t = 0, 1$. In each country the two classes start out with a given endowment of fiat money. Each worker is self-employed and runs her worker-owned firm. Period 0 in each country begins with each government producing a public good g_i with labor inputs provided by workers against a debt repayment promise b_i in period 1 ($i = A, B$). After the public good has been produced, firms use the remaining labor inputs available to produce a private consumption good. Production is realized in period 1 and sold in competitive markets after the government has levied a sales tax and serviced its debt obligations. We denote the final output in country i by y_i and the price that clears the goods market in each country by p_i. Both savers and workers in each country spend their cash holdings to purchase the final consumption good. We assume that the two countries' final goods are perfect substitutes. When the two countries have their own separate currencies we assume that only the domestic currency can be used to purchase goods or labor inputs in each country. However, there is a competitive currency market where one unit of currency of country A can be exchanged at rate e against country B' currency, and vice-versa.

The masses of savers and workers in each country are each normalized to 1. A saver has an endowment of fiat money $s_i > 0$ in period 0. A worker in period 0 has an endowment of labor inputs $l_i > 0$ and an endowment of money of $m_i > 0$, such mechanisms as the Currency Snake and ERM are consistent with logic of the optimal payment area that is rooted in the classical OCA theory. Both savers and workers are risk neutral. Their utility functions are the same in each country and given respectively by:

$$U(c_i) = c_i \text{ for savers,}$$

and

$$U(c_i, m_i^c) = c_i + \varphi \frac{m_i^c}{p_{i1}} \text{ for workers,}$$

where c_i stands for consumption in period 1 and m_i^c stands for continuation money balances obtained by workers from the sale of their output. Real continuation money balances m_i^c/p_{i1} are bequeathed to the next generation and the value of these bequests to the workers is given by $\varphi m_i^c/p_{i1}$, where $\varphi > 0$. This simple two-period model can be thought of as representing two periods of an infinite-horizon overvelaping generations (OLG) model, where each generation lives for two periods. In the first period of their life agents are workers, and in the second

period they are retirees consuming out of their savings. The only difference with the standard OLG model is that bequests to the next generation are made in the middle instead of the end of life. That is, the representative worker at the end of the first period splits m_i^c into s_i for her retirement and m_i for her offspring.

All worker-firms in each country are identical and have the following production function: $y_i \equiv \theta_i l_i$, where θ_i is a productivity shock and l_i is the total labor input available to the firm. For simplicity there is no discounting. Consumers must use cash to purchase firms' output in period 1; a worker is not allowed to consume the output of her own firm. For simplicity we assume that θ_i can only take two values $\theta \in \{\theta_L, \theta_H\}$, with $\theta_L > 0$, $\theta_H > \theta_L$, and with $\pi_i = \Pr(\theta_i = \theta_H)$.

In each country fiscal and monetary policy are determined by two separate government agencies, an independent central bank charged with the conduct of monetary policy and a finance ministry, or treasury department, charged with fiscal policy. The fiscal authorities in each country incur exogenously fixed public good expenditures g_i at time 0 that are financed by issuing debt b_i. This debt is repaid in period 1 through a combination of tax revenues $\tau_i m_i$ and possible monetization of the debt by the central bank. The combined agencies' objectives are to maximize the sum of the utilities of savers and workers, but they put slightly different weights on the utilities of each class: while in each country the welfare weight of a worker is 1, the welfare weight of a saver is $\kappa > \varphi > 1$. This is a simple way of modeling concerns over the erosion of the purchasing power of savings through monetization. In each country there is an exogenous maximum income tax rate $\bar{\tau}_i > 0$. We assume that taxes must be paid in the country's own fiat money.

Results

The equilibrium outcome in a one-country world is such that the government partially monetizes the debt in state L so as to avoid a costly default. Monetization of debt is not for free. It results in a transfer of purchasing power from savers to workers and a net welfare loss of

$$(\kappa - 1)[\left(\frac{s}{m+s}\right)\theta_L - \left(\frac{s}{(1+\delta)m+s}\right)\theta_L].$$

Still monetization is preferable to no monetization when the alternative is a costly default. This result captures in a succinct way the idea that nation-states "in extremis...call upon the assistance of the money-creating institutions" [Goodhart, 1998, page 410].

In a two-country world with a perfectly competitive foreign exchange (FX) market the equilibrium exchange rate is such that the terms of trade are equal to 1, so that:

$$e = \left(\frac{s+m^A}{s+m^B}\right)\frac{\theta^B}{\theta^A}.$$

When the FX market is frictionless, Hayek's (1978) *International Financial Neutrality* result obtains whereby a change in money supply in one country does not affect equilibrium allocations of goods in the other country. In this perfect world there are no benefits to monetary union and the OCAs are given by each country's borders. Moreover, with a frictionless FX market a country cannot benefit from a strategic monetization, as the effects of an increase in money supply m^i are undone by the instantaneous adjustment in e.

But we live in an imperfect world in which the exchange rate does not instantaneously adjust to a change in m^i. When there is exchange-rate stickiness a country may be able to boost its citizens' purchasing power through monetization. The two countries' central banks are then engaged in a strategic monetization game. Under no monetary union, we can show that the following Nash Equilibria obtain: When at least one country i is in the crisis state L then both countries maximally monetize their debts. Even if country j is in state H, it best responds to country i's monetization by also monetizing. This way it protects the purchasing power of its workers, but at the cost of eroding its pensioners' savings. When both countries are in the boom state H, there are two equilibria. One where neither country engages in monetization and the other where both engage in maximal monetization. Overall, under no monetary union there will be excess monetization and inflation, but no costly default.

The two countries can avoid excess monetization by forming a currency union under a single central bank. We first consider the case of pure

monetary union without any fiscal union, and we assume that the single central bank operates under a constitutional constraint that prevents it from engaging in any debt monetization. In this case the equilibrium is such that a member country incurs a default cost when state L occurs. This cost can be interpreted literally as a default cost or as a debt overhang cost. Whether the country defaults or not it incurs a deadweight cost in state L if it cannot service its debt through monetization. However, by construction there are no monetization costs under monetary union. The OCA is given by a single currency under monetary union when deadweight costs of default are not too high.

Note that even without fiscal union, monetary union does provide some mutualization benefits in states of nature (L, H) and (H, L). However, the benefits of integration are enhanced under a fiscal union. Indeed, under a fiscal union deadweight costs of default can be avoided in states of nature (L, H) and (H, L) by servicing the debts of the country in crisis through fiscal transfers. Finally, the benefits of integration are maximized not just by having both fiscal and monetary union but also by allowing the single central bank to monetize the member-states' debts in state of nature (L, L). Under this institutional arrangement it is always weakly best to have an OCA including both countries. But when there is no fiscal union and no ability for the single central bank to monetize debt *in extremis* then the OCA can be to have two separate currencies under some parameter values.

Concluding Remarks

Mundell's (1961) OCA paper counts among the most impactful modern economic theories. While the formation of the euro-area in 1999 and the creation of the European Central Bank (ECB) was a fundamentally political decision, it found a powerful economic justification in Mundell's OCA paper. The Eurozone sovereign-debt crisis, however, painfully revealed to costs of abandoning monetary sovereignty and forsaking the printing press in exigent circumstances. Before the creation of the European monetary union economic commentators had not fully appreciated the magnitude of these costs, with the notable exception of De Grauwe (1994) and Goodhart (1996, 1998).

Mundell's transactions-cost minimization perspective essentially sees the European OCA as a currency snake with no bandwidth. This is clearly optimal from a payments perspective but it fails to account for the issue of monetary sovereignty. Mundell's OCA theory is, in effect, a theory of an optimal payments area, whereas our theory, which focuses on the issue of monetary sovereignty, is closer to a true theory of optimal currency areas. Our model, which focuses on debt monetization and the flexibility benefits of the printing press, puts the spotlight on the institutional design flaws of the current Eurozone, namely the lack of a fiscal union and fiscal transfers to dampen adverse economic shocks to a member country, and the inability to use the printing press in times of extreme exigency across the entire union.

References

Bolton, Patrick, and Haizhou Huang (2018a) "The Capital Structure of Nations, " *Review of Finance* (forthcoming).

Bolton, Patrick, and Haizhou Huang (2018b) "Money, Sovereignty and Optimal Currency Areas" mimeo, Columbia University

De Grauwe, Paul (1994) "Towards European Monetary Union without the EMS, " *Economic Policy,* , 147-185.

Goodhart, Charles (1996) "European Monetary Integration, " *European Economic review,* 40, 1083-1090.

Goodhart, Charles (1998) "The two concepts of money: implications for the analysis of optimal currency areas" *European Journal of Political Economy,* 14, 407–432.

Hayek, Friedrich (1978) *Denationalization of Money: an analysis of the theory and practice of concurrent currencies.* London: Institute of Economic Affairs.

Mundell, Robert (1961) "The Theory of Optimum Currency Areas," *American Economic Review* 51, 657–664.