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To float or to sink? Revisiting the causal effects of exchange rate regimes.

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To Float or to Sink?

Revisiting the Causal Effects of Exchange Rate Regimes

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Abstract

This study proposes a novel instrumental variable construction procedure based on international trade concentration that has a sufficiently strong first stage for exchange rate policy choice globally and applies it to revisit the causal effects of exchange rate regimes on macroeconomic outcomes. Fixed exchange rates are shown to cause lower economic growth rates, higher volatility of output and inflation, and higher unemployment, without reducing average inflation. These effects persist even when monetary unions are excluded from the sample, across subsamples with varying levels of per capita income and institutional quality and is robust to alternative regime classifications as well as to property rights, human capital, and trade openness controls.

Keywords: exchange rate regime; fixed exchange rate; economic growth; causal inference

JEL codes: C26, F31, O24, O47

Introduction

"The profession knows surprisingly little about either the causes or consequences of national choices of exchange rate regimes"

Rose et al. (2011)

"To fix or to float" has been a relevant policy question well-discussed in the literature at least since Mundell's (1961) seminal work on optimum currency areas and it has spurred a plethora of empirical studies for over four decades (Baxter and Stockman, 1989; Ghosh et al., 1997; Levy-Yeyati and Sturzenegger, 2003; Tsangarides, 2012; Oeking, 2015). However, recently the literature seemingly conceded that the causal macroeconomic effects of exchange rate regimes are hard to establish and, even if present, they must be immaterial, with this view shared by multiple meta-analyses (Tavlas et al., 2008, Rose et al., 2011).

This study seeks to challenge the aforementioned consensus. It utilises a sample of 178 countries over 2002-2018 and proposes a novel instrumental variable construction technique based on international trade concentration to assess the macroeconomic implications of currency pegs regarding economic growth, inflation, unemployment, as well as inflation and output volatility. Trade concentration instruments are exogenous, have exceptionally strong first stages, and respective TSLS estimations differ significantly from their OLS counterparts. The findings imply fixed exchange rate policies cause markedly lower economic growth rates, higher unemployment, and higher output growth and inflation volatility, without reducing average inflation. A battery of robustness checks is performed to ensure the validity of the results, particularly regarding economic growth. The results remain negative and significant when (1) monetary unions are excluded from the sample, (2) alternative regime classifications are considered, (3) the estimator is weighted according to the economy size; across subsamples with varying levels of (4) economic development and (5) institutional quality, and (6) subject to a set of institutional, human capital, and trade-related controls. The findings and their overwhelming consistency decidedly suggest the favourability of floating exchange rate policies, at least when the aforementioned macroeconomic performance indicators are considered.

The rest of the paper is organised as follows. First, four decades of empirical literature on exchange rate regime effects, exchange rate determination, and regime classification methodologies are surveyed. Second, the estimation strategy utilised by this study is discussed, particularly regarding instrumental variable construction. Next, it is applied to assess the macroeconomic implications of exchange rate regimes and an extensive set of robustness checks is performed to reinforce the validity of the results. The final section concludes.

Literature Review

The early research on macroeconomic implications of exchange rate regimes resorted to de-facto regime classifications and mainly OLS estimations. As such, Baxter and Stockman (1989) investigated the differences in time series behaviour of key economic aggregates, such as output, consumption, trade flows, real exchange rates and government spending under alternative exchange rate regimes, using the data for 49 countries in period 1960-1986, divided into pre-1973 and post-1973 periods. They utilised OLS estimates and structural shift tests for countries that changed their exchange rate regimes throughout the observation period to show that although it was impossible to link the differences between the two time periods to the country's choice of the exchange rate regime, the international correlation of output fluctuations generally decreased in post-1973 compared with the earlier (Bretton Woods) period.

Ghosh et al. (1997) used a dataset of nine regime types, classified upon the stated commitment of the monetary authorities, for 136 countries in 1960-1990. The results suggested fixed exchange rates experienced significantly lower and less volatile inflation rates while per capita economic growth rates differed only marginally across the exchange rate regimes –

growth was found to be slightly slower under the fixed exchange rate regimes and the difference was statistically insignificant with all of the difference arising from low income countries. Output growth volatility, however, has been markedly higher under currency pegs. It was also demonstrated that the pegged regimes were characterised by higher investment ratios but slower trade growth. For the inflation implications, Ghosh et al. (1997) acknowledged the potential endogeneity problem regarding exchange rate regimes and proposed a TSLS procedure in a system of simultaneous equations that utilised a probit model to assess the propensity to fix. First differences in GDP, interest rates, and broad money, as well as central bank independence, were used as instruments, while trade openness and central bank governor turnover were used as additional control variables. Ghosh et al. (1997) find their TSLS estimators to be similar to their OLS counterparts both qualitatively and quantitatively, however they do not undertake any formal endogeneity tests. Another interesting finding of Ghosh et al. (1997) is that fixed exchange rate effects are much less pronounced for countries declaring a currency peg yet often changing the parities, serving as an early affirmation for the importance of de-facto regimes. Notably, Ghosh et al. (1997) only use TSLS for their inflation estimations, resorting to OLS in all other cases, particularly for economic growth and output volatility.

Levy-Yeyati and Sturzenegger (2001) studied the impact of exchange rate regimes on inflation, nominal money growth, real interest rates, and GDP growth. They reported that although for industrial countries there is no significant link between regimes and inflation, for non-industrial countries some material effects are present. As such, long pegs result in inflation lower than that of floats, but at the cost of slower economic growth, and the similar price stability-growth dilemma is still present in the case of hard pegs. In contrast, short pegs clearly underperform floats, as they grow slower without providing any gains in terms of inflation.

In their later work, Levy-Yeyati and Sturzenegger (2003) investigated the relationship between the exchange rate regime and economic growth using the dataset of 183 countries over the post-Bretton Woods period (1974-2000). That study can be considered one of the early sources on the de-facto approach to exchange rate regimes, with currency pegs being identified manually according to the 3 variables: the actual behaviour of the exchange rate volatility, the volatility of exchange rate changes, and the volatility of reserves. Their findings imply that, for developing countries, less flexible exchange rate regimes are associated with slower economic growth and greater output volatility, however, for industrial countries, exchange rate regimes do not have any significant impact on growth. Levy-Yeyati and Sturzenegger (2003) also resort to a TSLS estimation, however their instrumental variable set differs from that of Ghosh et al. (1997), including relative size of the economy in comparison to the US, area, island dummy, the ratio of reserves to monetary base, and the prominence of currency pegs among neighbouring countries, with propensities to fix being predicted using a logit model.

Bailliu et al. (2003) examined the effect of the exchange rate policy on the economic growth by estimating the impact of the exchange rate arrangements on growth in a panel dataset of 60 countries over 1973-1998. They established that fixed, intermediate, or flexible exchange rate regimes that were characterised by a monetary policy anchor, influenced economic growth rate positively, while flexible or intermediate regimes without such an anchor were detrimental for economic growth. Bailliu et al. (2003) acknowledge the endogeneity issue however they prefer GMM estimators over TSLS to address the potential inconsistency issue in the panel framework, using lagged independent variables as instruments, similar to Ghosh et al. (1997). Notably, Bailliu et al. (2003) find statistically significant effects only when considering de-facto pegs, with no relationship present when using the official classification.

Dubas et al. (2005) proposed an econometric procedure for obtaining de facto exchange rate regime classifications from independently floating to currency pegs, using the effective exchange rate. Additionally, the paper studies the economic growth dynamics across the four identified categories based on declared and factual exchange rate policy using OLS estimates. The findings show that the highest GDP growth is associated with de jure floaters - de facto fixers and de jure fixers - de facto fixers.

Overall, following the establishing consensus that de-facto policies can differ significantly from de-jure commitments with the latter having very limited if any macroeconomic implications, a new strain of literature emerged in the mid-2000s seeking to develop sufficiently simple, accurate, and replicable de-facto regime classifications. Apart from Dubas et al. (2005), the most notable studies in this tradition include Reinhart and Rogoff (2004), Levy-Yeyati and Sturzenegger (2005), and Klein and Shambaugh (2008). These approaches synthesise qualitative data on policy commitments with market exchange rate data and macroeconomic indicators such as inflation and reserves. Despite these methodologies being seemingly similar conceptually, they differ among each other in terms of country classification almost as much as each of them individually differs from the de-jure IMF classification, with agreement varying from 55% to 65% (Rose, 2011). Eichengreen and Razo-Garcia (2013) showed that the discrepancies in these classifications are systematic and are more prominent for low-income countries, economies with high financial development, low reserves, and high capital mobility. For OLS panel regressions and fixed effects models Eichengreen and Razo-Garcia (2013) report, the impact of exchange rate policy on economic growth is relatively assumption-sensitive: the effect is largely negative for Levy-Yeyati and Sturzenegger (2005) classifications and inconclusive for Klein and Shambaugh (2008) and Reihnart and Rogoff (2004) methodologies, with notable heterogeneity across subsamples with varying per capita incomes.

Starting from the early 2000s and reflecting lack of consensus in the literature regarding the macroeconomic implications of exchange rate regimes globally, a wide range of regional studies have been developed. As such, Domac et al. (2001) examined the effect of the exchange rate regime on inflation and growth performance in transition economies by developing an empirical framework, based on the IMF classification of exchange rate regimes for 22 countries. While the paper reports that exchange rate regime indeed affects the inflation in the way that transition countries that are switching from a floating exchange rate regime to an intermediate one might not reduce inflation, but if they are switching from an intermediate regime to fixed, inflation might be reduced. However, there is no evidence that one particular exchange rate might be superior to another in terms of economic growth performance.

Later, Huang and Malhotra (2005) also investigated the relationship between the choice of the exchange rate regime and the subsequent economic growth rate for 12 developing Asian and 18 advanced European countries over the period 1967-2001. The findings reported that for developing countries, there is a non-linear relationship between the economic growth and the choice of the exchange rate regime, with fixed and managed floating exchange rate regimes associated with the highest growth rates. Contrastingly, the choice of the exchange rate regime does not affect the rate of economic growth for European countries, though more flexible regimes are associated with slightly higher growth rates. Huang and Malhotra (2005) did use de-facto regime classification method, however in their estimation strategy they only reported OLS coefficients and did not account for potential endogeneity.

De Grauwe and Schnabl (2008) applied a GMM estimator to assess growth implications of de jure and de facto exchange rate stability in South-Eastern and Central European countries. While de jure regimes do not largely matter in their sample, de facto pegs affect growth positively. De Grauwe and Schnabl (2008) used their findings to assert that Eurozone membership will be economically beneficial to new member states.

Tsangarides (2012) examined the role of the exchange rate regime in the study of how emerging market economies were impacted by the recent global financial crisis, particularly in terms of output losses and economic recovery, using the dataset of 50 countries. The findings imply that during the crisis, the growth performance for fixed exchange rate regimes was similar to that of floats. However, this is different for the recovery period, during which the economies with pegged regimes experienced slower growth compared to the economies with floating exchange rate regime. The main results of Tsangarides (2012) come from an OLS regression with trade and financial controls, however the study also employs a simultaneous equation procedure with an instrumental variable for the propensity to fix based on the probit model with inflation, population, and geographic concentration of exports as first-stage regressors.

The same pattern is reinforced by more recent study of Oeking (2015) who reports that European non-Euro countries with floating exchange rate regimes demonstrated a more rapid recovery. Oeking (2015) estimates a panel regression with fixed effects and trade openness and human capital controls while assuming the independent variables, including the exchange rate regime, are exogeneous.

Another notable strain of empirical literature is concerned with identifying the determinants of exchange rate regime choice. In the seminal paper on the topic, Edwards (1996) examined whether some countries adopted fixed exchange rates, while other aimed for adoption of more flexible systems by developing a model which assumes the central bank minimises a quadratic loss function of the inflation-unemployment trade-off when they choose between a pegged and a flexible regime. The model is later advanced to cover the case when the central bank decides whether to pursue fixed-but-adjustable or flexible exchange rate regimes. The data for 63 countries in 1980-1992 is used to estimate the series of probit models with the explanatory variables such as historical degree of political instability, prominence of nominal (inflation) and real (unemployment) targets for the monetary authority, and probability of abandoning the peg.

Collins (1996) developed the empirical framework of exchange rate regime choices based on the perceived losses from exchange rate misalignment incurred under fixed versus more flexible regimes, using a dataset for 24 countries in Latin America and the Caribbean over period 1978-1992, classified according to the IMF methodology. The paper argues that the countries are more likely to switch to a floating exchange rate regime when their nominal exchange rates are misaligned, so that they can undertake needed adjustments without incurring the political costs of devaluation under fixed regimes.

Rizzo (1998) focused on the economic determinants of the exchange rate regime choice by developing the range of the probit models to analyse the choice of the exchange rate regimes by developing countries, classified as per the IMF de-jure methodology, in period 1977-1995. Among individual structural characteristics that have influenced the choice of the exchange rate regime, the degree of trade openness has proven to be associated with flexible exchange rates.

Alesina and Wagner (2006) examine the discrepancies between de-jure declarations and de-facto commitments regarding exchange rate regimes and find institutional quality to be a decisive factor: de-jure fixed regimes with low institutional quality tend to often abandon pegs due to poor economic management, while de-jure floaters can demonstrate “fear of floating” and effectively intervene into the foreign exchange market when their institutional and policy quality is high.

Levy-Yeyati and Sturzenegger (2010) revisit main economic, financial, and political theories surrounding exchange rate regime choice and jointly test them using various proxies for asymmetric shock susceptibility, capital mobility, and decision-making constraints. They establish all three theoretical arguments have merit and do significantly contribute to the propensities to float or fix.

Overall, the literature on the macroeconomic implications of the exchange rate regimes is generally inconclusive and far from reaching a consensus, as supported by meta-analyses (Tavlas et al., 2008; Rose et al., 2011). Researchers agree on the preferability of de-facto exchange rate regimes for estimations, but classification methodologies differ significantly and materially affect the results (Dubas et al., 2005; Eichengreen and Rizo-Garcia, 2013). Heterogeneity is also a common issue, with little to no studies identifying an unconditional effect robust across subsamples (Levy-Yeyati and Sturzenegger, 2003; Tavlas et al., 2008; Rose et al., 2011). The only genuinely robust macroeconomic implication of fixed exchange rates seems to be higher output volatility (Levy-Yeyati and Sturzenegger, 2003; Reinhart and Rogoff, 2004; Tavlas et al., 2008). Studies that sought to narrow their samples and assess the exchange rate policy implications regionally have also generally struggled to identify robust effects (Domac et al., 2001; Huang and Malhotra, 2005).

Econometrically, the studies mostly resort to OLS estimations or panel regressions, despite the overwhelming acknowledgement of regime endogeneity (Levy-Yeyati and Sturzenegger, 2010). Causal inference is present in some studies, yet it mostly serves as a robustness check and little discussion is directed at instrument exogeneity and weakness concerns. The literature on exchange rate regime choice has established several prominent stylised facts (Collins, 1996; Edwards, 1996; Rizzo, 1998; Alesina and Wagner, 2006; Levy-Yeyati and Sturzenegger, 2010), however few of its insights have been incorporated in instrumental variable construction methodologies. This study, therefore, endeavours to address these issues and develop an empirical strategy to identify the causal effects of exchange rate regimes on macroeconomic performance, while ensuring robustness and acknowledging contemporary methodological concerns surrounding instrumental variable estimations (Young, 2019).

Data and Methodology

This study seeks to estimate the causal impact of exchange rate regimes on a range of macroeconomic outcomes, mainly economic growth, while also addressing the implications for output growth volatility, inflation, inflation volatility, and unemployment. All macroeconomic variables are retrieved for the 2002-2018 period for an exhaustive sample of 178 countries from the World Development Indicators Database (World Bank). Economic growth is measured as the geometric mean of the growth rate in real GDP in constant 2010 US dollars, real GDP in constant 2010 US dollars per capita, and real GDP in constant 2010 US dollars per capita adjusted for purchasing power parity for additional robustness. Inflation is measured using the consumer price index and unemployment is defined according to the ILO estimates. Output growth and inflation volatility are the standard deviations of real GDP growth and inflation, respectively, during the 2002-2018 sample period.

Exchange rate regimes are recognised as fixed or floating based on the de-facto methodology established in the recent literature (Reinhart and Rogoff, 2004; Levy-Yeyati and Sturzenegger, 2005; Kleim and Shambaugh, 2008; Stone et al., 2008; Rose, 2011) and not according to the IMF de-jure classification. Namely, the study manually consults official monetary authority documents, market exchange rate dynamics, and verifies whether there is a prominent black foreign exchange market. In this study, countries that maintained a de-facto currency peg in 2002 are considered fixed exchange rate regimes and vice versa for the whole sample period to preserve exogeneity. In the sample of 178 countries, 87 regimes are classified as fixed ("hard" or "soft" pegs) and 91 are considered floating as of 2002, consistent with the results of Stone et al. (2008) and Kleim and Shambaugh (2008) that report a roughly 50/50 divide for this time period. As a robustness check, the study executes its estimations both including and excluding currency union member states (the Eurozone, Economic and Monetary Community of Central Africa, and West African Economic and Monetary Union). The estimations are also undertaken with de-facto regime data from existing sources, namely, Kleim and Shambaugh (2008), Reinhart and Rogoff (2004), and Levy-Yeyati and Sturzenegger (2005) to address the prominent assumption-sensitivity of exchange rate regime definitions highlighted in the literature (Rose, 2011; Eichengreen and Razo-Garcia, 2013).

The study also considers three additional covariates to ensure robustness in the estimations: property rights index in 2002 (obtained from Heritage Economic Freedom index), average years of schooling in 2000 (Barro and Lee, 1996, 2013), and trade openness (trade-to-GDP ratio in 2002 calculated using World Development Indicators data).

To assess the causal effect of exchange rate regimes on macroeconomic outcomes, the study resorts to the two-stage least squares regression with instrumental variables. To successfully instrument for fixed exchange rates, one has to identify a variable or variables that are sufficiently strongly correlated with the propensity to fix (strong first stage) but should be exogeneous, i.e., it should not theoretically influence the macroeconomic variables of interest directly (Angrist and Krueger, 2001).

To establish the instrumental variable construction strategy, this study surveys the rich volumes of literature on exchange rate regime determinants in search of potentially exogeneous instruments with strong first stages.

As such, Levy-Yeyati and Sturzenegger (2003) apply the logit model to estimate propensities to fix using ratio of country GDP to US GDP, geographic variables (country area and island dummy), reserve-to-monetary base ratio, and prominence of currency pegs among geographic neighbours. The predicted probability of a fixed exchange rate regime is then used to instrument for the actual exchange rate regime dummy.

Ghosh et al. (1997) consider central bank independence and lagged log-differences in GDP, interest rates, and broad money as their instrumental variable set and apply the probit model instead to derive the probability of fixed exchange rate. Bailliu et al. (2003) utilise a similar logic of lagged dependent variables in their GMM identification strategy. In the more recent studies, Tsangarides (2012) also uses a probit model with population, inflation, and geographic concentration of exports as potential determinants.

Another major strain of literature investigates the potential political determinants of exchange rate regime choice. For example, Collins (1996) argues nominal exchange rate misalignment is a crucial factor of peg decisions. Edwards (1996) finds political instability and macroeconomic targets (inflation versus unemployment) the main drivers of the propensity to float or fix. The political economy logic of exchange rate regime choice is also reinforced by Levy-Yeyati and Sturzenegger (2010), who report political leader tenure (years in office) and government weakness (veto points in the decision-making system) as significant factors. Additionally, Alesina and Wagner (2006) find de-jure floaters with good institutions tend to de-facto fix or at least to intervene on the foreign exchange market while de-jure fixers with poor institutions tend to abandon the declared pegs. From the more traditional economic and financial perspectives, Levy-Yeyati and Sturzenegger (2010) highlight trade openness, trade volatility, capital account liberalisation, portfolio investment, and financial development.

While all these factors can indeed be powerful predictors of exchange rate policy choice, most of them cannot be characterised as fully exogeneous. For example, political stability (Acemoglu et al., 2003), geographic factors (Gallup et al., 1998), central bank independence (Alesina and Summers, 2001), financial development (Levine, 1999), and exchange rate misalignment (Acemoglu et al., 2003) can be drivers of economic growth or other macroeconomic outcomes on their own, thus compromising the validity of the respective TSLS estimates.

Addressing this issue, this study uses a novel technique for instrumental variable construction exploiting international trade data on bilateral country-to-country trade flows in US dollars provided by International Trade Centre. To avoid forward-looking bias, this study considers trade flow data as of 2001. The hypothesised relationship between international trade and propensity to fix is intuitive – the more concentrated a particular country's trade is in terms of partner states or currencies, the higher the incentives are to maintain a currency peg (Levy-Yeyati and Sturzenegger, 2010). International trade concentration should not influence the macroeconomic outcomes of interest directly, therefore instrumental variables derived using this approach are theoretically exogeneous. Use of trade-related instruments in empirical macroeconomics has been relatively uncommon, most notably applied to assess the causal effects of trade openness (Hall and Jones, 1999) and institutional factors (Shanaev and Wanjiru, 2019).

The study estimates four distinct trade concentration indicators – Herfindahl-Hirschman (HH) index, maximum share, number of partners, and active weight – across exports, imports, and total trade volume as well as across partner countries and partner currencies. The indicators for ith country are calculated as follows:

$$HH_i = 10{,}000 * \sum_{\substack{j=1,\\ j\neq i}}^{n} \left(\frac{T_{ij}}{T_i}\right)^2$$

$$Max_i = \max_{i\neq j} \left(\frac{T_{ij}}{T_i}\right)$$

$$Active_i = \sum_{\substack{j=1,\\ j\neq i}}^{n} \left|\frac{T_{ij}}{T_i} - \frac{GDP_j}{GDP}\right|$$

Where T_{ij} is the respective trade flow (exports, imports, or total trade) between countries i and j, T_i is the total trade flow for country i, GDP_j is the USD-denominated GDP for country j in 2001, and GDP is the world's GDP in USD in 2001. The number of partner countries is calculated simply as the number of non-zero trade flows among T_{ij}.

All four indicators are plausible concentration metrics commonly used in various areas of economics and finance. As such, the HH index is conventionally applied to measure industry concentration (Matsumoto et al., 2012), while active weight is a well-known portfolio management statistic showing the deviation in asset allocation from a value-weighted portfolio or a benchmark (Jacobs and Levy, 2005). For trade flows, the HH index can similarly indicate concentration among partner countries or currencies, while the active weight can show the deviation of the real-world international trade mix from a hypothetical case where trade flows are proportionate to partner countries' GDPs. The maximum share of trade has been identified as an important factor in optimal currency area choice (Levy-Yeyati and Sturzenegger, 2010), and has been used as one of the first-stage regressors in the probit model by Tsangarides (2012), however there it is defined as the sum of export shares for the top three trade partners.

This study hypothesises that higher trade concentration leads to a greater propensity to fix, implying that a fixed exchange rate dummy variable is expected to be positively correlated with the HH index, maximum share, and active weight, and negatively correlated with the number of partners. Table 1 below reports the descriptive statistics for the computed trade concentration measures as well as their correlations with the propensity to fix.

Table 1. International trade concentration and propensity to fix: descriptive statistics

			Mean	Standard deviation	Minimum	Maximum	Median	Correlation with fixed
Countries	Exports	HH index	1718.00	1532.80	326.64	8795.82	1146.14	0.1517**
		Maximum	30.48%	17.98%	7.15%	93.69%	26.75%	0.1257*
		# of partners	120	50	11	178	128	-0.2517***
		Active weight	128.03%	31.00%	57.41%	195.49%	125.30%	0.1446*
	Imports	HH index	1426.46	1135.54	474.61	7443.56	1084.32	0.0925
		Maximum	27.54%	14.52%	9.68%	86.03%	23.61%	0.0609
		# of partners	120	30	45	176	118	-0.1771**
		Active weight	119.65%	24.20%	68.22%	181.92%	119.41%	0.1308*
	Total trade	HH index	1364.46	1114.92	372.05	7322.58	1021.29	0.1173
		Maximum	27.00%	14.77%	9.01%	85.39%	22.80%	0.0970
		# of partners	139	33	50	178	144	-0.2433***
		Active weight	117.51%	24.12%	60.38%	179.25%	115.53%	0.1403*
Currencies	Exports	HH index	2931.70	1611.67	857.54	9170.62	2493.11	0.1608**
		Maximum	45.59%	17.57%	15.16%	95.72%	42.27%	0.1511**
		# of partners	67	26	8	95	73	-0.2537***
		Active weight	103.60%	29.79%	43.61%	192.38%	100.64%	0.1484**
	Imports	HH index	2487.98	1230.23	1013.45	7444.28	2096.74	0.1964***

		Maximum	40.90%	15.52%	15.75%	86.03%	36.75%	0.1987***
		# of partners	69	17	29	95	69	-0.1780**
		Active weight	98.55%	27.42%	39.00%	181.09%	95.22%	0.1092
	Total trade	HH index	2452.22	1250.08	918.70	7364.60	2102.83	0.1610**
		Maximum	40.73%	15.95%	14.25%	85.57%	37.59%	0.1661**
		# of partners	78	16	32	95	81	-0.2363***
		Active weight	96.45%	25.76%	40.16%	176.40%	92.62%	0.1476**

Notes: ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

All correlation coefficients are of expected signs, and most are statistically significant. Notably, the statistical significance is higher for currency-clustered rather than country-clustered concentration metrics, reflecting the underlying incentive structure to peg national currencies to those of the most impactful partner countries or groups of partner countries utilising the same currency or a set of currencies pegged to the same anchor. This approach notably expands upon one of the insights of Levy-Yeyati and Sturzenegger (2003) who considered exchange rate regimes of neighbouring states to potentially impact the countries' propensity to fix. The procedure derived in this study more precisely accounts for the incentives to fix and explicitly utilises trade data instead of geographical proximity data.

Among the indicators considered, two (the number of export partners and the maximum share of imports) show the highest magnitude of correlation with the fixed exchange rate dummy. To derive the propensities to fix, the study considers a wide range of binary choice models – linear probability regression, probit, logit, and extreme value – with all indicators considered to establish the strongest first stage and ensure the validity of the TSLS estimators. This serves for additional robustness in comparison to existing research, as prior studies mainly limited their focus on probit (Ghosh et al., 1997; Tsangarides, 2012) or logit (Levy-Yeyati and Sturzenegger, 2003).

The estimations further emphasised the joint significance of the maximum import share and the number of export partners. None of the other trade concentration indicators were significant in the estimations when the two aforementioned variables were accounted for in the binary choice model. Table 2 shows the binary choice model estimation results (the first stage regressions for the propensity to fix instrumental variable) with Huber-White heteroskedasticity-consistent standard errors.

Table 2. International trade concentration and propensity to fix: first stage

Regressor	Propensity to fix			
	Linear	Probit	Logit	Extreme value
Constant	0.5029***	-0.0167	-0.0135	0.3644
	(3.5506)	(-0.0450)	(-0.0225)	(0.8116)
	0.0005	*0.9641*	*0.9820*	*0.4170*
Export diversification (number of partners)	-0.0051***	-0.0145***	-0.0233***	-0.0161***
	(-3.9057)	(-3.7678)	(-3.6627)	(-3.5773)
	0.0001	*0.0002*	*0.0002*	*0.0003*
Import concentration (maximum share)	0.7290***	2.1494***	3.4133***	2.4310***
	(-3.6822)	(3.5096)	(3.4281)	(3.2805)
	0.0003	*0.0004*	*0.0006*	*0.0010*

Notes: standard errors estimated using Huber-White heteroskedasticity-consistent covariance matrix. Z-stats are reported in parentheses and respective p-values are presented in italics. *** denotes statistical significance at 1%.

In all four binary choice models, both trade-related variables are significant at 1%, showing that trade concentration has high explanatory power over the exchange rate regime choice. The predicted probabilities of fixing are then extracted from the probit model[1] and used as instrumental variables for the fixed exchange rate dummy variable in TSLS estimations. This procedure helps to avoid instrumental variable multicollinearity and weak instrument concerns, as well as to account for potential non-linear relationships between trade concentration and propensity to fix.

In order to ensure specification validity and the adequacy of the instrumental variable strategy, this study follows the recommendations of Young (2019), reporting TSLS estimators alongside respective OLS coefficients and explicitly testing for endogeneity and weak instruments. To test whether obtained TSLS estimates are significantly different from their OLS counterparts, the Durbin-Wu-Hausman statistic (Nakamura and Nakamura, 1981) is

[1] The use of any of the four models outlined in Table 2 for instrumental variable construction does not change further results qualitatively or quantitatively. Trade concentration variables were also found to be significant determinants of the propensity to fix according to Kleim and Shambaugh (2008), Reinhart and Rogoff (2004), and Levy-Yeyati and Sturzenegger (2005) regime classifications.

applied, while potentially weak instruments are identified using the Cragg-Donald F-stat (Cragg and Donald, 1993). Such testing has been notably absent from past literature on the causal effects of exchange rate regimes.

First, cross-sectional TSLS regressions of average annual economic growth rate over the 2002-2018 period is estimated using three different measures of growth, namely real GDP, real GDP per capita, and real GDP per capita PPP. Cross-sectional regressions are preferable to panel regressions in this setting due to potential inconsistency of IV estimators (Bailliu et al., 2003) and time effect heterogeneity (Ghosh et al., 1997).

To control for convergence, all equations are augmented with log initial GDP per capita (real GDP per capita in 2002) as an additional exogeneous variable. These are estimated both including and excluding member states of monetary unions. To reflect potential heterogeneity across countries on various stages of economic development, notably observed in seminal studies (Ghosh et al., 1997; Levy-Yeyati and Sturzenegger, 2003), the equation is also separately considered for countries above and below the sample median for initial GDP per capita in 2002, as well as using an interaction term. For additional robustness, the estimations are also performed with three additional covariates – property rights, human capital (initial years of schooling), and trade openness (initial trade-to-GDP ratio), reflecting some of the notable drivers of economic growth highlighted in the literature (Acemoglu et al., 2003; Barro and Lee, 2013; Hall and Jones, 1999) and following control variable selection strategies in Ghosh et al. (1997) and Bailliu et al. (2003). Standard errors are estimated using a Huber-White-Hinckley heteroskedasticity consistent covariance matrix.

The same procedure is applied to identify the causal effect of exchange rate regimes on other important macroeconomic outcomes, such as inflation, unemployment, and output growth and inflation volatility, reflecting potential policy rationales for a fixed exchange rate and the findings of existing empirical research on the macroeconomic implications of exchange rate regimes.

Findings and Discussion

Table 3 below reports the baseline estimations for the whole sample. For all three measures of economic growth, a currency peg causes a 2.5%-2.8% lower annual rate of economic growth, which is both statistically and economically significant, contradicting the earlier assertions prominent in the literature that the effects of fixed exchange rates are, if present, immaterial at best (Rose, 2011). TSLS estimators are substantially different from their OLS counterparts as evidenced by significant (at 1%) difference in J-stats. For real GDP growth, the coefficients are of opposite signs, while for GDP growth per capita and GDP growth per capita PPP the IV estimators are almost four times greater in magnitude than the respective OLS estimators. Potential weak instrument concerns are rejected with an exceptionally high (exceeding 20) Cragg-Donald F-stat, evidencing the instrumental variables constructed using trade concentration have sufficiently strong first stages. The results are notably similar in sign and magnitude to those of Levy-Yeyati and Sturzenegger (2003) who reported 0.76% lower growth per annum for fixed exchange rate regimes in OLS models and 2.5%-4.0% in TSLS models. Additionally, OLS estimates are markedly close to those reported by Ghosh et al. (1997) at -0.5% and to the GMM coefficients of Bailliu et al. (2003) between -0.6% and -1.1%.

Table 3. Estimation results for economic growth

Regressor	GDP growth		GDP growth per capita		GDP growth per capita, PPP	
	OLS	IV	OLS	IV	OLS	IV
Constant	9.4282***	10.3824***	6.3452***	6.9741***	6.3309***	6.9721***
	(10.6281)	(9.3641)	(7.5583)	(6.6816)	(7.5392)	(6.6678)
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Log initial GDP per capita	-0.6584***	-0.6178***	-0.4359***	-0.4091***	-0.4358***	-0.4089***
	(-6.5017)	(-4.9343)	(-4.7223)	(-3.9437)	(-4.7250)	(-3.9407)
	0.0000	*0.0000*	*0.0000*	*0.0001*	*0.0000*	*0.0001*

Fixed exchange rate	0.0117 (0.0415) *0.9669*	-2.8187** (-2.4857) *0.0139*	-0.6862** (-2.3813) *0.0184*	-2.5519** (-2.4527) *0.0152*	-0.6725** (-2.3269) *0.0212*	-2.5550** (-2.4627) *0.0148*
Endogeneity test	13.8173*** *0.0002*		5.7498** *0.0165*		5.8884** *0.0152*	
Cragg-Donald F-stat	22.4483		22.4483		22.6262	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. *** and ** denote statistical significance at 1% and 5%, respectively.

Table 4 below checks for robustness when monetary union member states are excluded from the sample. The results do not change neither qualitatively nor quantitatively, remaining both statistically significant and within the -2.5% to -3.0% boundary for various economic growth metrics.

Table 4. Robustness check: excluding monetary unions

Regressor	GDP growth		GDP growth per capita		GDP growth per capita, PPP	
	OLS	IV	OLS	IV	OLS	IV
Constant	8.6908*** (8.2947) *0.0000*	10.5576*** (7.2747) *0.0000*	6.3224*** (6.5869) *0.0000*	7.4953*** (5.7735) *0.0000*	6.3094*** (6.5742) *0.0000*	7.4964*** (5.6630) *0.0000*
Log initial GDP per capita	-0.5678*** (-4.6467) *0.0000*	-0.6281*** (-3.9999) *0.0001*	-0.4429*** (-4.1176) *0.0001*	-0.4808*** (-3.8931) *0.0001*	-0.4433*** (-4.1251) *0.0001*	-0.4811*** (-3.8790) *0.0002*
Fixed exchange rate	0.2173 (0.6762) *0.5000*	-2.9653** (-2.3780) *0.0187*	-0.5749* (-1.7637) *0.0798*	-2.5746** (-2.1143) *0.0362*	-0.5591* (-1.7108) *0.0892*	-2.5787** (-2.2555) *0.0256*
Endogeneity test	14.5868*** *0.0001*		5.3435** *0.0208*		5.4841** *0.0192*	
Cragg-Donald F-stat	19.6683		19.6683		19.8234	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Table 5 below presents the estimations with exchange rate regime classifications from the existing literature to address the assumption sensitivity of its economic growth implications (Dubas et al., 2005; Eichengreen and Razo-Garcia, 2013). The estimators for the Klein and Stambaugh (2008) measure are the closest to the baseline results, highlighting the similarities in classification methodologies. However, all three regressions show negative and significant coefficients, with Levy-Yeyati and Sturzenegger (2005) classification yielding the highest magnitude result, albeit with the lowest t-stat, consistent with previous literature comparing alternative regime definition methodologies (Dubas et al., 2005). All three alternative estimations show high exogeneity as per the Durbin-Wu-Hausman test as well as, apart from Levy-Yeyati and Sturzenegger (2005), reasonably high Cragg-Donald F-stats (close to 10). This robustness check reinforces the validity of the instrumental variable construction methodology and its consistency in identifying negative and significant effects of fixed exchange rates on growth across a broad spectrum of potential regime classifications.

Table 5. Robustness check: alternative regime classifications

Regressor	GDP growth per capita					
	Klein and Stambaugh		Reinhart and Rogoff		Levy-Yeyati and Sturzenegger	
	OLS	IV	OLS	IV	OLS	IV
Constant	6.3601***	7.9168***	5.9198***	9.5165***	6.4110***	10.1229***
	(7.2756)	(5.0149)	(5.9721)	(4.1953)	(7.2732)	(3.4877)
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0006*
Log initial GDP per capita	-0.4467***	-0.4525***	-0.4418***	-0.5144***	-0.4466**	-0.4572***
	(-4.7959)	(-3.6292)	(-4.6681)	(-3.4913)	(-4.7594)	(-2.9384)
	0.0000	*0.0004*	*0.0000*	*0.0006*	*0.0000*	*0.0038*
Fixed exchange rate	-0.4915*	-3.5995*	0.2211	-3.8770**	-0.4101	-5.5322*
	(-1.7162)	(-1.9593)	(0.6541)	(-1.9826)	(-1.3605)	(-1.7181)
	0.0880	*0.0517*	*0.5139*	*0.0490*	*0.1755*	*0.0876*
Endogeneity test	6.1144**		9.0755***		6.8065***	
	0.0134		*0.0026*		*0.0091*	
Cragg-Donald F-stat	8.6685		9.5763		4.3215	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Another potential methodological concern regarding result validity can come from small countries in the sample skewing the results. To ensure robustness along these lines, the estimations are also performed using a generalised least squares framework, with respective GDPs in 2002 as weights. Performing such a procedure would prioritise the exchange rate effects in larger economies and test for economic significance and overall generalisability. Table 6 below reports the respective results and shows that the causal effects of currency pegs on economic growth again remain overwhelmingly negative and significant, albeit of smaller magnitude (around -1.6% compared to -2.7% in unweighted estimations). Hence, this test supports prior findings and suggests that initial results has not been significantly influenced by small countries in the sample.

Table 6. Robustness check: least squares weighted by initial GDP

Regressor	GDP growth		GDP growth per capita		GDP growth per capita, PPP	
	OLS	IV	OLS	IV	OLS	IV
Constant	17.1965***	18.3341***	14.9101***	16.0926***	14.9113***	16.0988***
	(5.7321)	(3.9546)	(4.4111)	(3.1017)	(4.4008)	(3.0998)
	0.0000	*0.0000*	*0.0000*	*0.0023*	*0.0000*	*0.0023*
Log initial GDP per capita	-1.4667***	-1.5260***	-1.3154***	-1.3770***	-1.3155***	-1.3777***
	(-4.8699)	(-3.5818)	(-3.9198)	(-2.8976)	(-3.9116)	(-2.8949)
	0.0000	*0.0004*	*0.0001*	*0.0043*	*0.0001*	*0.0043*
Fixed exchange rate	0.1095	-1.5965*	0.2071	-1.5661*	0.2070	-1.5618*
	(0.1845)	(-1.8528)	(0.3438)	(-1.7633)	(0.3439)	(-1.7720)
	0.8539	*0.0657*	*0.7314*	*0.0797*	*0.7314*	*0.0782*
Endogeneity test	16.2959***		17.7273***		17.6678***	
	0.0001		*0.0000*		*0.0000*	
Cragg-Donald F-stat	41.3200		41.3200		41.4148	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. *** and * denote statistical significance at 1% and 10%, respectively.

Next, the heterogeneity bias concerns are further addressed by performing the estimation on subsamples below and above the sample median for initial GDP per capita ($3498 in constant 2010 prices)[2] and initial property rights (a value of 50 as per the Heritage property rights index) as well as by including the respective interaction terms. The results (see Tables 7 and 8 below, respectively) highlight that the negative causal effect of fixed exchange rate regimes on growth is well-pronounced in countries with varying levels of economic development and property rights protection, however the impact is more modest for countries with higher GDP per capita. These findings are somewhat consistent with the results of Levy-Yeyati and Sturzenegger (2003) who report significant negative effects for non-industrial countries and insignificant

[2] The results are also consistent based on World Bank 2001 low-income country classification

effects for industrial countries, however in this study's estimations statistical and economic significance of exchange rates in developed countries is maintained. Endogeneity is significantly more well-pronounced for relatively less developed countries and for countries with lower institutional quality, evidencing that high-income economies with good institutions have more discretion over the exchange rate regime choice, reinforcing the findings of Alesina and Wagner (2006).

Table 7. Robustness check: heterogeneity for initial GDP per capita

Regressor	GDP growth per capita					
	low-income		high-income		interaction term	
	OLS	IV	OLS	IV	OLS	IV
Constant	2.4965	2.5220	9.1103***	8.5546***	5.0830***	11.0001***
	(1.1369)	(0.9534)	(5.9721)	(5.0557)	(4.7266)	(3.7528)
	0.2588	*0.3432*	*0.0000*	*0.0000*	*0.0000*	*0.0002*
Log initial GDP per capita	0.0833	0.2821	-0.7065***	-0.6188***	-0.2823**	-0.9306***
	(0.2658)	(0.7161)	(-4.3780)	(-3.1958)	(-2.3761)	(-2.6150)
	0.7911	*0.4759*	*0.0000*	*0.0020*	*0.0186*	*0.0097*
Fixed exchange rate	-0.2218	-3.1254*	-1.1302***	-1.8012**	1.8802	-10.5597*
	(-0.4676)	(-1.7963)	(-3.7286)	(-2.1908)	(1.1258)	(-1.9086)
	0.6413	*0.0761*	*0.0004*	*0.0313*	*0.2619*	*0.0580*
Log initial GDP per capita x fixed exchange rate					-0.3097*	1.0350
					(-1.6795)	(1.5193)
					0.0949	*0.1306*
Endogeneity test	4.5305**		0.8245		12.6073***	
	0.0333		*0.3639*		*0.0018*	
Cragg-Donald F-stat	10.0381		13.8010		6.9792	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Table 8. Robustness check: heterogeneity for institutional quality

Regressor	GDP growth per capita					
	low-quality institutions		high-quality institutions		interaction term	
	OLS	IV	OLS	IV	OLS	IV
Constant	5.9580***	6.4231***	7.3023***	8.1474***	6.3600***	7.0709***
	(5.1694)	(4.4989)	(6.4646)	(5.3728)	(7.3641)	(6.4081)
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
Log initial GDP per capita	-0.4109***	-0.3083**	-0.5195***	-0.5219***	-0.4404***	-0.4000***
	(-3.2218)	(-2.0060)	(-4.2966)	(-3.3309)	(-4.7395)	(-3.6137)
	0.0018	*0.0478*	*0.0000*	*0.0017*	*0.0000*	*0.0004*
Fixed exchange rate	-0.5796	-3.1848*	-1.0077**	-3.1087*	-1.0799*	-3.5712**

	(-1.4234)	(-1.9770)	(-2.1864)	(-1.7862)	(-1.8063)	(-2.8531)
	0.1580	*0.0510*	*0.0337*	*0.0804*	*0.0730*	*0.0050*
Property rights x fixed exchange rate					0.0067	0.0111
					(0.6675)	(0.7009)
					0.5055	*0.4845*
Endogeneity test	4.3224**		1.8220		7.0940**	
	0.0376		*0.1771*		*0.0288*	
Cragg-Donald F-stat	9.8263		3.7712		6.6437	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Finally, the robustness of the results is reinforced when property rights, human capital, and trade openness are included into the models as additional controls (see Table 9 below). The coefficients are more than twice higher in magnitude for these estimations (ranging from -6.0% to -7.4%), however relatively low Cragg-Donald F-stats suggest that these estimates are less reliable than the baseline coefficients. Nevertheless, the signs and statistical significance of the estimators of interest is overwhelmingly consistent across all models and robustness checks. Significant results for covariates are of expected signs.

Table 9. Robustness check: controlling for property rights, human capital, and trade openness

Regressor	GDP growth		GDP growth per capita		GDP growth per capita, PPP	
	OLS	IV	OLS	IV	OLS	IV
Constant	9.0008***	8.1596***	7.0725***	6.4384***	7.0597***	6.4281***
	(7.5520)	(3.1432)	(7.7915)	(3.5938)	(7.7684)	(3.5652)
	0.0000	*0.0021*	*0.0000*	*0.0005*	*0.0000*	*0.0005*
Log initial GDP per capita	-0.5609**	0.4332	-0.8567***	-0.1072	-0.8518***	-0.1003
	(-2.3410)	(0.5478)	(-6.2772)	(-0.2065)	(-6.2209)	(-0.1928)
	0.0210	*0.5850*	*0.0000*	*0.8368*	*0.0000*	*0.8475*
Fixed exchange rate	-0.4019	-7.3883*	-0.7040*	-5.9708*	-0.6998*	-5.9997*
	(-1.0423)	(-1.8645)	(-1.9459)	(-1.9141)	(-1.9334)	(-1.9242)
	0.2996	*0.0649*	*0.0542*	*0.0582*	*0.0558*	*0.0569*
Property rights	-0.0031	-0.0187	0.0005	-0.0113	-0.0002	-0.0117
	(-0.5353)	(-1.1520)	(0.0857)	(-0.8820)	(-0.0342)	(-0.9034)
	0.5936	*0.2518*	*0.9319*	*0.3797*	*0.9728*	*0.3683*
Years of schooling	-0.0716	-0.6788	0.3175***	-0.1402	0.3139***	-0.1448
	(-0.5994)	(-1.4535)	(3.9502)	(-0.4427)	(3.8882)	(-0.4564)
	0.5501	*0.1489*	*0.0001*	*0.6588*	*0.0002*	*0.6490*
Trade openness	0.0045*	0.0108	0.0038	0.0086	0.0040	0.0087
	(1.8822)	(1.5485)	(1.5689)	(1.4721)	(1.6649)	(1.4730)

	0.0624	*0.1244*	*0.1196*	*0.1439*	*0.0988*	*0.1436*
Endogeneity test	17.7952***		12.8500***		13.1334***	
	0.0000		*0.0003*		*0.0003*	
Cragg-Donald F-stat	4.9930		4.9930		5.0200	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Additionally, the causal effect of fixed exchange rate on some other macroeconomic outcomes is assessed in Table 10. It is evident that fixed exchange rate regimes are associated with substantially higher volatility of both output and inflation as well as higher average unemployment, while they notably fail to reduce average inflation. OLS estimates show that currency pegs are associated with marginally lower inflation, while the TSLS model implies inflation is higher, albeit insignificantly, contradicting earlier studies (Ghosh et al., 1997). For other three variables, the TSLS estimates are statistically significant, largely consistent with Ghosh et al. (1997), Levy-Yeyati and Sturzenegger (2003), and Reinhart and Rogoff (2004). Therefore, it seems fixed exchange rates do not deliver on any of the declared macroeconomic objectives when causality is considered, being detrimental to growth and unemployment dynamics, causing higher volatility of both output and inflation, and not reducing average inflation.

Table 10. Exchange rate regimes and other macroeconomic outcomes

Regressor	Growth volatility		Inflation		Inflation volatility		Unemployment	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Constant	3.5736***	0.8017	6.0483***	4.5066***	-1.8245***	-2.5722***	7.3754***	4.4286***
	(8.3124)	(0.7836)	(14.4596)	(3.4600)	(-3.0758)	(-3.6617)	(16.0735)	(2.8607)
	0.0000	*0.4343*	*0.0000*	*0.0007*	*0.0025*	*0.0003*	*0.0000*	*0.0048*
Fixed exchange rate	0.2579	6.2867**	-0.9046	2.4358	1.4457***	2.9707***	0.4273	6.9177*
	(0.4537)	(2.3821)	(-0.8371)	(0.7253)	(3.5533)	(2.6683)	(0.4899)	(1.9715)
	0.6506	*0.0183*	*0.4037*	*0.4693*	*0.0005*	*0.0084*	*0.6249*	*0.0503*
Endogeneity test	13.0316***		1.2679		2.0358		6.7614***	
	0.0003		*0.2602*		*0.1536*		*0.0093*	
Cragg-Donald F-stat	19.6218		20.0213		20.6515		19.6218	

Notes: T-stats are reported in parentheses and respective p-values are presented in italics. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

Conclusion

This study has utilised a novel instrumental variable construction procedure, exploiting exogeneous variation in exchange rate regime choice attributable to international trade concentration, to revisit the causal effects of de facto exchange rate regimes on macroeconomic outcomes, primarily economic growth, on a sample of 178 countries in 2002-2018.

This study is the first in the field to directly address instrument endogeneity issue, TSLS estimator inconsistency, and weak instrument concerns. The derived instruments are theoretically exogeneous, have notably strong first stages, and respective TSLS estimations are significantly different from their OLS counterparts.

The estimation strategy developed in this study has allowed to achieve the level of result robustness unmatched in prior literature: negative and significant growth implications of de facto currency pegs have been reinforced both in high- and low-income countries as well as in countries with varying institutional quality. A de facto fixed exchange rate policy causes 2.7% lower growth per annum, which is both statistically and economically significant. The results are not conditional on regime classification methodology or economic growth measures and are robust to property rights, human capital, and trade-related covariates. The derived methodology is also useful at assessing the impact of exchange rate regime on other macroeconomic outcomes, such as inflation, inflation volatility, output volatility, and unemployment, revisiting the research questions raised by the early studies in the field.

The implications of this study are two-fold. First, it has addressed the notable lack of consensus in the exchange rate literature, providing substantial evidence contradicting the immateriality of exchange rate policy effects. Second, it has shown that bilateral trade flows can be extremely useful in constructing instrumental variables, a technique that can be fruitfully utilised in further research in empirical macroeconomics. Finally, it provides a strong rationale for a floating exchange rate policy both in developed and emerging economies and sheds some light on potential causes of relatively slow growth in the Eurozone countries during the past two decades. In 2008, Tavlas et al. (2008) stated that "we remain a long way from having reliable empirical evidence that can help us choose among alternative [exchange rate] systems". This study can serve at least as one of the steps in the identified direction.

Further research might re-apply the techniques developed in this study in a panel setting while acknowledging for issues associated with estimator inconsistency and instrument endogeneity. New data on economic growth figures, particularly regarding a likely global recession in 2020 and subsequent recovery growth dynamics, can improve the general understanding of exchange rate performance under stress conditions and serve as a valuable out-of-sample test for this study's results.

References

Acemoglu, D., Johnson, S., Robinson, J., & Thaicharoen, Y. (2003). Institutional causes, macroeconomic symptoms: volatility, crises and growth. *Journal of Monetary Economics, 50*(1), 49-123.

Alesina, A., & Summers, L. (1993). Central bank independence and macroeconomic performance: some comparative evidence. *Journal of Money, Credit and Banking, 25*(2), 151-162.

Alesina, A., & Wagner, A. (2006). Choosing (and reneging on) exchange rate regimes. *Journal of the European Economic Association, 4*(4), 770-799.

Angrist, J., & Krueger, A. (2001). Instrumental variables and the search for identification: From supply and demand to natural experiments. *Journal of Economic Perspectives, 15*(4), 69-85.

Bailliu, J., Lafrance, R., & Perrault, J. (2003). Does exchange rate policy matter for growth? *International Finance, 6*(3), 381-414.

Barro, R., & Lee, J. (1996). International measures of schooling years and schooling quality. *American Economic Review, 86*(2), 218-223.

Barro, R., & Lee, J. (2013). A new data set of educational attainment in the world, 1950–2010. *Journal of Development Economics, 104*(1), 184-198.

Baxter, M., & Stockman, A. (1989). Business cycles and the exchange-rate regime: some international evidence. *Journal of Monetary Economics, 23*(3), 377-400.

Collins, S. (1996). On becoming more flexible: Exchange rate regimes in Latin America and the Caribbean. *Journal of Development Economics, 51*(1), 117-138.

Cragg, J., & Donald, S. (1993). Testing identifiability and specification in instrumental variable models. *Econometric Theory, 9*(2), 222-240.

De Grauwe, P., & Schnabl, G. (2008). Exchange rate stability, inflation, and growth in (South) Eastern and Central Europe. *Review of Development Economics, 12*(3), 530-549.

Edwards, S. (1996). *The determinants of the choice between fixed and flexible exchange-rate regimes* (No. w5756). National Bureau of Economic Research.

Eichengreen, B., & Razo-Garcia, R. (2013). How reliable are de facto exchange rate regime classifications? *International Journal of Finance & Economics, 18*(3), 216-239.

Gallup, J., Sachs, J., & Mellinger, A. (1998). *Geography and economic growth.* World Bank.

Ghosh, A. (2013). Exchange rate pass through, macro fundamentals and regime choice in Latin America. *Journal of Macroeconomics, 35*(1), 163-171.

Ghosh, A., Gulde, A., Ostry, J., & Wolf, H. (1997). *Does the nominal exchange rate regime matter?* (No. w5874). National Bureau of Economic Research.

Hall, R., & Jones, C. (1999). Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics, 114*(1), 83-116.

Huang, H., & Malhotra, P. (2005). Exchange rate regimes and economic growth: Evidence from developing Asian and advanced European economies. *China Economic Quarterly, 4*(4), 971-1003.

Jacobs, B., & Levy, K. (2006). Enhanced active equity strategies. *Journal of Portfolio Management, 32*(3), 45-55.

Klein, M., & Shambaugh, J. (2008). The dynamics of exchange rate regimes: Fixes, floats, and flips. *Journal of International Economics, 75*(1), 70-92.

Levine, R. (1999). *Financial development and economic growth: views and agenda.* The World Bank.

Levy-Yeyati, E., & Sturzenegger, F. (2001). *Exchange rate regimes and economic performance.* IMF staff papers.

Levy-Yeyati, E., & Sturzenegger, F. (2003). To float or to fix: Evidence on the impact of exchange rate regimes on growth. *American Economic Review, 93*(4), 1173-1193.

Levy-Yeyati, E., & Sturzenegger, F. (2005). Classifying exchange rate regimes: Deeds vs. words. *European Economic Review, 49*(6), 1603-1635.

Levy-Yeyati, E., Sturzenegger, F., & Reggio, I. (2010). On the endogeneity of exchange rate regimes. *European Economic Review, 54*(5), 659-677.

Matsumoto, A., Merlone, U., & Szidarovszky, F. (2012). Some notes on applying the Herfindahl–Hirschman Index. *Applied Economics Letters, 19*(2), 181-184.

Mundell, R. (1961). A theory of optimum currency areas. *American Economic Review, 51*(4), 657-665.

Nakamura, A., & Nakamura, M. (1981). On the relationships among several specification error tests presented by Durbin, Wu, and Hausman. *Econometrica, 49*(6), 1583-1588.

Oeking, A. (2015). The European periphery during the crisis: fix or float? *Applied Economics Letters, 22*(4), 285-290.

Reinhart, C., & Rogoff, K. (2004). The modern history of exchange rate arrangements: a reinterpretation. *Quarterly Journal of Economics, 119*(1), 1-48.

Rose, A. (2011). Exchange rate regimes in the modern era: fixed, floating, and flaky. *Journal of Economic Literature*, *49*(3), 652-72.

Shanaev, S., & Wanjiru, R. (2019). *New evidence on the institutional causes of economic growth: Using peer pressure to unbundle institutions across countries.* https://dx.doi.org/10.2139/ssrn.3497642

Stone, M., Anderson, H., & Veyrune, R. (2008). Exchange rate regimes: fix or float? *Finance and Development, 45*(1), 42.

Tavlas, G., Dellas, H., & Stockman, A. (2008). The classification and performance of alternative exchange-rate systems. *European Economic Review, 52*(6), 941-963.

Tsangarides, C. (2012). Crisis and recovery: Role of the exchange rate regime in emerging market economies*.* *Journal of Macroeconomics, 34*(2), 470-488.

Young, A. (2019). *Consistency without inference: Instrumental variables in practical application.* London School of Economics.