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ABSTRACT

While illicit capital flight is a major concern of policy makers in developing countries, there is only little research on the possible link between capital flight and development aid. In this paper, we address the issue for Nepal, a stereotypical financially-closed developing economy that is highly dependent on resources from abroad. Distinguishing features of our approach are the use of a narrowly defined proxy of capital flight, based on trade-cost adjusted mirror trade statistics, and the focus on the foreign-exchange cash component of development aid. We document a robust partial correlation between aid and outward capital flight that is economically and statistically significant. Interestingly, this positive correlation is not observable for remittances, an alternative form of foreign-exchange inflows where the capital flight motivation is absent. Furthermore, it is visible in the the FX-cash component but not in broader aid definitions that include in-kind transfers, or in multilateral and IMF loans. Finally, when comparing the subcomponents of export underinvoicing and import overinvoicing, only the latter is driving our results.

JEL CODES: F24; F32; F35.

KEYWORDS: Capital Flight; Development Aid; Remittances; Trade Misinvoicing.

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1. Introduction

The (in)effectiveness of development aid has been analyzed from both macro and micro perspectives,[1] but surprisingly little research has looked directly at the balance of payments and the illicit capital in-and-outflows that remain unrecorded in the official statistics. Nepal provides an interesting case study in this context as sizable amounts of foreign-currency from aid and remittances are sent every year to a country with a tightly controlled capital account.[2] In this paper, we report some stylized facts that are consistent with the view that development aid—unlike remittances or other official inflow components—has the unwelcome side effect of triggering sizable illicit capital outflows. We analyze the mechanism behind this result and document that the overinvoicing of imported goods is the key channel that drives the empirical regularities.

The potential of development aid to cause private capital outflows was first recognized by Bauer (1981) and was theoretically motivated and empirically studied by Collier *et al.* (2001; 2004). So far, the empirical evidence on the aid-capital flight nexus is mixed and leans toward a positive effect; i.e., official inflows trigger further private capital inflows (see also Lensink *et al.*, 2000; Hermes and Lensink, 2001). Apart from Collier (2001), these empirical studies treat aid inflows as a relevant control variable but put little emphasis on it.

A distinguishing feature of our paper is the use of a narrower definition of development aid and a narrower definition of capital flight. For the aid variable, we consider only foreign-exchange (FX) cash transfers, by using a novel dataset from the central bank of Nepal (Nepal Rastra Bank). Regarding the capital flight measure, we consider the concept of trade misinvoicing, which is conceptually linked more closely to the potential outflow effect and is seen as most relevant by policymakers in Nepal.[3] Earlier research has instead focused on the World Bank Residual measure of capital flight, a broad definition that also includes unrecorded portfolio flows, foreign direct investment, and general measurement errors in the balance of payments. Moreover, earlier studies have used the Organization for Economic Co-operation and Development's (OECD) broad definition of net official development assistance that includes in-kind transfers for which the capital flight motivation is weak. For Nepal, the FX cash component of aid makes up around half of total aid.

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[1] A few contributions are Bourguignon and Sundberg (2007), Rajan and Subramanian (2008), Hansen and Tarp (2001), Doucouliagos and Paldam (2009), Dreher *et al.* (2015), and Minasyan *et al.* (2017).

[2] Nepalese are barred from making any foreign investments abroad through the *Act Restricting Investment Abroad*, 2021 (1964).

[3] Policymakers in Nepal consider trade misinvoicing to be a main channel of capital flight; see, e.g., an interview with Maha Prasad Adhikari (former deputy governor of the Nepal Rastra Bank) in the *Kathmandu Post*, April 11, 2016.

We construct our proxy of illicit capital flight based on the concept of trade misinvoicing (TMI). In financially-closed economies like Nepal, capital is often moved across borders via exports or imports by manipulating the bills upwards or downwards.[4] Using trade statistics recorded by the statistical offices of Nepal and its trading partners – for the same transactions – we construct a time series that illustrates how Nepal's TMI index has evolved. We refine this proxy by taking into account the trading-partner and direction-specific transport costs, which in other studies have often been assumed to take a constant value of 10%. While the dynamics are largely unaffected by the choice of trade-cost adjustment, there is a sizable difference in the level and thus the total amout of capital flight. Using constant trade costs of 10% underestimates the extent of misinvoicing on average by $49 million per year. We mainly observe net capital outflows from Nepal, but interestingly the politically most stable period, after the Maoist insurgency and before the earthquake, also witnessed sizable illicit inflows. The largest illicit outflows are observed after the earthquake in 2015 (see Figure 2 below).

To explain the evolution of trade misinvoicing in Nepal, we set up a standard regression specification that explains the pattern by fundamental variables, such as interest rate spreads, real GDP growth rates, trade openness, and country-specific events, such as the 2015 earthquake or the subsequent India trade blockade. In particular, interest differentials appear to be an important variable, consistent with standard portfolio theory. In the second part of the regression analysis, we add different definitions of aid flows. Among potential candidates, the development aid in the form of FX cash transfers, IMF and other multilateral loans, and grants (including in-kind transfer), we find that only the former has a positive and significant impact on capital flight. Other forms of aid are statistically insignificant and have conflicting signs, thus confirming the lack of systematic evidence in the earlier literature.

Our findings are consistent with the view that the aid money transferred to help the country purchase critically needed goods, such as medical or construction equipment and IT hardware and software, is diverted, at least in part, to purchase investments assets abroad. These donated goods might be purchased at overpriced rates and thus might provide an opportunity for the buyer to circumvent capital controls and move capital out of the domestic economy. This behavior would explain the discrepancies in mirror-trade statistics, the disappointing track

[4] The leakage of the Panama papers, for instance, revealed substantial circumventions of Nepal's capital controls; see, e.g., "Nepalis in tax havens, Swiss banks, money laundering," *Nepali Times*, January 17, 2019, as well as "Nepalis parking wealth in Swiss banks," *The Himalayan Times*, July 2, 2018.

record of development aid, and the correlation of aid with our TMI measure.[5]

The remittances sent to Nepal by its working population abroad serve as a counterexample to this hypothesis. While aid from official donors abroad may be susceptible to being diverted by the recipient, a similar behavior is unlikely to be tolerated by foreign workers supporting their families back home. In this case, the money was initially earned in a foreign country and was thus out of reach for Nepalese capital controls and tax authorities. If capital flight was the objective, they might as well have kept the money abroad instead of first sending it home via official money transfer-companies and paying a sizable fee along the way.[6] In our regressions, we find remittances to behave remarkably different from development aid, as an increase in remittances is associated with a further net *inflow* of illicit capital. If there is a desire to bring money into the country, the citizens working abroad apparently use both official and unofficial channels.

In a further attempt to identify the mechanism, we decompose the overall index of net TMI into its subcomponent of import overinvoicing (IOI) and export underinvoicing (EUI). We find that (i) the largest share of trade misinvoicing in Nepal is indeed occurring via import overinvoicing and (ii) only the IOI component reacts in response to inflows of development aid. This is plausible, as development aid is largely given to the recipients to finance imports. While in principle, EUI could be a vehicle for capital flight, it is not directly linked to the inflow of development aid.

Based on these three comparisons, we consider the empirical evidence to be indicative of a causal link. In the absensce of an external instrument, however, it is important to further explore the potential biases resulting from endogeneity or simultaneity, i.e. both variables being driven by a third factor. Furthermore, there may be relevant control variables missing, beyond those typically used in the literature. We are aware of these limitations, but do not consider them to be large enough to crucially change our estimates. For instance, we document that the potential bias resulting from omitted variables – if any - is upwards, and rather small. The bias-adjusted estimate remains in the 95%-confidence interval of the original estimate and the identified set of coefficients remains well above zero. The recently developed Oster (2019) approach indicates that omitted variables are unlikely to affect our main result.

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[5] Not only Nepalese recipients in donor countries may be involved but also companies. Nepal's former finance minister, Madhukar SJB Rana, argued that "the German aided Marsyangdi project [...] was a case of 'aid in reverse' by implementing a project that was 5 times higher than the actual market price […] 70–80 % of all aid flows back to the donor country and no more than 10% to the beneficiaries […]," *Spotlight Nepal*, August 17, 2018. For empirical evidence on the link between aid and exports, see also Martínez-Zarzoso *et al*. (2014).

[6] See, e.g., Ahmed *et al.* (2021) on the transactions costs of remitting.

Further robustness tests include different treatments of residual autocorrelation, extended sets of control variables, and different trade cost assumptions in the calculation of our TMI measure. We illustrate that our key findings are robust to instrumental variable (IV) estimates, where we exploit heteroscedasticity in the data to form a set of valid internal instruments in the absence of convincing external instruments (Lewbel, 2012). The IV results formally confirm that aid can be treated as an exogenous variable in our regression specification; a C-test does not reveal a statistically significant difference compared to the OLS estimates. Overall, we find a robust positive effect of FX aid inflows on illicit capital flight that is statistically significant and economically sizable.

The rest of the paper is organized as follows: Section 2 describes the practice of misinvoicing in international trade. The data are shown in Section 3, in particular the construction of our index on trade misinvoicing. In Section 4, we provide a preliminary statistical analysis and establish the main results based on a multivariate regression analysis. Section 5 sheds light on the influence of unobservable factors. Sensitivity tests and further analyses are reported in Sections 6 and 7, respectively. Section 8 concludes the paper with some policy implications.

2. Trade misinvoicing

Trade misinvoicing is a well-established phenomenon that has been used to analyze capital flight patterns in many studies (e.g., Bhagwati, 1964, 1981; Cardoso and Dornbusch, 1989; De Wulf, 1981; Fisman and Wei (2004); Buehn and Eichler (2011), Ferrantino *et al.* (2012); Cheung *et al.* 2016, 2020). The underlying modus operandi builds on the illegal issuance of upward or downward manipulated invoices in international (goods) trade. An illustrative example adapted from the reports of Global Financial Integrity is given in Figure 1.[7]

One can think for instance of a Nepalese importer who purchases $1 million of medical goods, donated by an international aid-provider. Suppose he uses an intermediary in an offshore financial center to re-invoice the cost of the medical goods as $ 1.5 million. The foreign exporter receives his expected $1 million, but the remaining half a million dollars stay with the importers private offshore account. This way of processing the payment thus allows the importer to circumvent any restrictions placed on international capital movements in its juridiction.[8]

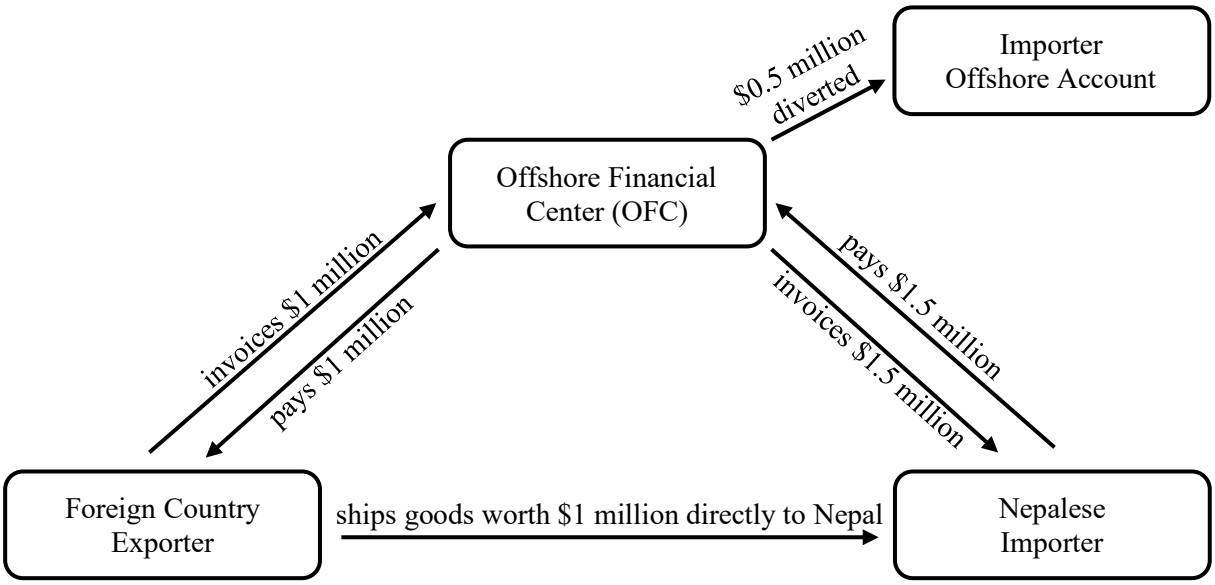
Of course, this is just a stylized example and real-world cases sometimes present

[7] See https://gfintegrity.org/issue/trade-misinvoicing/

[8] Nepalese are not allowed to invest abroad (Act Restricting Investment Abroad, 2021 (1964)). A summary of restrictions on international capital movements and holdings in Nepal is given in Maskay *et al.* (2018).

themselves in more complex forms. The 2012 report of the *Asian/Pacific Group on Money Laundering*, for instance, presents seven different case studies of trade misinvoicing, some involving complex corporate structures of shell companies, some disguising mere trans-shipments as re-exports, and some not only manipulating the value but also the quality of invoice positions (Asia/Pacific Group on Money Laundering, 2012).[9]

Figure 1: Basic Trade Misinvocing Example without Collusion



Furthermore, the im- and export misinvoicing need not be directly linked to the import of medical goods; this is just an illustrative example and it could occur in any other sector. Also, the intermediary bank account need not be in a classical offshore financial center, instead might be directly located in the foreign exporters jurisdiction and owned by the importer. The example in Figure 1 is nevertheless a plausible one. Andersen *et al.* (2021) have documented that part of foreign aid is diverted, by illustrating an increase in offshore deposits after an increase in foreign aid. Our analysis is complementary to theirs and approaches the same phenomenon through the lens of export- and import statistics.

3. Data and descriptive statistics

The value of merchandise traded between two economies is recorded independently by two different statistical agencies, in the domestic and the foreign country. By overinvoicing

[9] While these case studies all include at least one Asian country, trade misinvoicing cannot considered to be an Asian phenomonen alone; see various issues of The Economist for alternative examples and discussions ("Exports to Mars", Nov. 12th 2011; "Hot and Hidden", Jan. 18th 2014; "A bad boom", March 15th 2014; "Uncontained", May 3rd 2014).

imports, the cross-border payment exceeds the true value of the corresponding good and thus provides the resources to invest abroad, even when any official foreign investment is forbidden or subject to strict rules. Analogously, exports could be underinvoiced to move capital out of the country. To quantify the total level of trade misinvoicing, we thus compare the trade data reported by Nepal and its trading partners, both taken from the International Monetary Fund (IMF) Directions of Trade Statistics.

One practical limitation of the proxy is that export data are reported at free on board (FOB) prices and imports at cost, insurance, and freight (CIF) prices. Thus, there already exists a wedge between the two values, even in the absence of any fraudulent behavior. To capture this institutional aspect, we incorporate a variable *CIF* to correct the CIF effect in calculating Nepal's export underinvoicing, *EUI*:

$$EUI = \Sigma_i^p \, [XW_{i,t} - XC_{i,t}*(1+CIF)], \tag{1}$$

where $XW_{i,t}$ is economy *i*'s reported value of imports from Nepal, $XC_{i,t}$ is Nepal's reported value of exports to country *i, p* is the number of economies importing from Nepal, and *CIF* facilitates a fair comparison of the reported values of exports and imports. Similarly, we calculate Nepal's import overinvoicing, *IOI* as

$$IOI = \Sigma_i^q \, [MC_{i,t} - MW_{i,t}*(1+CIF)], \tag{2}$$

where $MC_{i,t}$ is Nepal's reported value of imports from country *i*, $MW_{i,t}$ is economy *i*'s reported value of exports to Nepal, and *p* is the number of economies exporting to Nepal. The total amount of Nepal's capital flight via trade misinvoicing is the sum of export underinvoicing and import overinvoicing. Henceforth, the sum is our TMI measure of capital flight:

$$TMI = EUI + IOI. \tag{3}$$

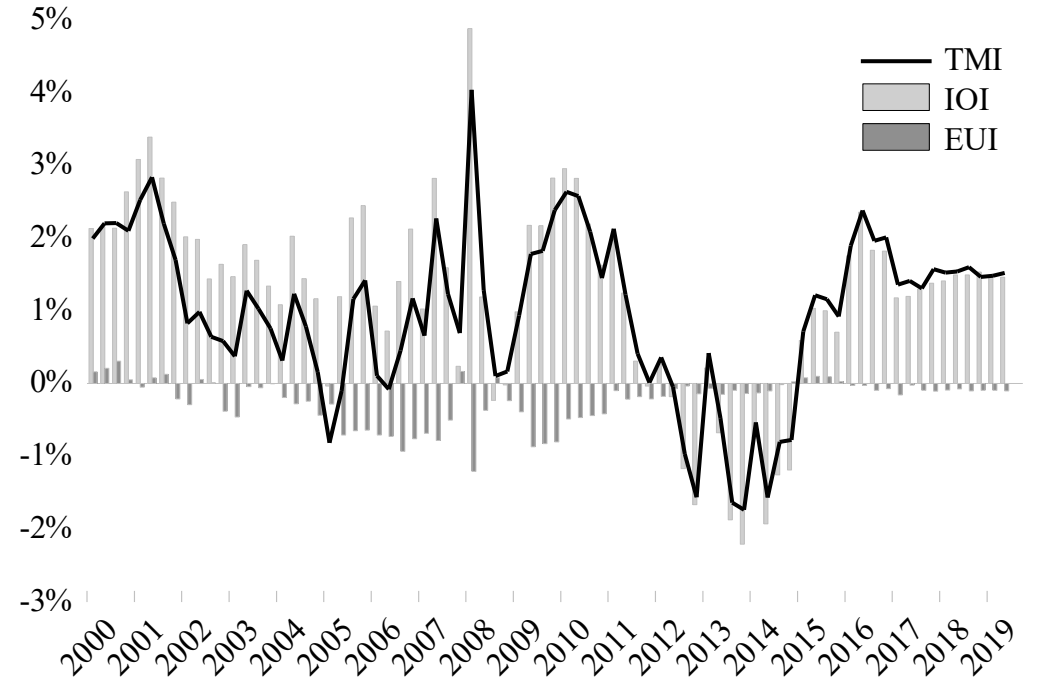
Early papers analyzing trade misinvoicing typically assume that *CIF = 10%*.[10] This approach neglects any differences in trade costs across countries that are caused (e.g., by the distance of trading partners or other geographical features, as in the case of Nepal) by the absence of direct access to any major trade port. Only very seldom have trade costs been taken into account that have been estimated based on actual observed data. In our paper, we follow

[10] See, e.g., Beja (2008), Buehn and Eichler (2011), Patnaik *et al.* (2012), and Kar and Freitas (2012). The CIF = 10% assumption is often justified by referring to the IMF. The IMF (2015) argues that "the 10 percent c.i.f./f.o.b. factor represents a simplified estimate of these costs, which vary widely across countries and transactions." For evidence on the variation of trade costs along several dimensions, see, e.g., Hummels (2007), Jacks *et al.* (2008), or Wei *et al.* (2020).

the approach of Cheung *et al.* (2020), who exploit a new dataset by the OECD (International Transport and Insurance Costs of Merchandise Trade, ITIC) to infer and back out the CIF estimate, that is not only country-specific but also varies with trading partners and trade direction.[11]

While the time series dynamics for TMI estimates under different CIF assumptions are very similar in our dataset, the assumption does affect the level and trend of trade misinvoicing estimates considerably.[12] Taking into account country specific trade costs results in roughly 25% higher estimates for trade misinvoicing activities. The CIF=10% assumption introduces a systematic downward bias (less net outflows/more net inflows) that becomes stronger over the sample period.

Figure 2: TMI and Components



Note: The solid line shows our estimate of trade misinvoicing (TMI) and, as bars, the two components—import overinvoicing (IOI) and export underinvoicing (EUI). All values are expressed as a percentage of annual nominal GDP. See equations (1) to (3) and Appendix A for definitions.

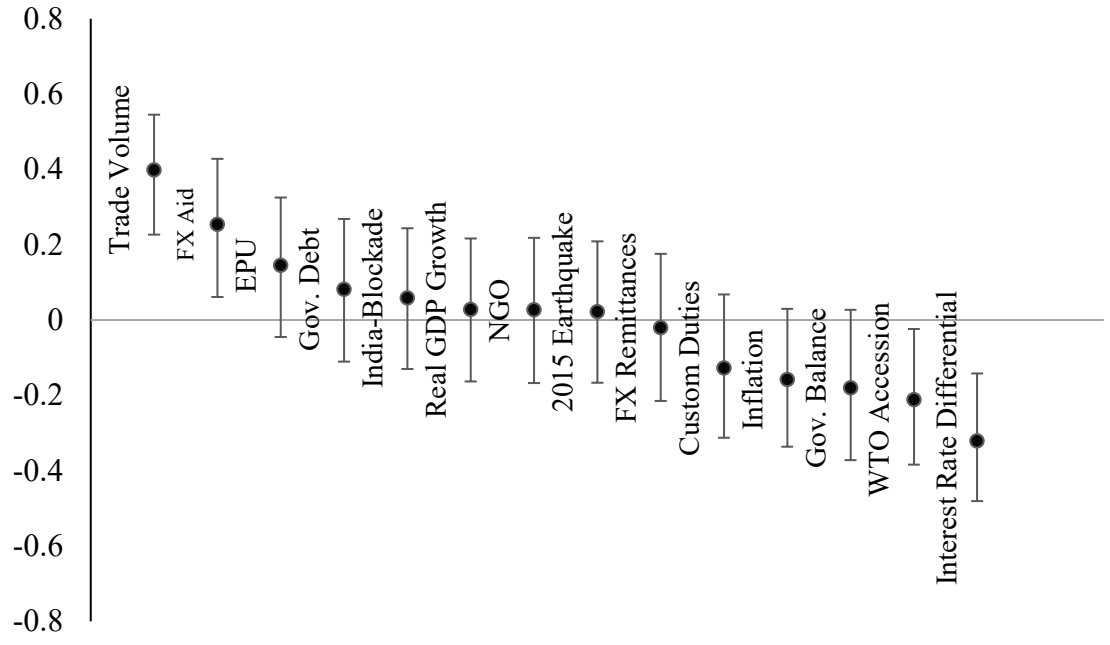
Figure 2 displays the historical evolution of net TMI standardized by nominal GDP for the period from 2000Q1 to 2019Q3. Positive values indicate outflows and negative values indicate inflows. For most of the period, Nepal has experienced illicit capital outflows, which in absolute terms have been particularly high in the period after the 2015 earthquake. When

[11] A subset of countries reports their imports in both CIF and FOB, which allows the OECD to estimate the missing values from a gravity-type equation model (Miao and Fortanier, 2017).
[12] In Section 4 (Table 3), we also analyse the sensitivity of our regression estimates to the CIF assumption.

standardized by GDP, remarkable periods of capital outflows are also visible in the early part of our sample, which declined after the tragic events of the royal family and the subsequent Maoist insurgency in mid-2001. While there have been individual quarters with large net outflows in the following years, a more continuous outflow pattern only emerged after Nepal became a republic in 2008 and lasted until about 2011. From 2011 until the earthquake in 2015, the picture substantially changed, and Nepal experienced net capital inflows rather than outflows. Since the earthquake, the illicit outflows have again been quite sizable and continuously positive.

Before formally analyzing the partial impact of development aid on trade misinvoicing, we first highlight the unconditional correlations, which already indicate the pattern: The seasonally adjusted ratio of FX development aid to GDP has a positive correlation with capital flight of 0.25 and is statistically significant at the 5% level, with a *p*-value of 0.03. It is among the strongest correlations, next to trade volume, and the interest rate differential, the most often used explanatory variable in the literature. Interestingly, and in contrast to aid flows, we do not find remittances to be correlated with capital flight—a first revealing indication that aid flows indeed stand out among the official capital flow variables.

Figure 3: Bivariate Correlations with TMI



Note: Dots represent bivariate Pearson correlation coefficients between our capital flight trade misinvoicing (TMI) measure and the respective variables. Bars indicate 90% confidence intervals calculated using Fisher's *z* transform. See Appendix A for variable definitions and sources.

4. A baseline specification

4.1. Preliminary analysis: Forming a benchmark regression

We start our empirical analysis by developing a benchmark regression that takes standard variables in the literature into account. In equation (4), these variables include three sets of controls:

$$Y_{t,TMI} = \alpha + \lambda' X_t + \theta' C_t + \delta' N_t + \varepsilon_t. \quad (4)$$

The first group, captured by the vector X_t, includes several theoretically motivated control variables. Most prominently, it includes the interest differential between Nepal and the United States, which is intended to capture portfolio effects (Dornbusch, 1984),[13] a variable of de facto trade openness, as suggested by Aizenman (2008); a measure of economic policy uncertainty (EPU) (Hermes and Lensink, 2001; Le and Zak, 2006); and customs duties (Slemrod and Yitzhaki, 2002). The second vector of variables, C_t, includes canonical macroeconomic control variables commonly used in the empirical capital flight literature (see, for instance, Cheung *et al.*, 2016, 2020), i.e., government debt, the government budget balance, real GDP growth, and inflation. Finally, we include a set of Nepal-specific factors, N_t: a dummy variable capturing the trade blockade from India, the earthquake in 2015, and the World Trade Organization (WTO) accession of Nepal; and another variable to capture aid fragmentation proxied by the change in the number of active non-governmental organizations (NGOs).

Table 1, Columns 1-3, reports the results of this preliminary regression, where the coeffients display largely the expected sign from the previous literature.[14] In column (4), we perform a stepwise regression approach where we successively drop the insignificant variables based on their t-statistics from the regression. This specification serves as our first tool to control for confounding factors that may affect the oberved empirical relationship between trade misinvoicing and aid.[15] Later, we will also analyze whether any variables we do not explicitly control for, may have the potential to alter our results by following the approach of Altonji et al. (2005) and Oster (2019).

[13] See also Cuddington (1986, 1987) and Diwan (1989).
[14] See also the country case studies for China, India, and Germany (see Fisman and Wei, 2004; Javorcik and Narciso, 2008; Mishra *et al*., 2008; Ferrantino *et al*., 2012; Cheung *et al*., 2016, 2019).
[15] In the spirit of Angrist and Pischke (2017).

Table 1: Baseline Specification

Dependent Variable: TMI [% GDP]				
Variables	(1)	(2)	(3)	(4)
Interest Rate Differential	-0.193***	-0.148*	-0.106	-0.225***
	(3.56)	(1.95)	(1.12)	(4.14)
Trade Openness	0.335***	0.360***	0.432***	0.372***
	(3.89)	(2.96)	(4.23)	(6.62)
EPU Nepal	0.785	1.019	1.053	0.920*
	(1.34)	(1.61)	(1.58)	(1.73)
Custom Duties	0.001	-0.009	-0.002	
	(0.02)	(0.12)	(0.03)	
Gov. Debt		-0.007	0.033	
		(0.42)	(1.32)	
Gov. Balance		-0.120	-0.100	
		(0.81)	(0.69)	
Real GDP Growth		-0.224	0.221	
		(0.67)	(0.51)	
Inflation		-0.022	-0.040	
		(0.38)	(0.68)	
India-Blockade			2.459***	1.616***
			(3.12)	(4.83)
2015 Earthquake			1.662**	1.073***
			(2.63)	(4.21)
WTO Accession			-0.214	
			(0.49)	
NGO			0.003	
			(1.65)	
Constant	-1.433	-1.467	-5.830**	-1.725***
	(1.11)	(0.80)	(2.37)	(2.71)
Adj. R2	0.29	0.24	0.33	0.37
Quarterly Obs.	73	63	63	77

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at the 10%, 5%, and 1% level, respectively.

4.2. Identifying the Mechanism

As a next step, we add a set of official inflow variables, captured by the variable *FX aid* and vector *R* in equation (5). They include foreign aid, specifically the cash component of foreign aid that is entering the country in foreign currency. Furthermore, subsumed in the vector *R,* we include FX remittances, multilateral loans, and grants (including in-kind). Among the loans, we also consider the subset of loans provided by the IMF.

$$Y_{t,TMI} = \alpha + \lambda' X_t + \theta' C_t + \delta' N_t + \beta' Aid_t + \mu' R_t + \varepsilon_t. \quad (5)$$

Table 2 illustrates that several of these variables have a significant partial correlation with capital flight. Regarding the FX aid variable, the multivariate regression confirms the

impression from the simple correlation; i.e., we find it to be positive and statistically significant at the 1% level. The same is also the case for the remittances but interestingly with the opposite sign. While an increase in foreign aid is associated with (outward) capital flight, an increase in remittances is associated with further inflows. This remarkable difference is a key finding of our paper. It is consistent with the view that development aid that enters Nepal in foreign currency is used to import goods at feigned overpriced rates, intending to move capital abroad. Remittances, in contrast, do not have this feature and instead signal the citizens' preference to move money into the country.[16,17]

The other variables, multilateral loans and grants, either have a much smaller coefficient or are statistically insignificant, but they generally have the same sign as the FX aid variable. The only exceptions are the IMF loans that, although statistically insignificant, have a dampening effect on capital outflows reminiscent of the catalytic effect of IMF lending (Corsetti *et al.*, 2006; Morris and Shin, 2006). The insignificance of this variable may be related to conditionality of IMF lending with regard to transparency and its tight grip on spending programs.

In the last column of Table 2, we again go through the stepwise regression routine. When considering the size of the coefficient in this last column, not only the significance level but also the magnitude of the coefficient of FX aid flows is striking: Our estimates imply that for every US dollar worth of FX aid inflow, 92 cents are moved out of the country. The following robustness test and further refinements are intended to both validate the impact's statistical significance as well as the magnitude of the point estimate.[18]

As an alternative way to pin down the identification analysis, we considered different variants of the definition of trade misinvoicing. So far, following the bulk of the literature, we have considered the net concept of trade misinvoicing, which is the sum of export underinvoicing and import overinvoicing. However, outward capital flight is much easier to implement via import overinvoicing, as illustrated by the example given in the introduction.

[16] This is observation is consistent with the poverty reducing effect of remittances in Nepal (see, e.g.,Wagle and Devkoata, 2018), or, more generally, the growth enhancing effect of remittances in financially less-developed economies (Giuliano and Ruiz-Arranz, 2009).
[17] On the empirical determinants of remittances see Yang (2011), Mallick (2017) and Azizi (2018).
[18] In a passing, we note that Table B4 of Appendix B confirms the included variables to be stationary, except for the interest rate differential where we cannot reject the null of a unit root.

Table 2: FX Aid vs. Remittances and in-kind Transfers

Dependent Variable: TMI [% GDP]							
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interest Rate Differential	-0.150***	-0.103*	-0.218***	-0.234***	-0.163***	-0.099*	-0.095*
	(2.77)	(1.85)	(4.04)	(4.19)	(3.10)	(1.87)	(1.90)
Trade Openness	0.390***	0.474***	0.372***	0.374***	0.396***	0.447***	0.461***
	(7.37)	(6.57)	(6.54)	(6.40)	(6.55)	(6.08)	(6.58)
EPU Nepal	0.954*	0.957*	0.899*	0.946*	0.911*	0.948*	0.990**
	(1.94)	(1.92)	(1.69)	(1.75)	(1.70)	(1.87)	(2.11)
India-Blockade	1.497***	2.035***	1.669***	1.701***	1.682***	1.823***	1.826***
	(4.17)	(4.34)	(4.76)	(4.13)	(4.80)	(3.85)	(3.90)
2015 Earthquake	1.471***	1.544***	0.974***	1.080***	0.875***	1.377***	1.765***
	(4.98)	(4.75)	(3.66)	(4.25)	(3.47)	(3.51)	(5.52)
FX Aid	1.125***					0.829*	0.928**
	(2.80)					(1.82)	(2.17)
FX Remittances		-0.222***				-0.101	-0.158**
		(3.50)				(1.07)	(2.17)
Multilateral Loans			-0.127			-0.151	
			(0.87)			(0.81)	
Of Which: IMF Loans				-1.192		0.177	
				(0.82)		(0.15)	
Grants, Incl. in-Kind					0.280	0.187	
					(1.17)	(0.84)	
Constant	-3.189***	-2.368***	-1.801***	-1.707**	-2.622***	-3.554***	-3.280***
	(4.52)	(3.62)	(2.69)	(2.64)	(3.80)	(4.38)	(4.92)
Adj. R2	0.41	0.39	0.37	0.37	0.37	0.39	0.43
Quarterly Obs.	72	72	77	77	68	68	72

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at the 10%, 5%, and 1% level, respectively.

Table 3: Import Overinvoicing versus Export Underinvoicing

Dependent Variable: TMI [% GDP]

	(1)	(2)	(3)	(4)	(5)
	Benchmark	TMI Components		CIF Assumption	
Variables	TMI	IOI	EUI	Ad-hoc 10% CIF	ØCIF (7.9% Imp; 9.8% Exp)
Interest Rate Differential	-0.095*	-0.177***	0.078***	-0.096*	-0.096*
	(1.90)	(2.92)	(3.96)	(1.92)	(1.90)
Trade Openness	0.461***	0.475***	-0.011	0.421***	0.440***
	(6.58)	(6.41)	(0.31)	(5.97)	(6.24)
EPU Nepal	0.990**	0.953*	0.045	0.984**	0.984**
	(2.11)	(1.94)	(0.47)	(2.13)	(2.12)
India-Blockade	1.765***	2.186***	0.259***	1.792***	1.774***
	(5.52)	(6.36)	(2.78)	(5.63)	(5.56)
2015 Earthquake	1.826***	1.846***	0.207**	1.802***	1.808***
	(3.90)	(3.91)	(2.12)	(3.83)	(3.85)
FX Aid	0.928**	0.987**	-0.005	0.940**	0.936**
	(2.17)	(2.13)	(0.05)	(2.19)	(2.18)
FX Remittances	-0.158**	-0.338***	-0.028	-0.175**	-0.163**
	(2.17)	(4.52)	(1.03)	(2.40)	(2.24)
Constant	-3.280***	-1.915**	-0.431	-3.121***	-3.220***
	(4.92)	(2.55)	(1.30)	(4.63)	(4.79)
Adj. R2	0.43	0.49	0.21	0.40	0.41
Quarterly Obs.	72	72	72	72	72

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at the 10%, 5%, and 1% level, respectively.

We follow up on this idea in Table 3. For easy reference, we first repeat the estimates with our TMI measure as the endogenous variable. Then, in Columns (2) and (3), we estimate the regressions for IOI and EUI separately. The striking finding is that the results for the TMI series are indeed driven by IOI, which does not come as a surprise given the time-series dynamics displayed in Figure 2 earlier. The FX Aid coefficient on EUI is slightly negative and close to zero. Statistically, it is insignificant. By contrast, the aid coefficient on IOI is close to one and significant at the 5% level.

We also address a typical shortcoming in the capital flight literature, as the TMI series is often based on the ad-hoc assumption of 10% trade cost. This assumption is inadequate, and thus we choose to compute the trade cost for each trading partner separately in our baseline regression. Columns (4) and (5) illustrate that this fine-tuning of the capital flight index is not driving our main results, as the impact of FX aid on TMI is also present when using either the standard 10% assumption or, alternatively, an average trade cost assumption across all countries. This confirms our initial impression that correctly taking into account the trade costs is important for estimating the extent of trade misinvoicing for Nepal, but it hardly affects the time series dynamics and, thus, inductive statistics.

5. Omitted variable bias and robust estimates

As no comprehensive theoretical model on capital flight via trade misinvoicing exists, we rely on different theoretical and empirical considerations in the choice of our control variables. This section analyzes whether the positive link between the aid and capital flight variables could also plausibly be explained by any omitted observable or unobservable factors in our empirical specification. Following a recent approach of Oster (2019), building on the work of Altonji et al. (2005), we confirm the aid coefficient to be remarkably stable even under extreme assumptions regarding the possible influence of any omitted variables.

Table 4 shows the results of the Oster (2019) approach in detail. We start by comparing the point estimates from a simple bivariate OLS regression ($\dot{\gamma}$) in Column (1), i.e. excluding any control variables, with the estimates from our baseline specification ($\tilde{\gamma}$) reiterated in Column (2). The FX Aid coefficient is only slightly lower in the presence of control variables; it declines from 0.979 to 0.928. Also, despite the lower degrees of freedom, there is no change in statistical significance.

Table 4: Robustness to Omitted Variable Bias

	(1)	(2)	(3a)	(3b)	(4a)	(4b)	(5)
Independent Variable	Uncontrolled Effect, $\dot{\gamma}$	Controlled Effect, $\tilde{\gamma}$	Identified Set $[\tilde{\gamma}, \gamma^*(R_{max} = 1.6\tilde{R}, \delta = 1)]$	Excludes Zero / γ^* within CI of $\tilde{\gamma}$	Identified Set $[\tilde{\gamma}, \gamma^*(R_{max} = 1, \delta = 1)]$	Excludes Zero / γ^* within CI of $\tilde{\gamma}$	$\tilde{\delta}$ for $\gamma = 0$, given $R_{max} = 1$
Interest Rate Differential	-0.117***	-0.095*	[-0.954, -0.081]	Yes/Yes	[-0.954, 0.039]	No/No	0.890
Trade Openness	0.284***	0.461***	[0.461, 0.587]	Yes/Yes	[0.461, 0.996]	Yes/No	14.88
EPU Nepal	0.595	0.990**	[0.990, 1.115]	Yes/Yes	[0.990, 1.437]	Yes/Yes	1.984
India-Blockade	0.460	1.826***	[1.826, 2.308]	Yes/Yes	[1.826, 3.657]	Yes/No	0.974
2015 Earthquake	0.332*	1.765***	[1.765, 2.227]	Yes/Yes	[1.765, 3.460]	Yes/No	1.049
FX Aid	0.979**	0.928**	[0.903, 0.928]	Yes/Yes	[0.812, 0.928]	Yes/Yes	2.398
FX Remittances	-0.013	-0.158**	[-0.158, -0.308]	Yes/No	[-0.158, -1.361]	Yes/No	1.083

Notes: The table shows the results of the Oster (2019) approach to obtain bias-adjusted estimates (γ^*). Uncontrolled effects ($\dot{\gamma}$) are based on a simple bivariate regression, whereas the controlled effect ($\tilde{\gamma}$) is based on the baseline specification of Table 2, Cl. 7.

Colum (3a) reports the identified set of coefficients, consisting of the multivariate estimate ($\tilde{\gamma}$) and a bounded estimate of a bias-adjusted coefficient based on the two following assumptions: First, we consider the maximal R-squared under a full specification including any unobservable variables to be 60% above the R-squared of our baseline model ($R_{max} = 1.6\tilde{R}$). Second, we assume the value for the relative degree of selection on observed and unobserved variables to be $\delta = 1$, which is considered an appropriate upper bound as it implies that unobservables and observables are equally related to the treatment variable. The bias-adjusted estimate (γ^*) for the FX Aid variable is 0.903. While this is slightly below our baseline coefficient, it is still within its 95%-confidence interval. More importantly, the identified set of coefficients remains well above zero, indicating that unobservable factors are unlikely to change the coefficient's sign.

When performing the same exercise for the control variables, we find their identified set of coefficients to also exclude zero in all cases, and the bias-adjusted estimates to fall within the original confidence bands with only one exception: For the FX Remittances variable, the estimate is robustly negative but we cannot exclude that the true effect may be stronger (i.e. more negative) than what is indicated by our baseline estimates.

While we already chose a reasonable upper bound for δ in our exercise, there is no theoretical guidance on how to set R_{max} within $\{\tilde{R}, 1\}$. The choice of 1.6 is mainly ad-hoc and justified only by the fact that Oster (2019) has chosen this value in her case study. We, therefore, repeat the exercise in Columns (4a) and (4b) for $R_{max} = 1$. Note, though, that this is a rather extreme case as it implies that a fully-specified model would be able to explain all variation in the dependent variable, leaving no room for measurement error. Despite the high demands this assumption places on the stability of our coefficients, we confirm omitted variables to play a minor role in our main results. The consistent estimate for the FX Aid variable becomes 0.812, which is again neither significantly deviating from the original estimate nor anywhere close to zero. The same is true for the variable capturing economic policy uncertainty. For the other control variables, we do find omitted variables to have the potential to change the point estimates in a statistically significant way. However, only the estimate for the interest rate differential may be affected to such a degree that it switches its sign.

Next, we stay with the $R_{max} = 1$ assumption but turn around the question: We ask, which $\tilde{\delta}$ would be necessary for the consistent estimates to become zero. Column (5) shows that for all variables $\tilde{\delta}$ is close to or above 1, indicating that any unobservables would have to be at least

as important as the included controls to move the estimated coefficients towards zero.[19] For our primary variable of interest, FX Aid, omitted variables would even need to have 2.4 times the relative importance of the included controls to potentially explain away the result. Summing up, the results of the Oster (2019) approach indicate that omitted variables are unlikely to affect our main results to any meaningful degree. While the point estimate of FX Aid may become slightly smaller, the positive coefficient remains undisputed.[20]

6. Other specification issues and estimation methodology

We continue the sensitivity analysis by focusing on technical aspects of the regression equation. In Table 5, the first three columns address possible autocorrelation in the residuals of our regression. In Column (1), we report the regression results based on Newey-West adjusted standard errors (including four lags), while in our baseline regression we applied the more common White-adjustment to the standard errors. In the second column, we use the Prais-Winston transformation to iteratively estimate a quasi-differenced model, taking into account potentially first-order serially correlated residuals. Finally, in Column (3), we explicitly include an autoregressive term of order one in the regression specification.

Using maximum likelihood (rather than OLS, ordinary least squares), we jointly estimate the autocorrelation coefficient and explanatory variables' coefficients. In all three specifications, the FX aid variable remains statistically significant, at least at the 10% level. The coefficient, however, is substantially smaller in Columns (2) and (3), falling to 0.504 and 0.560, respectively. Theoretically, it is not clear which one of the two approaches is more reasonable. While our benchmark specification might include an upward bias, the estimates in Columns (2) and (3) constitute an underestimation of the true impact, as the lagged errors terms also include shocks emanating from the FX aid variable. As our dataset is too small to estimate a full VAR specification, we choose to report the coefficient size as an interval, ranging from about 0.5 to 0.9.

A further technical issue is the potential endogeneity of our main variables, TMI and FX Aid. Although a reverse causality does not follow from an obvious mechanism, it could be the case that both variables are driven by third variables and are thus jointly determined. For example, aid donors may either increase or decrease their contributions in response to changes in the country's economic policy uncertainty.

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[19] $\delta = \{0,1\}$ are commonly seen as reasonable bounds (see Oster, 2019; Altonji, 2005).

[20] We also employed the more traditional Ramsey (1969) test on omitted variables in the form of higher order effects, by adding powers of the fitted values of our dependent variable up to the third order to our baseline specification. An F-Statistic of 1.02 does not reject the null of no omitted variables at any common level of statistical significance.

Table 5: Specification Issues and Estimation Methodology

Dependent Variable: TMI [% GDP]							
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	AUTOCORRELATION			SIMULTANEITY		ENDOGENEITY	
				Partial Correlations:		LEWBEL IV REGRESSIONS	
	Newey-West	Prais-Winston	AR1	Baseline Controls	Extended Controls	2S-GMM	LIML with weak IV robust inference
Interest Rate Differential	-0.095	-0.105	-0.116	-0.197	-0.201	-0.088*	-0.085
	(1.22)	(0.95)	(0.94)	(1.61)	(1.43)	(1.85)	(1.70)
Trade Openness	0.461***	0.343***	0.346***	0.614***	0.541***	0.448***	0.441***
	(5.54)	(6.06)	(7.70)	(6.23)	(4.46)	(6.65)	(6.16)
EPU Nepal	0.990***	0.657***	0.671***	0.308**	0.305**	1.023**	1.040**
	(3.57)	(3.00)	(3.53)	(2.59)	(2.22)	(2.44)	(2.50)
2015 Earthquake	1.765***	0.768	0.878	0.242**	0.220	1.987***	2.102***
	(3.36)	(1.24)	(0.55)	(2.00)	(1.58)	(6.49)	(6.21)
India-Blockade	1.826***	0.706	0.701	0.381***	0.330**	(partialled out)	
	(3.95)	(1.23)	(1.00)	(3.30)	(2.43)		
FX Aid	0.928**	0.504*	0.560**	0.287**	0.280**	1.860***	2.344**
	(2.29)	(1.77)	(2.44)	(2.39)	(2.02)	(2.99)	(2.54)
FX Remittances	-0.158*	0.024	-0.031	-0.211*	-0.189	-0.093	-0.060
	(1.74)	(0.20)	(0.26)	(1.73)	(1.33)	(0.26)	(0.57)
R2	0.43	0.37	0.66	–	–	0.44	0.37
Quarterly Obs.	72	71	72	72	72	72	72
IV Diagnostics							
First-Stage F-Stat.						46.25***	
Kleibergen-Paap Wald rk F-Stat.						2.29	
H_0: Underidentified						12.83**	
H_0: Not Overidentified						7.776	6.965
H_0: Aid Exogenous						1.061	1.061
95% CI of FX Aid						[0.64, 3.08]	[0.57, 5.46]

Notes: Column (1) uses Newey-West adjusted standard errors accounting for autocorrelated residuals up to 4 quarters. Column (2) uses the Prais-Winston variant of the Orchutt transformation. Column (3) includes an AR(1) term, estimated using maximum likelihood. Columns (4) and (5) show partial correlations (i.e., the bivariate correlation between the two residual series of regressing TMI and the respective variable on the explanatory variables of the baseline specification or the extended controls from Table 1. Column (6) and (7) both report IV regressions using $(Z - \bar{Z})\hat{\varepsilon}_1$ as the identifying instrument (see Lewbel, 2012), where Z is a vector of exogenous variables excluding the aid variable, $\bar{Z}$ is the vector of means of the Z variables, and $\hat{\varepsilon}_1$ is the residual of the first-stage regression explaining the aid variable with the Z variables. Whereas Column (5) is estimated using two-step generalized method of moments (2S-GMM) with heteroscedasticity-robust inference, Column (6) is estimated using limited information maximum likelihood (LIML) weak-IV robust inference; i.e., confidence interval and test statistics of the aid coefficient are based on the conditional likelihood ratio approach developed by Moreira (2003). To achieve full rank of the estimated covariance matrix of moment conditions, the variable *India-Blockade* has been partialled out without affecting other coefficients (Frisch-Waugh-Lovell). Regarding IV diagnostics, as a test of underidentification, we used the Kleibergen-Paap rk LM statistics. For overidentification, we used Hansen's J statistic, and the endogeneity test is based on the difference of Sargan-Hansen statistics. *, **, *** indicate test significance at the 10%, 5%, and 1% level, respectively.

To rule out this possibility, Column (4) shows partial correlations (in the narrow sense) of each variable with the TMI series; i.e., before the correlation is computed, the effect of all other variables is partialled out from both variables. Put differently, displayed values are identical to the bivariate correlation between the two residual series of regressing TMI and the respective variable on all other explanatory variables. Again, the FX aid variable remains highly significant, with a correlation coefficient roughly resembling the estimate reported earlier in the descriptive statistics. In Column (5), we additionally partial out the correlation with those variables that turned out to be statistically insignificant in the stepwise-regression procedure of Table 1 before. Some macroeconomic fundamentals (e.g., government debt) may affect both preferences to invest abroad and the donors' willingness to extend their aid programs. However, the partial correlations again roughly remain the same, and only the Earthquake dummy loses its statistical significance.

Finally, we employ an IV strategy that enables us to identify structural parameters in the presence of potential endogeneity. To generate statistically valid internal instruments, we take advantage of recent advancements in time-series econometrics that exploit the heteroscedasticity in our dataset. By imposing higher-moment restrictions, this approach yields consistent estimates even when valid external instruments are unavailable or weak (Lewbel, 2012).[21] Column (6) shows that when using the instruments in a two-stage GMM estimation, the FX aid coefficient remains highly statistically significant. Also, our original benchmark estimate still falls within the somewhat wider confidence interval of the IV point estimate. Our instruments are statistically valid in the sense that we can reject the null of underidentification and do not need to reject the null of overidentification.

Further, when re-estimating the IV regression using a weak-instrument robust inference approach, the coefficient is still positive at the 5% level of statistical significance (Column 7).[22] We also report the results because as weak-instrument test statistics yield conflicting results. While the instruments clearly fulfill the common rule of thumb of an F-statistic exceeding 10, in contrast, a Kleibergen-Paap rk-statistic of 2.29 casts doubt on the strength of the instruments. However, even with the strict yardstick of weak-instrument robust inference, the regression results confirm a positive point estimate. Interestingly, the IV estimates of both yield coefficients larger than one. Note, however, that due to the loss of estimation precision in

[21] Specifically, we use $(\mathrm{Z} - \bar{\mathrm{Z}})\hat{\varepsilon}_1$ as identifying instrument, where Z is a vector of exogenous variables excluding the aid variable, $\bar{\mathrm{Z}}$ is the vector of means of the Z variables, and $\hat{\varepsilon}_1$ is the residual of the first-stage regression explaining the aid variable using the Z variables. Key to this identification strategy is having regressors that are uncorrelated with the product of heteroscedastic errors, a common feature of models where error correlations are caused by an unobserved common factor. A Breusch-Pagan test confirms that this assumption is indeed valid. The null of homoscedasticity is rejected with a $\chi^2(1) = 5.30$ at a p-value = 0.021.

[22] Based on the conditional likelihood ratio approach developed by Moreira (2003). See also Andrews *et al.* (2006).

comparison to OLS, the standard errors are larger and the IV estimates are not significantly different from our baseline estimations. This finding is confirmed by a C-test (i.e., based on the difference in Sargan-Hansen statistics between the IV model where aid is treated endogenously versus the OLS model where aid is modeled to be exogenous), where we do not find evidence for substantial endogeneity. We thus do not draw inference from the magnitude of IV parameters here. It seems feasible in principle, however, that there might even be a full crowding out of FX aid by capital flight.

To summarize, when using various alternative technical approaches, the FX aid variable is always positive, statistically significant, and sizable. This is also true for the control variables trade openness, economic policy uncertainty, and the earthquake dummy but only to a lesser extent for FX remittances, the interest differential, and the India trade blockade.

7. Further analyses

Having established our main finding, we also report additional analyses in Appendix C, including, for instance, different definitions of economic policy uncertainty. While the policy uncertainty in Nepal seems to be an obvious candidate, we also have data for those countries in which most of the foreign workers of Nepal are employed. While there is no direct link to FX aid, the control variable remittances might be influenced by uncertainty in the host countries as much as by uncertainty in Nepal itself. Table C1 shows that this is not the case, however, and the uncertainty in Nepal is the only significant control variable. The FX remittances variable also remains nearly unchanged when including these additional controls.

Furthermore, we explore several alternative risk indicators in Table C2. We add stock market volatility and exchange rate volatility, as they have been included in other studies on TMI (e.g., Cheung *et al.*, 2016, 2020). We also add to the regression the geopolitical risk index by Caldara and Iacoviello (2019) for the relevant host countries for Nepalese workers abroad. None of these variables, however, turn out to be statistically significant or improve the fit of the regression in terms of the R-squared.

Finally, we analyze different ways of standardizing the data. Table C3 reports the baseline regression where FX aid is standardized by GDP (Column 1), is given in million US dollars (Column 2), in logs (Column 3), relative to remittances (Column 4), as a percentage of total FX inflows (Column 5). The impact of FX aid on TMI remains statistically significant in all variations. Interestingly, when expressing the cash component of FX aid as a percentage of total official development assistance (including, for instance, concessional lending and technical assistance) the coefficient becomes statistically insignificant (Column 6). This is consistent with the absolute amount of foreign-exchange cash aid affecting capital flight, not its relative

share. In Columns (7) and (8) we add seasonal dummies as alternative or additional means of controlling for seasonal effects. Also, instead of standardizing the TMI variable by GDP, we standardize it by trade volume in Column (9). Overall, the results are quite robust to different types of standardization and seasonal adjustment.

8. Conclusions

In this paper, we have shown substantial capital inflows and outflows via trade misincoiving in Nepal and have analyzed the determinants of this type of illicit capital flight. Our findings are relevant for several debates in the literature: First, they contribute to the understanding of development aid's ineffectiveness, which has spurred intensive academic debates and has been documented, for example, by Rajan and Subramanian (2008) and Dreher and Lohmann (2015). Furthermore, our findings add to the understanding of capital flight patterns in developing countries, suggesting that official inflows, such as aid and remittances, are an important explanatory variable not typically considered in the literature. Finally, our findings may re-open the debate on cash transfers versus in-kind development aid (see, for instance, Hidrobo *et al.*, 2014; Lei *et al.*, 2007). Also, budget aid has recently been considered superior to project aid, as it does not ignore the recipient countries' preferences and avoids welfare losses from large-scale prestige projects (see Cordella and Dell'Ariccia, 2007).[23] When tied to specific purposes such as schools or water wells, the FX inflows may be easily diverted for other purposes, not only for other forms of domestic consumption but also for capital flight abroad. A donation for a school in Nepal—in particular when well endowed—may end up not only financing the school, but also the recipients' house abroad.

Of course, caution is always in order when interpreting evidence on illicit capital flight. For instance, there is a long dispute between the trade literature and international finance literature on the interpretation of mirror-trade statistics. While we address some of the issues in this paper, in particular the country-specific trade cost estimation, not all problems are solved, such as the time-varying nature of trade costs and the issue of entre-port trade. Furthermore, data quality issues cannot be ignored despite our efforts to control for them. When no hard data are available, the reliance on proxies is always a second-best approach in empirical research.

Despite the potential shortcomings, the empirical finding of our analysis may be considered useful by policy makers as well as academics contributing to the ongoing capital flight and aid debate, as it uncovers a new channel of capital flight and substantiates the concerns of earlier researchers whose evidence has so far remained inconclusive.

[23] See also Koeberle *et al*. (2006).

Further research on this topic would be highly desirable, as due to data limitations, our study is confined to a single country. Nepal is one of the largest aid-receiving countries and thus clearly merits attention by itself. But the case of Nepal is also representative of a class of financially-closed developing economies that are highly depended on aid and remittances, and that would benefit from a similar analysis. Moving forward it would be very helpful to have broader coverage of quarterly data on the received payments of foreign aid (FX Aid). We have obtained this data from the central bank of Nepal. At the time of writing, however, it is not readily available in time-series format for other countries.

A final comment is regarding the welfare and policy implications of our analysis. From a normative perspective, there are two views that could be taken. As Cheung et al. (2016) point out, there is little disagreement on the adverse effect of capital flight, which hinders the capital formation process and strains the financial system. On the other side, capital flight could in principle be beneficial if it helps circumvent distortionary capital controls and trade barriers. Resolving this debate goes beyond the scope of this paper. Experiences from other developing countries, discussed for instance in Lukas (1990) and Tornell and Velasco (1992), however clearly illustrate that when money flows from poor to rich counties, it has little to do with an optimal allocation of capital. Instead, it often reflects common pools problems, rent-seeking of domestic elites and the lack of enforceability of property rights.

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Appendix A: Variable Definitions and Data Sources

TMI (Trade Misinvoicing). The net trade misinvoicing measure is given by the sum of export underinvoicing and import overinvoicing; i.e., TMI = [XWi,t – XC i,t*(1+CIF)] + [MCi,t – MWi,t*(1+CIF)], where XWi,t is economy i's reported value of imports from Nepal, XCi,t is Nepal's reported value of exports to country i, MCi,t is Nepal's reported value of imports from country i, MWi,t is economy i's reported value of exports to Nepal, p is the number of trading partners, and CIF is the country- and direction-specific estimate of the CIF/FOB rate by the OECD. TMI is expressed as a percentage of nominal GDP. Positive values indicate outward capital flight. Data sources: Directions of Trade Statistics (IMF) and International Transport and Insurance Costs of Merchandise Trade (OECD) by Miao and Fortanier (2017).

OTHER VARIABLES (IN ALPHABETICAL ORDER):

2015 Earthquake. Dummy variable given by the indicator function I(t = 2015Q2}), capturing the 7.8M_w earthquake of April 25, 2015, and its aftershocks.

Customs Duties. Average customs duties on imports (i.e., the sum of government revenue from tariffs and import VAT relative to the total value of imports). Data source: Nepal Rastra Bank (Code: GRCCUS) via NepStat.

EPU (Economic Policy Uncertainty). Change in the global- or country-level index of economic policy uncertainty, based on the relative frequency counts of the term "uncertainty" in country reports of the Economist Intelligence Unit. Source and description: Ahir *et al.* (2018), Baker *et al.* (2016).

Exchange Rate Volatility. The empirical standard deviation of daily logged levels of the Nepalese Rupee exchange rate against the US dollar (NRB buy rate). Data source: CEIC (Code: SR4381242).

FX Aid. Received foreign aid payments in convertible foreign currency (i.e., all except Indian rupees). If not specified otherwise (e.g., Table C3), it is expressed as a percentage of nominal GDP. It is seasonally adjusted using X-13-ARIMA. Data source: NRB Quarterly Economic Bulletin (Table "Receipts and Expenditures of Convertible Foreign Exchange").

FX Remittances. Received remittances payments in convertible foreign currency (i.e., all except India Rupees), expressed as a percentage of nominal GDP. Data source: NRB Quarterly Economic Bulletin (Table "Receipts and Expenditures of Convertible Foreign Exchange").

Gov. Balance. General government's operational balance as a percentage of nominal GDP. Positive/negative values indicate surpluses/deficits. It is seasonally adjusted using X-13-ARIMA. Data are misaligned by one month (the fourth quarter, e.g., refers to the period ending January 31). Data sources: CEIC (Codes: SR127545177, SR4376056).

Gov. Debt. General government debt as a percentage of nominal GDP. Linearly interpolated from annual to a quarterly frequency. Data source: NRB Quarterly Economic Bulletin.

GPR (Geopolitical Risk). Change in the normalized number of newspaper articles related to geopolitical risk in 11 large US and international newspapers. Source and detailed description: Caldara and Iacoviello (2019).

Grants. Investments grants (all currencies, including value-in-kind) as a percentage of GDP. Data source: NRB Quarterly Economic Bulletin (Table "Balance of Payments").

IMF Loans. Change in outstanding IMF loans (all currencies) as a percentage of GDP. Data source: Joint External Debt Hub via World Bank (Code A1.07).

India-Blockade. Dummy variable given by the indicator function $I(2015Q3 \leq t \leq 2016Q1\})$, capturing the India–Nepal Trade blockade.

Inflation. Nepalese inflation rate (p.a.) in percentage points. Based on the quarter-to-quarter relative change in the consumer price index. Data source: IMF's International Financial Statistics (Code: PCPI_IX), Nepal Rastra Bank.

Interest Rate Differential. Quarterly average of the interest rate differential given by the difference of Nepal's central bank policy rate and the US federal funds rate, both in monthly frequency. Data source: IMF International Financial Statistics (Code: FPOLM_PA).

Multilateral Loans. Change in outstanding multilateral loans (all currencies) as a percentage of GDP. Data source: Joint External Debt Hub via World Bank (Code A1.06).

NGO (Non-Governmental Organization). New registrations of non-governmental organizations at the Nepal Social Welfare Council. It is linearly interpolated from an annual to a quarterly frequency. Data source: Social Welfare Council Website.

Nominal GDP. Gross domestic product at current prices. It is linearly interpolated from an annual to a quarterly frequency. Data source: Datastream.

ODA (Official Development Assistance). As defined by the OECD. Provided by official agencies, including state and local governments, or by their executive agencies; Concessional (i.e. grants and soft loans) and administered with the promotion of the economic development and welfare of developing countries as the main objective. Data are linearly interpolated from an annual to a quarterly frequency. Data Source: OECD.

Real GDP Growth. The quarter-to-quarter growth rate of Nepal's real GDP. Data source: Datastream (Code: NPXGDSA%R).

Stock Market Volatility. The empirical standard deviation of daily logged levels of the Nepal Stock Exchange (NEPSE) index in daily frequency. The NEPSE index is a value-weighted index of companies listed on the Nepal Stock Exchange and is calculated using the last trading price of the included stocks (02/121994 = 100). Data source: Nepal Stock Exchange (via NepStat).

Trade Openness. A measure of de facto trade openness, given by the value of the total trade volume (exports plus imports) as a percentage of nominal GDP. Data source: IMF International Financial Statistics (Code: TXG_FOB_USD, TMG_CIF_USD).

WTO Accession. Dummy variable given by the indicator function $I(t >= 2004Q2\})$, capturing Nepal's accession to the WTO on April 23, 2004.

Appendix B: Time-Series Properties

Table B4: Unit Root Tests

	H0: Series has Unit Root	
	ADF (*t*-stat)	PP (Adj. *t*-stat)
Main Variables		
TMI	-3.5171**	-3.453**
FX Aid	-5.984***	-5.984***
Control variables (excl. Indicator Variables)		
Interest Rate Differential	-2.500	-1.430
EPU Nepal	-9.973***	-10.723***
Trade Openness	-4.500***	-3.453**
FX Remittances	-3.863***	-2.940**
Joint Test of all series	86.53***	75.4675***

Notes: The table shows (adjusted) *t*-statistics of Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests with the null of the series having a unit root. All tests include a constant but no deterministic trend. Lag length selection is based on Schwarz Criterion. Bandwidth is chosen using Bartlett Kernel (Andrews).

Appendix C: Further Analyses

Table C1: Global and Regional EPU

Dependent Variable: TMI [% GDP]							
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interest Rate Differential	-0.095*	-0.095*	-0.097*	-0.095*	-0.095*	-0.095*	-0.095*
	(1.72)	(1.90)	(1.72)	(1.74)	(1.74)	(1.74)	(1.81)
Trade Openness	0.438***	0.461***	0.439***	0.438***	0.447***	0.438***	0.458***
	(6.42)	(6.58)	(6.57)	(6.99)	(6.53)	(6.50)	(6.28)
India-Blockade	1.677***	1.826***	1.679***	1.675***	1.694***	1.667***	1.826***
	(4.20)	(3.90)	(4.07)	(4.28)	(4.03)	(4.19)	(3.40)
2015 Earthquake	1.548***	1.765***	1.681***	1.537***	1.538***	1.555***	1.953***
	(5.25)	(5.52)	(4.47)	(5.00)	(4.93)	(4.32)	(5.15)
FX Aid	0.895**	0.928**	0.931**	0.894**	0.879**	0.893**	0.979**
	(2.08)	(2.17)	(2.18)	(2.07)	(2.02)	(2.05)	(2.23)
FX Remittances	-0.144*	-0.158**	-0.142*	-0.144**	-0.152**	-0.144*	-0.154*
	(1.93)	(2.17)	(1.87)	(2.01)	(2.02)	(1.95)	(1.98)
EPU Global	0.000						0.002
	(0.16)						(0.77)
EPU Nepal		0.990**					1.035**
		(2.11)					(2.25)
EPU India			0.498				0.379
			(0.65)				(0.46)
EPU Malaysia				0.039			0.080
				(0.07)			(0.12)
EPU Saudi Arabia					-0.409		-0.244
					(0.50)		(0.31)
EPU Qatar						-0.205	-0.210
						(0.19)	(0.23)
Constant	-3.084***	-3.280***	-3.126***	-3.086***	-3.126***	-3.080***	-3.312***
	(4.91)	(4.92)	(4.97)	(4.96)	(4.91)	(4.91)	(4.76)
Adj. R2	0.37	0.43	0.37	0.37	0.37	0.37	0.39
Quarterly Obs.	72	72	72	72	72	72	72

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at 10%, 5%, and 1% level, respectively.

Table C2: Other Risk and Uncertainty Exposures

Dependent Variable: TMI [% GDP]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interest Rate Differential	-0.098*	-0.095*	-0.096*	-0.093*	-0.095*	-0.098*	-0.093*
	(1.94)	(1.86)	(1.89)	(1.83)	(1.90)	(1.96)	(1.75)
Trade Openness	0.463***	0.447***	0.461***	0.465***	0.465***	0.462***	0.462***
	(6.56)	(6.36)	(6.57)	(6.81)	(6.66)	(6.68)	(6.39)
EPU Nepal	0.954**	1.006**	0.992**	1.004**	1.037**	0.988**	1.067**
	(2.14)	(2.17)	(2.11)	(2.09)	(2.19)	(2.14)	(2.26)
India-Blockade	1.838***	1.761***	1.818***	1.829***	1.851***	1.839***	1.809***
	(3.91)	(3.96)	(3.95)	(3.89)	(4.24)	(4.05)	(4.37)
2015 Earthquake	1.738***	1.676***	1.790***	1.805***	1.720***	1.741***	1.675***
	(5.64)	(4.64)	(5.42)	(5.56)	(5.16)	(5.42)	(4.27)
FX Aid	0.942**	0.963**	0.959**	0.964**	1.021**	0.959**	1.144**
	(2.12)	(2.34)	(2.11)	(2.15)	(2.30)	(2.00)	(2.26)
FX Remittances	-0.153**	-0.131	-0.155**	-0.163**	-0.152**	-0.149*	-0.130
	(2.02)	(1.66)	(2.06)	(2.20)	(2.10)	(1.81)	(1.48)
Stock Market Volatility	-1.339						-0.507
	(0.45)						(0.13)
Exchange Rate Volatility		-6.624					-5.975
		(0.48)					(0.37)
GPR Global			0.001				0.000
			(0.48)				(0.04)
GPR India				-0.003			-0.005
				(0.76)			(0.90)
GPR Malaysia					0.003		0.004
					(0.73)		(0.69)
GPR Saudi Arabia						0.003	0.001
						(0.47)	(0.13)
Constant	-3.260***	-3.220***	-3.319***	-3.341***	-3.424***	-3.339***	-3.507***
	(4.90)	(4.59)	(4.92)	(5.16)	(5.10)	(4.85)	(4.73)
Adj. R2	0.42	0.42	0.42	0.42	0.43	0.42	0.39
Quarterly Obs.	72	72	72	72	72	72	72

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at the 10%, 5%, and 1% level, respectively.

Table C3: Different Standardizations of FX Aid and TMI

Dependent Variable:	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% GDP]	TMI [% TV]
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Interest Rate Differential	-0.095*	-0.110**	-0.108**	-0.126**	-0.125**	-0.108**	-0.100*	-0.094*	-0.177
	(1.90)	(2.11)	(2.10)	(2.18)	(2.22)	(2.07)	(1.93)	(1.84)	(1.45)
Trade Openness	0.461***	0.453***	0.454***	0.450***	0.447***	0.472***	0.467***	0.458***	0.849***
	(6.58)	(6.01)	(6.26)	(5.97)	(5.95)	(6.52)	(6.78)	(6.29)	(4.64)
EPU Nepal	0.990**	1.010**	0.986**	0.919*	0.917*	1.007**	0.973*	0.964*	2.039*
	(2.11)	(2.19)	(2.09)	(1.81)	(1.82)	(2.10)	(1.98)	(1.94)	(1.75)
India-Blockade	1.826***	1.788***	1.770***	1.897***	1.843***	1.940***	1.937***	1.835***	4.768***
	(3.90)	(3.81)	(3.86)	(4.13)	(4.01)	(3.99)	(4.74)	(3.52)	(3.81)
2015 Earthquake	1.765***	1.988***	2.057***	1.319***	1.299***	1.906***	1.689***	1.714***	4.262***
	(5.52)	(4.82)	(5.26)	(3.71)	(3.73)	(4.73)	(5.14)	(4.36)	(5.45)
FX Remittances (% GDP)	-0.158**	-0.282***	-0.294***	-0.096	-0.038	-0.237***	-0.183***	-0.160**	-0.434**
	(2.17)	(4.37)	(4.76)	(0.96)	(0.32)	(3.99)	(2.76)	(2.06)	(2.33)
FX Aid [% GDP]	0.928**							0.919**	1.992*
	(2.17)							(2.09)	(1.95)
FX Aid [Mio. USD]		0.004*							
		(1.86)							
Ln(FX Aid)			0.516**						
			(2.23)						
FX Aid [% FX Remittances]				0.007**					
				(2.44)					
FX Aid [% Total FX]					0.025**				
					(2.38)				
FX Aid [% ODA]						2.230			
						(1.39)			
FX Aid [% GDP], w/o Seasonal Adj.							0.825*		
							(2.00)		
Seasonal Dummies (F-Stat.)	No	No	No	No	No	No	Yes (1.68)	Yes (0.23)	No
Constant	-3.280***	-2.280***	-4.085***	-2.782***	-3.281***	-2.732***	-3.401***	-3.325***	-5.165***
	(4.92)	(3.44)	(4.69)	(4.23)	(4.63)	(4.28)	(4.99)	(4.84)	(2.97)
Adj. R2	0.43	0.42	0.43	0.40	0.41	0.40	0.41	0.40	0.32
Quarterly Obs.	72	72	72	72	72	70	72	72	72

Notes: The table shows OLS estimates with robust *t*-statistics in parentheses. *, **, *** indicate variables significant at the 10%, 5%, and 1% level, respectively.