

The Gravity Model for Measuring Money Laundering and Tax Evasion

Paper prepared for the Workshop on Macroeconomic and Policy Implication of Underground Economy and Tax Evasion, February 5-6, 2009 at Bocconi University, Milan, Italy

Send to conference2009@uniparthenope.it and to fbusato@gmail.com

Brigitte Unger
Professor of Public Sector Economics
Utrecht University School of Economics
Tel +31 -(0)30 – 253 -9809
Email: B.Unger@uu.nl

Introduction

Measuring global money laundering, the proceeds of transnational crime that are pumped through the financial system worldwide, is still in its infancy. Sometimes, measuring of money laundering includes tax evasion, sometimes it does not. Money laundering refers to the proceeds from activities in the underground economy, but also to parts of the shadow economy (such as tax evasion) and to white collar cross border crime (such as capital flight and proceeds from fake invoicing) which is usually not part of the discussion on underground and shadow economies (see e.g. the table in Schneider and Enste 2000 defining the diverse parts of the economy). Therefore, methods such as case studies, proxy variables, or models for measuring the shadow economy all tend to under- or overestimate money laundering. However, measuring the scale and impact of money laundering more accurately becomes increasingly important, both for political and economic reasons. Politically, the increased efforts of combating money laundering involve, both for the public and the private sector, costs, and will sooner or later have to be legitimized by the positive effects of the measures taken. This means that politicians will have to show that either money laundering has decreased, or that the negative economic, political or social effects of it have decreased.

Once the scale of money laundering is known, also its macroeconomic effects and the impact of regulation and law enforcement effects on money laundering and transnational crime can be measured. Knowing how much money is being laundered, is hence a necessary precondition for legitimizing anti money laundering policy and for preventing economic, social and political harm from money laundering.

The model presented here is a gravity model which allows estimating flows of illicit funds from and to each jurisdiction in the world and worldwide. This “Walker Model” was first developed in 1994, and used and updated recently. Using triangulation, we showed that the original Walker model estimates are compatible with recent findings on money laundering, in particular with the findings of Baker (2005), Schneider (2006) and Savona (2000) (Walker and Unger 2009).

In the following, first the precarious relation between money laundering and tax evasion will be presented. Then the gravity model for money laundering, and its theoretical underpinning will be discussed. Empirical results of this model for the Netherlands will be presented. Finally, possible modifications of this model will be discussed. The importance of measuring money laundering accurately for political and economic reasons and the macroeconomic effects of money laundering will not be explored here. But a literature survey overview over all economic, social and political effects as well as an empirical estimate of the effect of money laundering on economic growth can be found in Unger (2007).

1. The precarious relation between money laundering and tax evasion

By definition, money laundering can only take place when there is an underlying crime (‘ a predicate offence’) which gives rise to illegal proceeds which are then laundered, i.e. brought back into the legal circuit of the economy. If drugs were legal, their sales proceeds would not have to be secretly laundered. Mostly, the definition refers to bringing money back into the legal circuit by using the financial system (see Unger 2007 chapter 1 for an overview of money laundering definitions).

1.1. Precarious definitions of money laundering

Tax evasion can be part of fiscal or financial fraud, which constitutes a predicate crime for money laundering in most countries. However, when looking at legal definitions of money laundering and at law enforcement in different countries, one can see that a large part of tax evasion is often excluded from the money laundering definitions or from enforcement.

In the US, foreign or domestic tax evasion--other than failure to pay U.S. taxes on the proceeds of a crime--does not qualify as a predicate crime (Reuter and Levi 2006). Note that also mixing criminal with non criminal proceeds is a predicate crime in the US, that means that evading taxes from partly criminal proceeds is also part of money laundering (Unger TNI 2007). So, parts of tax evasion are a predicate crime for money laundering in the US and parts are not!

The Directive 2005/60/EC of the European Parliament and of the Council formally adopted on 20 September 2005, on the prevention of the use of the financial system for the purpose of money laundering and terrorist financing (the ‘Third EU Money Laundering Directive’), which had to be implemented by the member states by December 2007, has tried to harmonize several legal definition differences for its member states. However, it did not tackle the problem of tax evasion. One reason is certainly that tax is still perceived strongly as something under national sovereignty (see Rawlings 2007, see also the OECD and EU tax harmonization efforts over 20 years with very little success, mainly on the VAT).

This leaves out a large problem of international soft or hard criminal financial behavior. Unger (in Masciandaro, Takats and Unger 2007, chapter 3) gives an overview over differences in money laundering definitions of different countries and international organizations. The Austrians and Swiss do not consider tax evasion as a crime, the Germans do not consider tax evasion from individuals, but only from business and criminal organizations, as a predicate crime for laundering, the Dutch do not consider tax evasion as a serious crime but only as a misdemeanour, so only when connected to serious fraud can there be an offence related to money laundering.

With the third EU AML/CTF Directive, EU national governments change currently from a rule based to a risk based approach. The old system was assessed not to be very effective, and neither the assessment methods themselves. High administrative burdens for banks and other reporting units involved costs which were not compensated by sufficient benefits in terms of catching more criminals or finding more illegal money. All these problems led to a change in EU policy. The change from a rule to a risk based approach implies that suspicious behavior is no longer defined by the political top, but by many different actors, usually experts, on the street- and shop-floor levels of private (e.g. banks) and public (police, prosecution) implementation and enforcement organizations.

According to the EU AML definition, fraud is a predicate crime for money laundering, while tax evasion is not. However, there is conceptual confusion about what is (really) illegal or criminal. Is it tax evasion, is it fiscal fraud, or is it money laundering, and which types of crime does the latter include? This confusion exists within and between individual persons, organizations, and even countries. Therefore, this problem is not solved by decentralizing the decision. Neither banks nor police will be able to solve this conceptual problem of unclear or not homogenous definitions.

1.2. Precarious estimates of Tax Evasion and Fraud

In the table below one can see that tax evasion is a very sizeable amount of money laundering. When including tax evasion as a part of money laundering, misreporting or underreporting income is one of the most common methods of conducting money laundering.

For the US Reuter and Truman (2004) showed that income from tax evasion is by far the largest part of criminal income (Levi and Reuter 2006). It amounts to about 4% to 6% of GDP (the difference between column 3 and 5 in the table below).

**Table 1: Money Laundering and Tax Evasion in the US
In billion of US\$**

Year	Tax Evasion Included Estimated		Tax Evasion Excluded Estimated	
	Criminal Income	Percent Of GDP	Criminal Income	Percent of GDP
1965	49	6.8	18	2.5
1970	74	7.1	26	2.5
1975	118	7.2	45	2.7
1980	196	7.0	78	2.8
1985	342	8.1	166	4.0
1990	471	8.1	209	3.6
1995	595	8.0	206	2.8
2000 (estimate)	779	7.9	224	2.3

Source: Reuter and Truman (2004) quoted in Levi and Reuter (2006)

For the Netherlands, de Kam (2004) estimates fiscal fraud and tax evasion to be even higher, namely to lie between 6% and 15% of Dutch GDP. From the Dutch fiscal fraud investigation office data (FIOD), one can see that about 700 million euro of the 20 -70 billion estimated tax evasion is being detected by the authorities as serious fraud. In interviews with the tax investigation authorities, done by Unger et al (2006), the people questioned guessed that they catch about 5% to 10% of all serious fiscal and financial fraud. If the estimates of de Kam (2004) are right and combined with the FIOD data, then the tax authorities detect only between 1% and 5% of all tax evasion. The differences between estimates are still very large and estimates are still in the dark.

The EU was mainly concerned with estimating Value Added Tax fraud, but also estimated total tax fraud by far lower than in the US and in the Netherlands, namely at around 200 billion Euro, between 2% and 2.5% of the EU GDP (EU Memo 2006).

Fraud data and estimates – from evading taxes, from financial fraud with regard to securities, from company fraud, from credit card fraud etc - are still very weak and internationally not comparable. In this area better data are urgently necessary. Reuter and Greenfield (2001) for example criticized that empirical works on fraud often make use of fraud data without questioning the quality of the database. They investigated for example some fraud data of the Association of Certified Fraud Examiners, ACFE., which had 10,000 members surveyed, of which only 10 percent responded.

Table 2: Tax Evasion in the Netherlands and the EU

Tax fraud and Financial Fraud Discovered	The Netherlands 2003	698 million Euros	FIOD-ECD 2003
Fiscal fraud, tax evasion	The Netherlands 2003	20-70 billion Euros or 6%-15% of GDP	CBS, de Kam 2004
Value Added Tax Fraud	EU wide	10-15% of VAT tax revenues	EU Memo 2006
Tax Fraud	EU wide	2 to 2.5% of GDP 200-250 billion Euros	EU Memo 2006

Source: Unger 2007

1.3. Little theoretical and empirical knowledge about the relationship between money laundering and tax evasion

Yaniv (1999) developed a model demonstrating how money launderers respond to tax policies. The incentive to launder increases with lower tax rates and laxant money laundering regimes, according to him. A point not mentioned in the literature is that money laundering can also increase the revenue of the public sector. Criminals want their money to be “legal”. A way of doing this is to pay taxes on income. Non-existent high turnovers from restaurants with no clients are sometimes voluntarily declared to the tax authorities. This way, the illegal money is turned into taxed legal money (Unger 2007).

Though according to many estimates of money laundering, tax evasion and fraud in general is by now more sizeable than drugs money (see Reuter and Truman 2004, Walker 1995 and 2009, Unger et al 2006 and Unger 2007), we know little about the relationship between tax evasion and drugs money. Legal definitions on money laundering allow parts of tax evasion to escape from being prosecuted for money laundering. Empirical estimates on tax evasion and on fraud are based on very poor data. And there is little theoretical knowledge about the link between money laundering and tax evasion, as is little known about the differences or similarities in behavior of drugs criminals, fraudsters and tax evaders.

In the following, a model for money laundering will be presented which is based on the proceeds of crime or illegal activities. As such it can include heavy crime such as drugs money, human trafficking, arms trafficking but also fraud money and tax evasion. In Section 2 the model and its theoretical underpinning will be presented.

2. The gravity model for money laundering and its theoretical underpinning

2.1. The Gravity Model in International Trade Theory

In 1687, Newton proposed the “Law of Universal Gravity”, which held that the attractive force between two objects i and j depends on their masses M_i and M_j , the square distance between these objects D_{ij} and a gravitational constant G , which depends on the units of measurement for mass and attractive force (see Head 2003).

$$\text{Attractive Force } F_{ij} = G * M_i * M_j / (D_{ij})^2$$

F_{ij} ...Attractive Force between object i and j

M_i ...Mass of object i , M_j ..Mass of object j

D_{ij} ...Distance between object i and object j

G ...Gravitational constant

In 1962, the Dutch Nobel prize winner Tinbergen transformed the understanding of the newly established economics of international trade by applying Newton’s formula to bilateral trade flows. The trade from country i to country j depends on the economic mass of the two countries (measured by GDP) and the distance between the two locations (see Head 2003).

$$F_{ij} = G * M_i^\alpha * M_j^\beta / (D_{ij})^\theta$$

The export flows from country i to country j depend on the GDP of both the exporting and importing country and the distance between them. Note that if $\alpha, \beta = 1$ and $\theta = 2$, then this is the same as the original Newton formula.

For a long time, this formula was criticized as being a-theoretical and ad hoc (see Gauws 2005 chapter 6). Despite its use in many early studies of international trade, the equation was particularly suspect, considered in so far as that it could not easily be shown to be consistent with the dominant paradigm of international trade theory, the Heckscher-Ohlin model which explained net trade flows in terms of differential factor endowments (see Head 2003). According to the predominant economic paradigm it was the amounts of labour and capital that determined the comparative advantage of countries that in turn determined which goods countries traded with each other.

Tinbergen’s formula, however, had one convincing advantage: it predicted international trade flows very well (Head 2003: 9). “Measurement without theory” turned out to perform better than measuring from existing trade theories. Tinbergen’s use of Newton’s model of physics in economics can be applied to other fields: the inflow of migrants, the inflow of tourists into a country, and of foreign direct investment. So why not also to money laundering flows?

Since the Tinbergen formula worked so well but lacked theoretical justification, many scholars attempted to develop an adequate economic theory that was

commensurate with the gravity formula. The first to develop such a theory was Anderson (1979), who showed that the gravity model was evident in expenditure share equations assuming commodities to be distinguished by place of production. Anderson also included remoteness measures in order to be fully consistent with the generalized expenditure share model. Helpman (1984) and Bergstrand (1985) and (1989) demonstrated that the gravity model could also be derived from models of trade in differentiated products. Deardorff (1998) showed that a suitable modelling of transport costs produces the gravity equation as an estimation, even for the Heckscher-Ohlin model (for an overview, see Helliwell 2000).

Over time, R_j , a factor of remoteness, replaced the constant factor G of the old gravity model:

$$F_{ij} = R_j * M_i * M_j / D_{ij}^\theta$$

In more recent literature, this remoteness factor, R_j stands for each importer's set of alternatives. Countries that have many nearby sources of goods themselves will have a low value of R_j and, therefore, import less. This factor of "remoteness" explains why country groups that have the same distance from each other might still have different trade flows.

The formula also includes a nasty element M_i/D_{ii} , the distance of the country from itself. Head (2003) suggests taking the square root of the country's area multiplied by about 0.4 as an approximation for this internal distance. Other authors (Helliwell 2000) just use a value of 1 instead.

2.2. The Gravity Model for Money Laundering

The first gravity model for money laundering was developed by Walker (1995) for estimating money laundering in Australia and globally. It was revised and re-estimated for the Netherlands by Unger et al (2006). In the following, the assumptions and modification of the model as well as its (still weak) theoretical underpinning will be shown.

The formula that Walker suggested in his seminal 1995 paper is the following:

$$F_{ij}/M_i = \text{Attractiveness}_j / \text{Distance}_{ij}^2 \quad \text{where}$$

$$F_{ij}/M_i = (\text{GNP/capita})_j * (3\text{BS}_j + \text{GA}_j + \text{SWIFT}_j - 3\text{CF}_j - \text{CR}_j + 15) / \text{Distance}_{ij}^2$$

Where GNP/capita is GNP per capita, BS is Banking Secrecy, GA is Government Attitude, SWIFT is SWIFT member, CF is Conflict, CR is Corruption.

If one compares this to the original gravity model, Walker assumes, $R_j = (3\text{BS}_j + \text{GA}_j + \text{SWIFT}_j - 3\text{CF}_j - \text{CR}_j + 15)$ and $M_j = (\text{GNP/capita})_j$. He has divided the flow formula by M_i . M_i represents the proceeds of crime in the sending country. In the receiving country the 'mass' is welfare (GNP per capita). All the variables

relevant for money laundering have been captured in the remoteness variable. The gravitational “masses” of the two objects country i and country j have been assumed to be GNP per capita and money generated for laundering, respectively.

For the distance indicator D_{ij} Walker assumed $\Theta = 2$ and used the squared kilometre distance between capitals. As mentioned above, this can overestimate the effective distance due to intense cross border trade. Unger et al (2006) opted for $\Theta = 1$, using linear and not squared distance. This is backed up by the fact that many trade gravity equations come up with this coefficient as well (Helliwell 2000)¹.

2.3. Assumptions of the Gravity Model for Money Laundering

The assumptions Walker built into the model about criminal income were:

- Crime generates income in all countries
- Income from crime depends on the prevalence of different types of crime and the average proceeds per crime
- Sophisticated and organised crimes generate more income per crime than simpler and individual crimes
- In general, richer countries generate more income per crime than poor ones.
- Income inequality or corruption may support a rich criminal class even in a poor country
- Not all criminal income is laundered. Parts of the criminal money is reinvested in criminal business (see also Masciandaro in Masciandaro, Unger and Takats, 2007 for this assumption). But criminals also do need some laundered money, for paying their rent or proving legal income to the tax authorities.

The assumptions he built into the model about laundering processes were:

- Not all laundered money leaves the country - some countries' finance sectors provide perfect cover for local launderers
- Countries where official corruption is common provide benign environments for launderers
- Laundered money seeks countries with attractive banking regimes
 - Tax Havens
 - "No questions asked" banking
 - Countries with stable economies and low risk

¹ I owe this point to Thijs Knaap. Economists usually claim to be very precise. They have applied Newton's principles to economics when creating a theory of exchange. It is therefore not without irony that physics rightly complains that economists turn the universe around when modifying Newton's formula. The universe would collapse if Newton's distance square term would be only changed by a marginal amount, let us say from 2 to 1.999. When done so in trade equations the economic system apparently appears to be quite robust.

The Walker model was revised for the Netherlands, by integrating findings of international trade theory about the role of distance. Not only geographical distance is important, but also social distance (see Unger et al 2006).

- Trading, ethnic and linguistic links will determine launderers' preferred destinations - other things being equal, "hot" money will be attracted to havens with trading, ethnic, linguistic or geographic links to the generating country.
- Furthermore, the role of big financial centers was accentuated. It was assumed that countries with large financial centers attract more money for laundering than countries with unimportant financial centers.

The following formula shows the revised Walker formula estimated by (Unger et al 2006) for the Netherlands. The variables printed in red (or grey) were added to the original Walker model. With this Unger et al followed Walker's 1995 advice to improve some of the variables.

2.4. A Revised Walker Model for the Netherlands

Percentage of World Criminal Money Flowing into a country X (the Netherlands)

$$P(X, y_i) = \frac{1}{\sum_{i=1}^n \left[\frac{\text{attractiveness}(y_i)}{\text{dist}(X, y_i)} \right]} \times \frac{\text{attractiveness}(y_i)}{\text{dist}(X, y_i)}$$

Country X, countries y_i $i=1 \dots n$

Attractiveness=f(GDP per capita, BankSecrecy, AntimoneylaunderingPolicy, SWIFTmember, Financial Deposits, -Conflict, -Corruption, -Egmont Group.

Distance deterrence=f(Language, colonial background, trade, physical distance)

The formula shows the percentage P of a country y_i 's (e.g. the US) criminal money flowing to a country X (the Netherlands). This percentage of the US total money for laundering sent to the Netherlands depends on how attractive the Netherlands are for the US (attractiveness y_i) and on the distance between the Netherlands and the US (dist (X, y_i)). The first part of the right hand side of the equation just guarantees that all shares sent by each country add up to 100%.

The Netherlands will be more attractive for launderers based in foreign countries like the US if it has a higher GDP per capita, because money hides easier in rich economies than in poor ones, if it has high bank secrecy, if it has technological means to transfer money quickly like being a SWIFT member, and if it has low conflicts and corruption so that criminals do not have to fear to lose their laundered money. We added to this another variable for strict anti money laundering policy, namely being member of the Egmont Group, a group established and meeting in the Dutch village Egmont aan de Zee in order to combat money laundering, and Financial Deposits. This last variable is meant to express the fact that large financial centers will be more attractive for launderers

because they have the expertise and financial skills to handle large amounts of money discreetly.

For the distance deterrence index, Walker’s suggestions were followed by including social and cultural distance variables as well as geographical distance. If two countries speak the same language, if they share a common colonial background and if they are top trading partners for each other, they have more common links and hence less “distance” to each other, than if they do not have these joint experiences. The closer countries are to each other, the lower the distance between them, the more laundering will take place. A precise description on how we measured the variables can be found in Unger et al (2006).

3. Empirical results of the gravity model for the Netherlands

Figure 1: Flows of Dirty Money into the Netherlands



Using 220 times 220 matrixes for covering all jurisdictions in the world, and the global proceeds of crime estimated by Walker in an update of 2005, it was looked how much of this global crime money was sent to the Netherlands and from which countries. The results of the (most likely) estimates are presented in Figure 1. According to Unger et al (2006) about 14,5 billion Euro of dirty money were sent to the Netherlands in 2005. The main sending countries were the US, Russia, Italy, Germany, the UK and France. In the Netherlands another 4 billion Euro were laundered from proceeds of Dutch crime (drugs and fraud mainly). This means that the Netherlands has to face about 18,5 billion Euro money laundering yearly, which amounts to about 5 percent of the Dutch Gross Domestic Product (GDP). The Netherlands seem to be mainly a through flow country for laundering. From suspicious transaction reports of the Dutch FIU (MOT 2005) one can assume that money goes mainly to the Dutch Antilles, Colombia, Turkey and Spain. In a recent report (FIU 2008) the Dutch former colony Suriname has

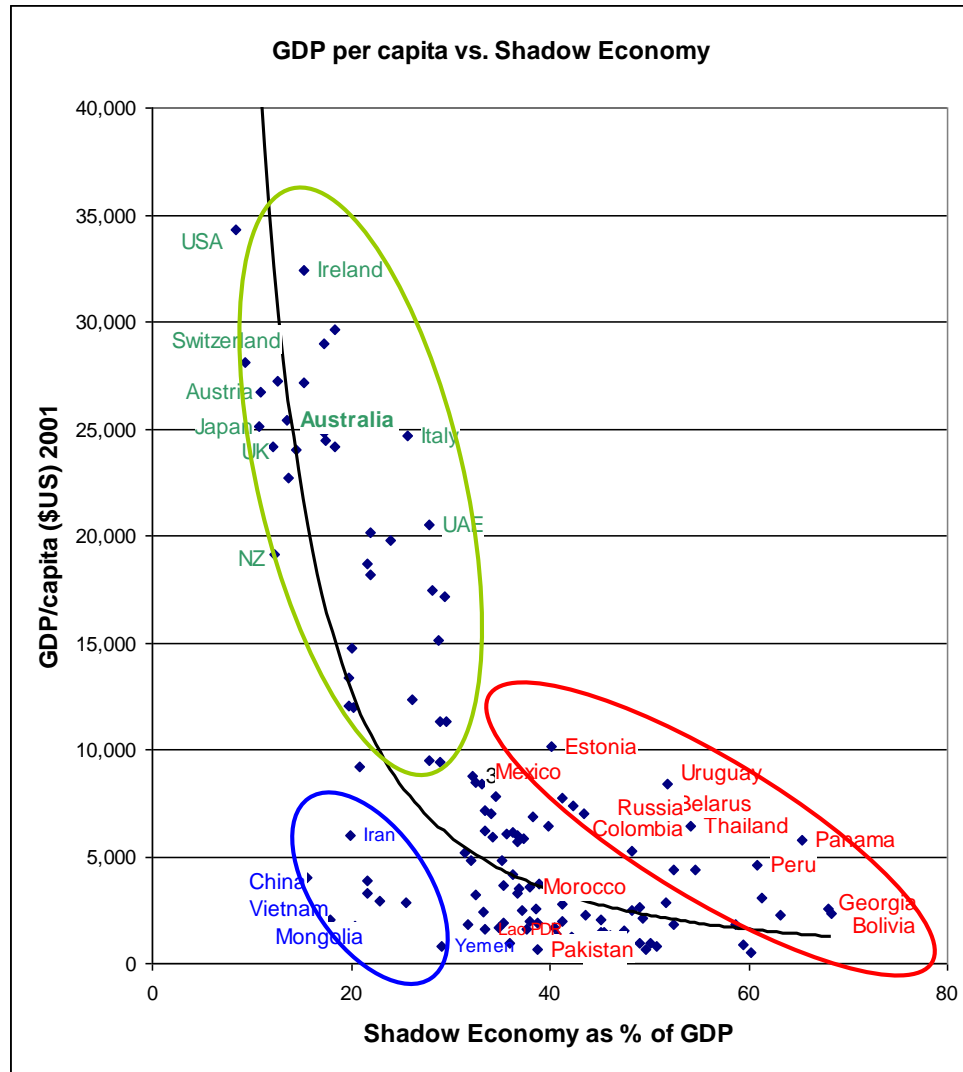
become the top country of suspicious illegal flows out of the Netherlands. But the Walker model would also allow to precisely calculating how much money flows to which countries. For this, the Walker model must be calculated for all countries and for all (cultural, social and geographic) distances between all countries of the world; something, that was not done in our study.

4. Empirical findings on the shadow economy and money laundering

The Walker model and also its revised form share the beginner's fate regarding this kind of model: namely, to be called ad hoc and a-theoretical. International trade theory, from the Heckscher Ohlin to the Dixit-Stiglitz and Krugman model, shares important theoretical synergies with the Walker model. One can also hope that the theoretical underpinning of the Walker model will not take as long as the microeconomic theoretical underpinning of the gravity formula by international trade theory. While the Tinbergen formula could always take the credit for predicting trade flows so accurately, the Walker model has, thus far, not received the same degree of acknowledgement. This is for the simple reason that the flows of money laundering stay in the dark and are unobservable. This means that it is not possible to assess the quality of the formula, the effectiveness of the fit and of forecasting. However, there are many parallels between flows of laundered money and FDI and the gravity model has been shown to be valid and theoretically sound in these contexts.

Furthermore, comparing the results of the Walker model with other studies on the shadow economy and the underground economy, have shown that the outcomes are compatible with them. To give an example: In 2006, Austrian economist Friedrich Schneider published some interesting estimates of shadow economy for 145 different countries (Schneider 2006). In many countries, the shadow economy consists mostly of legal activities that are kept hidden for tax avoidance purposes, but logically, since criminals do not report their illegal incomes to the tax authorities, the proceeds of crime should be a subset of the shadow economy.

Schneider's estimate of the shadow economy is about twice as high as the estimates on money laundering from the gravity model for the Netherlands and Australia. Unsurprisingly, his analysis suggests that the poorer countries have higher percentages of shadow economy than the rich countries, and there appears to be a nice "J"-curve when regressing GDP per capita on its results. The outliers can be grouped into 'rich countries' outliers', with mainly tax evasion and into 'poor countries' outliers'. The latter can be countries which have a lower than expected shadow economy (including China). They tend to have "command" economies in which the shadow economy is suppressed. Poor countries which have a higher than expected shadow economy can be suspected of significant transnational crime, illicit drug production and corrupt business practices (these countries include Russia and Columbia) (for further triangulation results see Walker and Unger 2009).



Source: Walker 2008

5. Possible extensions and modifications of the gravity model

Besides the compatibility of the empirical findings of the gravity model with other empirical studies on unobservable parts of the economy (with the studies of Baker 2005 on capital flight, or the findings of Savona’s Law Based Index showing a country’s willingness to combat money laundering (Savona et al 2000)) the question is in how far theoretical improvement and micro foundation a la international trade theory can help the model to fly.

To assume arbitrary weights of the influence of diverse variables in the remoteness (attractiveness) indicator for money laundering is certainly a

weakness of the gravity model presented so far. However, before going into this, also the role of distance can be questioned.

5.1.The role of distance

In international trade theory distance is important for trade flows because it is a proxy for transport costs. It also indicates the time elapsed between shipment, the damage or loss of the good which can occur when time elapses (ship sinks in the storm) or when the good spoils. It also can indicate the loss of the market, for example when the purchaser is unable to pay once the merchandise arrives. As such it does not have the same role in a money laundering model. However, distance also stands for communication costs, it is a proxy for the possibilities of personal contact between managers, customers, i.e. for informal contacts which cannot be sent over a wire. Distance can also be seen in a wider perspective as transaction costs, as the searching for trading opportunities, the establishment of trust between partners.

The distance indicator used by Walker (1995) assumes a similar importance of distance for money laundering flows than it has for trade. Though physical distance is less important for money flows, since money cannot perish, and transportation costs are negligible given that money can be sent around the globe at the click of a mouse, the communication costs, transaction costs and cultural barriers might still be important. Therefore, the role of cultural distance (clashes in negotiation style, language etc Head 2003, p.8) of historical common backgrounds, of trade relations has to be emphasized more in money laundering gravity models. Following Walker's suggestion, Unger et al have built in these new factors of cultural and social distance into the gravity model.

Speaking a common language and sharing a common history and cultural background can lower transaction costs. "Two countries that speak the same language will trade twice to three times as much as pairs that do not share a common language" (Head 2003, see especially the works of Helliwell, e.g. Helliwell 2000). This aspect seems captured well in the Walker model. The only assumption is that what holds for legal trade also holds for illegal transactions.

However, the question stays in how far geographical distance plays a role at all and in how far do borders matter? In international trade theory, Mc Callum (1995) claimed that borders still matter as far as it concerns trade. He compares trade between two Canadian provinces to trade between Canadian provinces and US States and shows that borders are a barrier to trade. Countries trade more if they have no border than if they have one. But when borders exist, it is better for trade to share a border than to be further apart. Trade is about 65% higher if countries share the same border than if they do not have a common border (Head 2003). So the Netherlands, for example, will trade more with Belgium than with France, even if one corrected for the difference in distance, just because they share a border. This means that if one takes coordinates of capitals and their distance to

each other (as Walker and Unger et al did), one might overestimate the effective distance, because neighbouring countries often engage in large volume border trade². However, the role of borders and geographical distance for money laundering is not clear yet.

5.2. The role of GDP and per capita income

The gravity model has been augmented by welfare concerns, expressed in the variable 'income per capita'. This takes into account that richer countries tend to trade more. Walker assumes the same for money laundering. Richer countries attract more money laundering funds from poorer countries. However, gravity models usually also include a variable for mass, i.e. income and not only for welfare (income per capita). Walker did not include a mass variable, since money laundering of small islands would be overwhelmed by a giant like the US if one included volume variables. But it will certainly need some serious thought of how to justify this dropping of one of the apples' masses in the formula³.

Also the sign of GDP and GDP per capita for money laundering is contested lately. Do big and rich countries launder more than small and poor countries? In the gravity model it is assumed that poor countries launder less because they can create less proceeds of crime to launder.

According to Schneider (2008) money laundering and GDP are negatively related. The larger the country, the less it will launder in his dynamic model. Also Argentiero, Bagella and Busato (2008) find a negative relationship between GDP and laundering in a dynamic two sector model:

A negative correlation scenario is relatively more economically reasonable, because although an increasing regular sector would mean more chances to launder money, there exist idio-synchratic costs both from working into the underground sector (the lack of social security contribution, of social insurance) and from laundering money (penal sanctions) which makes them relatively more costly than the regular economy. Therefore when the benefits of belonging to regular economy increase (i.e. a positive phase of the business cycle), criminal economy should be weakened and so does money laundering..

However, these results hold only for a closed economy. What if trans-national crime uses rich countries for laundering money and poor countries for committing the crime or vice versa? In a recent theoretical paper on policy competition between countries Unger and Rawlings (2008) show that small countries like the Seychelles have a larger incentive to attract criminal money for laundering and that this might lead to a race to the bottom of AML regulation if not a supranational (or intergovernmental) authority sets a stop to it. Gnutzmann, Mc Carthy and Unger (2008), find that small countries have a larger incentive to

² I owe this point to Thijs Knaap

³ I owe this point to Jaap Bikker

launder (a larger propensity), however large countries launder might more in volume due to differences in anti money laundering policy. In this model, smaller countries bear only a tiny share of the total costs relative to potential benefits of investment that money laundering offers, and so have a higher incentive to tolerate the practice compared to their larger neighbours..

5.3. Phases of Money Laundering

What is still not captured in this and Walker's model of money laundering is the full layering phase of money laundering (money laundering is measured at the first phase, at placement, when it is generated and invested domestically or sent abroad). But the second phase of money laundering, when money is transferred all over the globe in order to hide its origin, is much higher in volume and much more prone to all kinds of financial tricks and sophisticated constructions, but is only sporadically treated. The advantage of avoiding double counting faces the disadvantage of underestimating actual gross criminal flows

5.4. The weights of the variables

The weakest point of the model at the moment are the weights. Is it three times bank secrecy plus five times the size of the financial markets or the other way round? The weights are given arbitrarily and are rather influenced by pragmatic knowledge about money laundering activities of some countries, so that the ranking of the index of attractiveness of countries for laundering, calculated from it, makes some sense. We would not like to see Sweden as the top money laundering country and Russia as the least laundering country, because it would contradict empirical findings by international organizations such as the Financial Action Task Force or the UN.

The goal however must be, to derive these weights from a microeconomic foundation of the gravity model for money laundering as a reduced form equation.

For this, the behaviour of launderers has to be known and modelled. Cooperation with criminologists and their findings can shed a light on how money launderers (at least convicted ones) behave, by studying police dossiers, their income, their expenditures and their wealth. And it is very likely that tax evaders behave differently from drug barons. They might chose different countries, and may be need a gravity model on their own.

As a next step one has to look what other groups for which the gravity model has a micro foundation, such as traders, FDI senders, tourists and migrants have in common with money launderers. and what not? There is still some modeling necessary in order to move from the gravity model to a money laundering model, but given the progress that international trade theory has made, there is optimism that this can happen soon. The money laundering debate can draw on a long history of developments and findings in economic trade theory. And the move from an ad hoc gravity model for money laundering to a micro founded one will certainly take less time than the foundation of Tinbergen's ad hoc formula.

Summary and Conclusions

Measuring money laundering allows to account for both tax evasion and laundering from crime. The proceeds of crime can be estimated for all sorts of crime, ranging from drugs to company and fiscal authority fraud. Using a gravity model allows to show how much of global illicit money flows to which country.

The gravity model has proven to be a powerful instrument for forecasting trade, migration, tourism and FDIs. So why not predicting illicit flows of money with it?

First empirical results of the gravity model are compatible with other findings on the shadow economy and on the underground economy, and on capital flight.

The gravity model presented here, assumes that the percentage of its criminal proceeds that a country sends to another country, depend on this latter country's attractiveness for laundering, the GDP per capita of this country and on the geographical, social and cultural distance between these countries. A strict anti money laundering policy, very high corruption and a lot of political conflicts will deter launderers, while big financial markets and high bank secrecy will attract them. The higher the GDP per capita of a country, the richer it is, the more money for laundering it will attract, because money can easier be hidden in a large and wealthy economy than on a poor island, where it shows more (e.g. when each island inhabitant is the CEO of 1000 companies, see Unger and Rawlings 2008). If countries are very distant from each other in the sense that they do not trade much with each other, do not speak a same language, and have no historical colonial experience with each others, less money will be sent to them for laundering purpose.

The gravity model still has some weaknesses. In particular there are doubts about the signs of some of the variables (in particular GDP per capita, but also corruption) and especially on the arbitrary weights the variables have for laundering. A microeconomic foundation of the model is necessary in order to derive a reduced form equation with the corresponding weights. This must follow from maximizing launderers utility under the constraint of getting punished and losing their wealth or going to jail. Tax evaders and drug barons might behave quite differently and, therefore, necessitate a gravity model on their own.

The developments in international trade theory shed a positive light on the probability of getting such micro foundations soon.

Another point not mentioned so far in this paper, is the quality of anti money laundering policy. In order to measure the effect of AML policy on laundering, as assumed in this model, one must be able to evaluate its effectiveness. At the moment, little is known about its effectiveness. The effects of the switch from the rule based to the risk based reporting system in Europe has not been studied yet.

Neither have international efforts to combat money laundering and terrorist financing have proven extremely promising so far. Measures such as blacklisting countries as non cooperative have failed. It has seriously to be doubted whether the FATF blacklisting of non cooperative countries is still a way of identifying money laundering countries. Between 1999 and 2006 less and less countries have been put on this list. In June 2006 only Myanmar seemed to launder. As of 13th October 2006 there are no non cooperative countries and territories according to the FATF (<http://www.fatf-gafi.org/document/>).

The history of blacklisting shows that the international community is very sensitive to this issue (Arnone et al 2006, Unger and Ferwerda 2008). Furthermore, Rawlings (2007) and Rawlings and Sharman (2006) showed that blacklisting might have had reverse effects. Some states have experienced loss of business, but other OFC have prospered. Through complying with the FATF, some OFC like Cayman Islands, Bermuda, Jersey Guernsey and the Isle of Man, have increased their reputation.

So, not only the effects of the underground economy on policy should be studied, but also the effects of policy on money laundering and the underground economy.

Bibliography

Argentiero Amedeo, Michele Bagella and Francesco Busato (2008), *Money Laundering in a Two Sector Model: Using Theory for Measurement* CEIS Tor Vergata RESEARCH PAPER SERIES, Vol. 6, Issue 8, No. 128 – September 2008

Arnone, Marco and Pier Carlo Padoan (2006), Anti-Money Laundering by International Institutions: A Very Preliminary Assessment, Paper presented at the Conference “Corralling the Economy of Crime and Money Laundering: A Challenge for Banks and International Institutions into the 21st Century, organized by the European Center for the Study of Public Choice (ECSPC) and the Research Center for International Economics (CIDEI) Rome, University “La Sapienza”, Sept 28-30, 2006. Preliminary Draft.

Baker, R.W. (1999). ‘*The Biggest Loophole in the Free-Market System*’. Washington Quarterly vol. 22, No. 4, 29-46

Baker, R., (2005), *Capitalism's Achilles Heel - Dirty Money and How to Renew the Free-Market System*, Wiley.

Busuioc, Madalina (2007), Defining Money Laundering, in Unger (2007, Chapter 2).

Carrington Ian and Heba Shama 2006, Elements of an Effective AML/CFT Framework: Legal, Regulatory, and Best Institutional Practices to Prevent Threats to Financial Stability and Integrity, paper presented at a seminar on Current Developments in Monetary and Financial Law, Washington DC, Oct 23-27, 2006 quoted in TNI (2007)

Christensen, John (2007), The long and winding road: tackling capital flight and tax evasion, paper prepared for TNI Conference on Money Laundering, Tax Evasion and Capital Flight, June 2007),

Gauws, A.R. (2005). ‘*The determinants of South African exports*’. PhD university of Pretoria, South Africa, February 2005, <http://upetd.up.ac.za/thesis/available/etd-04182005-141139/unrestricted/06chapter6.pdf>

Gnutzmann, Hinnerk, Mc Carthy Killian and Brigitte Unger (2008), *Dancing with the Devil: A Study of Country Size and the Incentive to Tolerate Money Laundering*, paper submitted to the International Review of Law and Economics
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1244022

International Monetary Fund (2005), *Technical Review of the Quality and Consistency of the AML/CFT Assessments*, Report by the Independent panel of experts on behalf of the IMF and Worldbank, Washington DC.

International Monetary Fund (2005-2006), *Financial Sector Assessment Program – Detailed Assessment of Observance of Standards and Codes*, Washington DC (for Belgium, France, Ireland, Italy, Sweden and Switzerland).

Levi, Michael and Peter Reuter (2006), Money Laundering, Crime and Justice, Vol 34, 2006, pp. 289-375. 9.

Masciandaro, D., E. Takats, B. Unger (2007), Black Finance, The Economics of Money Laundering, Edward Elgar:UK, to appear in May or June 2007.

Organisation for Economic Co-operation and Development (2000). '2000 Report: Towards Global Tax Co-operation: Progress in Identifying and Eliminating Harmful Tax Practices'. OECD Publications, Paris, 2000

Rawlings, Gregory (2007) "Taxes and Transnational Treaties: Responsive Regulation and the Reassertion of Offshore Sovereignty", in: Law and Policy, vol 38, 2007
<http://www.blackwell-synergy.com/doi/pdf/10.1111/j.1467-9930.2007.00245.x?cookieSet=1>

Rawlings, Gregory and Jason Sharman (2006). "National Tax Blacklists: A comparative Analysis. in: Law and Policy, Vol. 29, No. 1: 51-66

Reuter, P., Greenfield, V. (2001). 'Measuring Global Drug Markets: How good are the numbers and why should we care about them?'. World Economics 2 (4), October–December 2001.

Reuter, P and Edwin M. Truman (2004) *Chasing Dirty Money: The Fight Against Money Laundering*, Institute for International Economics, November 2004

Savona, E., et al (2000), Euroshore – Protecting the EU Financial System from the Exploitation of Financial Centres and Off-shore Facilities by Organised Crime, Final Report, prepared for the European Commission, Trento. (<http://eprints.biblio.unitn.it/archive/00000191/>)

Sinn, Hans Werner (2003), The New Systems Competition, Yrjö Jahnsson Lectures, Basil Blackwell: Oxford 2003

Thoumi, F. (2003) 'The Numbers' Game: Let's All Guess the Size of the Illegal Drugs Industry!'. Paper prepared for TNI seminar on The Economic Impact of the Illicit Drug Industry, December 2003.

TNI (2007) Seminar on Money laundering, Tax Evasion and Financial Regulation 2007, no author, www.tni.nl

Unger, B, J. Ferwerda, W. de Kruijf, G. Rawlings, M. Siegel, K. Wokke (2006), The Amounts and the Effects of Money Laundering, Report. for the Dutch Ministry of Finance, February 2006. http://www.minfin.nl/binaries/minfin/assets/pdf/old/06_011a.pdf

Unger, B. and G. Rawlings (2008), *Competing for Criminal Money*, Global Business and Economic Review, Volume 10, Issue 3, 2008, Special Issue on the Economics of Illegal Financial Markets *Guest Editor*: Professor Donato Masciandaro

Unger, B., Siegel, M. (2006). *Workers' Remittances, The corridor between The Netherlands and Suriname*. Project done for the World Bank and the Dutch Ministry of Finance, September 2006, www.minfin.nl

Unger, B. (2007), *The Scale and Impacts of Money Laundering*, Edward Elgar: UK, March 2007.

Unger, B. and J. Walker (2007), *Global and European Money Laundering*, Sheets Presented at the Forum for Financial Crime, London 22-24 March 2007.

Unger, B., Siegel, M. (2006). *Workers' Remittances, The corridor between The Netherlands and Suriname*. Project done for the World Bank and the Dutch Ministry of Finance, September 2006

United Nations (1988). *UN Convention against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances*. Vienna, 1988

United Nations Office on Drug and Crime (1998). *Financial Havens, Banking Secrecy and Money-Laundering*. New York: United Nations

United Nations Office on Drugs and Crime (2004). *Drugs and Crime Trends in Europe and Beyond*. Vienna: UNDOC 29th of April, 2004

Walker, J. (1995). *Estimates of the Extent of Money Laundering in and through Australia*. Paper Prepared for the Australian Transaction Reports and Analysis Centre, September 1995, Queanbeyan: Jonh Walker Consulting Services

Walker, J. (1999). *How Big is Global Money Laundering?*. Journal of Money Laundering Control, Vol. 3, No. 1

Walker, John (2005), update of AUSTRAC money laundering data, to appear soon.

Walker, John and Brigitte Unger (2009), *Measuring Global Money Laundering: A Gravity Model*, paper submitted to the Review of Law and Economics, forthcoming December 2009.

Yaniv, G. (1999). *Tax Evasion, Risky Laundering, and Optimal Deterrence Policy*. International Tax and Public Finance, 1999, vol. 6, issue 1, pages 27-38