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A VATCoin Solution to MTIC Fraud:
Past Efforts, Present Technology, And the EU's 2017 Proposal

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On October 4, 2017, in an effort to recover *some* of the VAT lost annually, the European Commission proposed “far-reaching reforms.” The immediate target is a €50 billion slice of an estimated €150 billion overall annual loss. In its proposal the Commission is looking only at Missing Trader Intra-Community (MTIC) fraud in goods.¹

Goods (alone) are targeted for a number of reasons: (a) the MTIC-enabling transitional arrangements of January 1, 1993 were predominantly goods-based rules and they need immediate correction; (2) the “VAT package,” adopted by the Council on February 12, 2008 addressed services issues with two draft Directives and a draft Regulation;² (3) intra-community goods transactions are particularly complicated and need the simplification that will come with this proposal;³ (4) the Commission’s preferred solution builds on the one-stop-shop mechanism (OSS), and by limiting the focus of this reform to goods the Commission will be able to further perfect this mechanism in a staged roll-out;⁴ and (5) cross-border trade in goods dominate intra-community trade, as services transactions are approximately one third the commercial volume of goods transactions.⁵

Focusing on goods is appropriate, however, if we have learned anything about MTIC fraud since January 1, 1993, it is that fraudsters engaged in this activity are exceptionally agile.⁶ MTIC frauds migrate and mutate on command. For example, MTIC fraud in cell phones quickly

¹ Press Release – *European Commission, European Commission proposes far-reaching reform of the EU VAT system* (October 4, 2017) IP/17/3443, available at: http://europa.eu/rapid/press-release_IP-17-3443_en.htm

² COMMISSION STAFF WORKING DOCUMENT – IMPACT ASSESSMENT, *accompanying the document Proposal for a Council Directive amending Directive 2006/112/EC as regards harmonizing and simplifying certain rules in the value added tax system and introducing the definitive system for the taxation of trade between Member States*, SWD(2017) 325 final (October 4, 2017) at 11, available at:

<https://ec.europa.eu/transparency/regdoc/rep/10102/2017/EN/SWD-2017-325-F1-EN-MAIN-PART-1.PDF>

³ COMMISSION PRESS RELEASE, *VAT Package: Commission welcomes adoption by the ECOFIN Council of new rules on the place of supply of services and a new procedure for VAT refunds*, IP/08/208 available at: http://europa.eu/rapid/press-release_IP-08-208_en.htm?locale=en

⁴ *Supra*, note 2, IMPACT ASSESSMENT, SWD at 11.

⁵ *Supra*, note 2, IMPACT ASSESSMENT, SWD at 12, further referencing *Eurostat*. Of the roughly €8 billion in cross-border trade in the EU single market in 2015, €6.062 billion (75%) is trade in goods, and €1.939 billion (25%) is trade in services.

⁶ Consider for example the 26 year-old Samir Azizi, who was extradited from the US to Germany for allegedly stealing €61,104,368 in VAT from the German Treasury with 12 distinct MTIC fraud schemes ranging from cell phones, computer chips, gold, emission certificates, copper cathodes, automobiles, and ending with petroleum products before fleeing the country. Azizi moved from one good to another and in and out of various tradeable services depending on what was available to trade in at a particular time. He began forming MTIC companies when he was 16 years old, using his sister as founder before he was old enough to form them in his own name. *In the Matter of: the Extradition of Samir Azizi, Order Granting Motion for Certificate of Extraditability* 5:14-xr-90282-PSG (March 20, 2015) District Court, N. D. CA

migrated to computer chips in 2006 when the UK launched Nemesis, a computer program which tracked cell phones by IMEI (International Mobile Equipment Identity) numbers.⁷ But, as tax authorities chased the fraudulent computer chip trade, cost-conscious fraudsters migrated out of the small, high value, easy to transport chips market into tradeable services. Transferring supplies with a mouse and a keyboard is easier than shipping computer chips across EU borders to complete a fraud. And besides, the tax authorities were not looking in this direction at the time.

MTIC has now moved strongly into digitally transferred services, notably emissions permits,⁸ VoIP,⁹ and phone cards.¹⁰ If we know anything about MTIC, it is that it refuses to be confined to a country, a type of supply, or a commercial sector.¹¹ In the gas and electric markets MTIC fraud occurs in a “virtual economy,” one that intersects with the real economy only at the very beginning and very end of a highly controlled fraud chain. In other words, gas and electric MTIC fraud effectively occurs in the “cloud.”¹² What could be easier, or harder to prevent?

The difficulty with the Commission’s October 4 proposal and its impact analysis is that it ignores the fungibility of MTIC fraud. Stopping one MTIC manifestation, will not necessarily reduce the overall economic loss. A system-wide fix is needed.

⁷ An IMEI is a factory-installed unique serial number that identifies each unit, or line of service under GSM (Global System for Mobile Communications) specifications. It is a 15-digit number and is used on all non-SIM card enabled devices. Ian Pollock, *The Nemesis for VAT fraudsters?* BBC NEWS (June 18, 2006)

Nemesis has arrived for the Value Added Tax, or VAT, fraudsters depriving the tax authorities of around £2bn a year through so-called carousel frauds.

Nemesis, in this case, is not the Greek god of vengeance. It is a computer database containing the IMEI or unique identification number of every single mobile phone being exported from the UK.

Millions are imported into the UK every year. Their small bulk and high value means they have become the key product in the carousel frauds, known more formally as Missing Trader Intra Community (MTIC) Frauds.

Available at: <http://news.bbc.co.uk/2/hi/business/5060702.stm>

⁸ Richard T. Ainsworth, *MTIC Fraud Infects Tradable Carbon Permits*, 55 TAX NOTES INTERNATIONAL 733 (August 31, 2009).

⁹ Richard T. Ainsworth, *VoIP MTIC: VAT Fraud in Voice Over Internet Protocol*, 57 TAX NOTES INTERNATIONAL 1079 (March 22, 2010).

¹⁰ Stacey Meightry and Sabrina Cohen, “Billionaire Is Sought in Sweeping Fraud Probe,” *Wall Street Journal*, Feb. 24, 2010, at B1. (concerning the the *Operazione “Phuncards-Broker”* investigation where:

An [Italian] judge . . . ordered the arrest of 56 people, including one of Italy’s richest men as part of an international probe into an alleged \$2.7 billion money-laundering and tax-evasion scheme involving two major Italian telecommunications providers. Prosecutors allege billionaire Silvio Scaglia was part of a ring with mafia.)

¹¹ Commission Proposal for a Council Directive amending Directive 2006/112/EC as regards an optional and temporary application of the reverse charge mechanism in relation to supplies of certain goods and services susceptible to fraud, COM(2009) 511, at Annex VI, A (indicating that there are over 40 discrete commercial markets infected by MTIC fraud by 2009).

¹² EU COMMISSION, TAXUD, *Guide on enhanced cooperation between Member States and Business in the field of fighting VAT fraud*, EU VAT Forum, at 8.1.1 through 8.1.5 (Brussels, February 2016) available at: https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/tax_cooperation/vat_gap/2016-03_guide-on-adm-cooperation_en.pdf

Stated in terms of a specific “successful” fraud,¹³ assume a terrorist organization needs to raise €6 million, and has found a MTIC opening in Customs Procedure 42 (CP-42). Suppose it knows it can import frozen chicken meat from China into the Netherlands, and then immediately re-export it under CP-42 to a missing trader in Denmark who will collect Danish VAT on forward sales. What would happen if the CP-42 route is suddenly closed off (as it will be under the Commission’s proposals)?

Would the fraudster/ terrorists simply close up shop, or would they adjust? Adjustment has been the norm. There are a lot of other MTIC avenues open for the fraudsters. VoIP is an option, but not in the UK after February 1, 2016,¹⁴ or they might trade in CO2 permits but not after January 1, 2017,¹⁵ or they might move into the provision of labor services on construction sites,¹⁶ or they might trade in Guarantees of Origin (GO’s) in the gas and electric exchanges. This last fraud vector remains wide open to MTIC today in some Member States.¹⁷

This paper considers the Commission’s “far-reaching reform” proposal of October 4, 2017 in three respects.

- First it considers an immediate antecedent reform, one proposed by the Commission in 1996 that relied on a clearing house mechanism. This proposal failed largely due to a

¹³ This fact pattern is drawn from the investigative reporting in the first program of the three-part Danish documentary on VAT fraud, *How Fraudulent Denmark (Sådan Svindles Danmark)* which appeared on DR TV January 12, 2016. A copy of the broadcast, with English subtitles is on file with the authors.

¹⁴ Pinset Masons, *Telecom VAT Changes Planned to Prevent Fraud*, OUT-LAW.COM, available at: <https://www.out-law.com/en/articles/2016/february/telecom-vat-changes-planned-to-prevent-fraud/>

¹⁵ Emissions certificates (CO2 permits) were deemed a service by the Commission in 2004 (TAXUD/1625/04 REV 1). This decision effectively opened up CO2 to MTIC. (See: Richard T. Ainsworth, *CO2 MTIC Fraud – Technology Exploiting the EU VAT (Again)* 57 TAX NOTES INTERNATIONAL (January 25, 2010)). This loophole was finally closed on January 1, 2017 by the re-classification of permits as non-taxable financial instruments. Currently, the approach (under MiFID II) is to exclude emission allowances from taxable services by defining them as financial instruments under Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2000 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC (MiFID). This changed the rules throughout the EU with the exception of Romania, where EUA’s were already classified as financial instruments.

¹⁶ HM Revenue & Customs, *Fraud on Provision of Labor in Construction Sector: Consultation on VAT and Other Policy Options*, (March 20, 2017) available at: <https://www.gov.uk/government/consultations/vat-fraud-in-labour-provision-in-construction-sector>. The Labor Services Tax Advisor summarizes HMRC’s concerns as:

HMRC reports that organized fraud has largely involved civil engineering projects but has concerns that these arrangements could be found in any large construction project. They are aware of organized crime groups artificially extending the supply chains with the intention of failing to pay VAT and making incorrect income tax deductions.

Angela Fernside, *Combating VAT fraud: options to tackle fraud on the provision of labor in the construction sector* TAX ADVISOR (May 1, 2017) available at: <https://www.taxadvisermagazine.com/article/combating-vat-fraud-options-tackle-fraud-provision-labour-construction%C2%A0sector>

¹⁷ Europ/ex, *VAT Fraud – A Persisting Threat to Gas, Electricity and Emissions Trading* (May 31, 2017) (explaining how Guarantees of Origin (GOs) based on the Renewable Energy Directive strongly resemble EU Emission Allowances (EUAs) in the way they are structured and traded) available at: <http://www.europex.org/wp-content/plugins/download-attachments/includes/download.php?id=3622>. The response to MTIC in the gas and electric exchanges has been inconsistent. France adopted a reverse charge (2012); Netherlands adopted a zero-rate on suppliers who opt to supply through a VAT warehouse; Germany and Austria both sought derogations from the VAT Directive for wholesale gas and electric measures, and the EU Commission refused the request in 2013.

lack of trust among the Member States that were required to share collected revenue.¹⁸ Trust remains a critical component of any solution, and needs to be part of this “far-reaching reform” proposal.

- Secondly, it demonstrates how the current proposal works, how it prevents some types of MTIC fraud outright, and limits others. This discussion accepts the Commission’s proposal as it finds it, and ignores the fact that a simple migration of MTIC *goods* frauds into *services* frauds would likely swallow up all the gains in MTIC prevention that this proposal brings to the table.
- Thirdly, it presents a blockchain solution that employs VATCoins. The paper concludes that the Commission’s current proposal, if placed on a blockchain would bring *trust* back into this discussion in a manner that allows the Commission’s current proposal to flourish as a solid technological extension of its original 1996 proposal.

This paper concludes that if the Commission’s current proposal places cross-border transactional data on a blockchain, and utilizes VATCoins instead of fiat currency for cross-border tax payments, then the Commission will resolve the problem of Member State *trust* that doomed its 1996 solution. This solution can be rolled out over all cross-border trade (goods and services), and it should be if we hope to immunize the VAT from MTIC.

BASIC DIAGRAM – MTIC

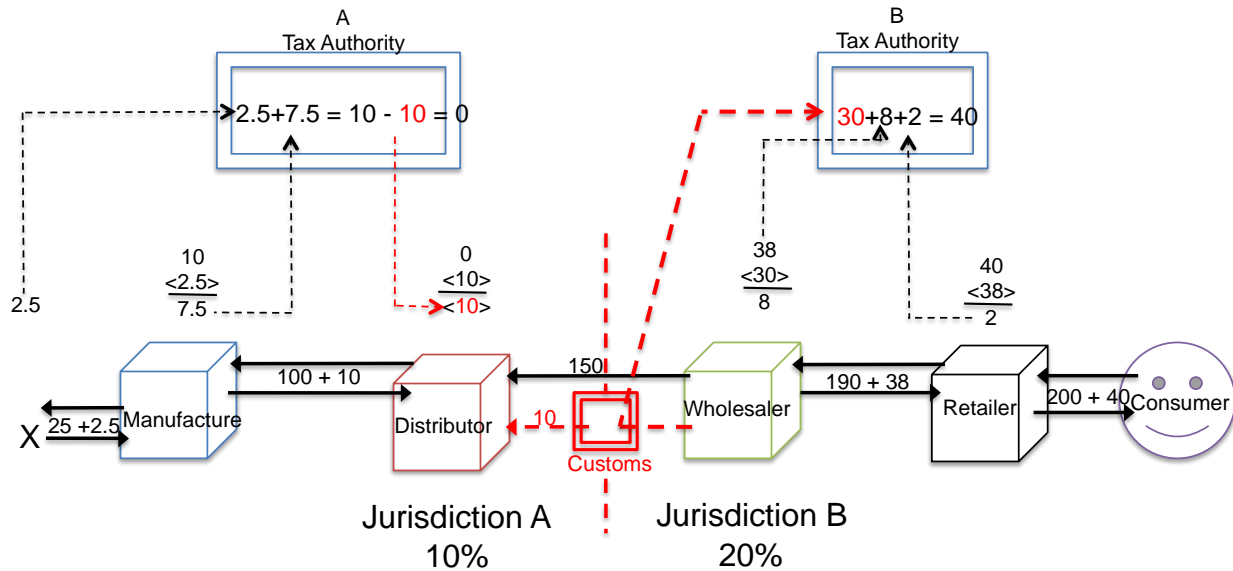
This paper assumes that the reader has a basic understanding of MTIC fraud. There are a large number of reference materials on this topic that can be consulted, if necessary.¹⁹ The following diagram will be referenced throughout this paper. Figure 1 (below) sets out a cross-border supply chain in goods prior to January 1, 1993.

The accumulated VAT collected in Jurisdiction A at 10% is returned to the exporting *Distributor* at customs. The importing *Wholesaler* in Jurisdiction B is charged VAT at 20% on the value of the imported goods. Final consumption is presumed to occur in Jurisdiction B.

¹⁸ EU Commission, *A Common System of VAT: A Program for the Single Market* (July 22, 1996) COM(96) 328 final, available at: <https://publications.europa.eu/en/publication-detail/-/publication/6547b7d2-47d3-4b30-956b-03e217f1a8c4/language-en>. Franz Vanistendael, *A Proposal for a Definitive VAT System: Taxation in the Country of Origin at the Rate of the Country of Destination, Without Clearing*, 1995 EC TAX REVIEW 45.

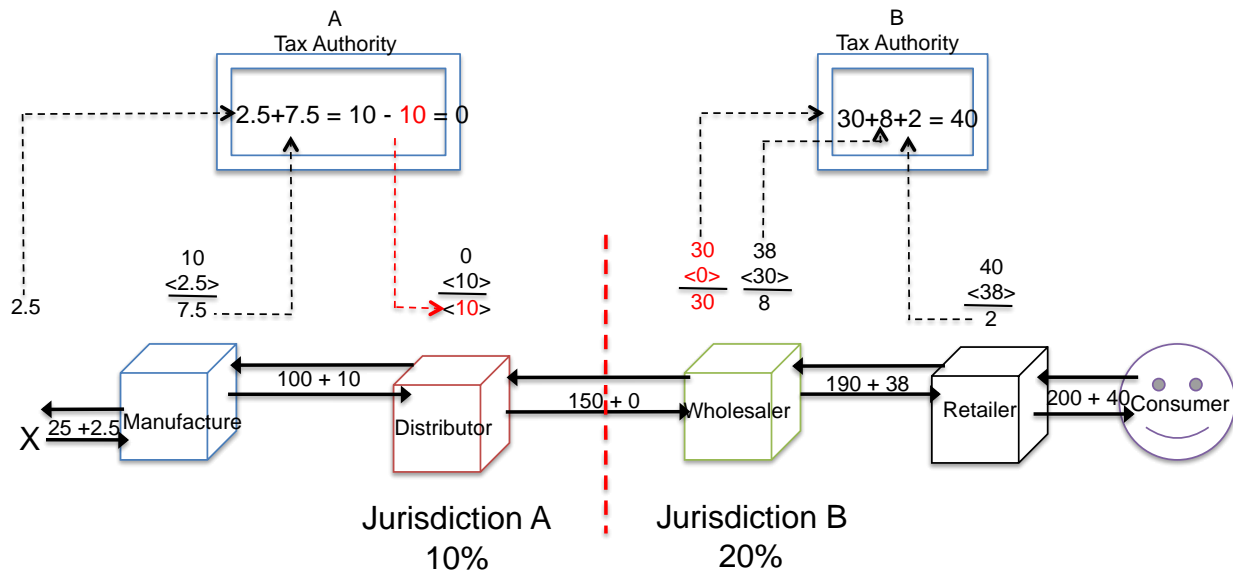
¹⁹ Europol, *MTIC (Missing Trader Intra-Community) Fraud*, available at: <https://www.europol.europa.eu/crime-areas-and-trends/crime-areas/economic-crime/mtic-missing-trader-intra-community-fraud>.

Figure 1:
Pre January 1, 1993 Intra-Community sale of Goods
Customs at Internal EU borders



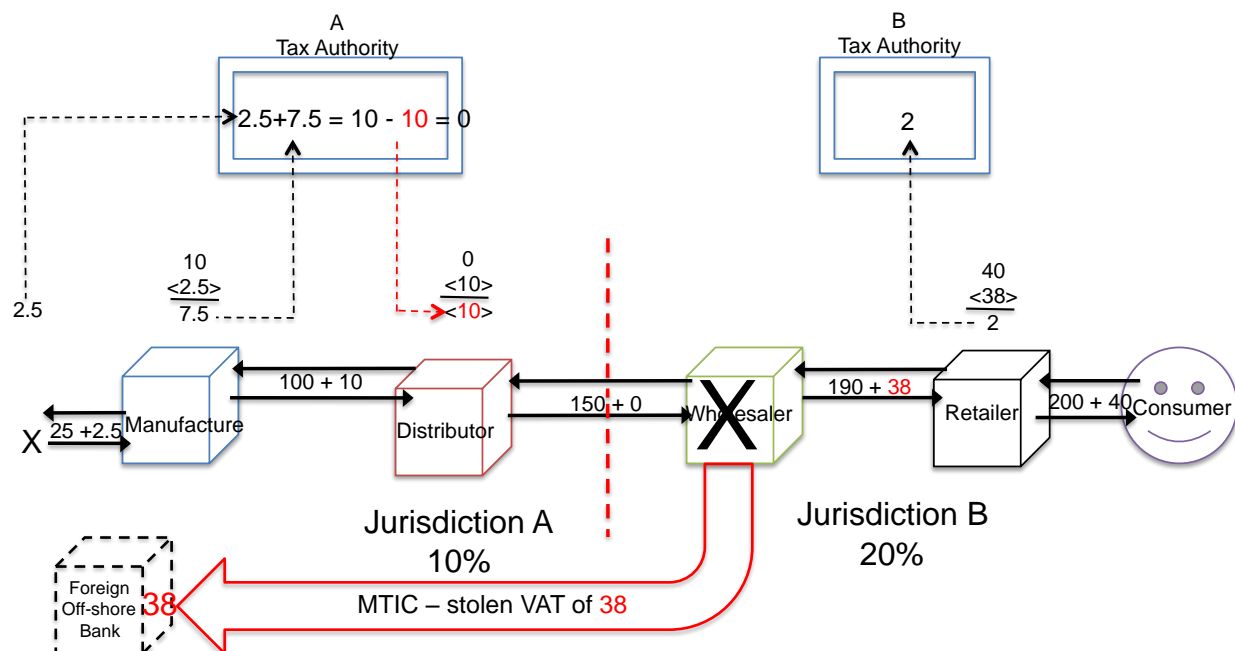
This arrangement needed to change on January 1, 1993 when internal customs borders were removed to facilitate the development of the Single Market. The customs function (returning VAT to the *Distributor* and collecting VAT from the *Wholesaler*) was replaced with a set of accounting procedures. See Figure 2 (below).

Figure 2:
Post January 1, 1993 Intra-Community sale of Goods
Customs function removed
Accounting function replaces Customs function



Using this pattern, MTIC occurs when the *Wholesaler* “goes missing,” does not file a return, but sells on with VAT. The VAT the *Wholesaler* collects is transferred immediately to a foreign off-shore banking institution. See Figure 3 (below). MTIC was made possible by the removal of the customs function at the internal borders. There are a number of other patterns this fraud can take including “carousel” MTIC, and “contra-trading” MTIC. The basic principles of the fraud remain the same.

Figure 3: MTIC



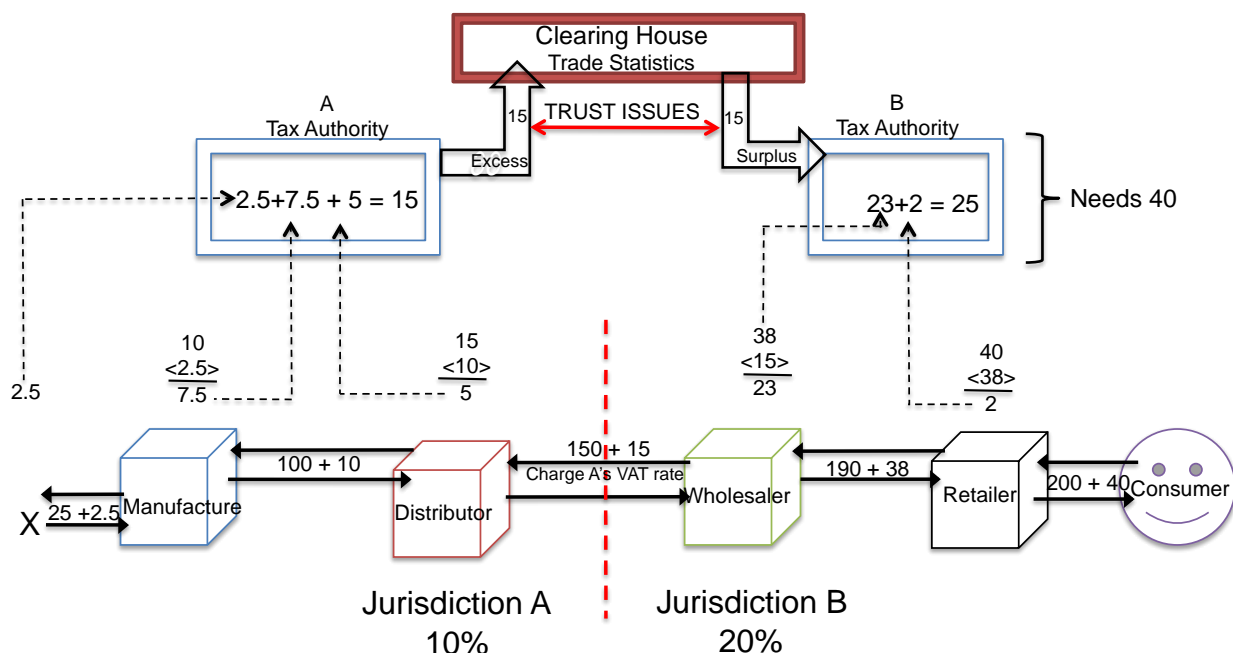
1996 “CLEARING HOUSE” PROPOSAL

The Commission’s 1996 proposal for an “origin” based Clearing House solution, *A Common System of VAT: A Program for the Single Market*, sought to prevent MTIC by fixing the break in the cross-border commercial chain made by the 1993 Single Market decision. The concern was the “zero-rated” export. This “break” allowed the importer to secure goods without VAT.

In the common diagrams used here, the 1996 proposal would mean that the *Distributor* (in Jurisdiction A) would be required to collect VAT from the *Wholesaler* (in Jurisdiction B). To simplify the Distributor’s compliance obligations the VAT rate was Jurisdiction A’s rate, and funds would be remitted to Jurisdiction A’s tax authority.

The difficulty with this solution is that VAT is a destination-based tax. The full value needs to be taxed at Jurisdiction B’s rate, and remitted to Jurisdiction B’s tax administration. Final consumption occurs in Jurisdiction B. The 1996 proposal uses a Clearing House to transfer the excess VAT from Jurisdiction A to Jurisdiction B. Essentially, all VAT collected on cross-border transactions is transferred to the Clearing House, and from there it is re-allocated to the Member States based on trade statistics. The re-allocation is not precise. It is not transactional. The Clearing House makes an aggregate, “rough justice” allocation. Figure 4 (below) applies the 1996 proposal to the common fact pattern.

Figure 4: July 22, 1996 Proposal
A Common System of VAT: A Program for the Single Market COM(96) 328
 VAT at origin rate (10%); Clearing House [trade statistics]; Trust needed

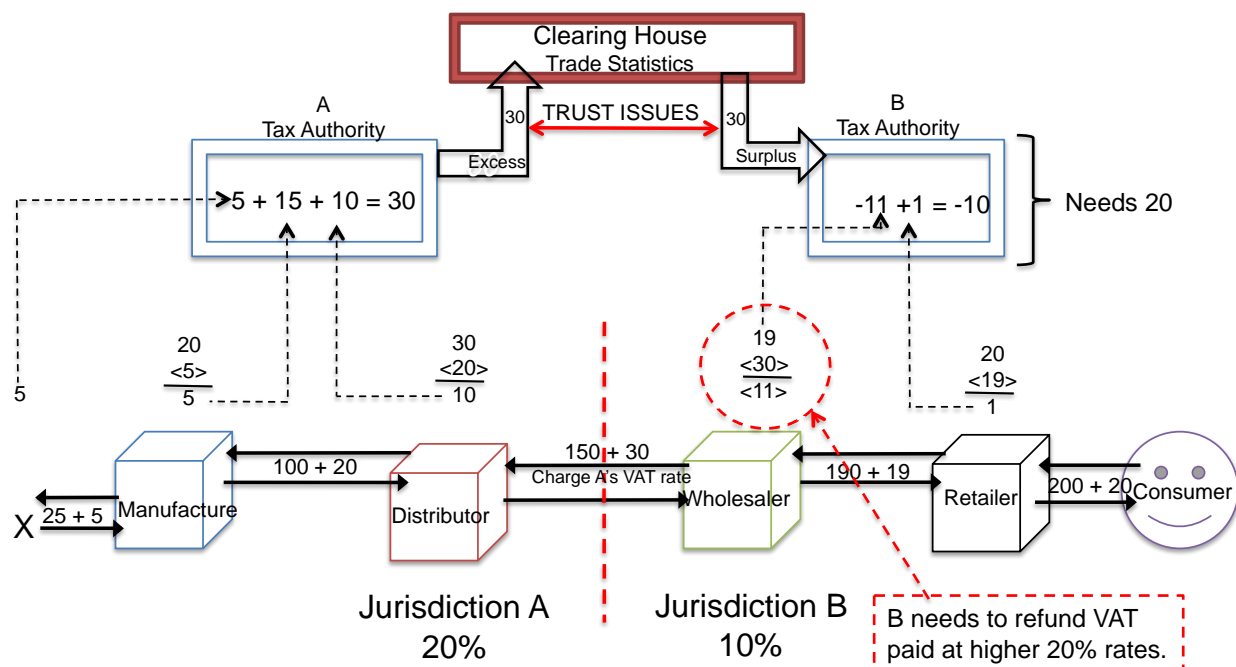


In this representation Jurisdiction B should properly receive VAT of 40, based on its tax rate of 20% and the price charged the final consumer of 200. It is collecting 25 on its own. The missing VAT is held by Jurisdiction A.

If we assume there is only one transaction chain involved, one supply of goods, then it is reasonably easy to see that Jurisdiction A has over-collected VAT by 15, and Jurisdiction B has under-collected VAT by 15. But this is not how the Commission's 1996 proposal works. It collects the VAT from all cross-border transactions, but it does not re-allocate transaction-by-transaction. The transfers out are done quarterly, with aggregate amounts, that use trade statistics as a proxy for an accurate allocation formula.

Jurisdiction B needs to *trust* that the allocation is correct, but so does Jurisdiction A. There may be just as many transactions running the other way around. In fact, if we simply switch the VAT rates around, the need for *trust* becomes even more apparent. See Figure 5 (below).

Figure 5: July 22, 1996 Proposal
A Common System of VAT: A Program for the Single Market COM(96) 328
 VAT at origin rate (20%); Clearing House [trade statistics]; **Trust needed**



When the rates are switched it becomes apparent that low tax jurisdictions will be waiting on Clearing House allocations to meet refund obligations that are set in motion by the requirement that their importers pay the higher VAT of exporting jurisdictions. Without the Clearing House allocation in Figure 5, Jurisdiction B is in a net loss position of 10. It is paying out 11 in refunds while collecting only 1 in VAT. B in other words, needs to refund its taxpayers out of excess VAT collected by A, and is entirely dependent on the Clearing House allocation to realize any of the 20 it is due from this final sale to its consumer.

Further, one can imagine that the reason Jurisdiction A's rates are so high is that it is in fiscal difficulty. Jurisdiction A will be reluctant to remit large amounts to the Clearing House, and it has an incentive to exaggerate its trade statistics to allow it to retain a larger portion of the excess VAT collected by the Clearing House.

The unresolved *trust* issue underlying the 1996 proposal is all about the inability to easily and accurately verify the funds that need to be transferred between Member States. Lack of *trust* doomed the 1996 proposal.

2017 "ONE-STOP-SHOP" PROPOSAL

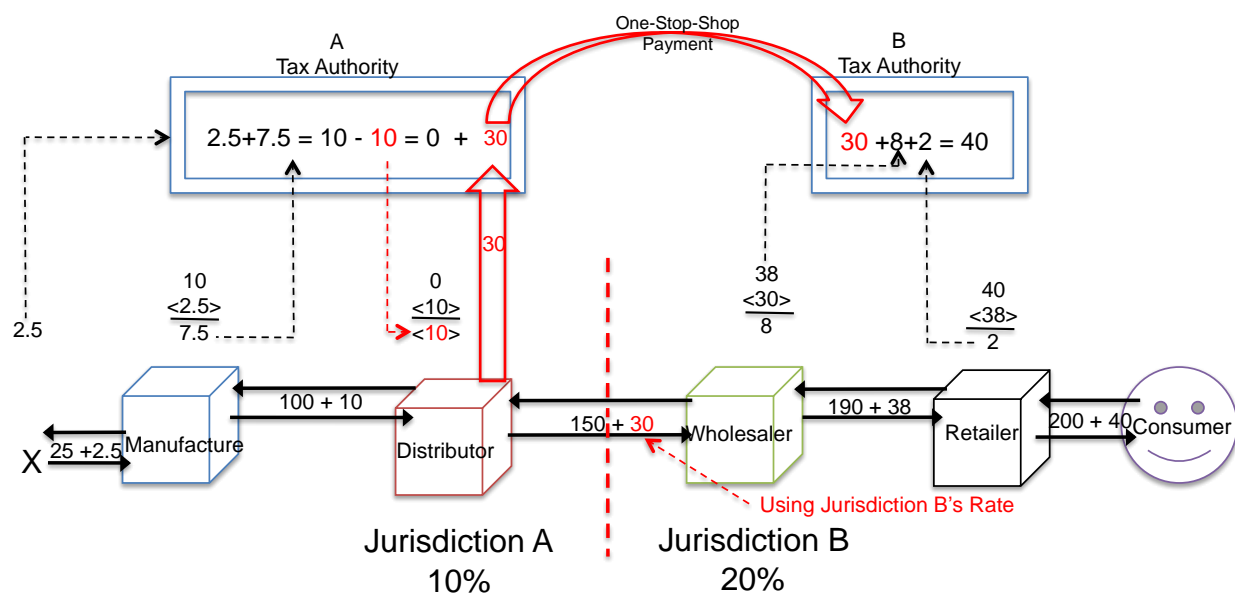
The Commission's 2017 proposal goes a long way to resolving the inherent *trust* issue in the 1996 proposal by:

- replacing the Commission-controlled Clearing House with the taxpayer-controlled one-stop-shop mechanism;
- replacing the “rough justice” allocation of trade statistics with a direct tracing of VAT paid by the buyer to the seller, and on through the two relevant tax administrations;
- providing both tax administrations with an auditable trail of VAT payment.

The key to the workability of the Commission’s 2017 proposal is the decision to have the seller (the *Distributor* in the diagrams used here) collect VAT on the cross-border transaction at the *rate applicable in the buyer’s jurisdiction*. The 1996 proposal had the seller collecting VAT at the *rate applicable in the seller’s jurisdiction*.

In Figure 6 (below) the cross-border seller (the *Distributor*) collects 30 in VAT from the buyer (the *Wholesaler*). This is 20%, times the price of 150. This differs from the calculation in Figure 4 (above) which used the same commercial chain and tax rates to illustrate the 1996 proposal. In Figure 4 the tax was 10%, times the price of 150, or 15.

Figure 6: October 4, 2017 Proposal
One-Stop-Shop replaces Clearing House



The one-stop-shop mechanism is successful in resolving the *trust* issue that has plagued the Commission’s efforts in this area. If the *Distributor* files a one-stop-shop return both tax authorities will be on notice that VAT was paid (by the *Wholesaler*), collected (by the *Distributor*), and itemized as an amount to be remitted to Jurisdiction B from the Treasury of Jurisdiction A. The problem with this solution is that it does not eliminate MTIC fraud in

general, nor does it eliminate MTIC fraud in the goods areas that it specifically targets. The Commission agrees:

[U]nder Option 2 [the preferred option] ... there will still be an opportunity for MTIC fraud to be perpetrated, it will be significantly reduced in scale. The magnitude of this reduction will be influenced by the level of the mark-up applied by businesses on their purchases.²⁰

We need to ask: If the Commission's 2017 one-stop-shop proposal were to be implemented, where would we find the MTIC in goods that the Commission says will remain in the system? How significant will be its volume of fraud? Will these remnants of MTIC in goods damage Member States' *trust* in the workability of the proposal? Would these doubts be sufficient to prevent adoption?

Using the common diagrams of this paper in Figure 7 below, we can see that the standard MTIC pattern will easily morph so that the *Distributor*, not the *Wholesaler* becomes the missing trader. If we keep the numbers in the diagram constant (and there is no guarantee that the fraudsters would do this), the amount of VAT stolen is reduced. Where the *missing Wholesaler* in Figure 3 could steal 38, the *missing Distributor* in Figure 7 can only steal 20 (this amount is the full VAT of 30 collected from the Wholesaler, less the 10 that was paid to the Manufacturer).

We should also note, that there is some added complexity to enforcement under this regime. Jurisdiction B will have allowed the *Wholesaler* a deduction for the full 30 paid to the *Distributor*, however the missing trader, most of the relevant data, and the obligation for audit enforcement resides in jurisdiction A.

Jurisdiction B intends to fund the credit of 30 it has given to the *Wholesaler* with the one-stop-shop payment of 30, but this payment is never made by the *Distributor*, and likely will not be made by Jurisdiction A's Treasury. It is unlikely that Jurisdiction A will pay funds across under the one-stop-shop if neither a OSS return has been filed or a OSS payment has been made.

Most likely the kind of enforcement we will see is the familiar *Kittel* denial of a deduction of 30 by the tax authority of B for the *Wholesaler* on the basis that the Wholesaler *knew, or should he have known* that the *Distributor* was engaged in fraud.²¹ Even though most

²⁰ *Supra* note 2, COMMISSION STAFF WORKING DOCUMENT – IMPACT ASSESSMENT, at 68. There are problems with this statement by the Commission that extend well beyond this paper, notably the phrase “significantly reduced.” The type of MTIC targeted by this proposal is goods MTIC, and the services area remains wide open for MTIC fraudsters to migrate to. In addition, it is unclear what the term “significantly” is measuring, because we are not plugging holes in a dike, rather we are building half a dam in a river that still flows unimpeded around the far end of the barrier.

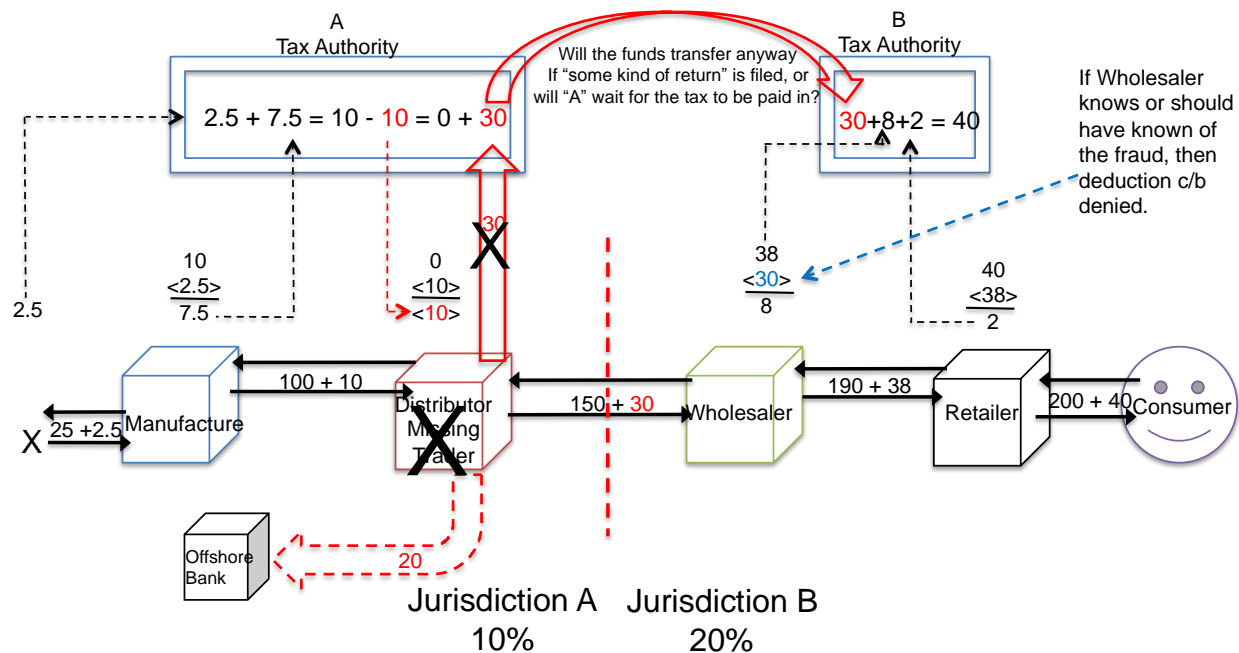
²¹ *Alex Kittel v. Belgium*, Case 439/04 (July 6, 2006). The due diligence requirement essentially requires purchasers to examine whether or not their counterparty is likely to be engaged in fraud:

... where it is ascertained, having regard to objective factors, that the supply is to a taxable person who *knew or should have known* that, by his purchase, he was participating in a transaction connected with fraudulent evasion of value added tax, it is for the national court to refuse that taxable person entitlement to the right to deduct. (emphasis added)

Kittel was specifically looking at MTIC fraud on the *purchase* side of the commercial chain. The ECJ applied the *Kittel* holding on the *sale* side of the commercial chain in *Mahagében kft v. Nemzeti Adó-és Vámhivatal Dél-dunántúli Regionális Adó Főlgazgatósága* C-80/11.

of the evidence of collusion will be in Jurisdiction A, there is very little incentive for Jurisdiction A to *initiate* an enforcement action. All of the VAT due to Jurisdiction A has been paid, and deducted. The net return due to Jurisdiction A from the portion of the commercial chain that rests within Jurisdiction A is zero. Any audit enthusiasm on the part of Jurisdiction A would be driven by demands from Jurisdiction B to help by compelling the filing of a one-stop-shop return and remission of VAT associated with the sale through the OSS mechanism.

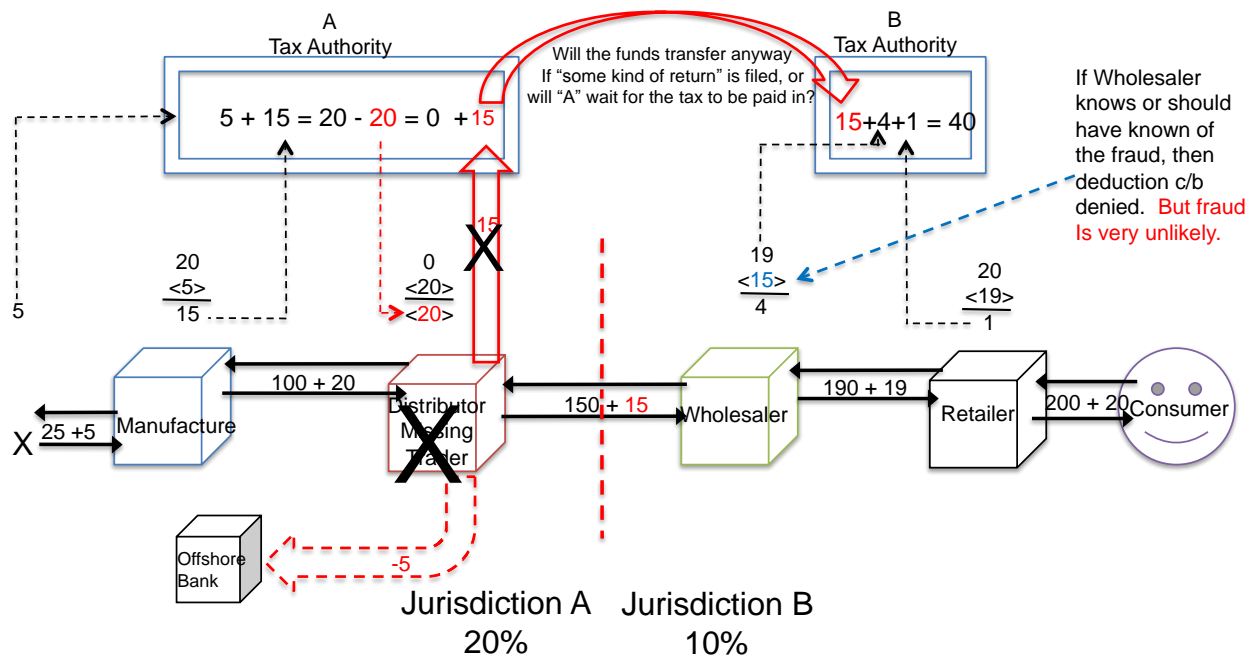
Figure 7: MTIC fraud remains
Distributor, not Wholesaler Goes Missing
Fraud is reduced from 38 to 20



But the diagrams can tell us more. What happens if the VAT rates are reversed, so that Jurisdiction A imposes VAT at 20%, and Jurisdiction B impose VAT at 10%? Is MTIC likely in this situation?

The answer is “no.” As Figure 8 (below) demonstrates, if the *Distributor* is in a high tax jurisdiction it is unlikely to go missing when selling to a *Wholesaler* in low tax Member State. There is no excess VAT to steal. In Figure 8 the *Distributor* has paid VAT of 20 to the manufacturer, but will only be collecting VAT of 15 from Jurisdiction B’s *Wholesaler*. It makes no sense to *not* file a return in Jurisdiction A. The return will seek a refund of 20. To disappear with the *Wholesaler*’s VAT of 15 in hand (without filing a return in Jurisdiction A) produces a net loss for the *Distributor*.

Figure 8: Reverse the Tax Rates
MTIC Fraud Very Unlikely



As a result, if the 2017 one-stop-shop proposal is adopted a very distinct MTIC fraud pattern in goods will likely develop. It will involve taxpayers (like the Distributor) established in a low tax jurisdiction, like:

- Luxembourg at 17%,
- Malta at 18%, or
- Germany, Cyprus, and Romania at 19%,

selling to other taxpayers (like the Wholesaler) established in high tax jurisdictions, like:

- Hungary at 27%, or
- Croatia, Denmark and Sweden at 25%.

It is highly unlikely that a pattern of MTIC fraud in goods will develop in the opposite direction.

In other words, the tax authorities in Hungary, Croatia, Denmark and Sweden will likely be asking the tax authorities in Luxembourg, Malta, Germany, Cyprus, and Romania for assistance in auditing their taxpayers (missing traders) for OSS returns that were not filed, and the related tax amounts that should be transferred. The enforcement effort, and the fraud's

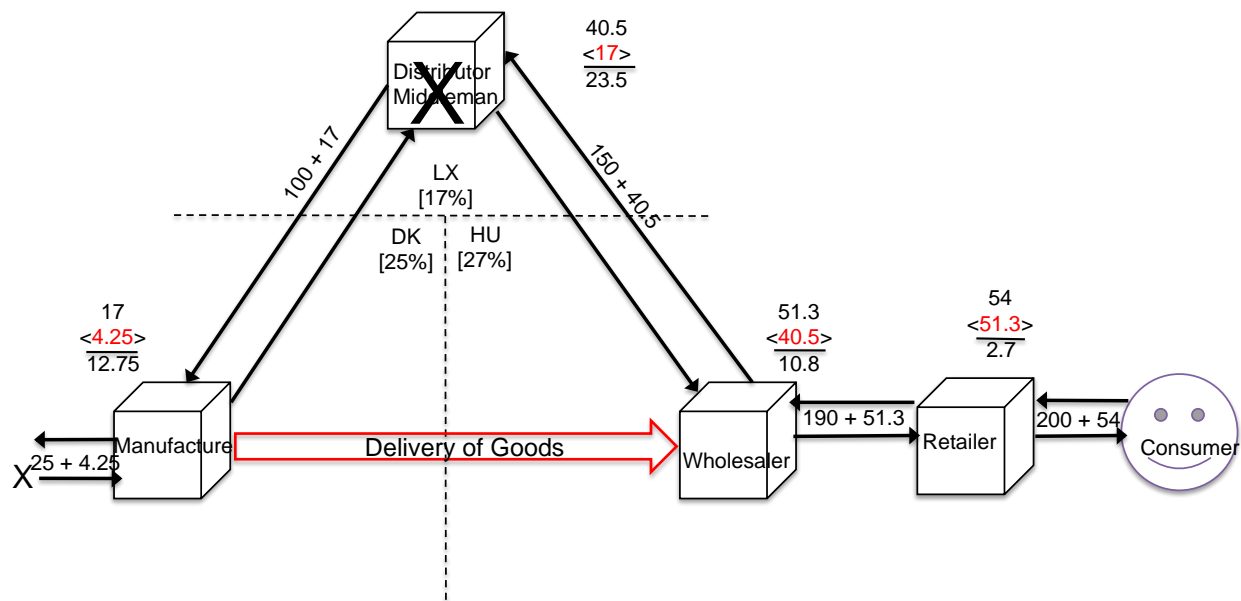
impact will not be spread evenly among the Member States. The *trust* question that follows from this is critical for adoption of the Commission's one-stop-shop proposal.

Would Hungary, Croatia, Denmark and Sweden *trust* that Luxembourg, Malta, Germany, Cyprus, and Romania will be more cost effective and efficient in rooting out domestic missing traders that are impacting the VAT gap in neighboring systems, than the countries suffering from the VAT gap would be in auditing their own taxpayers under the current system?

This question of *trust* becomes more complex when the binary examples we have been considering are placed in a triangular fact pattern. This is a favorite cloaking device of MTIC fraudsters. If we take the common fact pattern, place the Manufacturer in Denmark, the Distributor as a middle man in Luxembourg, and the Retailer along with the rest of the commercial chain in Hungary we get Figure 9 (below). Goods are drop shipped directly from the Manufacturer (Denmark) to the Wholesaler (Hungary). The high Hungarian VAT (27%) is collected by the (soon to be) missing Distributor (Luxembourg).

Using the same numbers for the price of goods through the commercial chain as before, we see that the VAT collected by the Distributor from Hungary will be 40.5, and the VAT paid to the Danish manufacturer will be 17. If the Distributor does not file a OSS return he can steal 23.5. The Distributor/Middleman's operation need be no bigger than a laptop computer. There is no receipt of goods or onward shipment of them from Luxembourg.

Figure 9: Triangulation



Admittedly, in this example the fraudster nets 23.5, rather than the 40.5 he would under present rules, but the fraudster would seem to have a much better chance of "getting away with

it” here. There is the real possibility that Hungarian reliance on Luxembourgian audits of an ephemeral middleman with a laptop might not be well placed.

Although there would be lesser amounts stolen per fraudulent transaction, there is the distinct possibility that the overall fraud would accelerate, because the audit/ enforcement incentives are misplaced. Why would Luxembourg devote the considerable time and resources needed to close the VAT gap in Hungary? Why would they do it for Croatia, Denmark and Sweden after that?

There is a better way forward.

IMPLEMENTING THE 2017 PROPOSAL WITH A VATCOIN BLOCKCHAIN

By the middle of 2016 it became apparent to us that the strength and virtues of blockchain have a natural “fit” with MTIC fraud prevention. After a particularly engaging VAT course at NYU in the Spring of 2016 we began publishing our observations, and by 2017 conferences working toward practical blockchain applications in VAT became commonplace.²² It is not surprising to us that the EU Commission appears to be positioning itself to announce that the “definitive VAT system” will be brought in on the back of blockchain technology.²³ The time has come for the EU Commission to make a blockchain announcement.

We have also pointed out that the new VATs of the Gulf Cooperation Council (GCC)²⁴ are similarly poised to adopt blockchain technology. The GCC announced in their Framework Agreement²⁵ the digital structure needed to bring blockchain compliance to the GCC VATs.²⁶ We expect to see this GCC blockchain application in the very near future.

Blockchain technology creates a robust, secure, transparent *distributive* ledger.²⁷ The technique is revolutionary. Blockchain is a software protocol based on cryptography. It was

²² Consider for example the series of conferences sponsored by the WU Global Tax Policy Center (GTPC) at the Institute for Austrian and International Tax Law. It established a multistakeholder program to examine digital tax transformation: (1) Vienna: *Blockchain: Taxation and Regulatory Challenges and Opportunities* (March 15-16, 2017); (2) Singapore: *Digital Economy Symposium: Reimagining Taxation in the Age of Disruption* (August 15-16, 2017); (3) Vienna: *Digital Tax Transformation* (December 18-19, 2017).

²³ Richard T. Ainsworth & Andrew Shact, *Blockchain Technology Might Solve VAT Fraud*, 83 TAX NOTES INTERNATIONAL 1165.1166 (September 26, 2016)

²⁴ The GCC is a regional intergovernmental political and economic alliance of six Middle Eastern countries – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. It was formed in 1981.

²⁵ Although originally issued in Arabic, by late November 2016 the *Unified VAT Agreement for The Cooperation Council for the Arab States of the Gulf* was available in authoritative English translations. See: THE UNIFIED GULF COOPERATION COUNCIL VALUE ADDED TAX FRAMEWORK AGREEMENT, available at: <http://www.allaboutvat.com/wp-content/uploads/GCC-VAT-Framework-English-Version.pdf>

²⁶ Richard T. Ainsworth & Musaad Alwohaibi, *GCC VAT: The Intra-Gulf Trade Problem*, 84 TAX NOTES INTERNATIONAL 315 (October 17, 2016).

²⁷ A ledger, as used in this sentence and in this field generally, means a value recording and transfer system. Simply stated, a ledger is an accounting tool that keeps track of who owns what. The ledger itself is a very old technology that has not changed much since its development by the Venetian Republic in the 15th century. Ledgers have long been digitized (in the 20th century), but it was only with blockchain that they have been *decentralized*. Prior to 2008 ledgers were only understood as *centralized*.

devised in 2008, and was announced simultaneously with its most famous application – Bitcoin.²⁸ The application in this proposal for a VATCoin is derivative of Bitcoin. It is a limited-purpose cryptocurrency used only for payment of VAT obligations, denominated in local currency, convertible from cryptocurrency to fiat currency, but *only by the government*.

Bitcoin (the application) is often confused with blockchain (the technology). Bitcoin is only one application of blockchain technology, VATCoin is another. Ledger entries in the VATCoin application will be the VATCoins generated by the VATCoin protocol.

VATCoins are acquired by purchase from the national Treasury, and are denominated in local currency units. VATCoins are convertible into fiat currency only by the same national Treasury that issued them. Thus, each Hungarian VATCoin (VATCoin-HUF) represents one Hungarian Forint. It is issued by the Hungarian Treasury in a 1 for 1 exchange for Hungarian currency, and is only transferrable in a VAT-payment transaction. The transaction is recorded on the blockchain.

Blockchain technology is *trustless*.²⁹ It is *trustless* in the sense that it does not require third party verification. It does not need a *trusted* third party (like a bank) to help it negotiate (exchange) value. Instead of trusted intermediaries, blockchain uses powerful consensus mechanisms with cryptoeconomic incentives to verify the authenticity of transactions in the database.³⁰ Depending on the application this incentive mechanism can change.³¹ The consensus mechanism makes the database safe (highly *trustworthy*) even in the presence of powerful or hostile third parties trying to manipulate the registry. For this reason, *The Economist* called blockchain, “The Trust Machine.”³²

²⁸ Satoshi Nakamoto, Bitcoin, *A peer-to-peer electronic cash system* (2008) available at: <https://bitcoin.org/bitcoin.pdf> (note: Satoshi Nakamoto is a pseudonym).

²⁹ The trust element is very important to the adoption of blockchain in tax compliance areas. It needs to be stressed that trusting the blockchain technology is different than trusting Bitcoin. Europol contends that it is not blockchain, but the “... Bitcoin [application that] is establishing itself as the single common currency for cybercriminals within the EU.” Europol, 2015 INTERNET ORGANIZE CRIME THREAT ASSESSMENT, *Key Findings* available at: <https://www.europol.europa.eu/ioc/2015/key-findings.html>.

³⁰ Tim Swanson, *Great Wall of Numbers Cryptoeconomics for beginners and experts alike*, citing Vlad Zamfir of the Ethereum project at the Cryptocurrency Research Group conference (brainstorming session) on Cryptoeconomics as posted January 30, 2015 at: <http://www.ofnumbers.com/2015/01/30/cryptoeconomics-for-beginners-and-experts-alike/>. Cryptoeconomics is:

A formal discipline that studies protocols that govern the production, distribution and consumption of goods and services in a decentralized digital economy. Cryptoeconomics is a practical science that focuses on the design and characterization of these protocols.

³¹ Cryptoeconomic incentives are most strongly associated with cryptocurrency systems. Bitcoin *mining* is such an incentive system. This is because Bitcoin uses pseudonymous and anonymous nodes to validate transactions, whereas a basic distributive ledger that engage entities with legal identities (banks, financial institutions, government agencies) will use “permissioned” nodes to validate transactions. This proposal uses permissioned nodes. Tim Swanson, *Consensus-as-a-Service: A Brief Report on the Emergence of Permissioned, Distributed Ledger System* (April 6, 2016) available at: <http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf>.

³² THE ECONOMIST, *The Promise of Blockchain: The Trust Machine* (October 31, 2015) available at: <http://www.economist.com/news/leaders/21677198-technology-behind-bitcoin-could-transform-how-economy-works-trust-machine>.

A Trust Machine is precisely what the EU Commission needs to make its “definitive solution” work. It has needed it since 1996.

Only recently have decentralized, distributive ledgers been possible. Blockchain was not a solution available in 1996 when the EU Commission proposed the Clearing House solution. Advances in technology, computing capacity, and connectivity (post-2000) have made blockchain possible. Replacing very expensive *centralized ledgers* with *decentralized distributive ledgers* captures huge cost savings and efficiencies.³³ Decentralized distributive ledgers ride three exponentially declining cost curves:

1. *Moore’s Law*: the cost of processing digital information (speed), halves every 18 months;³⁴
2. *Kryder’s Law*: the cost of storing digital information (memory) halves every 12 months;³⁵
3. *Nielson’s Law*: the cost of shipping digital information (bandwidth) halves every 24 months.³⁶

VATCoin’s Blockchain

A VATCoin is a digital asset acquired in exchange for fiat currency. It is denominated in the local currency that was used to initially acquire it. VATCoin is a VAT payment system utilizing open source software.³⁷ The system is peer-to-peer. Transactions take place between users directly. There is no intermediary (bank or other trusted third party).

Transactions are verified by network nodes, and recorded in a *private* distributed ledger where the VATCoin itself is the unit of account. This is the blockchain. There is no central depository of VATCoins. There is no administrator.

One of the great novelties of Bitcoin’s blockchain is that it is a *public* ledger that is maintained by a network of anonymous communicating nodes running the Bitcoin software.³⁸

³³ Sinclair Davidson, Primavera De Philippi & Jason Potts, *Economics of Blockchain* (March 8, 2016) available at: <http://ssrn.com/abstract=2744751>

³⁴ Gordon E. Moore, Cramming More Components onto Integrated Circuits, Proceedings of the IEEE, Vol. 86, No. 1, January 1998) reprinting the same title from Electronics, 114-117 (April 19, 1965) available at: <http://www.cs.utexas.edu/~fussell/courses/cs352h/papers/moore.pdf>. Mr. Moore is the founder of Intel and Fairchild Semiconductor.

³⁵ Mark Kryder, *Kryder’s Law*, SCIENTIFIC AMERICAN (August 2005) available (as a reprint) at: <https://web.archive.org/web/20060329004626/http://www.sciam.com/article.cfm?chanID=sa006&colID=30&articleID=000B0C22-0805-12D8-BDFD83414B7F0000>. Mr Kryder was the senior Vice President of Research and the Chief Technology Officer at Seagate Corp.

³⁶ Jakob Nielson, *Nielson’s Law of Internet Bandwidth*, NIELSON NORMAL GROUP <https://www.nngroup.com/articles/law-of-bandwidth/>. Mr. Nielson was an engineer at Sun Microsystems.

³⁷ Open source software is computer software where its source code is made available (with a license) in which the copyright holder provides the right to study, change, and distribute the software to anyone and for any purpose.

³⁸ Terminology can be confusing. Different terminology (different from *public v. private*) is used by the European Central Bank (ECB) to draw the same distinctions about blockchain. The ECB discusses *unrestricted* (i.e., *public*) ledgers, and prefers *restricted* (i.e., *private*) ledgers. Other writers employ still different terminology. They distinguish between *permissioned* (i.e., *private*) and *un-permissioned* (i.e., *public*) distributive ledgers. (Tim Swanson *Great Wall of Numbers Cryptoeconomics for beginners and experts alike*, Supra note, 30). They do this to bring into sharp relief the use of white lists (or black list) of users, who are identified through KYB (know your bank) or KYC (know your customer) procedures. This process is common in traditional finance.

The European Central Bank is considering blockchain for post trading activities in securities, but the ECB rejects *public* ledgers, preferring *private* ledgers in the securities field.³⁹ This allows the selection of a less costly consensus mechanism than the *proof-of-work* used by Bitcoin. Up through the end of 2016 most writers in this field agreed with the ECB – a *private* distributed ledger works best in a governmental context.⁴⁰ That assessment may be changing.

Proof-of-stake and proof-of-identity are two of the alternate (less expensive) consensus processes identified by the ECB. Both are well suited for *private* distributed ledgers. The ECB indicates:

A second type of validation system is proof-of-stake (PoS) consensus process. This assigns shares of validation rights to users according to their stake in the system ... or the reputation of the validator in a restricted DLT (known as proof-of-identity (PoI)).

However, if a *public* distributed ledger is desired, then strong consideration needs to be given to Algorand, developed by MIT Professor Silvio Micali, one of the world's leading cryptographers. Algorand is a more efficient alternative to Bitcoin's public blockchain design that retains the "public" aspect of consensus.⁴¹

Regardless of the public or private nature of the blockchain adopted for VATCoin, transactions will be constructed in the form of "X sends Y number of VATCoins to Z." Network nodes receive this transaction and if they validate it the transaction will be added to *their copy* of the ledger. This copy is then broadcast to the other nodes. In the Bitcoin blockchain approximately six times per hour a new group of accepted transactions (a block in the blockchain) is created. This "block" is what is added to the "chain" that comprises the "blockchain." Each block contains a cryptographic hash of the previous block. The Bitcoin blockchain uses the SHA-256 hashing algorithm to *chain* the new block to the previous block, VATCoin will use the same hashing algorithm.⁴²

³⁹ European Central Bank, *Distributed Ledger Technologies in Securities Post-trading: Revolution or Evolution?* OCCASIONAL PAPER SERIES, No. 172 (April 2016) available at: <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>

⁴⁰ Marcella Atzori, *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?* (December 2015) at 16-24, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2709713 (discussing the difference between *private* (aka, *permissioned*) and *public* (aka, *un-permissioned*) distributive ledgers and opting strongly for permissioned ledgers in the government sphere).

⁴¹ Silvio Micali, *Algorand: The Efficient Public Ledger* (November 18, 2016) available at: <http://www.the-blockchain.com/blockchain-news-research-library/>

Algorand is a truly democratic and efficient way to implement a public ledger. Unlike prior implementations based on proof of work, it requires a negligible amount of computation, and generates a transaction history that will not fork with overwhelmingly high probability.

⁴² Andreas M. Antonopoulos, *MASTERING BITCOIN: UNLOCKING DIGITAL CRYPTOCURRENCIES* at Chapter 8: *Mining and Consensus* 175-216 (2015) (explaining that to be acceptable by the rest of the network each new block must contain a proof-of-work. The proof-of-work requires miners to find a number (called a nonce) such that when the block is hashed along with the nonce the result is numerically smaller than the network's *difficulty target*. The proof is easy for any node to verify, but very difficult to generate. For a secure cryptographic hash miners must try many different nonce values before meeting the difficulty target.)

Owning and spending VATCoins requires an individual to have a specific address. A payer must digitally sign a transaction with a private key.⁴³ If the private key is lost, the VATCoin network (unlike the Bitcoin network) will have mechanisms in place to identify ownership.⁴⁴ The Bitcoin network does not recognize any other evidence of ownership.⁴⁵

VATCoin transactions must have one or more inputs. For the transaction to be valid, every input must be an *unspent output* of a previous transaction. Every input must be digitally signed.⁴⁶ (In cases of multiple inputs, the VATCoin system is simply indicating that multiple coins are being used to consummate a single transaction. The same is true in reverse, for a transaction with multiple outputs. Multiple payments can be made through the same transaction.)⁴⁷

Specific Application

The adoption of a VATCoin blockchain as a tax payment, recordkeeping, and fraud prevention mechanism is a natural “fit” with the EU Commission’s efforts to achieve “far-reaching reforms” in 2017. This application is narrow, and specific. It is an application designed to “fit” with the specific changes advanced by the Commission. There is a wider application considered in the section that follows.

⁴³ Cryptographic systems use a pair of keys, one of which is public and can be shared widely, and the other of which is private and known only to the owner. Using a public key a message can be authenticated as originating with a holder of the paired private key. Additionally, encrypting a message with a public key will assure that only the holder of the paired private key can decrypt the message. Public-key cryptographic systems rely on cryptographic algorithms based on mathematical problems that currently admit no efficient solution.

⁴⁴ A business in possession of VATCoins that forgets a private key could contact the tax authority. The tax authority could identify all VATCoin purchased by the taxpayer, follow them through the blockchain, and identify all of the VATCoins not already spent. The un-spent VATCoins could be destroyed, new VATCoins issued, and the Taxpayer provided a new private key within minutes.

If the loss of the private key is associated with the theft of VATCoins, then this too could be found by the tax authority. It would follow the VATCoins through the blockchain, and identify all of the transactions where the VATCoins were used. However, if the theft is followed quickly by the use of the stolen VATCoins in another commercial transaction it might be possible to complete the fraud before getting caught. If however, the VATCoin mechanism is adopted in conjunction with the Digital Invoice Customs Exchange (DICE) then there would be a third-party (the tax administration) engaged in validating each transaction in real-time. Thus, VATCoin, and DICE in conjunction with AI would solve the potential fraud. See Richard T. Ainsworth & Goran Todorov, *Stopping VAT Fraud with DICE – Digital Invoice Customs Exchange* 72 TAX NOTES INTERNATIONAL 636 (November 18 2013). The specific application of a VATCoin cyber-theft in a system that applied DICE with VATCoin is considered in the *Immunity to Cyberattack* heading and Figure 4 in: Richard T. Ainsworth, Musaad Alwohaibi, & Mike Cheetham, *VATCoin: Can a Crypto Tax Currency Prevent VAT Fraud?* 84 TAX NOTES INTERNATIONAL 703, 711-712 (November 14, 2016).

⁴⁵ CBS-DC, *Man Throws Away 7,500 Bitcoins, Now Worth \$7.5 million* (November 29, 2013) available at: <http://washington.cbslocal.com/2013/11/29/man-throws-away-7500-bitcoins-now-worth-7-5-million/>

⁴⁶ See the diagram at page 2 in Satoshi Nakamoto, *Bitcoin, A peer-to-peer electronic cash system* (2008) *supra* note 28.

⁴⁷ As with a transaction in real currency, if the sum of the inputs (cash in your pocket) exceeds the sum of the outputs (funds needed to make a purchase), the difference is returned to the payer in the form of an additional output.

The Commission indicates that it wants a system that is “... simpler ... robust to fraud ... exploiting ... digital technology [that] ... enhanc[es] greater trust ...” This is the precise recipe for blockchain.

The purpose of this initiative is to put in place a definitive VAT system so as to pave the way for the creation of a genuine single EU VAT area for the internal market. This means a VAT system *simpler* for businesses trading across the EU while at the same time *more robust to fraud*, to the benefit of the Member States and also of compliant businesses. The efficiency of the VAT system needs to be further improved, in particular by *exploiting* the opportunities of *digital technology* and by *enhancing greater trust* between business and tax administrations and between EU Member States' tax administrations. (emphasis added)⁴⁸

Figure 10 (below) shows the first steps in a VATCoin blockchain application. The taxpayer-buyer seeking to make a cross border purchase requests an allotment of VATCoins denominated in the local currency, sufficient to pay the VAT due on the cross-border supply. 30 VATCoins-Currency Type B are requested.⁴⁹ VATCoins are denominated in local currency, because the VAT in a cross-border transaction is also stated in the local currency. Thus, if the Wholesaler was in the UK it would be requesting VATCoins denominated in pounds, whereas if he were in France the request would be for euro-based VATCoins, or forint-based VATCoins if the Wholesaler was in Hungary.

Formally, this request is for Jurisdiction B to “make” or “mint” 30 VATCoins. In this case the price of 150 x 20% VAT requires 30 VATCoins. The diagram indicates that Jurisdiction B already has 500 VATCoins in circulation from other cross-border transactions entered into by other importing businesses. These transactions have not been completed/ closed yet, and as a result VATCoins are outstanding (or in circulation within various commercial chains).

⁴⁸ COMMISSION STAFF WORKING DOCUMENT – IMPACT ASSESSMENT, *supra*, note 2, at 11.

⁴⁹ VATCoins are denominated in the local currency. The EU Commission’s “far-reaching reforms” require the seller in Jurisdiction A to collect VAT from the buyer in Jurisdiction B at the rate applicable in Jurisdiction B. Thus, the VAT due is $20\% \times 150 = 30$

Figure 10. Buyer requests 30 VATCoin

The diagram illustrates the VATCoin flow and tax calculation for a buyer request of 30 VATCoin. The flow is as follows:

- Jurisdiction A (10%):** Manufacturer (100 + 10) to Distributor (10% tax). Tax Authority A calculates $2.5 + 7.5 = 10$.
- Jurisdiction B (20%):** Distributor (150) to Wholesaler (20% tax). Tax Authority B calculates $10 + 30 = 40$.
- Wholesaler:** Wholesaler to Retailer.
- Retailer:** Retailer to Consumer.

The flow is represented by arrows and boxes, with a red dashed line separating Jurisdiction A and Jurisdiction B. The flow is as follows: Manufacturer (100 + 10) to Distributor (10% tax), Distributor (150) to Wholesaler (20% tax), Wholesaler to Retailer, and Retailer to Consumer. Tax Authorities calculate the VATCoin flow based on the flow between the Manufacturer and Distributor, and between the Wholesaler and Retailer.

- The number of VATCoins needed (30 in this instance);
- Identifying information about the Taxpayer-buyer (name, address, VAT ID number);
- Identifying information about the Taxpayer-seller (name, address, VAT ID number); and
- The nature and quantity of goods (or services) being purchased.

The request, if accepted by the Tax Administration of Jurisdiction B, will become a *smart contract*⁵⁰ that will be lodged on the blockchain. Smart contracts have been proposed in a number of tax compliance areas to simplify data storage, increase accuracy and overall efficiency. Those areas range from estate tax, to VAT, to payroll tax compliance.⁵¹

⁵¹ Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, (March 12, 2015) available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664

In this diagram, the *smart contract* that is formed as a result of the request is placed in “block 1.” This particular *smart contract* will be aggregated with other data points (smart contracts or VATCoin exchanges) involving Jurisdiction B. They will be validated together. If there are blocks already formed ahead of block 1, then when block 1 is validated by the consensus mechanism it will be bound to the prior blocks (thus making a chain of blocks of transactional data).

Figure 11 indicates that the *smart contract* has been executed. In this case 30 VATCoins are created by Jurisdiction B’s Treasury, transferred to the Tax Authority [2], and then further transferred to the Wholesaler who requested them [3]. Both transfers [2] and [3], are recorded on the blockchain. We have assumed some time-lag between these steps. This is why the diagram represents that these steps are recorded in two different blocks (numbers 2 and 3 respectively).

It should be noted, that there is no requirement that Jurisdiction B “sell” its VATCoins 1-to-1 for Jurisdiction B’s currency units. There could be other arrangements. For example, a concern about cash flow for domestic businesses that are importing heavily, could be accommodated in the smart contract, which might issue VATCoins for partial payment up front, but with an automatic withdrawal from the Wholesaler’s bank account at a fixed date, or subject to a fixed contingency later in time.

The technology [of blockchain] could be employed to create smart contracts that automatically check the state death registries and allocate assets from a testator’s estate, send applicable taxes to government agencies without the need of administering the will through probate. (at 12)

UK Government Office for Science, *Distributed Ledger Technology: Beyond block chain* (2016) available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf. The discussion in the VAT portion of this document focuses on efficiency gains in government auditing, and recommends the development of an ...

... EU-wide series of VAT standards and protocols [that] would enable DLT to be deployed across Europe, with unilateral alignment of all VAT accounting transactions, from invoices to bank receipts. The system could include *smart contracts* designed to outsmart the tax quasi-compliant economy, which would also help to address the various threshold differences in VAT applicability across EU member states.

With machine-learning devices reading the EU’s VAT transactions in real time, erroneous transactions (including so-called carousel fraud) are far more likely to be spotted than by the current methods of auditing. Increasing traceability and transparency — including payment providers, banks and other financial institutions — would make the black-market economy more difficult to conceal. (at 70-71)

UK Government Chief Scientific Advisor, Government Office for Science, *Distributed Ledger Technology: Beyond Block Chain* (December 2015).

Blockchains are not just powering digital currencies. They are also enabling the creation of smart contracts, one of the first truly disruptive technological advancements to the practice of law since the invention of the printing press. Using a distributed database like blockchain, parties can confirm that an event or condition has in fact occurred without the need for a third party. ... To date, smart contracts have mostly been created to automatically execute derivatives, futures, swaps, and options. ... The development of smart contracts is expanding rapidly. Over the past several months, a number of open source projects — such as Ethereum, Counterparty, and Mastercoin — have been developed to create programming languages that enable the creation of increasingly sophisticated smart contracts. Using these programming languages, smart contracts could be used to enable employees to be paid on an hourly or daily basis with taxes remitted to a governmental body in real time. (at 18)

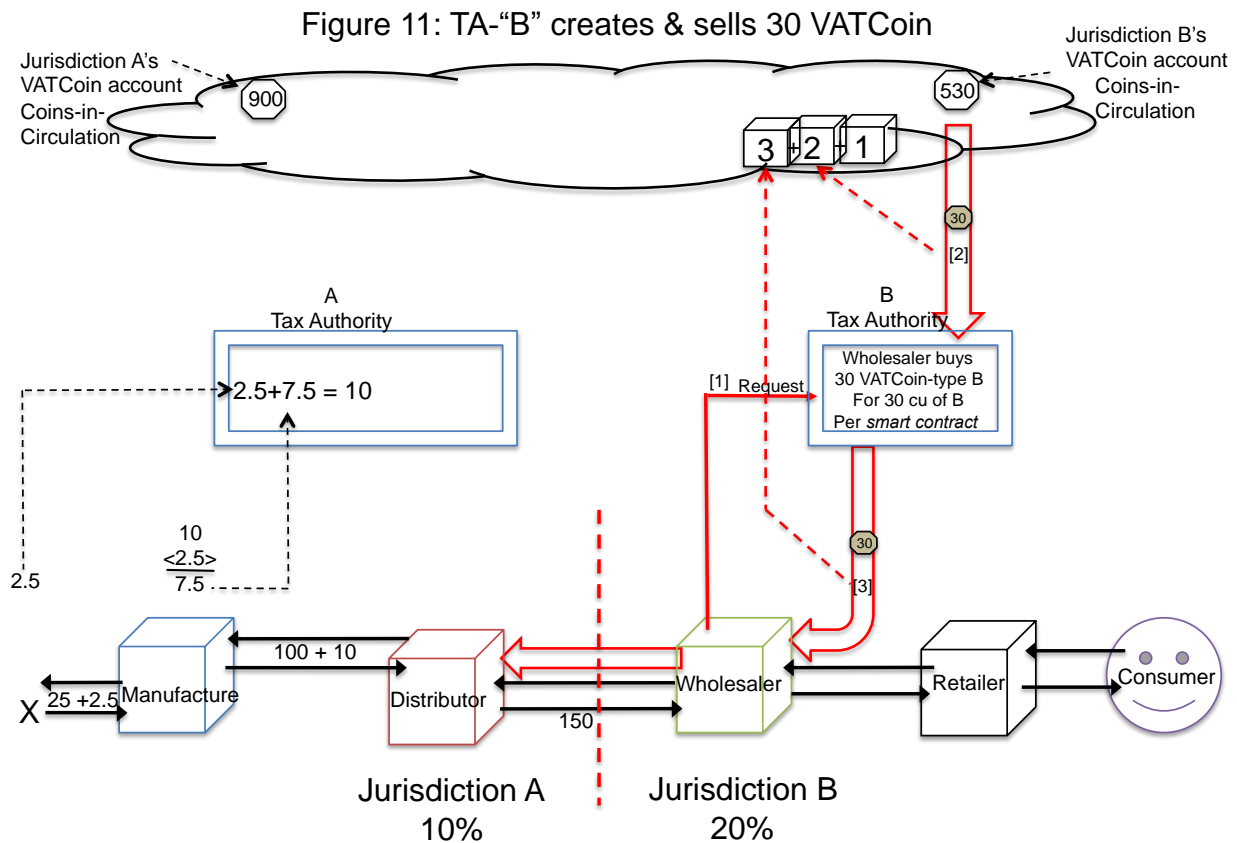
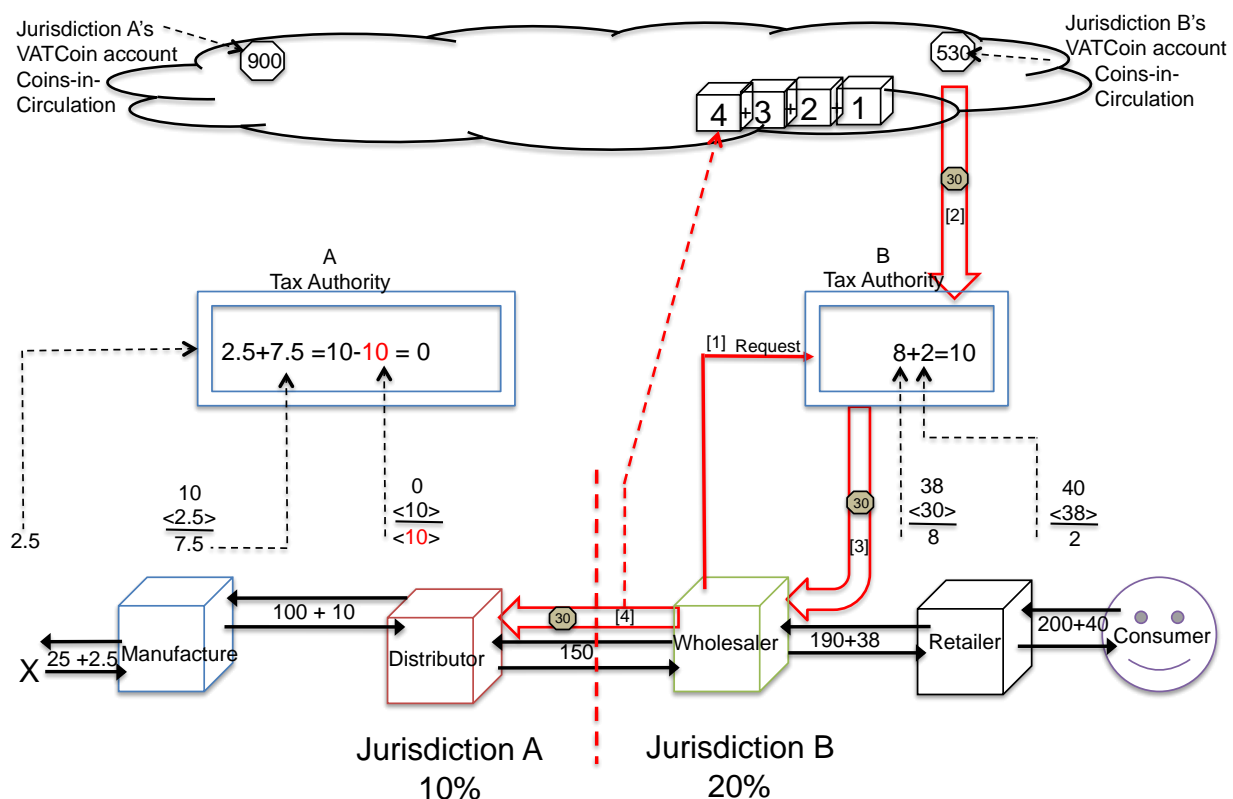


Figure 11 also indicates that Jurisdiction B's VATCoins in circulation have increased by 30, from 500 to 530. This amount will decrease after the One-Stop-Shop return is filed by the Distributor, and the VATCoins are returned and then destroyed. Figure 11 also assumes that if the Distributor in Jurisdiction A is able to enter into a cross-border contract with the Wholesaler, then the transactions with the Manufacturer are complete, and Jurisdiction A has received 10 in net VAT revenue.

In Figure 12 the Wholesaler uses the VATCoins to complete its transaction with the Distributor [4]. This transfer is recorded in block 4, which is bound to blocks 1, 2, and 3 after validation by the consensus mechanism. The transfer of the VATCoins confirms the cross-border transaction, and the Distributor is able to claim a full refund for input VAT. This can be immediately checked by Jurisdiction A by accessing the blockchain.

Figure 12 also assumes that the Wholesaler and the Retailer in Jurisdiction B are able to conclude the sale to the final consumer. The aggregate VAT collected in Jurisdiction B is 10, but it should be 40. The missing VAT of 30 resides with the Distributor in Jurisdiction A, awaiting the filing of the OSS return, and the formal transfer of the 30 VATCoin through the OSS mechanism.

Figure 12: Wholesaler pays Distributor 150+30 VATCoin for a supply, then sells on



It needs to be observed however, that there is no real revenue delay in this system. Jurisdiction B already has the 30 in local currency from the transaction it engaged in through the executed *smart contract*. The contract is found in block 1, and the execution in blocks 2 and 3. Jurisdiction B still has 530 VATCoins in circulation, and it can find each one of them by consulting the blockchain.

Figure 13 shows the 30 VATCoin being submitted to the Tax Authority in Jurisdiction A [5]. The transfer is recorded on the blockchain in block 5, and is bound to the other blocks. Importantly, the number of VATCoins in circulation for Jurisdiction A does not change when they receive the 30 VATCoins from the Distributor. These VATCoin's have been called "type B," because they originated in Jurisdiction B. They cannot be mixed with "type A" VATCoins, which are issued by Jurisdiction A, to Jurisdiction A businesses, that are importing goods from other Member States. There remains 900 VATCoins "type A" in circulation. Nothing in the current transaction has changed that.

Figure 13: Distributor files O-S-S return & transfers 30 VATCoin to TA-“A”

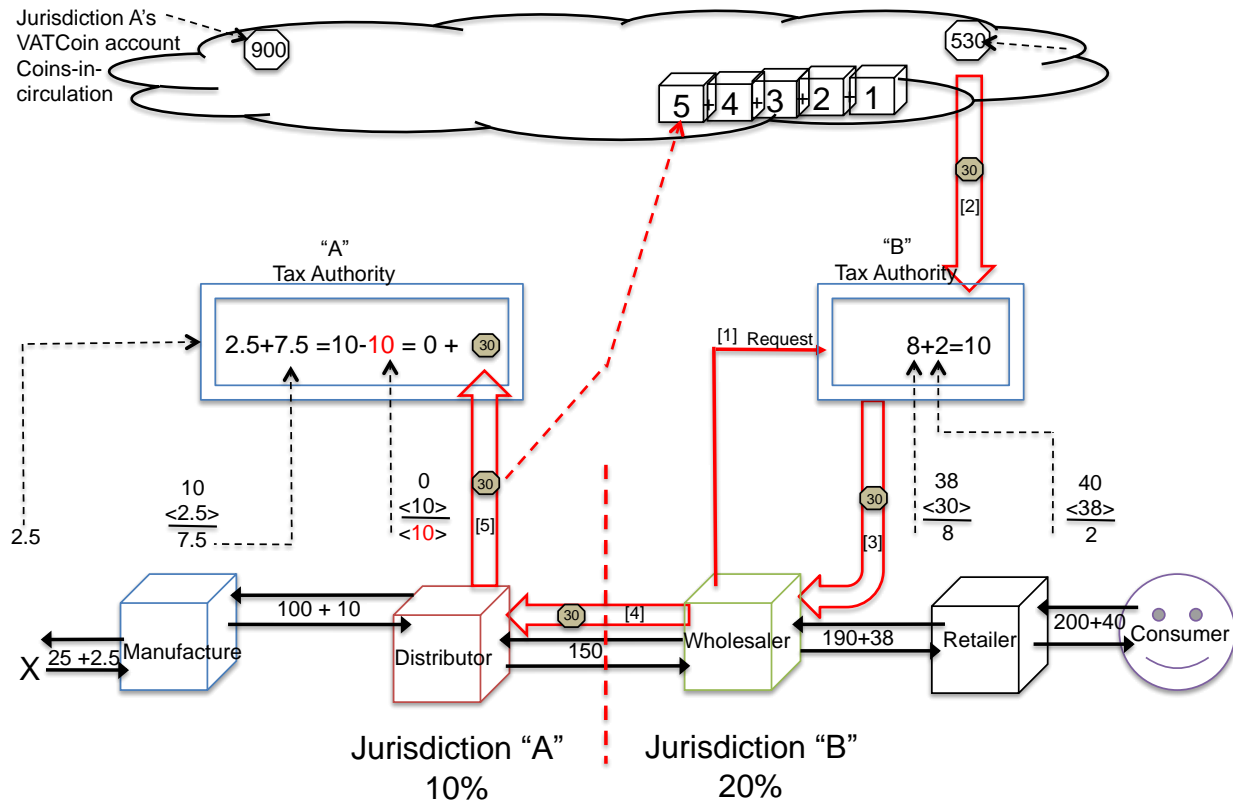


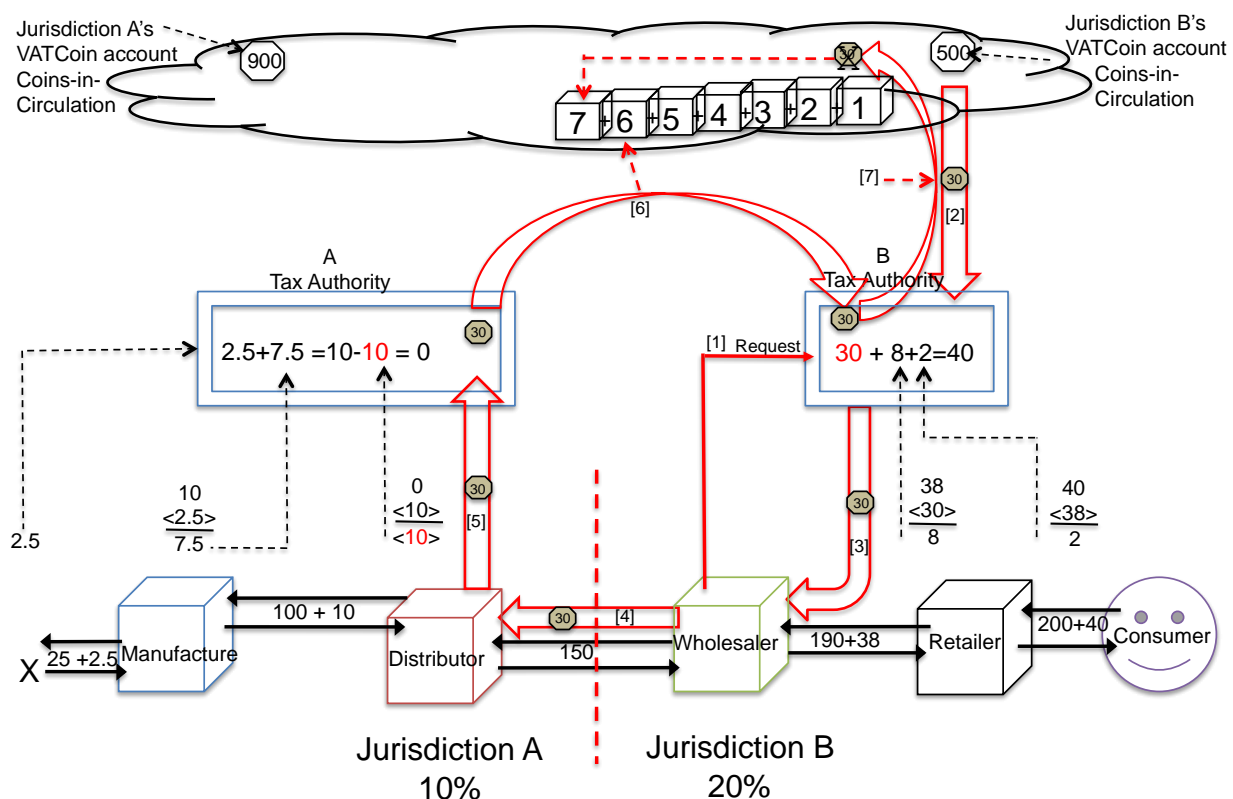
Figure 14 shows the final steps in this sequence. After verification and aggregation of all the transactions and all the VATCoins available to the Tax Administration of Jurisdiction A⁵² the 30 VATCoins passed up with the OSS return will be sent to the Tax Administration of Jurisdiction B [6]. The transfer is recorded in block 6.

Importantly, this is not a transfer of currency. There are no banking fees associated with it, nor are there concerns with currency inflation or deflation during the time it takes to complete this circle. The funds (or *smart contract* based agreements to get them) have always resided with Jurisdiction B. The blockchain and the *smart contract* entered into at [2] and [3] make this clear. The transaction is completed.

Receipt of the 30 VATCoins brings the record of VAT revenue from this commercial chain back up to 40. Based on sales to final consumers at 200 under a 20% VAT all revenue is accounted for.

⁵² It needs to be stated that this set of diagrams is only a thin sliver of all the transactions, OSS returns, and VATCoins that are deposited with the Tax Authority. It is difficult to imagine that this entire process might not take a few days or longer to make sure everything is properly done. Although nothing indicates this in the Commission documents, it should be anticipated that if a VATCoin and blockchain system were to be established, then the OSS returns and VATCoin transfers would most likely be done in close to real-time. Quarterly returns are a function of a paper system. Technology should change this.

Figure 14: TA-“A” remits 30 VATCoin to TA-“B” ... VATCoins are destroyed

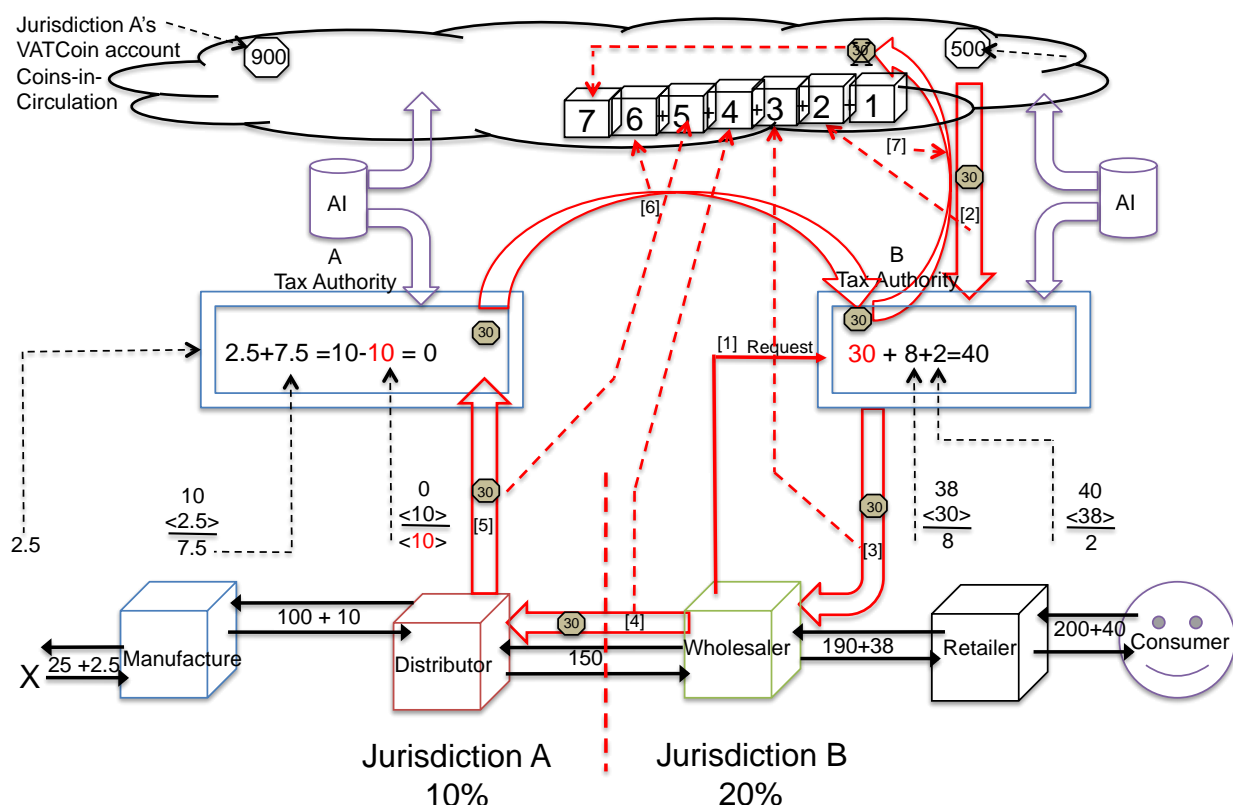


The last remaining step is for the Tax Administration of B to transfer the 30 VATCoins to its Treasury where they will be destroyed. The coins-in-circulation for VATCoin-“type B” falls from 530 to 500 upon the destruction of the VATCoins.

This step is necessary to prevent the collection of unused VATCoins in the system which might leave them vulnerable to hackers. Importantly, in this system every VATCoin has an identified commercial place where it belongs, it has a discernable history, and can be located on the blockchain at a moment's notice. Theft of a VATCoin would not provide the thief with currency, it would only allow payment of a VAT amount due, but the provenance of a stolen VATCoin would be immediately visible through the consensus mechanism. There are no VATCoins unassociated with an immediate transaction.

Figure 15 (below) presents a summary of the transactions. When the data trails are seen in aggregate, and when it is realized that hundreds, if not thousands of transactions like this will happen each minute in the EU, it becomes apparent why one thing more is needed. Each Member State will want to secure a robust artificial intelligence (AI) engine to risk-analyze the data streams, both within their own tax authority and within the Community blockchains. It would be exceedingly helpful if the Community-level risk analysis was overseen by the Commission.

Figure 15: Summary & AI



Wider Application

The proposals above are a “narrow fit” to the EU Commission’s proposal to change the treatment of B2B cross-border sales in goods. It is directed at the heart of MTIC fraud in goods. There is a wider application. It is not developed here in full.

VATCoins could be required in all domestic B2B transactions. They could (also) be required in B2C transactions whether cross-border or domestic. These applications were considered in a previous article which proposed that VATCoins be adopted in the GCC in conjunction with a DICE solution.⁵³ That proposal considered a number of additional issues including how the VATCoin structure as a whole (and in conjunction with a DICE mechanism) would be able to fend off cyberattacks by denying a thief the benefit of stolen VATCoins.⁵⁴

Two aspects of the wider application are relevant to our current proposal – the workability of a VATCoins system (as we more widely propose it) in terms of the huge amount of data processing contemplated, and secondly the importance of coupling VATCoins with DICE to *granularly* track the flow of goods and services in real-time in tandem with the VATCoin

⁵³ Richard T. Ainsworth, Musaad Alwohaibi, & Mike Cheetham, *VATCoin: Can a Crypto Tax Currency Prevent VAT Fraud?* 84 TAX NOTES INTERNATIONAL 703 (November 14, 2016)

⁵⁴ See the discussion above at note 44.

flows. This second concern is important if we are concerned about VAT fraud more generally, and not just cross-border MTIC in goods.

The first concern is a *workability* issue (we apply a Hungarian example); the second concern is a *coupling* issue (we apply an Indian example).

Workability. The workability concern is – Do we have the computing capacity to place VATCoins from all cross-border B2B transactions in goods on a blockchain where the scope of the data collected is from the entire EU? If we could do this in the limited cross-border goods case, would it be possible for us to “scale-up” to all B2B transactions in the EU, and then further to all B2B and B2C transactions?

The size of the problem can be estimated.⁵⁵ There are (roughly) 10 billion cross-border B2B transactions in the EU. The Commission’s Staff Working Document which is concerned with revenue losses measured this trade in euro, not transactions. It indicated that there was €3,068,000 export transactions (dispatches) in goods, and €2,993,000 import transactions (arrivals) in goods throughout the EU in 2015.⁵⁶

For the technology piece of this system, the important figures are the number of transactions. Our question is: can present blockchain technology deal with 10 billion transactions per year? The Red Belly blockchain, which is still in laboratory development at the University of Sydney’s School of Information Technologies, is giving every indication that it could handle this data stream easily.⁵⁷

The most recent reports out of the Australian research team indicates that the Red Belly Blockchain can process more than 660,000 transactions per second on 300 machines in a single data center. As a result, it would take Red Belly a little less than 5 hours to place a *full year* of cross-border VATCoin transactions (in goods) on a blockchain.⁵⁸

We conclude, based on these early indications that with present technology, we *may be able* to place the entire EU’s cross-border transaction record in goods on a blockchain. We certainly could not do it with the blockchain utilized by Bitcoin. Even if we assume that there are seven distinct transaction records (as in Figure G above), each of which needs to be added to

⁵⁵ During conversations with Theodoros Vassiliadis, DGTCU, Head of Unit, Taxation systems and IT compliance, we came to a rough estimate of 10 billion B2B transactions in the EU, based on 7.5 million traders engaged in B2B transaction in 2016. Personal e-mail communications November 8, 2017.

⁵⁶ These figures are extrapolated from COMMISSION STAFF WORKING DOCUMENT – IMPACT ASSESSMENT, *supra*, note 2, at 12. The source figures are the volumes of trade in goods taken from *Eurostat* records by the EU Commission. These figures are not counting transactions, but are aggregating commercial values. There are €3.068 billion in goods exports (dispatches) and €2.996 billion in imports (arrivals) in the base year of 2015. The figures above derive a rough estimate of the number of transactions by assuming that all transactions were for €100.

⁵⁷ Jennifer Peterson-Ward, *University of Sydney’s Super-fast Blockchain Gets Even Faster*, PRESS RELEASE UNIVERSITY OF SYDNEY (October 25, 2017). Neither this Press Release, nor other articles on the Red Belly Blockchain explain its capacity or operations with respect to complex *smart contracts* or its effectiveness with particular consensus mechanisms. While the reports are promising, more data is necessary to evaluate the Red Belly Blockchain. Press Release available at: <https://sydney.edu.au/news-opinion/news/2017/10/25/university-of-sydneys-super-fast-blockchain-gets-even-faster.html>

⁵⁸ $10,000,000,000/660,000 = 15,152$ seconds, or 253 minutes, or 4 hours and 22 minutes.

the blockchain, we only need 35 hours, or a day and a half to place a full year's worth of VATCoin transactions, the entire EU cross-border trade in goods, on the Red Belly Blockchain.

Red Belly has been tested across 14 diverse geographical regions including Australia, the US, Canada, UK, Germany, Brazil, Japan, India, South Korea, and Singapore, with up to ten machines participating in each region. Vincent Gramoli, who heads up the Concurrent Systems Research Group that is developing the Red Belly Blockchain compares the processing of the system with the global VISA network which has a peak capacity of 56,000 transactions per second. Bitcoin is limited to about 7 transactions per second.⁵⁹

Hungarian example. Although Hungary is not (yet) talking about putting their domestic VAT compliance on blockchain, that appears to be the direction they are going in. Since 2014 Hungary has been moving toward real-time, fully digital VAT reporting. Data Tech International observed the early signs of this in the manner in which Hungary mandated fiscal cash registers. All invoices were to be encrypted, digitally signed, and stored on site.⁶⁰ By 2016 the Hungarian Ministry of Finance attempt through regulations to mandate real-time reporting of all domestic B2B (but not B2C) transactions in goods and services.⁶¹

The Hungarian effort attracted wide notice. The regulations covered invoices that reported at least 100,000 HUF (Hungarian Forint) VAT (roughly \$374 USD).⁶² However, implementation was delayed by Parliament until mid-2017.⁶³ As the deadline approached, real-time reporting was further delayed until mid-2018.⁶⁴

⁵⁹ Asha McLean, *University of Sydney touts Red Belly Blockchain as Outperforming VISA*, ZDNet (October 25, 2017) available at: <http://www.zdnet.com/article/university-of-sydney-touts-red-belly-blockchain-as-outperforming-visa/>

⁶⁰ Data Tech International, *Hungary: Use of Fiscal Cash Register – with remote audit is mandatory* (September 20, 2014) available at: <http://www.salesdatacontroller.com/hungary-fiscal-cash-register/>

⁶¹ Beginning in January 1, 2016 all invoicing software in Hungary was required to provide data for the tax authority when an audit was conducted. These regulations were issued as ERP (Enterprise Resource Planning systems like SAP, and Oracle) invoicing software requirements.

By July 1, 2016 real-time data was to be transmitted from the ERP and invoicing software directly to the tax administration. Richard Cornelisse, *Real-time VAT Ledgers in Hungary*, TAX NEWS – TAX ASSURANCE RESEARCH (July 29, 2016) available at: <https://taxnewsreader.wordpress.com/2016/07/29/real-time-vat-ledgers-in-hungary/>

⁶² This represents an invoice amount of 370,370 HUF or (roughly) \$1,385 USD.

⁶³ By the end of 2016 nothing had happened, because Parliament had not approved the regulations. When legislation passed the implementation date for real-time transmission had been extended to mid-2017. EY reported:

According to recently adopted legislation in Hungary, as of 1 July 2017, the invoicing software of Hungarian taxpayers will be required to have a direct data connection with the Hungarian tax authority in order to report sales invoice data in real-time

EY, Indirect Tax Alert, *Hungary to Implement Invoice Data Reporting during 2017* (December 13, 2016) available at: <http://www.ey.com/gl/en/services/tax/international-tax/alert--hungary-to-implement-invoice-data-reporting-during-2017>

⁶⁴ Anna Norden, *The Final Countdown to Hungarian Real-Time Reporting?* (April 27, 2017) available at: <https://www.trustweaver.com/final-countdown-hungarian-real-time-reporting/>

The likely decision to postpone the implementation of changes in VAT reporting has now finally been announced. Hungary has now postponed the entry into force of this [real-time reporting] requirement by one year until July 2018 for two reasons:

- 1) To actually get the technical specification published well in advance
- 2) To give taxpayers and service providers some time to implement and test their solutions

When real-time reporting arrives in Hungary we will have multiple digital silos storing domestic transaction data sets. Data storage on site will replicate the data storage at the center. Each party to a single transaction will store the same data. This situation is digitally-ripe for blockchain. There is no reason, other than political will and Ministry of Finance's effort, that should block a transition to blockchain. DICE would be clearly appropriate. A domestic VATCoin would allow the transition to proceed smoothly without raising cash flow concerns.

If the Red Belly Blockchain can build a blockchain in real-time with the EU's annual cross-border B2B goods transactions in less than a minute, it could do the same for Hungary's domestic transactions. Both the supplies and the VATCoin payments should be integrated into a single blockchain.

Coupling VATCoin with DICE. VATCoin and DICE address different fraud vectors. VATCoin extinguishes *cash* refunds on cross-border transactions. Doing so eliminates the pay-off for cross-border missing trader frauds. VATCoins cannot be converted into fiat currency by any person or entity (other than the National Treasury that created them). The VATCoin principles work both under current EU VAT rules, and under the EU Commission's "far-reaching reforms" proposals of 2017. VATCoins do not eliminate all fraud vectors. If the EU estimates that annual cross-border missing trader fraud in goods is €50 billion, then adding services should bring the cross-border fraud tally roughly to €80 – €100 billion. VATCoin can handle this.

DICE differs from VATCoin. DICE is not a currency-centric fraud solution. DICE is data-driven on the supply side (either the goods or the services being supplied). DICE assures rapid (real-time) information flows about the supplies in the commercial transactions. Its premise is that massive, rapid, and accurate information exchange preempts fraud, provided (a) robust AI program(s) is (are) scanning the data streams for signs of fraud. DICE has a cross-border aspect, but it is also highly effective tool locally (within a single jurisdiction).

The key to DICE is that it is both a real-time and a granular data capture and exchange mechanism. The granularity of DICE rests on its ability to capture and compel a matching of each invoice item. DICE does not *follow* the physical transfer of a good or the performance of a service; it *precedes* it. DICE captures information, and allows tax administrations to apply AI risk analysis to transactional data flows to *preempt* frauds of many varieties before they are consummated. Because of the size of the data flows, the scope of the fraud opportunities in any VAT system, and the adaptability of the fraudsters, the AI used in a DICE application needs to be constructed using a *situational awareness* model.⁶⁵ AI based in black-box algorithmic-processing is not sufficient to the task.

⁶⁵ Mica R. Endsley, *Toward a Theory of Situational Awareness in Dynamic Systems* 37 HUMAN FACTORS 32 (1995).

In the context of a new VAT regime anticipated in the GCC beginning January 1, 2018, we proposed both a stand-alone DICE solution,⁶⁶ and a VATCoin solution with DICE.⁶⁷ A stand-alone DICE has been proposed for the EU.⁶⁸

Indian example. On July 1, 2017, India replaced multiple cascading taxes levied by the central and state governments with a national Goods and Services Tax (GST). It was adopted in *The Constitution Act 2017 (One Hundred and First Amendment)*.

The Indian GST has dual fraud control mechanisms: (a) *invoice matching*, a supply-side granular digital matching mechanism like DICE, performed *after* delivery of the goods or performance of the services; and (b) *cash pre-payment*, the input tax credit (ITC) is allowed to the buyer when it is confirmed by invoice matching and linked to actual (cash) payment of the GST by the supplier to the Treasury.

Invoice matching is a central element in the Indian GST. This is a DICE-like mechanism applied *after* a transaction has been completed and the invoice issued, not before the transaction is consummated, as in DICE. It is designed to accomplish two things: to (a) "... ensure eligible input tax credit is accurately transferred between the states ...," and to (b) "... curb the possible tax evasion on account of fake invoice frauds."⁶⁹ The first (a) addresses MTIC fraud concerns, the second (b) addresses a side variety of other VAT frauds.

Under invoice matching all taxable supplies of goods (or services) are matched to confirm that *what the buyer said he bought is what the seller said he sold*. The amounts and related VAT must match.

Figure 16 set out below illustrates the invoice matching function in the Indian GST using the Wholesaler and the Retailer from the previous examples. The fact pattern as drafted arises within a single jurisdiction, although it could just as easily have been drafted across two Indian States. In Figure 16 the central tax administration is represented by a "cloud" and the cylinder within the cloud represents the IT function.

[1] Indicates that the Wholesaler and the Retailer have reached an agreement on a sale of product from the Wholesaler to the Retailer. This could just as easily been the provision of a service.

[2] Indicates that the Wholesaler files an initial form (GSTR-1) with the Tax Administration. The form indicates the supplies sold, the price (taxable amount), the

⁶⁶ Richard T. Ainsworth & Musaadi Alwohaibi, *GCC VAT: The Intra-Gulf Trade Problem*, 84 TAX NOTES INTERNATIONAL 315 (October 17, 2016).

⁶⁷ Richard T. Ainsworth, Musaadi Alwohaibi, & Mike Cheetham, *VATCoin: Can a Crypto Tax Currency Prevent VAT Fraud?* 84 TAX NOTES INTERNATIONAL 703, 711-712 (November 14, 2016).

⁶⁸ Richard T. Ainsworth, *Stopping VAT Fraud with DICE – Digital Invoice Customs Exchange*, 72 TAX NOTES INTERNATIONAL 637 (November 18, 2013).

⁶⁹ Comments of the Finance Minister, Arun Jaitley in a letter to Congress Rajya Sabha MP Digvijaya Singh on May 8, 2017 as reported in *Invoice Matching Mechanisms in GST to Check Frauds*, Jaitley, THE TIMES OF INDIA (May 8, 2017) available at: <https://timesofindia.indiatimes.com/business/india-business/invoice-matching-mechanism-in-gst-to-check-frauds-jaitley/articleshow/58579498.cms>

GST charged, the GST Identification number (GSTIN) of the buyer and seller, the invoice (or debt note) number & date.

[3] When the GSTR-1 is received by the Tax Administration, the data submitted is used to automatically populate a form GSTR-2A, which can be seen by the Retailer (and the Wholesaler) in the “common portal” (*i.e.*, online).

[4] The Retailer is notified of the GSTR-2A in the common portal, makes any corrections necessary, and submits form GSTR-2 to the Tax Administration. This form [4] is comparable to the GSTR-1 form [2]. Normally, (that is, if everything has been reported accurately by the Wholesaler on the GSTR-1) the Retailer’s GSTR-2 is an *acceptance* of the GSTR-2A.

[5] A “temporary ITC” is available to the Retailer upon submission of the GSTR-2

[6] As in [3] when the GSTR-2 is received the Tax Administration automatically populates a form GSTR-1A which the Wholesaler can view in the “common portal.”

[7] If the Wholesaler recognizes that he made a mistake in the GSTR-1 that he previously submitted, based on his review of the GSTR-1A (derived from the GSTR-2 submitted by the Retailer) he can go back and correct his initial filing of the GSTR-1.

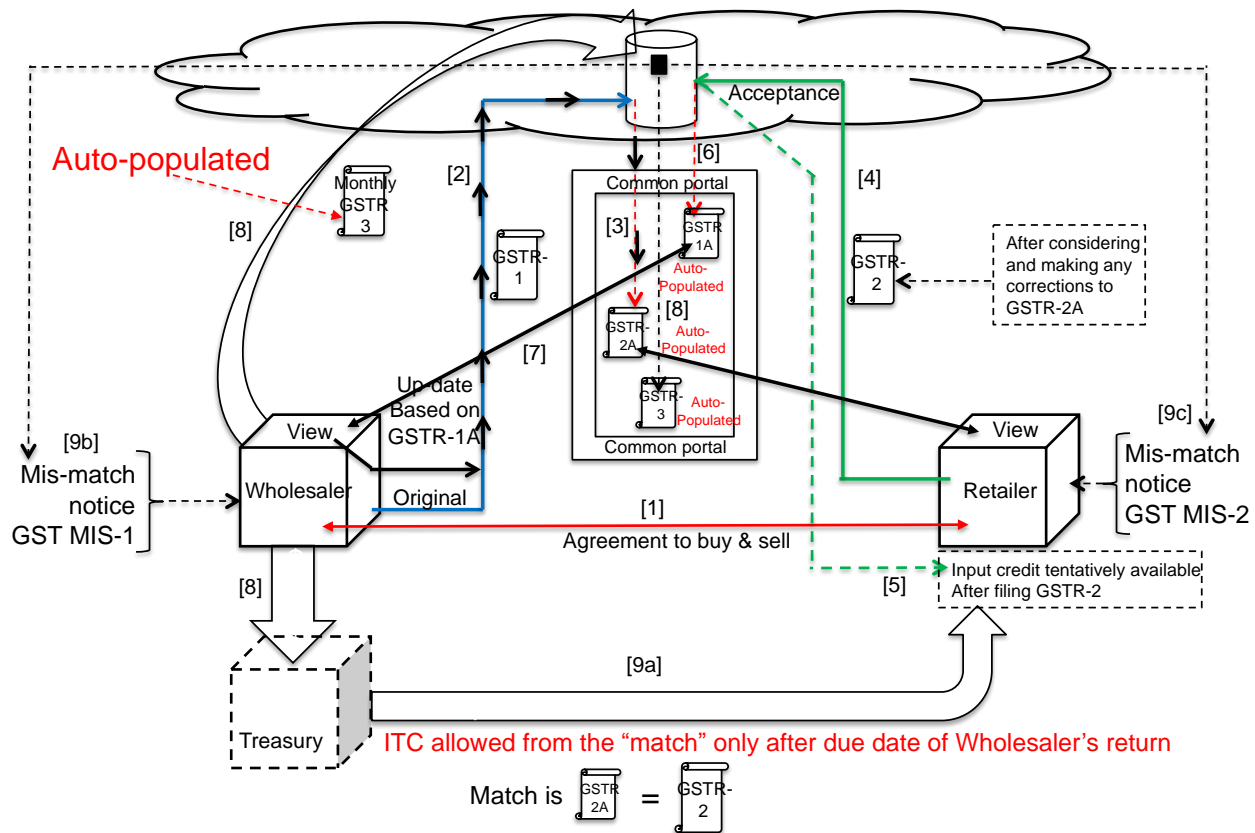
[8] Three steps should occur simultaneously. On the *due date of the Wholesaler’s return*, the system will auto-populate the tax return, form GSTR-3, using only the data that is agreed upon between Wholesaler and Retailer. The GSTR-3 is visible to the Wholesaler and the Retailer in the “common portal.” In addition, the Wholesaler must make the appropriate tax payment.

[9a] *Provided the tax has been paid*, the Retailer is now allowed the ITC for the full amount of the credit on the GSTR-3.

[9b] If there was a mis-match the Wholesaler is notified on a form GST MIS-1.

[9c] Similarly in the case of a mis-match the Retailer is notified on a form GST MIS-2.

Figure 16: Indian GST – Invoice Matching



There are a number of similarities between Indian “invoice matching” and DICE. Both perform data-intensive matches of buyer and seller invoice records. Both apply AI to the data streams of invoice criteria to identify fraud patterns.

The most notable difference between them is that Indian “invoice matching” is linked directly with actual payment of the GST. The *Retailer* in Figure 16 cannot take an input tax credit (ITC) if the *Wholesaler* has not already paid the tax. In other words, the Retailer is not given a credit for *the tax he has properly paid*. He is given a credit only for so much of the tax he has paid as is *actually remitted to the Treasury by the Wholesaler*. In addition, he must wait 10 days after the 30th of the following month to find out how large his ITC deduction will be.

This difference is significant. There is a considerable difference between paying the GST in cash (in advance of the ITC being authorized) and using a crypto-currency as a token of the GST payment that will be finally collected from the end consumer. This is the source of early criticism of the Indian GST. In our opinion, it would have been far better if India had linked its “invoice matching” with a cryptotax currency, like VATCoin, rather than linking it to actual payment in advance of the final sale:

The problem [with the Indian GST] is not the ‘management of a manifest risk’ [through the invoice matching element] – the problem is the *side-effects of cash flow, improper accounting, and reduced ability for people to trade with new*

suppliers and new customers – since there is uncertainty about the business outcome. ...

... by the additional *linkage of payment* the beauty of the [invoice matching] system breaks down. No longer can a business assume that the transaction is ‘over’ – and has to wait until 10 days after the return cycle (which is, 30th of the following month), to know whether they will be eligible to receive the Input Credit for the Tax they have paid (*emphasis added*).⁷⁰

Commentators who do not focus on the linkage to the actual payment requirement in the Indian GST are generally very enthusiastic about the DICE-like “invoice matching” mechanism. KPMG notes:

This concept [of invoice matching] is likely to stimulate the integration between suppliers and their vendors in the industry to ensure that there are minimal discrepancies (*inter alia* goods in transit, difference in invoice booking), with respect to the claim of ITC. Also, since impact of incorrect details filed by the vendor will be faced by the recipient, there would be a need for effective vendor management. Implementation of GST inevitably may create an interdependent ecosystem for businesses and in the long run ensure better compliance. It is likely to substantially reduce work of audit by the tax authorities.⁷¹

In an interview with the *Economic Times*, reported by *GST India*, Deloitte’s Global Leader for Indirect Tax, David Raistrick, indicated, “India is the only country that is doing it (invoice-to-invoice matching). This is unique... People will have to comply or they will fall out of the GST chain.”⁷² The authors may have been overstating things when they titled their article *World will follow Invoice matching concept introduced under Indian GST*, but such is the level of enthusiasm for Invoice Matching/ DICE.

CONCLUSION

The EU Commission has proposed “far-reaching reforms” to solve *some* of the fraud in the EU VAT. It hopes to re-capture the annual loss of €50 billion in MTIC fraud in goods without plugging the holes in services where MTIC has largely migrated, and by all accounts is running strong.

Fortunately, the Commission is open to technological solutions, and realizes that *trust* is the heart of the matter. Most of the best plans in this area have come undone because of lack of *trust*. However, *trust* leads directly to blockchain. This advance in technology is not called the

⁷⁰ Tejas Goenka, *Understanding Input Tax Credit in GST and why it may have drastic impact on Companies*, THE ECONOMIC TIMES – ET RISE (May 13, 2017) available at: <https://economictimes.indiatimes.com/small-biz/policy-trends/understanding-input-tax-credit-in-gst-and-why-it-may-have-drastic-impact-on-companies/articleshow/58655290.cms>

⁷¹ KPMG, *The Process of Matching of Input Tax Credit (ITC) under GST*, TAX FLASH NEWS (May 12, 2017) available at: <http://www.in.kpmg.com/taxflashnews/KPMG-Flash-News-Matching-of-claim-of-ITC-under-GST-2.pdf>

⁷² *World will follow Invoice matching concept introduced under Indian GST: Deloitte’s Global Indirect Tax Leader*, (October 26, 2016) GST INDIA, available at: <http://gstindiaupdates.com/world-will-follow-invoice-matching-concept-introduced-under-indian-gst-deloitte-global-indirect-tax-leader/#>

“Trust Machine” for nothing. Properly designed, code is inherently trustworthy. In the age of cyberspace – the code (computer code) is the regulator. It regulates better than the law written in the legal texts.

We have presented a workable solution to some problems in the Commission’s “far-reaching reforms.” It is a technological solution to a problem in tax law. It is similar to the VATCoin solution we presented to the GCC as they prepared to adopt a VAT. It also follows some of the insights of the GCC in terms of harnessing the blockchain to share cross-border trade information. It relies in part on technology observations in the GCC Framework Agreement, but it goes further than either of these GCC sources to specify the mechanisms through which VATCoins work within the blockchain, and it articulates measures that need to be taken to avoid hacks of the system.

This paper is not critical of the “missing pieces” in the EU Commission’s “far-reaching reforms” (largely the omission of services from the reforms). It is fairly easy to see how services can be added-on to the VATCoin approach we have taken. Fraudsters, particularly when they have adopted VAT fraud as their means to raise funds for terrorist organizations, are not deterred by half-measures. The Commission is very aware that this tax fight has terrorists on the other side of it, and should be anxious to close the circle.

We believe that blockchain will align the government’s interest in improving revenue yields, simplifying the processes for businesses, and opening the VAT to verified observation by everyone. We know more than enough about how a blockchain works from all the efforts expended in this field since Satoshi Nakamoto’s Bitcoins first appeared in 2008. We also understand how *smart contracts* (enforceable digital agreements) can be placed on the blockchain after Vitalik Buterin showed us how it works with Ethereum in 2013. We can also craft a full *public* distributed ledger if we adopt Silvio Micali’s Algorand as a consensus mechanism for a governmental blockchain. We can bind 660,000 transactions per second to the Red Belly Blockchain, out-performing VISA by a factor of 10.

It is clear to us that VATCoin’s time has come. As Larry Lessig famously observed that in the Age of Cyberspace “code is law.”⁷³ We believe the time has come for the EU Commission to look at encoding the VAT in a blockchain and solve MTIC once and for all with VATCoin.

⁷³ Lawrence Lessig, CODE AND OTHER LAWS OF CYBERSPACE (1999); Lawrence Lessig, *Code Is Law*, HARVARD MAGAZINE (March 11, 2015).