

Orchestrated Crime: The High Yield Investment Fraud Ecosystem

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Abstract—A High Yield Investment Program (HYIP) is an online ‘Ponzi scheme’, a fraudulent scheme in which unusually high returns are financed by new investors until the scheme collapses. An ecosystem of enabling and promoting entities facilitates the industrialisation of this type of investment fraud. Aggregators are paid to list active HYIPs and receive a referral fee for every investor they introduce to a HYIP. A specialist software house provides ‘kits’ for both HYIPs and aggregators, drastically lowering the barriers to entry for criminals, so much so that they have dominated the market for the past ten years. We find clear rules and incentives throughout the ecosystem, and we show that this fraud is considerably more ‘orchestrated’ than suggested in previous studies. By analysing the flow of money between the various parts of the ecosystem we have been able to provide an accurate estimate of overall turnover (\$47 million in 2013), and also to show that the average HYIP made a profit of \$8 000; successful aggregators had individual revenues in excess of \$250 000; and the kit supplier had an annual revenue of at least \$500 000 and potentially, under reasonable assumptions, twice that figure. By analysing over 100 000 discussion comments made on HYIP sites we find that investors showing interest in HYIPs are from many countries, but the largest group are from the USA. Our financial modelling shows that even if investors are aware of the true nature of the HYIPs – and invest early to maximise their receipts – they still incur, even on some favourable assumptions, a mean loss of 24% of their investment. Regulatory action is needed to tackle this fraud and this paper demonstrates that targeting the sale of kits for HYIPs and aggregators would be a key step towards disrupting the HYIP ecosystem, with the removal of the aggregator sites the next most important action that is needed.

I. INTRODUCTION

A High Yield Investment Program (HYIP) is a fraudulent online investment scheme promising unusually high returns on investment. The interest payments owed to existing investors are paid from the funds supplied by new investors; an arrangement usually referred to as a ‘Ponzi scheme’. When the operator of an HYIP no longer makes the promised interest payments then the scheme is said to have collapsed.

Previous work by Moore et al. measured the lifetime of over 1 500 HYIPs, from instantiation to collapse, and provided an estimate of overall turnover for this type of fraud [8]. They drew attention to the “extensive online ecosystem” that supported HYIP schemes and in particular to the existence of third-party ‘aggregator’ websites which tracked HYIP performance, providing key information to investors such as interest rates, minimum investment terms and funding options. Their paper studied 9 aggregator sites and, having found no evidence of collusion between them, used the aggregators sites’

assessments of whether HYIPs had collapsed as the raw data for their analysis.

In this paper we take a much closer look at the HYIP ecosystem, collecting data from over 50 aggregator sites which track 80 or more new HYIP websites per week and which have yielded historical data going back to 2004. We find that the aggregator sites charge for listing new HYIPs and do not, as earlier studies believed, invest their own money into the HYIPs. Instead, they require the HYIP owner not only to pay for a listing but also to make an investment on their behalf and then remit the necessary interest payments on a regular basis. When those interest payments cease, the aggregator reports that the HYIP has collapsed.

The aggregator sites clearly play a key role in marketing HYIPs to potential investors and when a new investment is made they will often receive a referral fee. The HYIP schemes also offer referral fees to individuals who introduce new investors, with some sites listing contact details for “country representatives” who can provide investment advice.

A key finding of our study is that the software and design for not only the vast majority of HYIP sites, but also the vast majority of aggregator sites, have been supplied as ‘turn-key’ packages (or ‘kits’) by a single shadowy software house called Gold Coders¹ and we are able to provide an accurate estimate of their annual turnover.

We believe that the kit builders and the aggregator sites are the key facilitators that make HYIPs viable. The easy access they provide to software and marketing underpins such a substantial part of the fraudulent HYIP activity that we believe it is appropriate to term it ‘orchestration’.

In Section II we consider the HYIP ecosystem in detail, explaining the role of the various entities involved. In Section III we discuss the numerical data we have been able to collect and in Section IV we set out a model of the ecosystem. We apply this model and the data we have collected in Section V to provide estimates of turnover and profit within the ecosystem. In Section VI we consider legal and policy issues and discuss how best to disrupt the ecosystem. In Section VII we discuss related work and then in Section VIII we conclude.

II. THE HYIP ECOSYSTEM

High Yield Investment Programs are supported by an ecosystem of entities that profit from the fraudulent activity by

¹<http://www.goldcoders.com>

acting as enablers and promoters. We start by briefly describing these entities and then consider the relationships between them in more detail.

A. Entities

There are six main entities in the ecosystem:

1) *High Yield Investment Programs*: are websites operating fraudulent investment schemes which promise unusually high returns on investments. At the time of writing legitimate investments offer less than 2% per annum; it would not be unusual for an HYIP to offer a similar return per day.

2) *Investors*: are the individuals that deposit funds into High Yield Investment Programs. A subset of these investors is fully aware of the fraudulent nature of HYIPs but they try to make a profit by investing at an early stage [8].

3) *Aggregators*: monitor HYIP websites and both passively and actively advertise and promote them.

4) *Meta-aggregators*: monitor aggregator sites and summarise the information they provide.

5) *Kit Developers*: provide ready-to-use software kits and graphic designs for HYIPs and aggregators.

6) *Referrers*: provide information about HYIPs to potential investors and receive a referral bonus (commission) if an investment is made. Aggregators and meta-aggregators act as referrers as well as individuals who choose to promote HYIPs.

There are also two entities which provide services for a wide range of activities, of which HYIPs are just one:

7) *Hosting Companies*: provide website hosting facilities for HYIPs, aggregators and kit suppliers.

8) *Payment Processors*: enable the payment of deposits, interest and any other cash flow in the ecosystem for a transaction fee. Many well known services and digital currencies such as Perfect Money and Bitcoin are used in the HYIP ecosystem.

B. Relationships

The relationships between the HYIP ecosystem entities are illustrated in Figure 1.

Many of these relationships are obvious, such as those between the kit suppliers and the websites that use their wares; or between investors, referrers and HYIPs. Other entities have more complex relationships, particularly the aggregators.

The main service that aggregators provide is the publishing of lists of HYIPs and reports as to whether they are still paying out, i.e. they monitor the HYIPs to check if they appear to be collapsing and they enable investors to learn about brand new HYIPs in a timely manner.

HYIPs can choose to register on as many aggregator websites as they wish and they will pay an up-front fee to each aggregator in order to be listed. Additionally, they must allot an investment stake in their scheme to the aggregator free of charge. From a practical perspective this means that they will need to pay interest, at the appropriate rate, to the aggregator without ever having received any capital. The aggregator then tracks the status of the HYIP through the

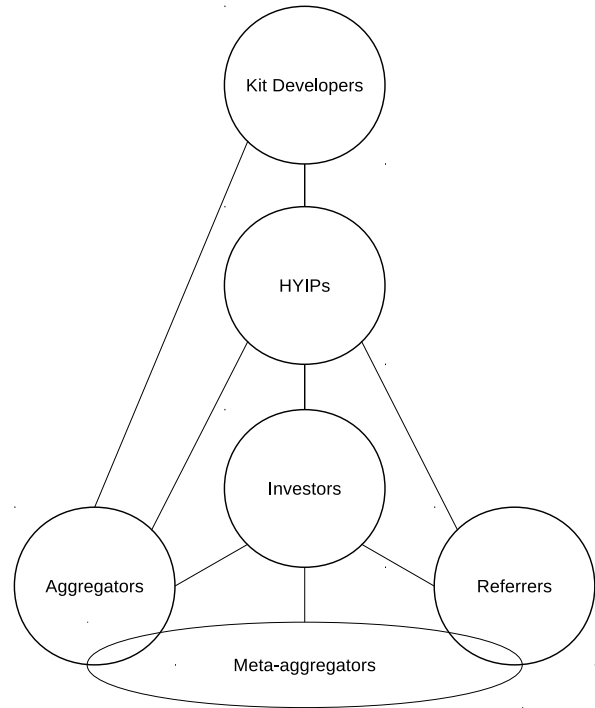


Fig. 1. The High Yield Investment ecosystem

returns received on this (notional) investment stake. If the aggregator stops receiving interest, it will blacklist the HYIP which will immediately reduce its attractiveness to investors.

HYIPs can also spend further at the aggregator sites to buy premium listings, banner and other advertisements.

Alongside their income for marketing services, aggregators will earn a referral bonus on all funds deposited by investors that reach a HYIP through their listing. We found that some aggregators are actively promoting their listed HYIPs on forums and other platforms, doubtless to increase the amount of referral income they receive.

The meta-aggregators provide details of aggregators and of HYIPs. They do not require payment for listings, but they do sell banner advertisements and they also make money on referral fees when investors click through from their site and make a deposit.

III. MEASUREMENTS

For this study, data has been collected on 2 meta-aggregators, 57 aggregators, 1 kit developer, 5 531 HYIPs and miscellaneous other sources. The data collected includes HYIP program metrics and connection data, aggregator metrics, visitor comments and connection data, kit developer offerings and terms, and miscellaneous other data.

In particular, we have used the meta-aggregators to create a historical dataset covering the calendar year 2013 and we have also collected a contemporary dataset, over the period April 14 to June 5 2014, from live HYIPs.

TABLE I. PER COUNTRY BREAKDOWN OF THE ORIGIN OF COMMENTS LEFT ON THE GOLDPOLL.COM AGGREGATOR SITE. THE LEFT COLUMN GIVES THE PROPORTION OF UNIQUE IP ADDRESSES PER COUNTRY, THE RIGHT COLUMN THE OVERALL PROPORTION OF COMMENTS.

Distinct IPs		All comments	
Country	Share	Country	Share
United States	15.29%	United States	17.29%
Thailand	9.79%	Thailand	6.94%
China	5.46%	Germany	4.76%
India	4.68%	Ukraine	4.06%
Germany	4.55%	China	3.99%
Russia	4.36%	United Kingdom	3.96%
Indonesia	3.51%	Russia	3.71%
Ukraine	3.28%	Indonesia	3.41%
Vietnam	3.07%	France	3.01%
South Korea	2.64%	Netherlands	2.93%
Italy	2.30%	Vietnam	2.81%
United Kingdom	2.28%	India	2.74%
Others	37.49%	Others	38.56%

It is important to note that all of the data needs to be critically assessed as much of it is self-reported by the criminal entities themselves. We are therefore careful to base our further analysis on data for which we assume there is little to no incentive for the respective entities to manipulate. The following subsections list our findings.

A. HYIP numbers

For 2013 the meta-aggregator hyip.biz provides a list of 57 aggregators and reports the launch of 4 658 new High Yield Investment Program websites (12.76/day).

During our April–June 2014 monitoring period 873 new HYIPs were launched (16.73/day), but only 500 (9.58/day) of these appeared on hyip.biz. However, the activity is not necessarily slowing down because 833 new HYIP launches (15.96/day) were listed on the meta-aggregator allhyipmonitors.com which covers 85 aggregators rather than just 57.

B. Investors

We would like to understand who invests in HYIPs and how they learn about their existence. We cannot answer these questions directly but we do have some clues.

Some aggregator websites have forums where investors and others can leave comments about High Yield Investment Programs. These comments usually pertain to the current payment status of a specific HYIP or other details about it.

Goldpoll.com lists the first three octets of a commentator’s IP address along with the comment, which is sufficient to identify the ISP being used and hence will indicate the country and often the city where the commentator is based. Mapping the comments’ (n=115 603) IPs found to their respective geo-location² yields the distribution by country shown in Table I. We show both the proportion of unique IP addresses per country and also, because some ISPs may rotate dynamic IP addresses more quickly than others, we show the overall proportion of comments – albeit some people may post more

than others. Either way, it is apparent that people in the USA are interested enough in HYIPs to post more comments than any other nation.

Investors can potentially learn of the existence of HYIPs in many different ways, other than the use of aggregator sites, but there seems to be no other consistent view from the HYIPs as to how they should market themselves. We have seen promotional YouTube videos and Facebook fan pages for several HYIPs but we can find little evidence of the marketing of HYIPs via email. It is however clear, that referrals are important.

C. Referrers

The 2013 data shows that High Yield Investment Programs paid a mean referral bonus of 5.37% on funds deposited by investors referred to the program by any registered referrer.

Some HYIPs report data on the success of their referrers along with their overall number of investors. For those HYIPs (n=54) where this data was available during the April–June 2014 collection period, a mean of 35.13% of the investors reached the HYIPs by referral, i.e. through the promotion efforts of an external entity. The figure is, for each HYIP, calculated as the quotient of the sum of the referrals and the overall number of investors.

As the self-reported number of investors in a HYIP is a potential target for manipulation, these figures warrant further scrutiny. In particular we are concerned that the HYIPs reporting very large numbers of investors may not be being entirely truthful and that the inflation of these numbers has depressed the average referral rate.

Therefore we ordered the HYIPs by the number of investors they reported and found that the mean referral rates were 43.46% (stdev 25.82%) and 40.51% (stdev 24.09%) for the bottom 75% (n=40, 29 to 970 investors) and bottom 50% (n=27, 29 to 331 investors) respectively. Given how similar these 50% and 75% figures are we believe it is reasonable to ignore the more dubious data for the 25% most popular HYIPs and we exclude those reporting more than 970 investors. Hence for the remainder of our analysis we will assume a mean of 43.46% of investors reach HYIPs by referral.

We note that our adjustment upwards from 35.13% may well be in the right direction to indicate the importance of referrals since the figures will exclude investors that were in practice referred but did not use the referral link that allows this to be tracked.

The actual referrers are not just aggregators and meta-aggregators, but also any other individuals who are interested in promoting HYIPs. In total, 21 740 accounts were opened by investors who were referred to the HYIPs that published lists of their referrers (n=108) during the 2014 data collection period. 48.05% of these accounts can be linked to a referral by an entity identified as an aggregator. Correspondingly, 51.95% were not. Each of the 10 aggregators we will study in detail in the next section referred between 0.02% and 3.98% of the investors who opened the 21 740 accounts. Note that these figures are an unlikely target for manipulation as there is little to no benefit to HYIPs in altering them.

²For geo-location we used <http://www.maxmind.com> data.

TABLE II. REFERRER LOCATION AND SUCCESS OF UNITEDHYIPLEAGUE.COM REGIONAL REPRESENTATIVES

Country	Referrers	Referrals	Share of total referrals
Uganda	21	112	56.28%
Brazil	19	36	18.09%
Georgia	2	13	6.53%
Ghana	3	12	6.03%
Portugal	2	10	5.03%
Nigeria	10	9	4.52%
Pakistan	2	4	2.01%
Russia	9	3	1.51%
Others	43	0	0.00%

As an example of what we can learn about the individuals who act as referrers we consider unitedhyipleague.com, an HYIP active from 21 September 2012 to 7 April 2014. The website for this scheme provided a list of local representatives, i.e. individual promoters. For these referrers their country of residence, (mobile) phone, e-mail, Skype and Facebook contact data was also given. Matching these details with the list that the website also provides of the top 100 most successful referrers allows us to create Table II that shows that referrers in some countries were more successful than others – suggesting that for this HYIP the investor locations differed from the results we obtained when analysing forum comments. Note however that referrers who were not in the top 100 are omitted from this analysis as are the referrals (which we have just seen is likely to have been about half of the total) that came from aggregators.

D. Aggregators

The data collected from the meta-aggregators hyip.biz and allhyipmonitors.com shows that there were at least 57 aggregators active during 2013. Of these, 35 (61%) tracked more than 100 of the HYIPs launched in 2013. Overall, 18312 HYIP-aggregator pairs can be observed in the data collected. Note that while allhyipmonitors.com lists as many as 85 aggregators, only data from the 57 previously mentioned ones is available and used in the further analysis.

We placed the aggregators into rank order by the number of HYIPs that they listed during 2013 and selected the first ten which provided sufficient data that we could fully determine their various sources of income for the year. The results are shown in Table III – where it should be noted that almost every figure can be exactly calculated, as we will shortly explain, from the data we have collected. The only exception is the referral bonuses (and hence also the grand total) the estimation of which we will cover in Section IV.

1) *Listing fees:* The ten aggregators monitored between 545 and 1451 HYIPs in 2013. Their fees for this monitoring varied between \$0 and \$89, yielding a revenue of up to \$71 200 (average=\$20 877, stdev=\$25 318).

2) *Interest payments from investment stakes in HYIPs:* The ten aggregators were allocated investment stakes in the HYIPs they monitored. The mean value of these stakes varied between \$92 and \$235 (mean=\$128.62, stdev=\$45.46). The aggregators reported average payout ratios, i.e. paid out returns as a proportion of their investment stake, between 18% and

147% (average=83%, stdev=37.37%). This yielded revenues of up to \$124 677 (average=\$79 302, stdev=\$35 947).

We can also use all the data available to us to calculate the average payout ratio for all aggregators for all the HYIPs they monitored. This figure was similar to the ten large aggregators we studied at 76.39%. It is also worth noting that it was above 100% in just 16% of instances.

3) *Advertising revenue:* We ascertained the prices for advertising on the aggregator sites and then observed the average level of utilisation of this space. This yields average weekly advertisement revenues of up to \$1 300 (average=\$640, stdev=\$473) and therefore annual revenues of up to \$67 600 (average=\$33 280, stdev=\$24 604).

4) *Referral bonuses:* This data is not available for most aggregators. One of the ten aggregators, uhyips.com, does however have a “referral commission back” program: investors that invest through them can claim a proportion of the referral bonus paid out to the aggregator. uhyips.com publishes a list of these referral transactions, including the amount deposited, for every HYIP they monitor.

The data implies that investors deposited a total of \$796 969 in 1 004 HYIPs via uhyips.com during 2013. We found no indicators that would suggest the numbers were manipulated and see little to no incentive for an established aggregator such as uhyips.com to do so, especially considering the scale of 1 004 HYIPs covered.

Note that while the deposits translate to \$42 797 in referral bonuses at the average referral bonus rate of 5.37% on deposits, the reported paid back commission amounted to \$73 068. There is no data available providing further insight into whether uhyips.com is willing to take losses from this program in order to attract investors to its site or whether it is being paid a higher referral bonus rate by the HYIPs.

E. Kit Developers

Besides some very small competitors, the main HYIP kit developer is Gold Coders, at goldcoders.com who charge \$145 for their offering. They also make design templates available at a range of prices. Some are free, but they will create a unique design for \$99. The Gold Coders marketing material gives an extensive list of the functions and flexibility of their kit and lays particular stress upon the ease of use and the availability of technical support, claiming that sites can be up and running in 15 minutes. Reports from users on forums claim that there are back doors and other defence mechanisms in the software to prevent pirating.

The Gold Coders website allows users to check the licensing status of HYIP websites, this being tied to the domain name. The aggregator hyips-analysis.com publishes this licensing information for all of the HYIPs it tracks, showing that 75.94% of the HYIP websites it tracked in 2013 (n=374) used the Gold Coders kit.

Gold Coders also sell a kit for aggregators (which they call HYIP Listers). This kit is made available for free, but 10% of the aggregator revenue must be passed on to Gold Coders. Alternatively, it can be bought for \$145. We utilised a number of distinct image file names in the kit’s folder structure as

TABLE III. AGGREGATOR REVENUE STREAMS AND RESULTING γ_i FOR TEN OF THE MOST USED AGGREGATORS i FOR HYIP MONITORING

Rank	Aggregator	HYIPs monitored	Revenue investment stakes	Revenue monitoring fees	Revenue advertising	Revenue referrals	Total revenue γ_i
1	List4hyip	1451	\$100 656	\$58 040	\$67 600	\$5 212	\$231 508
2	Goldpoll	1061	\$113 265	\$0	\$0	\$7 216	\$120 482
3	HYIPexplorer	993	\$106 006	\$0	\$62 400	\$1 353	\$169 759
4	All-Hyips	950	\$79 133	\$19 000	\$13 000	\$852	\$111 985
5	InvesTracing	882	\$124 677	\$26 460	\$65 000	\$43 348	\$259 486
6	UHyips	800	\$89 634	\$71 200	\$29 640	\$42 797	\$233 271
8	F-Monitor	762	\$4 745	\$7 620	\$36 400	\$200	\$48 965
11	SQMonitor	617	\$69 752	\$0	\$14 560	\$5 663	\$89 974
12	HyipHall	593	\$46 967	\$23 720	\$33 800	\$4 560	\$109 047
13	MaxHYIP	545	\$58 180	\$2 725	\$10 400	\$22 150	\$93 456

markers to identify which websites use the kit. If an aggregator website is observed to have at least 2 of the 3 defined markers,³ we assume it is running the Gold Coders kit. We found that to be the case for 36 (63.16%) aggregators from the 2013 dataset.

We looked at the records of past website contents kept by the Internet Archive⁴ to find that goldcoders.com was up and running, with essentially the same software (and pricing), in 2004. Examining the hyips-analysis.com data for earlier years shows that the Gold Coders market share has been at least 50%, sometimes as high as 80% in every year since 2005.

Other, smaller, commercial sites offer HYIP kits and there is even an open source HYIP system available. However, the latter does not appear to be under active development and there are claims that it contains malware (although this may just be scanners that recognise the criminal content as contravening local policy settings).

F. HYIP hosting and operating costs

The costs associated with operating a HYIP can be split into initial costs and running costs. The initial costs are:

1) *The cost of hosting the website:* Table IV shows which hosting providers were used by the HYIP websites we observed in the Apr–June 2014 time period. We believe that it is particularly relevant that the most popular providers make a specific point of offering denial of service protection. This is for marketing reasons, because there is a perception in the HYIP community that it is important to ensure that the HYIPs cannot be taken down by a denial of service attack. A hosting contract, including a limited denial of service protection service, at one of the popular providers costs up to \$45 per month.

2) *Software and appropriate graphics:* We estimate the cost of the development and design of a HYIP website to be well in excess of \$1 000. As noted above, the majority of sites purchase a kit for \$145 and may also spend \$99 on a custom design.

3) *Aggregator listing fees:* The 2013 data shows that HYIPs chose to be monitored by an average of 4.04 (stdev=4.29) aggregators. Given a mean up-front monitoring fee of \$23.4 (stdev=\$28.03) at the aggregators examined in detail, a typical HYIP is estimated to pay initial fees of \$94.52 to be listed by aggregators.

³images/m_pay.gif, /images/r1.gif, /images/aintgold.gif

⁴http://archive.org

TABLE IV. HYIP HOSTING ASN DISTRIBUTION

	ASN	Share
BLCC - Black Lotus Communications,US		18.95%
CLOUDFLARENET - CloudFlare, Inc.,US		16.96%
DANCOM LTD,BZ		7.98%
OVH OVH SAS,FR		6.98%
ESECURITY Esecurity S.A.,NL		5.99%
AS-26496-GO-DADDY-COM-LLC - GoDaddy.com, LLC,US		3.99%
SOFTLAYER - SoftLayer Technologies Inc.,US		2.74%
ST-BGP - Sharktech,US		2.49%
NAMECHEAP-NET - Namecheap, Inc.,US		2.49%
STAMINUS-COMM - Staminus Communications,US		2.49%
Others		28.93%

The running costs, after the HYIP has been launched, break down as follows:

4) *Aggregator payouts:* HYIPs paid out a mean total of \$303 (stdev=\$1 216) over the course of their lifetime to the aggregators monitoring them.

5) *Investor payouts:* Payouts to investors cannot be directly quantified on a per HYIP basis given the available data particularly since when an HYIP is close to collapse it may prefer to pay aggregators rather than investors.

6) *Additional advertising:* There is no data available on how much individual HYIPs spend on advertising.

7) *Referrer bonuses paid:* the average referral bonus across HYIPs was 5.37% on deposited funds in 2013.

Some HYIPs report data about the funds deposited on their websites, i.e. their revenues. During the 2014 April–June data collection period, HYIPs reported deposits of up to \$30 712 001 with a mean of \$586 278. We have not attempted to adjust these figures to deal with edge effects at the start of the period (long-lived HYIPs) or at the end of the period (HYIPs which have just been launched). The reason we haven't done this statistical exercise is that not only do we consider the figures to be untrustworthy as a prime target for manipulation but also because they are not the actual cash inflows. It appears to be standard practice to count any interest not immediately paid out as an additional deposit. The reported deposits are therefore neither trustworthy nor a good proxy for the actual deposits by investors – meaning that they have little practical value and will not be used in the further analysis.

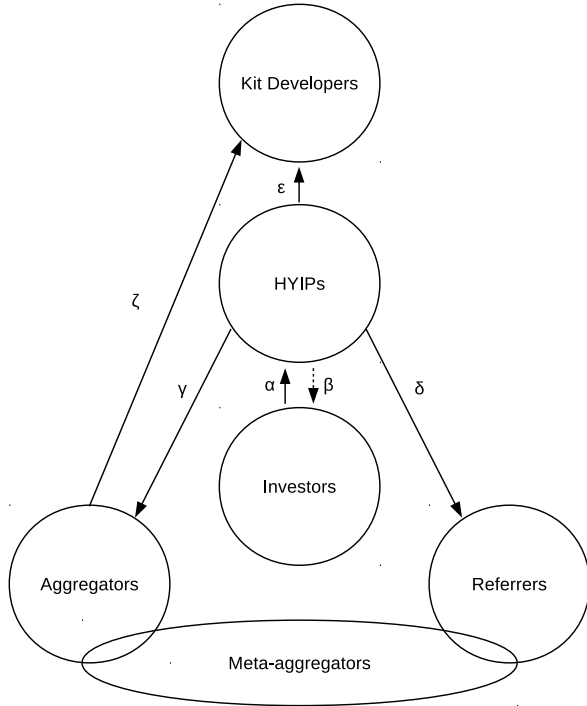


Fig. 2. The cash flows in the High Yield Investment ecosystem

G. Payment Processors

Payment processors are widely used for payments within the HYIP ecosystem and the processors charge a percentage fee for their services.

Moore et al. [8] drew particular attention to the payment processors, suggesting that there was scope for disrupting HYIPs by targeting these entities. The payment processor most widely used by HYIPs during the period of their study was Liberty Reserve – and in May 2013 it was shut down and its founder arrested at the behest of the US authorities [4].

Based on the data we have collected, more HYIPs were launched in the three months following the shutdown than in the same period during the previous year – which suggests that existing HYIPs that accepted Liberty Reserve were replaced earlier than would otherwise have been the case by new schemes that used other payment processors.

On a year-over-year basis, the following differences in the monthly launched HYIPs could be observed: +34%, -13%, +12%, and +43% for May, Jun, Jul and Aug 2013 respectively. The standard deviation in the monthly year-over-year differences in the 12 months prior to the shutdown was 45.3%.

IV. A MODEL OF THE HYIP ECONOMY

The cash flows in the High Yield Investment Program ecosystem can be modelled as depicted in Figure 2. We will now explain the parameters for this model and how we can approximate the sizes of these cash flows, given the data we have available.

A. Cash inflows to HYIPs from investors: α

The revenue of a High Yield Investment Program is the total of the funds deposited by its investors. These deposits, denoted α , cannot be directly calculated given the data available.

However, we can do a scaling exercise from some of the other data that we have collected – albeit only by making the fairly reasonable assumption that the HYIP ecosystem is in a steady enough state for us to mix observations from different time periods.

For the referrals to the HYIPs launched during the Apr-June 2014 data collection period, 3.93% came from uhyips.com and we know that in 2013 \$796 969 was deposited via uhyips.com’s “referral commission back” program. Furthermore, as we argued earlier, we can reasonably assume that an average of 43.46% of all accounts were opened by investors referred to the HYIPs.

$$\text{Hence: } \alpha = \$796\,969 \div 3.93\% \div 43.46\% = \$46\,661\,550$$

B. Payouts to investors: β

The total payout ratio for investors, i.e. what proportion of their investment was paid back, cannot be directly calculated given the data available.

Furthermore, we would expect the payout ratio to vary across investors and aggregators because of an effect we call ‘selective payouts’. Selective payouts refers to the strategy of only paying out to aggregators (to avoid being blacklisted) or selecting which investors to pay based on their investment or upon the likelihood of them alerting other users to an expecting payout not materialising.

Selective payout is a particular issue for naïve investors who are unaware of the forums and platforms that exist to report delayed/missing payouts, for example on the aggregator sites. It may be possible for the HYIP administrator to identify this type of investor because of the timing or size of their deposit and having done so, there are few incentives to pay them in preference to anyone else – particularly if the payment such an investor should receive exceeds the expected earnings over the remaining lifetime of the scheme. Due to selective payouts we assume the payout ratio for naïve investors to be 0%.

More sophisticated investors will almost certainly know that HYIPs are scams and can use methods and precautions to alleviate selective payouts. These include only investing small amounts and reporting missing payouts on the aggregator sites that will blacklist HYIPs not only if they do not receive payouts themselves, but also if their members do not.

We assume that investors who are in the know will invest right at the launch of an HYIP and will take appropriate precautions to avoid selective payout. This then puts them in effectively the same position as the aggregators and so we can assume that they will achieve the average aggregator payout ratio of 76.39%.

To approximate the proportion of knowledgeable investors (and calculate β), we assume that every account opened by a knowledgeable investor will involve an aggregator referral,

since both investing early and being able to complain requires the use of aggregators. Of the 43.46% of accounts linked to a referral, 48.05% were referred by an aggregator and combining these values leads us to estimate that 20.88% of accounts are being opened by investors who are aware of the scam.

β is then derived as the product of α and the weighted average payout ratio of investors aware and unaware of the scam respectively:

$$\beta = \alpha * [20.88\% * 76.39\% + (100\% - 20.88\%) * 0\%]$$

At an α of \$46661550 and the resulting weighted average payout ratio of 15.95%, β is equal to \$7443527.

C. Payments to aggregators: γ

The aggregator's income γ can be computed fairly accurately on a per aggregator basis from the data collected.

In addition to the revenue streams previously mentioned, the less tractable referral bonuses earned from active and passive promotion can now be derived. The 10 aggregators referred between 0.02% and 3.98% of the 43.46% of accounts opened on HYIPs during the 2014 data collection period. At an α of \$46661550 and an average referral bonus of 5.37%, revenues from referrals of up to \$43348 (average=\$13335, stdev=\$16858) were made in 2013. This is of course under the assumption of similar referrer and aggregator performance in 2013 and 2014.

Overall this yields γ_i 's of between \$48965 and \$259486 for the aggregators i , as shown in Table III. The revenues imply that the aggregators have an average revenue of \$169.62 per HYIP monitored. Assuming a similar monetization across all aggregators, an overall γ value of \$3106081 can be derived based on the 18312 HYIP-aggregator pairs observed in 2013.

D. Referral bonuses: δ

The referral bonuses δ that are paid to referrers that are not aggregators are computed as the product of α , the average referral bonus and the proportion of investors reaching HYIPs by referrals from non-aggregators.

At an α of \$46661550 and a mean referral bonus of 5.37%, this yields \$565729 in bonuses paid out to individual referrers in 2013 overall.

E. License revenues from HYIP website kits: ε

Given the market share we measured of 75.94%, a lower bound of 4658 HYIPs launched in 2013, and a price of \$145 per licence, Gold Coders' revenue from selling HYIP website kits was at least \$512906.

An extrapolation from the 16.73 HYIPs launched per day during Apr–June 2014 suggests a volume of 6106 HYIPs in 2014. This would translate to an annual revenue of \$672400. If just 50% of those HYIPs also buy a design template for \$99, Gold Coders stands to generate an annual revenue of \$974669 from HYIP kit sales in 2014.

F. Revenues from aggregator kits: ζ

Although Gold Coders' aggregator kit has a substantial market share among aggregators, it is not clear whether these operate on the 10% revenue share agreement or bought the kit for \$145 (albeit the latter does seem the better deal). The lack of data on the number of new aggregator sites throughout 2013 means that ζ cannot be estimated, but its value must be very low anyway.

G. Overall commission from money transfers: η

The widely used payment processor Perfect Money charges transaction fees between 0.5% and 2% of the amount transferred and other payment processors have similar charges. Assuming an average 1% transaction fee the previously derived model cash flows lead to

$$\eta = (\alpha + \beta + \gamma + \delta + \varepsilon + \zeta) * 1\% = \$582898$$

V. WHO PROFITS WITHIN THE HYIP ECOSYSTEM?

We will now consider how much money is likely to be made by individual entities within the HYIP system.

A. HYIP sites

The total initial cost for launching a HYIP is approximately \$384 for hosting, HYIP kit, design template, and average aggregator coverage. To this must be added some unknown (and doubtless somewhat variable) amount for advertising. The minimum cost, using budget hosting and a non-unique graphical template would bring the price as low as \$150.

The running costs for an HYIP are the payouts to the aggregators and investors, as well as any referral bonuses. Note that the former two depend on the funds α_j deposited in each HYIP j .

We do know that in 2013 the average payout to aggregators over the lifetime of an HYIP was \$303, but there is no reliable data on individual HYIP j 's revenue α_j . However, the overall turnover α of \$46661550 as well as the 4658 HYIPs launched in 2013 give an average α_j of \$10018 per HYIP. The more comprehensive data captured during Apr–June 2014 indicates a significantly higher number of HYIPs and implies an average α_j of \$7641.

Figure 3 shows how the revenue, cost and profit of an average HYIP varies with α_j (the amount deposited). The potential profit ranges from $-\$687$ to \$15656 for deposited funds between \$0 and \$20000. An average HYIP breaks even if investors deposit funds in excess of \$840 over its lifetime and makes a profit of \$5557 at the average α_j of \$7641.

We can also consider how the deposited funds α_j are distributed to various entities. Figure 4 shows the absolute cash flows to all entities in the HYIP ecosystem based on the HYIP's revenue. Note that both Gold Coders and the aggregators earn a fixed minimum amount of the deposited funds. The cash flows to the HYIPs, referrers and investors are dependent on the deposited funds and may not be realized at all.

Figure 5 shows what proportion of the deposited funds are routed to the respective entities. A steady 15.95% of the

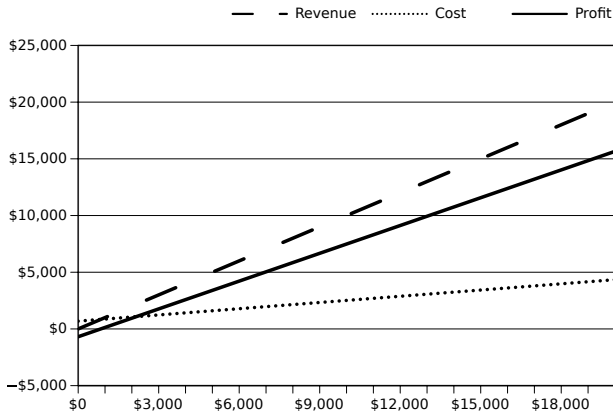


Fig. 3. Revenue, cost and profit breakdown of a HYIP j depending on the deposited funds α_j

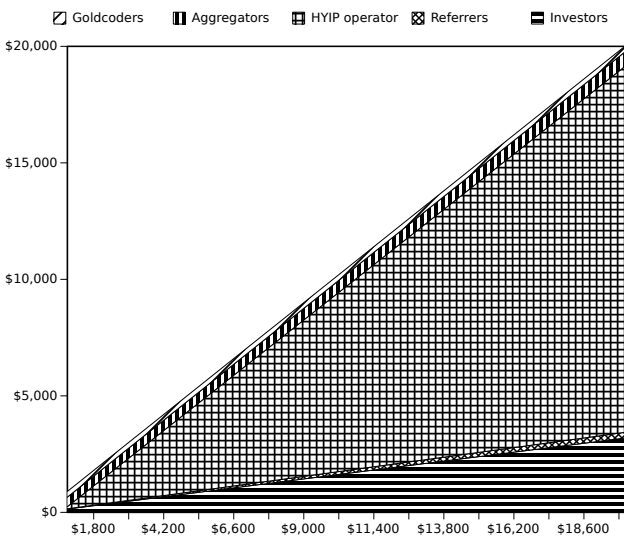


Fig. 4. Absolute cash flows resulting from the deposited funds α_j in a HYIP j

deposited funds are paid out to actual investors and a steady 1.21% are paid out to non-aggregator referrers. The figure also illustrates the profit shares of the aggregators and Gold Coders, which start at approximately 48% and 29% respectively at the HYIP's break-even of \$840, and then decrease as the deposited funds increase. Again, these graphs highlight that due to their fixed compensation, Gold Coders and the aggregators will be profiting even if the HYIP operator is not.

B. Investors

We earlier made the calculation that 21% of investors are aware of the fraudulent nature of the HYIPs they invest in. Since they take measures against selective payments, these investors should receive the same level of payouts as aggregators. They therefore stand to be paid back about 76% of their investment, i.e. lose 24% of their investment, on average. They will of course sometimes do better than average and 16% of the time they will invest profitably. However, it is reasonably clear that that even investors who fully understand what is going on will not be able to profit from HYIPs.

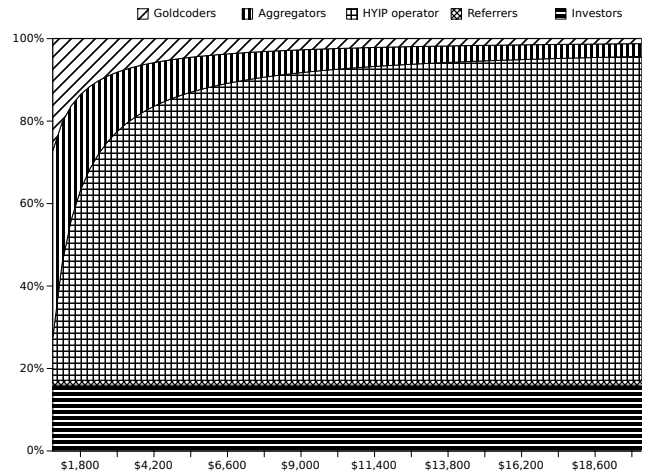


Fig. 5. Relative profit shares resulting from the deposited funds α_j in a HYIP j

C. Aggregators

Our analysis shows that the promotional activities carried out by the aggregators are not only crucial to the functioning of the HYIP ecosystem but also yield substantial incomes of over \$250 000 for some of these websites.

D. Referrers

Any individual choosing to be a referrer stands to earn an average referral bonus of 5.37% of the funds that he can convince investors to commit to a HYIP, but we have very limited data as to how successful such people are.

E. Kit Developers

Excluding any revenue from profit sharing or licensing of aggregator websites, Gold Coders earned a minimum profit of \$512 906 in 2013 and it could well have been twice this.

F. Payment Processors

No data on individual payment processor's revenue is available but there is an overall revenue potential of \$582 898.

VI. POLICY OPTIONS FOR TACKLING HYIPs

Ponzi schemes, whether online or offline, are illegal in a great many jurisdictions and have been so for many years. They may be treated as straightforward fraud, because their marketing materials contain untrue statements about the source of the profits that will be distributed as interest payments. They are often treated as illegal lotteries because it is somewhat of a gamble as to whether a profit will be made – and they may fall foul of specific legislation which will typically also address pyramid schemes and multi-level marketing.

Besides the HYIP schemes themselves, all of the other HYIP-specific parts of the ecosystem will also be illegal; either because an anti-ponzi law is writ wide enough to catch them, or because of more general laws against providing support services and tools to criminal activities.

Quite clearly the HYIP problem is not confined to a small number of countries so that it may be hard for any particular law enforcement agency to tackle. On the other hand, few law enforcement agencies will be unable to find any victims within their jurisdiction – and many will have locally hosted examples of HYIPs or aggregators that could be investigated.

It is not necessary to target every part of the HYIP ecosystem in order to effect a major disruption. We now consider how effective action might be against particular targets.

A. HYIP websites

While the data shows a preference for services or providers that offer protection against Distributed Denial of Service attacks, such as Black Lotus Communications or CloudFlare, a large variety of hosting providers are used, so that shutting down all the HYIPs at a particular hosting provider (or within a particular country) is not likely to have much impact.

B. Referrers

An average of 20.28% of investors reach an HYIP because of the referral from a non-aggregator, i.e. through the promotion efforts of an individual. Such individual promotion is especially pernicious as it has the potential to attract investors that are not aware of the fraudulent nature of the schemes. These investors may be willing to make large deposits, especially on professional looking HYIP websites.

The case study of unitedhyipleague.com illustrates that referral programs can dramatically improve an HYIPs ability to reach investors all over the world, and they are clearly a crucial part of the HYIP ecosystem. However, it is unlikely that any single intervention will dramatically disrupt this part of the ecosystem and so there are better areas to direct attention towards.

C. Payment Processors

As we have already discussed, the shutting down of Liberty Reserve in May 2014 had a short-term impact on the HYIP ecosystem. However, there is no evidence of a long term impact since the HYIPs have switched to other payment processors and others are now accepting Bitcoin. We therefore conclude that shutting down other payment processing systems that are intimately bound up with HYIPs is unlikely to have any ongoing impact – unless all can be closed simultaneously, an unlikely and undoubtedly very complex proposition.

D. Aggregators

As we have calculated, the aggregators can make substantial profits and have an important marketing role in attracting investors. It can also be assumed that they attract new HYIP administrators, therefore implicitly keeping the scheme going by recruiting new criminals to execute it. The aggregators are therefore a potential target for disruptive measures.

However, the existence of low-cost ready-to-deploy software for aggregator sites means that it would be easy for new aggregators to spring up if the current sites were to be closed down. So, although there would be some impact if it became harder to keep aggregator sites running, this would be limited whilst it was still extremely simple to create new aggregators using kits.

E. Kit Developers

Gold Coders states that an HYIP or aggregator site can be launched in 15 minutes by a technically unsophisticated user and provides the deployment service for free with every purchased license. By removing hurdles, kit developers are key enablers for the scale and industrialisation of the HYIP ecosystem, particularly because their code underpins both the HYIPs and the aggregators.

As we showed in Section III, Gold Coders is the main kit developer with a current market share of over 75%. They have been active since 2004, with their software continuously being utilized by 50% to 80% of HYIPs and over half the aggregators. In our view, their key role in orchestrating HYIP frauds makes them the prime target for disruptive action by law enforcement.

VII. RELATED WORK

High Yield Investment Programs have seldom been discussed in the academic literature. In 2012 Moore et al. identified the existence of aggregators and then used their data to measure the time until HYIPs collapse, finding that longer lifetimes were associated with lower interest payments and longer mandatory investment terms [8]. Unfortunately, they failed to understand the financial relationships between the aggregators and the HYIPs and missed the role played by Gold Coders altogether.

They estimated that investors were putting \$6 million a month into HYIPs by assuming that the average investment was \$1000 and that 1% of the people who searched for HYIPs, for which they had some figures from Google, would ultimately invest. This method gives a result that is almost 50% higher than ours, which isn't too bad considering how much of a guess some of these numbers were. They also found that digital currencies were of key importance, but when they considered a number of policy options for dealing with HYIPs their conclusion was that it would be most effective to try and get the aggregators and the longest lived HYIPs taken down.

In 2013 Oram built a data collection system for HYIPs and evaluated a number of features for clustering the websites into groups [9]. He found that features which considered the textual content were the most effective. This is of course consistent with Gold Coders using a common codebase but generating custom design templates. Oram also used the self-reported investment figures to estimate total HYIP turnover at \$35 million a month, which we believe to be a factor of almost 10 – although he did observe that some of the figures he used were quite clearly falsified.

In 2014 Drew and Moore presented a new clustering method that combined features such as HTML tags, textual content and file structure in a weighted manner to try and identify linkages between websites even when criminals were trying to make them look distinct [3]. When applied to 1216 new HYIP websites from the period January to June 2012 they found 161 clusters of at least size two, plus seven singletons. This is consistent with their method treating Gold Coders sites with different design templates as being different – whereas we would argue that they form one large cluster.

A number of studies of online criminal activity have noted a lack of diversity at various points in the supply chain and suggested that interventions at these points would be particularly disruptive. When studying goods advertised by email spam, Levchenko et al. [5] found a substantial concentration in the registrars used by spam-advertised websites and that the bulk of payments were processed by a mere handful of banks. When looking at search redirection attacks, made by the sellers of illicit pharmaceuticals Leontiadis et al. found a handful of concentrated communities linking many otherwise disparate online pharmacies [6]. When analysing Japanese ‘1-click’ frauds, Christin et al. found that over 2 000 seemingly unrelated reports were the result of just a few fraudsters [1].

Clayton described how shutting down hosting providers that facilitate spam transmission can have a disruptive short term effect [2], but Liu et al. [7] found that suspending ‘known bad’ domains was locally effective but that global action was necessary because criminals were adept at moving to other registrars. This necessity for intervention at an appropriate scale is something we concur with – whilst noting that the near monopoly that Gold Coders enjoys means that disrupting their business may well be at the appropriate scale even though a single enterprise is targeted.

VIII. CONCLUSION

We have provided a detailed account of the High Yield Investment Program ecosystem, highlighting the mechanisms that facilitate the industrialisation of this online investment fraud. The extent of this industrialisation becomes apparent when considering that over 4 500 HYIPs were launched in 2013. In presenting our model of the ecosystem we have corrected previous misapprehensions of the way in which various parts operate and we have identified many new sources of data which have enabled us to give extremely accurate numbers for many aspects of this type of fraud.

Furthermore, we have modelled and estimated the cash flows between the ecosystem’s different entities, so far as data availability allows. Our results suggest a total annual turnover for this fraud of approximately \$47 000 000 based upon extrapolations from aggregator referral commission figures which aggregators have little incentive to manipulate. The result is more accurate, robust, and subject to less limitations and assumptions than previous estimates of \$72 000 000 [8] based on measurements of search activity and \$420 000 000 [9] based on self-reported deposit values where there is substantial exaggeration occurring.

Our research shows that this criminal activity is a lot more structured, with clear rules and incentives, than suggested in previous work. Kit developers and aggregators have put a system in place in which they profit handsomely without being on the sharp end of criminal activity, creating a dynamic we find appropriate to term ‘orchestration’.

A single aggregator website can generate revenues of over \$250 000 per annum; Gold Coders, as the main kit developer with a market share of over 75%, can be shown to have an annual income of at least \$500 000 up to an estimated \$1 000 000 under reasonable assumptions. Individual HYIP websites, on the other hand, can be shown to make an average profit of about \$8 000, given the costs typically incurred.

Previous investigators completely overlooked the significant economic activity that was occurring in the other parts of the ecosystem.

We have also shown, for the first time, that even the investors who are aware that HYIPs are Ponzi schemes and hope to make a profit by investing early on, stand to make a loss of 24% on average – and that is a best case view, applying beneficial assumptions in their favour. Only in 16% of the HYIPs in which they invest would we expect them to make any profit at all.

Meanwhile, our analysis indicates that aggregators and kit developers are the most promising targets for measures aiming at putting a stop to High Yield Investment Programs. Aggregators refer a substantial share of at least 21% of investors to the HYIPs and are also likely to attract the majority of the front-line perpetrators necessary to launch the HYIPs. However, creating new aggregators is not in the least bit difficult so long term disruption of aggregators would be hard.

However, with market shares of over 75% and 60% for the provision of HYIPs and aggregator software and design templates, Gold Coders enables the majority of the criminal activity we observe. Their software is low cost and can be rapidly deployed even by those with limited technical skills. At present they are almost single-handedly removing almost all barriers to entry for a criminal that wishes to join those committing HYIP fraud.

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