

# Dumping

June 28, 2018

## 1 Find Dumping Offers

### 1.1 Observations:

- For the same model, pvp varies (depending on configuration I guess)
- Average difference between pvp and cash-price varies among brand and model
- Some brands are underrepresented, like Audi (only 2 samples)

### 1.2 Actions:

- Taking the ratio  $(\text{pvp} - \text{cashprice}) / \text{pvp} = \text{dump\_value}$  instead of only difference for normalizing. This value is between 0 and 1
- Calculate z-score per brand and per model
- Discarding brands that made less than 10 offers

### 1.3 Load Packages

```
In [3]: import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt # Plotting
import numpy as np
import re # regular expressions --> Finding Postal Code
from datetime import datetime
```

### 1.4 Read Data

```
In [2]: data = pd.read_csv('Dumping.csv', delimiter = ',', skiprows=0, squeeze=False, skip_blank_lines=0)
#data
```

### 1.5 Discard brands with less than 10 offers

```
In [4]: def brandNumber(brand):
        return brand, len(data[data.brand==brand])

In [6]: # Get all unique brands and models
brand_names = np.unique(np.asarray(data.brand[:]))
model_names = np.unique(np.asarray(data.model[:]))
```

```
In [27]: # discard brands with less than 10 offers
print 'Before Dropping: {} entries'.format(len(data))
brandNumbers = map(brandNumber, brand_names)
for nr in brandNumbers:
    if nr[1] <= 10:
        data = data[data.brand != nr[0]]
        print '{} dropped'.format(nr[0])
print 'After Dropping: {} entries'.format(len(data))
brand_names = np.unique(np.asarray(data.brand[:]))
model_names = np.unique(np.asarray(data.model[:]))
```

```
Before Dropping: 155609 entries
Audi dropped
Volkswagen dropped
After Dropping: 155609 entries
```

## 1.6 Calculate mean and std of dump-value (pvp-cashprize/pvp) per model and brand

```
In [16]: def brandDifferences(brand):
    differences = []
    for offer in data[data.brand==brand].iterrows():
        differences.append((offer[1].pvp_build-offer[1].cash_price)/offer[1].pvp_build)
    return (brand, np.mean(differences), np.std(differences))

def modelDifferences(model):
    differences = []
    for offer in data[data.model==model].iterrows():
        differences.append((offer[1].pvp_build-offer[1].cash_price)/offer[1].pvp_build)
    brand = data[data.model==model].iloc[0].brand
    return (model, brand, np.mean(differences), np.std(differences))

In [28]: # For each brand/model, calculate dumping-values mean and std
brands = map(brandDifferences, brand_names)
models = map(modelDifferences, model_names)

In [30]: # Convert to numpy array for later operations
brands_np = np.asarray(brands)
models_np = np.asarray(models)

In [34]: # Sort by mean dump-value to draw conclusions
brands_sorted = sorted(brands, key = lambda x: -x[1])
models_sorted = sorted(models, key = lambda x: -x[2])
```

Opel offers in average 19% under pvp and Dacia 3% over pvp ! The model with the best relative offers is the S60 from Volvo with 33% under pvp. The model with the worst relative offers is Mercedes-Benz Clase S with 183% over pvp !

## 1.7 For each offer, calculate z-score (how many stds is the dumping\_value away from mean)

```
In [49]: def zscore(offer, brands_np, models_np):
    # Calculate z-score for each offer, based on the mean and std from its brand and model
    # negative z-scores are below average offers and positive z-scores are above average
    dumpv_offer = (offer[1].pvp_build - offer[1].cash_price) / offer[1].pvp_build
    dumpv_model = models_np[models_np[:, 0] == offer[1].model][0, 2:]
    dumpv_brand = brands_np[brands_np[:, 0] == offer[1].brand][0, 1:]
    if float(dumpv_model[1]) != 0:
        # zscore = (dumpv_offer - dumpv_model) / std_model
        zscore_model = (dumpv_offer - float(dumpv_model[0])) / float(dumpv_model[1])
    else: zscore_model = 0
    if dumpv_brand[1] != 0:
        zscore_brand = (dumpv_offer - float(dumpv_brand[0])) / float(dumpv_brand[1])
    else: zscore_brand = 0
    return dumpv_offer, zscore_model, zscore_brand

In [50]: # Calculate z-score per model and brand and add it for each offer to the data-frame
    # positive z-score represent really low offers
    dumping_values = []
    zscores_model = []
    zscores_brand = []
    for offer in data.iterrows():
        dumping_values.append((offer[1].pvp_build - offer[1].cash_price) / offer[1].pvp_build)
        scores = zscore(offer, brands_np, models_np)
        dumping_values.append(scores[0])
        zscores_model.append(scores[1])
        zscores_brand.append(scores[2])
    zscores_brand = np.asarray(zscores_brand)
    zscores_model = np.asarray(zscores_model)

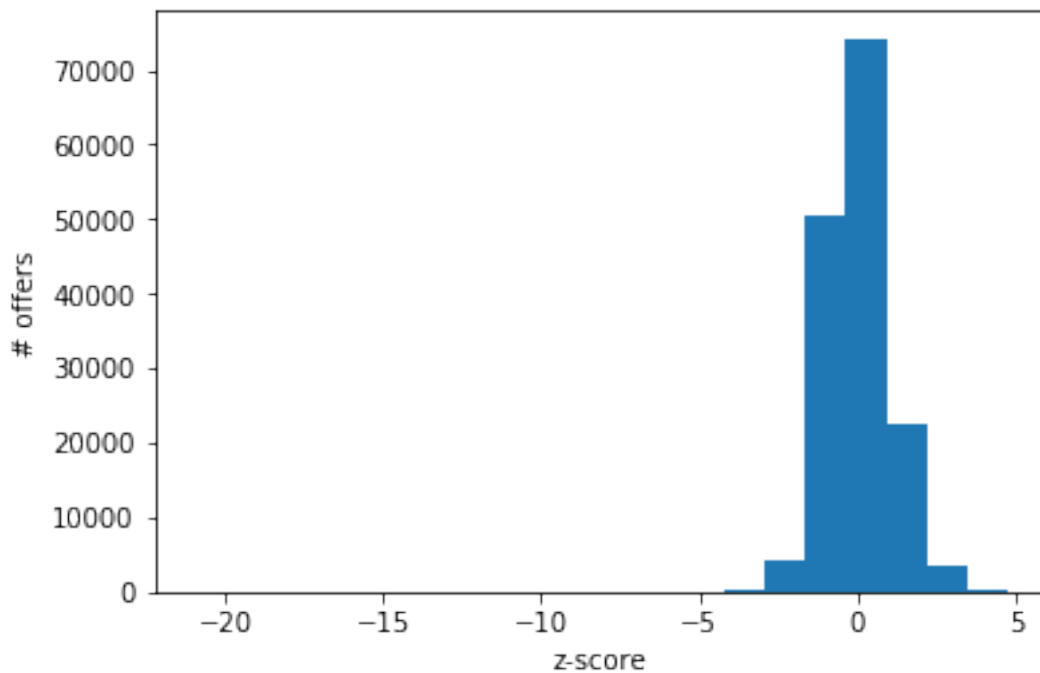
    # Add Columns to data-frame
    data.loc[:, 'zscore_model'] = pd.Series(zscores_model, index=data.index)
    data.loc[:, 'zscore_brand'] = pd.Series(zscores_brand, index=data.index)
```

## 1.8 Visualize z-score distribution with histogram

### 1.8.1 Based on brand

```
In [63]: # Histogram for all offers, based on brand-z-score
    plt.hist(zscores_brand, bins=20)
    plt.xlabel('z-score')
    plt.ylabel('# offers')
    plt.show()
    print '# Total Samples: {}'.format(len(zscores_brand))
    print ('zscore > 2: Classify {}% as Dumping offers'
           .format(100 * float(len(zscores_brand[zscores_brand > 2])) / len(zscores_brand)))
```

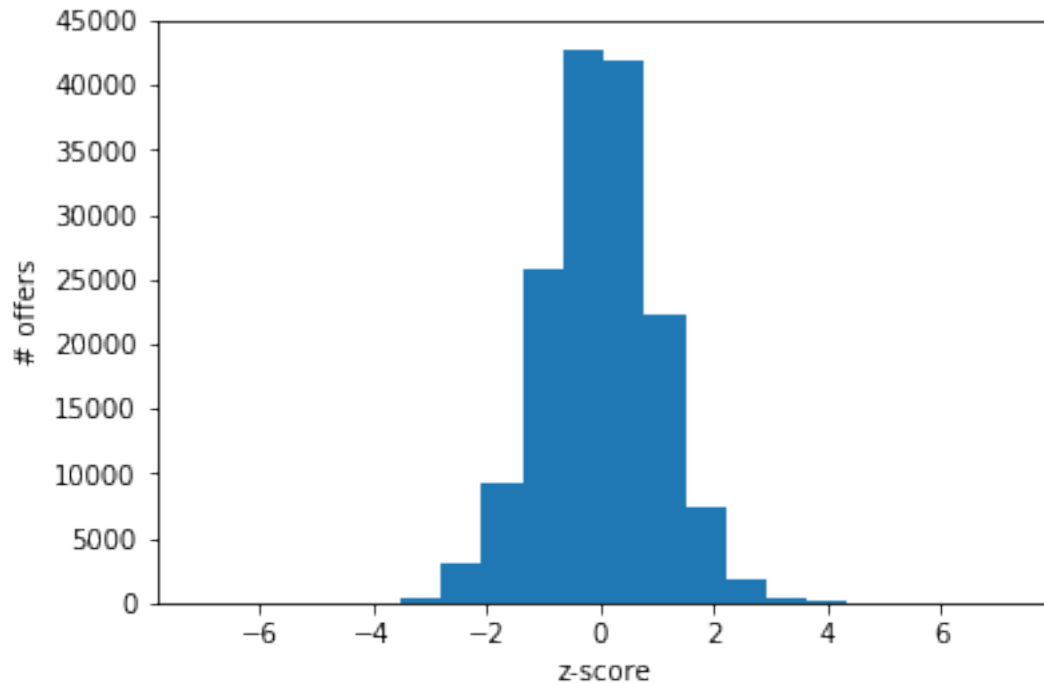
```
print ('zscore > 3: Classify {}% as Dumping offers'
      .format(100*float(len(zscores_brand[zscores_brand>3])/len(zscores_brand))))
```



```
# Total Samples: 155609
zscore > 2: Classify 3.24595621076% as Dumping offers
zscore > 3: Classify 0.593795988664% as Dumping offers
```

## 1.8.2 Based on Model

```
In [61]: # Histogramm for all offers, based on model-z-score
plt.hist(zscores_model, bins=20)
plt.xlabel('z-score')
plt.ylabel('# offers')
plt.show()
print '# Total Samples: {}'.format(len(zscores_model))
print ('zscore > 2: Classify {}% as Dumping offers'
      .format(100*float(len(zscores_model[zscores_model>2])/len(zscores_model))))
print ('zscore > 3: Classify {}% as Dumping offers'
      .format(100*float(len(zscores_model[zscores_model>3])/len(zscores_model))))
```



# Total Samples: 155609

zscore > 2: Classify 2.36297386398% as Dumping offers

zscore > 3: Classify 0.307822812305% as Dumping offers

## 1.9 Select the possible dumping offers, taking into account brand and model z-score

In [59]: # Show the offers, that have a model z-score below -6 and brand z-score below -5

```
DUMPINGS = data[data.zscore_model>(2)]
```

```
DUMPINGS = DUMPINGS[DUMPINGS.zscore_brand>(2)]
```

```
print '\n {}% of all offers were classified as dumpings \n'.format(100*float(len(DUMPINGS)/len(data)))
DUMPINGS
```

1.12397097854% of all offers were classified as dumpings

```
Out[59]:
```

	build_id	brand	model	\
5	a65ac74e-89eb-41fd-817f-956e1128289c	Peugeot	508	
6	a65ac74e-89eb-41fd-817f-956e1128289c	Peugeot	508	
9	a65ac74e-89eb-41fd-817f-956e1128289c	Peugeot	508	
199	392c682b-14bb-417c-9e4e-0e907767154b	Citroën	C4 Spacetourer	
375	b45e4aec-9d26-49ee-adf0-6cd0c9566bc6	Suzuki	Swift	
611	b8795638-7cfc-4a84-a67d-5140c9302b12	Toyota	Yaris	

733	31de4ad5-976a-420d-9398-a5050ae4d2fe	SEAT	Ibiza
858	26d751d2-2589-40bb-a63f-0ee0a8d422b6	Dacia	Sandero
859	26d751d2-2589-40bb-a63f-0ee0a8d422b6	Dacia	Sandero
860	26d751d2-2589-40bb-a63f-0ee0a8d422b6	Dacia	Sandero
861	26d751d2-2589-40bb-a63f-0ee0a8d422b6	Dacia	Sandero
862	26d751d2-2589-40bb-a63f-0ee0a8d422b6	Dacia	Sandero
908	f73e8b1b-d4fb-46c9-81f6-b923dfcb4a87	SEAT	Ibiza
909	f73e8b1b-d4fb-46c9-81f6-b923dfcb4a87	SEAT	Ibiza
910	f73e8b1b-d4fb-46c9-81f6-b923dfcb4a87	SEAT	Ibiza
911	f73e8b1b-d4fb-46c9-81f6-b923dfcb4a87	SEAT	Ibiza
912	f73e8b1b-d4fb-46c9-81f6-b923dfcb4a87	SEAT	Ibiza
925	5f30722f-dde2-4544-a951-b9b6d8c98d6b	SEAT	Ibiza
927	5f30722f-dde2-4544-a951-b9b6d8c98d6b	SEAT	Ibiza
986	e9502a75-a6e3-40c7-a641-be7149c31bcd	Ford	Focus
993	4bf79a77-0358-41fc-a0b6-247069fc2d6d	SEAT	León
994	4bf79a77-0358-41fc-a0b6-247069fc2d6d	SEAT	León
995	4bf79a77-0358-41fc-a0b6-247069fc2d6d	SEAT	León
996	4bf79a77-0358-41fc-a0b6-247069fc2d6d	SEAT	León
1090	2be58236-995d-4f34-a9bf-a51d8a04ba7e	Opel	Astra
1092	2be58236-995d-4f34-a9bf-a51d8a04ba7e	Opel	Astra
1144	8312dac5-0ace-4f7d-a6b2-1f307be1ed72	Dacia	Lodgy
1145	8312dac5-0ace-4f7d-a6b2-1f307be1ed72	Dacia	Lodgy
1146	8312dac5-0ace-4f7d-a6b2-1f307be1ed72	Dacia	Lodgy
1147	8312dac5-0ace-4f7d-a6b2-1f307be1ed72	Dacia	Lodgy
...	...	...	...
152372	538fb6d9-333e-464c-9b29-e2d20286fafc	Honda	Civic
153130	55ccb155-2541-43be-9448-ffd84b1cc1a6	Peugeot	Traveller
153404	4386c01a-c605-435b-bde8-0fc4c675f816	Honda	Civic
153418	1cb0474c-9c2c-4691-8bad-a09e1f52ade2	Nissan	JUKE
153419	1cb0474c-9c2c-4691-8bad-a09e1f52ade2	Nissan	JUKE
153420	1cb0474c-9c2c-4691-8bad-a09e1f52ade2	Nissan	JUKE
153733	b6ad7d20-9990-4eba-af47-f25377ea99a9	Nissan	QASHQAI
154000	686f8bef-1974-497b-8c4c-9958f2da51e8	Hyundai	i30
154014	cc8aa692-baed-4ad7-980e-dbf9d9365cb1	Peugeot	308
154104	47bd379f-7be5-47f8-8f6d-91f3b34f9c87	Nissan	QASHQAI
154180	4a160849-1e92-45b0-a7b8-d419b8387160	Peugeot	208
154181	4a160849-1e92-45b0-a7b8-d419b8387160	Peugeot	208
154182	4a160849-1e92-45b0-a7b8-d419b8387160	Peugeot	208
154194	ca4bfa9c-6eed-456e-9483-e18d3f3fa9c0	Honda	Jazz
154408	f29cd2b2-7fb8-4b8e-aeff-6227b5e9b38d	Kia	cee'd
154410	f29cd2b2-7fb8-4b8e-aeff-6227b5e9b38d	Kia	cee'd
154554	f13a64b1-0d16-42fb-947a-182bcf44da58	Citroën	C4
154804	cf6c20fb-27f3-48c4-a1ae-dc21e1fee468	Opel	Corsa
154805	cf6c20fb-27f3-48c4-a1ae-dc21e1fee468	Opel	Corsa
154813	2b483229-8fa3-498e-8d0b-5ec0f9bcbf17c	SEAT	Ibiza
154847	ab83a46e-f32f-4c94-8817-d775670c594e	Peugeot	208
154848	ab83a46e-f32f-4c94-8817-d775670c594e	Peugeot	208
155011	ed36963d-0d28-4df4-a778-ff03613291e0	Peugeot	308

155132	40cd4018-2c22-41dd-b926-8010a5b90a5e	Ford	S-MAX
155241	ab0284d3-6eb1-424b-80ad-3ad3b66eb8fe	Peugeot	308
155242	ab0284d3-6eb1-424b-80ad-3ad3b66eb8fe	Peugeot	308
155243	ab0284d3-6eb1-424b-80ad-3ad3b66eb8fe	Peugeot	308
155579	d79874d9-f697-4b0d-affe-e0474f56bf6b	Nissan	Micra
155580	d79874d9-f697-4b0d-affe-e0474f56bf6b	Nissan	Micra
155590	311d536e-bd28-4732-8427-09ba82a38ba4	SEAT	Ibiza

	date_build_created	pvp_build \
5	2018-05-23 00:48:24	30720.00000
6	2018-05-23 00:48:24	30720.00000
9	2018-05-23 00:48:24	30720.00000
199	2018-05-23 05:20:56	27350.00000
375	2018-05-23 06:10:09	15921.50000
611	2018-05-23 07:15:03	15400.00000
733	2018-05-23 07:36:52	17840.00000
858	2018-05-23 07:56:40	11350.86000
859	2018-05-23 07:56:40	11350.86000
860	2018-05-23 07:56:40	11350.86000
861	2018-05-23 07:56:40	11350.86000
862	2018-05-23 07:56:40	11350.86000
908	2018-05-23 08:15:45	17590.00000
909	2018-05-23 08:15:45	17590.00000
910	2018-05-23 08:15:45	17590.00000
911	2018-05-23 08:15:45	17590.00000
912	2018-05-23 08:15:45	17590.00000
925	2018-05-23 08:17:36	17750.00000
927	2018-05-23 08:17:36	17750.00000
986	2018-05-23 08:22:52	20150.00000
993	2018-05-23 08:25:07	22920.00000
994	2018-05-23 08:25:07	22920.00000
995	2018-05-23 08:25:07	22920.00000
996	2018-05-23 08:25:07	22920.00000
1090	2018-05-23 08:48:08	23350.00000
1092	2018-05-23 08:48:08	23350.00000
1144	2018-05-23 08:56:33	12109.00000
1145	2018-05-23 08:56:33	12109.00000
1146	2018-05-23 08:56:33	12109.00000
1147	2018-05-23 08:56:33	12109.00000
...	...	...
152372	2018-06-20 21:14:45	24050.00000
153130	2018-06-21 05:00:43	48313.00000
153404	2018-06-21 07:06:23	23550.00000
153418	2018-06-21 07:18:48	19859.59998
153419	2018-06-21 07:18:48	19859.59998
153420	2018-06-21 07:18:48	19859.59998
153733	2018-06-21 09:12:24	24900.00000
154000	2018-06-21 10:31:05	24675.00000

154014	2018-06-21	10:33:13	24500.00000
154104	2018-06-21	10:50:30	25000.00000
154180	2018-06-21	11:05:16	16540.00000
154181	2018-06-21	11:05:16	16540.00000
154182	2018-06-21	11:05:16	16540.00000
154194	2018-06-21	11:07:41	20700.00000
154408	2018-06-21	12:24:20	18400.00000
154410	2018-06-21	12:24:20	18400.00000
154554	2018-06-21	13:00:54	20650.00000
154804	2018-06-21	14:15:13	21197.03995
154805	2018-06-21	14:15:13	21197.03995
154813	2018-06-21	14:16:33	17590.00000
154847	2018-06-21	14:21:57	16360.00000
154848	2018-06-21	14:21:57	16360.00000
155011	2018-06-21	15:14:52	27350.01001
155132	2018-06-21	15:49:22	33075.00000
155241	2018-06-21	16:12:07	21800.00000
155242	2018-06-21	16:12:07	21800.00000
155243	2018-06-21	16:12:07	21800.00000
155579	2018-06-21	17:31:53	19200.00000
155580	2018-06-21	17:31:53	19200.00000
155590	2018-06-21	17:34:36	18880.00000

	showroom_id \
5	524ce0df-be93-4592-a409-1bcf4dbe40ad
6	cfb8a53c-543b-4f60-896e-758949863331
9	14800a40-cacb-41f4-831c-f90ef77d1f17
199	4f1fea75-46a4-4a2e-a0f4-47891656b4a2
375	13003390-61c1-4e07-82aa-3d338a16ce6e
611	a3c35b00-1394-4ee6-b423-2b72be4545f6
733	c7a264c9-809d-4c63-a2d9-5fcc57f8c09d
858	df73cfa3-80f7-485e-bc40-a994922fac23
859	5a02394e-0ea4-4ee2-ac1f-d0833bab8eb3
860	a5e734ab-0651-4b48-9063-3e2f66355922
861	c9f5cc49-849e-40a3-8272-f61c5523e2fa
862	76e20fbb-936c-4539-b669-c8699cbf52a5
908	6af9791a-f589-49b0-bcdc-c683019ee4f3
909	264b5607-271d-4e9b-b3f0-56fe487b2ea3
910	45099172-6307-4c44-95d5-cea05f36cf54
911	b7c0ed88-b5a0-44b2-a126-9921b2d7b811
912	a102fb85-1969-4630-826b-63fb1fcdee7b
925	a102fb85-1969-4630-826b-63fb1fcdee7b
927	264b5607-271d-4e9b-b3f0-56fe487b2ea3
986	d82a0570-7899-4a0b-ab1f-b884e96397da
993	264b5607-271d-4e9b-b3f0-56fe487b2ea3
994	5bb81ee7-a91a-4b28-92eb-ae3333875081
995	737c1d7a-3a05-4042-ad69-2150cf3840ea
996	a697a59c-7553-402a-8c01-578572fe0528



```

1090    150703d5-913f-45b3-9658-cf2947dc93cd
1092    3588cde5-e56e-4956-a2b6-df371eb8e9ad
1144    df73cfa3-80f7-485e-bc40-a994922fac23
1145    76e20fbb-936c-4539-b669-c8699cbf52a5
1146    5a02394e-0ea4-4ee2-ac1f-d0833bab8eb3
1147    e64e7d6d-0b49-4aab-abfa-7e6f87ca255d
...
152372  b515b35c-4cc5-41b8-99ff-78eb0a439a8b
153130  455ef877-f7e4-4a6e-a12d-6ce8ba48800f
153404  3ebfdc1b-4b92-4196-818c-ed4361a64688
153418  39ce5aaf-e207-4aec-8a44-cca426fe4481
153419  bb11f17f-bf37-43d8-a2ba-f3114c2d8e62
153420  3c8394af-31ee-417d-9d24-5a010264e815
153733  ae9cd202-9c89-4da0-9c51-d977ed0a8600
154000  5d9edb28-d60b-4538-8b4d-9c6a86f2a4d4
154014  2c1fc5d4-f16e-4d03-bedc-c5f02c2f449e
154104  ae9cd202-9c89-4da0-9c51-d977ed0a8600
154180  c07dc641-87ed-46d2-8f20-4e0091b4297e
154181  455ef877-f7e4-4a6e-a12d-6ce8ba48800f
154182  9a79b84c-51e7-45e9-8c19-8ee94ab748a6
154194  f4ab9c3d-59d0-48b5-8ac0-42217784a53e
154408  ee28299e-df4e-4151-b4f5-3cfc4a0af2e3
154410  fdbf9a6a-d9ca-419d-b44f-9fd3e290eacc
154554  4f1fea75-46a4-4a2e-a0f4-47891656b4a2
154804  206a8a17-658d-4571-a1d4-12760cbc1859
154805  9153959e-9402-4c0f-9748-99f42766f553
154813  14f17261-8283-46d5-aaac-bf3aa2744cb5
154847  27a52584-ca40-4072-91ba-daa7635d5305
154848  a93f3e84-f0e6-4495-a27d-f587f66b0045
155011  14800a40-cacb-41f4-831c-f90ef77d1f17
155132  51e3ccb1-42d0-440d-a403-75d510e95a6e
155241  9a79b84c-51e7-45e9-8c19-8ee94ab748a6
155242  2f980700-cff1-46e9-972a-6e884a0533b8
155243  455ef877-f7e4-4a6e-a12d-6ce8ba48800f
155579  e878694a-d2fd-487d-995a-bf4270a38acc
155580  e2666035-3ff6-46d4-8e64-67905a2cd95f
155590  14f17261-8283-46d5-aaac-bf3aa2744cb5

```

	offer_id	cash_price	zscore_model \
5	3d079109-5a61-469f-9192-bd8a34f0a38d	21016.0	2.188891
6	42fda9ec-fe25-40d2-864c-cd6980166d76	20682.0	2.393836
9	a8535b35-aa14-43fa-b14f-3685a4754b34	21016.0	2.188891
199	dcdc1abb-7c73-47a5-8897-6e73f0a1cf35	19537.0	2.352952
375	cdf52275-a03c-4447-946c-539cd00d7519	12597.0	2.234561
611	98d8ee0b-cdc1-47e1-94f5-dd8f66daaf3d	10110.0	2.799226
733	2f6a1b99-4542-43ed-9699-5c13dc0e66f1	14119.0	2.022566
858	01617d63-a0e7-4666-a59d-7d10f7cd2f8a	10555.0	3.103528
859	1fdaca49-d895-42a8-9a94-db15396d0150	10541.0	3.140438

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[1749 rows x 10 columns]

## 1.10 From Dumping offers, get the car-dealerships

```
In [67]: dumping_dealers = np.unique(np.asarray(DUMPINGS.showroom_id))
        dumping_dealers
```

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